RAJAH SERFOJI GOVERNMENT COLLEGE

(AUTONOMOUS)

THANJAVUR – 613 005

PG & RESEARCH DEPARTMENT OF CHEMISTRY

CURRICULUM AND SYLLABUS

FOR

M.Sc. Degree Programme in Chemistry

Semester Pattern (TWO YEAR DEGREE PROGRAMME)

CBCS - LOCF

&

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION

Effective from the Academic Year 2023-2024

RAJAH SERFOJI GOVT COLLEGE (AUTOMONOUS), THANJAVUR-5
C.B.C.S PATTERN FOR ALL P.G. COURSES
SUBJECT:CHEMISTRY
(Applicable to the Students admitted from the academic year 2023-2024 onwards)

Sem	PART	COURSE	CODE	TITLE	CREDIT	HRS /WEEK	EXAM HOURS	MARKS		TOTAL
				I SEMESTER				IA	WE	
I	III	CC1	T1PCHC1	Organic Reaction Mechanism - I	5	7	3	25	75	100
	III	CC2	T1PCHC2	Structure and Bonding in Inorgainc Compounds	5	7	3	25	75	100
	III	CC3	T1PCHC3	Organic Chemistry Practical - I	4	6	3	25	75	100
	III	EC-1	T1PCHECA	Inorganic Chemistry Practical - I	3	5	3	25	75	100
		EC-2	T1PCHECB	Green Chemistry	3	5	3	25	75	100
	TOTAL				20	30				500
				II SEMESTER						
II	III	CC4	T2PCHC4	Orgainc reaction mechanism - II	5	6	3	25	75	100
	III	CC5	T2PCHC5	Inorganic Chemistry Practical - II	5	6	3	25	75	100
	III	CC6	T2PCHC6	Physical Chemistry - I	4	6	3	25	75	100
	III	EC3	T2PCHECC	Organic Chemistry Practical - II	3	4	3	25	75	100
		EC4	T2PCHECD	Bio Inorganic Chemistry	3	4	3	25	75	100
	IV	SEC1	T2PCHS1	Cosmetic Chemistry	2	4		25	75	100
	TOTAL				22	30				600

				III SEMESTER						
III	III	CC7	T3PCHC7	Organic synthesis and Photochemistry	5	6	3	25	75	100
	III	CC8	T3PCHC8	Coordination Chemistry - I	5	6	3	25	75	100
	III	CC9	T3PCHC9	Physical Chemistry - II	5	6	3	25	75	100
	III	CC10	T3PCHC10	Physical Chemistry Practical	4	6	3	25	75	100
	III	EC5	T3PCHECE	Molecular Spectroscopy	3	3	3	25	75	100
	IV	SEC2	T3PCHS2	Chemistry in everyday life	2	3		25	75	100
	IV	Internship/ industrial activity		Intenship/ Industrial Activity	2					
	TOTAL				**26**	**30**				**600**
				IV SEMESTER						
	III	CC11	T4PCHC11	Coordination Chemistry - II	5	6	3	25	75	100
	III	CC12	T4PCHC12	Analytical Intrumentation technique practical	5	6	3	25	75	100
	III	CC13	T4PCHC13	Project Work with Viva - voce	7	10		25	75	100
	III	EC6	T4PCHECF	Nano and Computational Chemistry	3	4	3	25	75	100
	IV	PCS	T4PCHS3	Industrial Chemistry	2	4	3	25	75	100
	V			Extension Activity	1					
	TOTAL				**23**	**30**				**500**
GRAND TOTAL					**91**					**2200**

****Intenship will be carried out during the summer vacation of the first year and marks will included in the Third Semester Mark Statement**

Passing Minimum is prescried for Internal and External

(a) The Passsing minimum for CIA shall be 12 out of 25 Marks

(b)The Passing minimum for Autonomous Examinations shall be 38 out of 75 marks

List of Elective Papers

Course Code	Title of the Paper
TPCHECA	Inorganic Chemistry Practical - I
TPCHECB	Green Chemistry
TPCHECC	Organic Chemistry Practical - II
TPCHECD	Bio Inorganic Chemistry
TPCHECE	Molecular Spectroscopy
TPCHECF	Nano and Computational Chemistry

Component Wise Credit Distribution

Part	Credit					
	Sem I	Sem II	Sem III	Sem IV	Total	
Part - A						
(Core Paper 1 to 13)	14	14	19	17	64	Under CGPA Calculation
Part - B						
(i)Discipline - Centric /Generic Skill	6	6	3	3	18	
(ii) Soft Skill		2	2		4	Under Non CGPA Calculation
(iii) Summer Internship/Industrial Training			2		2	
(iv) Professional Competitive Skill (PCS)				2	2	
Part - C						
Extra Activities				1	1	
Total	20	22	26	23	91	

TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	**M. Sc., Chemistry**
Programme Code	
Duration	**PG – 2YEARS**
Programme Outcomes (Pos)	**PO1: Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment. **PO7: Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.

Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. **PSO3 – Research and Development** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Title of the Course	ORGANIC REACTION MECHANISM - I						
Paper No.	Core - CC1						
Category	Core	Year	I	Credits	5	Course Code	T1PCHC1
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice			Total	
	6	1	-			7	
Prerequisites	Basic concepts of organic chemistry						
Objectives of the course	• 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.						
Course Outline	**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. Linear free energy relationship, partial rate factor, substituent and reaction constants.						
	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.						
	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, S_Ni, and S_E1 mechanism and evidences, Swain- Scott, Grunwald-Winstein relationship - 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 . Absolute and relative Configurations D, L system, Cram's and Prelog's rules: R, S-notations (Cahn-Ingold-Prelog rules). Absolute Configurations for allenes, spiranes and biphenyls. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization and mutarotation.
	UNIT-V: Stereochemistry-II: Concept of Conformation and methods of determining the configuration of geometrical isomers,acyclic systems, intramolecular rearrangements, neighbouring group participation, chemical consequence of conformational equilibrium - Curtin-Hammett Principle. Stability of five and six-membered rings: mono-, di- and polysubstituted cyclohexanes, conformation and reactivity in cyclohexane systems. Fused and bridged rings: bicyclic, poly cyclic systems, decalins and Brett's rule. exo-cyclic alkylidene-cycloalkanes. Topicity and prostereoisomerism, chiral shift reagents and chiral solvating reagents. Criteria for optical purity: Resolution of racemic modifications, asymmetric transformations, asymmetric synthesis, destruction. Stereoselective and stereospecific synthesis
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /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	1.https://sites.google.com/site/chemistryebookscollection02/home/organic-

e-learning source	chemistry/organic 2. https://www.organic-chemistry.org/

Course Learning Outcomes (for Mapping with POs and PSOs)

Students will be able

CLO1: To recall the basic principles of organic chemistry.

CLO2: To understand the formation and detection of reaction intermediates of organic reactions.

CLO3: To predict the reaction mechanism of organic reactions and stereochemistry of organic compounds.

CLO4: To apply the principles of kinetic and non-kinetic methods to determine the mechanism of reactions.

CLO5: 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

Signature of the HOD

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RAJAH SERFOJI GOVT. COLLEGE
THANJAVUR - 613 005

<table>
<tr><td>itle of the Course</td><td colspan="8">STRUCTURE AND BONDING IN INORGANIC COMPOUNDS</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core – CC2</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">T1PCHC2</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>6</td><td>1</td><td colspan="3">-</td><td colspan="3">7</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basic concepts of Inorganic Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• 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="4">Course Outline</td><td colspan="8">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; main group clusters –zintl ions and mno rule.</td></tr>
<tr><td colspan="8">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="8">UNIT-III: Solid state chemistry – II: Structural features of the crystal systems: Rock salt, zinc blende & 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>
<tr><td colspan="8">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</td></tr>
</table>

	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 / TRB / NET/ UGC-CSIR / GATE /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)

Students will be able

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

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<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC CHEMISTRY PRACTICAL-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core – CC3</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>Course Code</td><td>T1PCHC3</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>1</td><td colspan="3">5</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic concepts of In organic chemistry practical</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To understand the concept of separation, qualitative analysis and preparation of organic compounds.
• To develop analytical skill in the handling of chemical reagents for separation of binary and ternary organic mixtures.
• To analyze the separated organic components systematically and derivative them suitably.
• To construct suitable experimental setup for the organic preparations involving single stages.
• To experiment different purification and drying techniques for the compound processing.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">Separation and analysis:
A. Two component mixtures.
B. Three component mixtures.</td></tr>
<tr><td colspan="7">Single stage preparation of organic compounds

(a) Nitration: methyl m- nitrobenzoate from methyl benzoate.
(b) Addition: Benzophenone oxime from benzophenone.
(c) Chlorination cum diazotization : o-chloro benzoic acid from anthranilic acid.
(d) Oxidation: p-benzoquinone from hydroquinone.
(e) Diazotisation; Phenly azo 2-naphthol from aniline..</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 / TRB / NET/ UGC-CSIR / GATE /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">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.</td></tr>
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	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.
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)

Students will be able:

CO1: To recall the basic principles of organic separation, qualitative analysis and preparation.
CO2: To explain the method of separation and analysis of separated organic mixtures and convert them as derivatives by suitable preparation method.
CO3: To determine the characteristics of separation of organic compounds by various chemical reactions.
CO4: To develop strategies to separate, analyze and prepare organic compounds.
CO5: To formulate a method of separation, analysis of organic mixtures and design suitable procedure for organic preparations.

CO-PO Mapping (Course Articulation Matrix)

	PO 1	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

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<table>
<tr><td>Title of the Course</td><td colspan="7">INORGANIC CHEMISTRY PRACTICAL-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – ECI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td>T1PCHECA</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>1</td><td colspan="3">4</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic principles of qualitative analysis</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To impart knowledge on Qualitative analysis of Inorganic mixture
• To gain the depth knowledge in the Colorimetric estimation of different metals.
• To train the students for improving their skill in estimating the amount of ion accurately present in the solution
• To estimate metal ions, present in the given solution accurately without using instruments.</td></tr>
<tr><td>Course Outline</td><td colspan="7">Analysis of mixture of cations: Analysis of a mixture of four cations containing two common cations and two rare cations. Cations to be tested.
Group-I : W, Tl and Pb.
Group-II : Se, Te, Mo, Cu, Bi and Cd.
Group-III : Tl, Ce, Th, Zr, V, Cr, Fe, Ti and U.
Group-IV : Zn, Ni, Co and Mn.
Group-V : Ca, Ba and Sr.
Group-VI : Li and Mg.</td></tr>
<tr><td></td><td colspan="7">Colorimetric Estimation
a) Copper
b) Iron
c) Nickel
d) Chromium using photo electric colorimeter.</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 / TRB / NET/ UGC-CSIR / GATE /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">1. A. JeyaRajendran, Microanalytical Techniques in Chemistry: Inorganic Qualitative Analysis, United global publishers, 2021.
2. V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rded., The National Publishing Company, Chennai, 1974.
3. Vogel's Text book of Inorganic Qualitative Analysis, 4thed., ELBS,</td></tr>
</table>

	London.
Reference Books	1. G. Pass, and H. Sutcliffe, *Practical Inorganic Chemistry*; Chapman Hall, 1965. 2. W. G. Palmer, Experimental *Inorganic Chemistry*; Cambridge University Press, 1954.

Course Learning Outcomes (for Mapping with POs and PSOs)

Students will be able:

CO1: To identify the anions and 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: Examine a given inorganic mixture and find out the different groups of cations in it.

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

CO5: Investigate the presence of trace metal ions using colorimetry.

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

Signature of the HOD

CONTROLLER OF EXAMINATIONS
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)
THANJAVUR - 613 005.

HEAD OF THE DEPARTMENT OF CHEMISTRY
RAJAH SERFOJI GOVT. COLLEGE
THANJAVUR - 613 005

<table>
<tr><td>Title of the Course</td><td colspan="7">GREEN CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective - EC2</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</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">T1PCHECB</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>-</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of green 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 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>
<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 / TRB / NET/ UGC-CSIR / GATE /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. 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, NewDelhi,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	2. https://www.organic-chemistry.org/ 3. https://www.studyorgo.com/summary.php

Course Learning Outcomes (for Mapping with POs and PSOs)

Students will be able:

CO1: To recall the basic chemical techniques used in conventional industrial preparations and in green innovations.

CO2: To understand the various techniques used in chemical industries and in laboratory.

CO3: To compare the advantages of organic reactions assisted by renewable energy sources and non-renewable energy sources.

CO4: To apply the principles of PTC, ionic liquid, microwave and ultrasonic assisted organic synthesis.

CO5: To design and synthesize new organic compounds by green 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

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THANJAVUR - 613 005.

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC REACTION MECHANISM-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core – CC4</td></tr>
<tr><td>Category</td><td>Core</td><td>Year
Semester</td><td>I
II</td><td>Credits</td><td>5</td><td>Course Code</td><td>T2PCHC4</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>1</td><td colspan="3">-</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of organic chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• 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>Course Outline</td><td colspan="7">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></td><td colspan="7">UNIT-II: Oxidation and Reduction Reactions: Mechanisms: Direct electron transfer, hydride transfer, hydrogen transfer, oxidative and reductive coupling reactions. Mechanism of oxidation reactions: Dehydrogenation by quinones, selenium dioxides, 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, dimethyl sulphoxide- dicyclohexyl carbodiimide (DMSO-DCCD). Mechanism of reduction reactions: Wolff-Kishner, Clemmenson, Rosenmund, reduction with Trialkyl and triphenyltin hydrides, McFadyen-Steven's reduction, Homogeneous hydrogenation, Hydroboration with cyclic systems, MPV and Bouveault-Blanc reduction.</td></tr>
<tr><td></td><td colspan="7">UNIT-III: Rearrangements:
Rearrangements to electron deficient carbon: Pinacol-pinacolone rearrangements, Wagner-Meerwein, Dienone-phenol, and Wolff rearrangements.
Rearrangements to electron deficient nitrogen: Hofmann, Curtius, Schmidt, Lossen and Beckmann rearrangements.</td></tr>
</table>

	Rearrangements to electron deficient oxygen: Baeyer-Villiger oxidation rearrangements. **Rearrangements to electron rich atom:** Favorskii, Stevens, Wittig rearrangements. **Intramolecular rearrangements** – 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. **Addition to Carbon-Hetero atom Multiplebonds:** Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl. Mechanism of condensation reactions involving enolates –Stobbe reactions.
	UNIT-V: Reagents in Organic Synthetic Reactions: Lithium diisopropylamine (LDA), Sodium cyanoborohydride ($NaBH_3CN$), *meta*-Chloroperbenzoic acid (m-CPBA), Dimethyl aminiopyridine (DMAP), Triethyl amine(TEA), Diazobicyclo[5.4.0]undec-7-ene (DBU), Diethyl azo dicarboxylate (DEAD), *N*-bromosuccinimide (NBS), Trifluoroacetic acid (TFA), Tetramethyl piperiridin-1-oxyl (TEMPO), 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 and 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 / TRB / NET/ UGC-CSIR / GATE /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*, 8thedn, New Age International Publishers, 2015. 4. P. Y.Bruice, *Organic Chemistry*, 7thedn.,Prentice Hall, 2013. 5. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee*Organic Chemistry*, 7th edn., Pearson Education, 2010.
Reference	1. S. H. Pine, *Organic Chemistry*, 5thedn, McGraw Hill International

Books	Editionn, 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)

Students will be able:

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

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RAJAH SERFOJI GOVT. COLLEGE
THANJAVUR - 613 005

<table>
<tr><td>Title of the Course</td><td colspan="7">INORGANIC CHEMISTRY PRACTICAL-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core – CC5</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">T2PCHC5</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>1</td><td colspan="3">5</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic principles of gravimetric analysis and Preparation of metal complexes</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To understand and enhance the visual observation as an analytical tool for the quantitative estimation of ions.
• To recall the principle and theory in preparing standard solutions.
• To train the students for improving their skill in estimating the amount of ion accurately present in the solution
• To estimate metal ions, present in the given solution accurately without using instruments.
• To determine the amount of ions, present in a binary mixture accurately.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I: Estimations of Metal Ions in a Binary Mixture

1. Quantitative analysis of a mixture of iron (volumetry) and nickel (gravimetry)
2. Quantitative analysis of a mixture of copper (volumetry) and nickel (gravimetry)
3. Quantitative analysis of a mixture of iron (volumetry) and zinc (gravimetry)
4. Quantitative analysis of a mixture of zinc (volumetry) and copper (gravimetry)
5. Quantitative analysis of a mixture of copper (volumetric) and zinc (gravimetry)</td></tr>
<tr><td colspan="7">UNIT-II: Preparation of metal complexes: Preparation of inorganic complexes:
a. Preparation of tristhioureacopper(I)sulphate
b. Preparation of potassium trioxalate chromate(III)
c. Preparation of tetramminecopper(II) sulphate
d. Preparation of Reineck's salt
e. Preparation of hexathioureacopper(I) chloridedihydrate
f. Preparation of cis-Potassium tri oxalate diaquachromate(III)
g. Preparation of sodium trioxalatoferrate(III)
h. Preparation of hexathiourealead(II) nitrate</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
</table>

examination question paper)	
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. A. JeyaRajendran, Microanalytical Techniques in Chemistry: Inorganic Qualitative Analysis, United global publishers, 2021. 2. V. V. Ramanujam, *Inorganic Semimicro Qualitative Analysis*; 3rded., The National Publishing Company, Chennai, 1974. 3. *Vogel's Text book of Inorganic Qualitative Analysis,* 4thed., ELBS, London.
Reference Books	1. G. Pass, and H. Sutcliffe, *Practical Inorganic Chemistry*; Chapman Hall, 1965. 2. W. G. Palmer, Experimental *Inorganic Chemistry*; Cambridge University Press, 1954.

Course Learning Outcomes (for Mapping with POs and PSOs)
Students will be able:
CO1: Understand the crystal structure of inorganic solids.
CO2: Learn metalo organic framework in organometalic system.
CO3: Learn various experimental method for studying solid state molecule.
CO4: To prepare single stage preparation of inorganic compounds
CO5: To synthesize coordination compounds in good quality.

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

Signature of the HOD

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THANJAVUR - 613 005.

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RAJAH SERFOJI GOVT. COLLEGE
THANJAVUR - 613 005

<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 - CC6</td></tr>
<tr><td>Category</td><td>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">T2PCHC6</td></tr>
<tr><td></td><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>5</td><td>1</td><td colspan="3">-</td><td colspan="3">6</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 study the fundamental principles and concepts of Quantum chemistry
• To learn about Transport and Activity of ions and Electrolyte equilibrium in a solution.
• To gain the depth knowledge in Electro kinetic phenomena.
• 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>Course Outline</td><td colspan="8">UNIT-I: Quantum Chemistry: Wave particle duality, Uncertainty principle, Particle wave and Schrodinger wave equation, wave function, properties of wave function. Properties of wave function, Normalized, Orthogonal, orthonormal, Eigen values, Eigen functions, Hermitian properties of operators. Introduction to quantum mechanics-black body radiation, photoelectric effect, hydrogen spectrum. Need for quantum mechanics, Postulates of Quantum Mechanics, Schrodinger wave equation, Time independent and time dependent</td></tr>
<tr><td></td><td colspan="8">UNIT-II: Ionics:Arrhenius theory -limitations, van't Hoff factor and its relation to colligative properties.Debye Huckel theory of strong electrolytes - asymmetry and electrphoretic effect. Activity and Activity coefficient of strong electrolytes - concept of ionic strength. Determination of activity and activity coefficient –vapour pressure method, solubility method and EMF method. Derivation of Debye-Huckel limiting law at appreciable concentration of electrolytes modifications and applications.</td></tr>
<tr><td></td><td colspan="8">UNIT-III: Electokinetic phenomena: Theories of electrical double layer – Electrical double layer potential- theory of multiple layers at electrode electrolyte interface- double layer capacity-ectrokinetic phenomena- zeta potential- electro osmosis- sedimentation potential Processes at the electrodes- the rate of charge transfer- exchange current density- Butler- Volmer equation- Tafel equation.Principles of corrosion electrochemical corrosion- construction and use of pourbaix and Evans diagram and prevention of corrosion-</td></tr>
</table>

	electrochemical oxidation and reduction.Cyclic voltametry – principles and applications.
	UNIT-IV: Kinetics of Reactions: Theories of reactions-effect of temperature on reaction rates, collision theory of reaction rates, Unimolecular reactions - Lindeman and Christiansen 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 catalysis.
	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 flash photolysis methods and pulse radiolysis. Kinetics of polymerization-free radical, cationic, anionic polymerization - Polycondensation.
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 / TRB / NET/ UGC-CSIR / GATE /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. BenjaminPublishers, 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)

Students will be able:

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

CO2: Understand the knowledge on the experimental determination, modification and extension of Debye-Huckel theory and electrode –electrolyte equilibrium.

CO3: Understand the various theories of electrical double layer, corrosion and cyclic voltammetry.

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

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<table>
<tr><td>Title of the Course</td><td colspan="8">ORGANIC CHEMISTRY PRACTICAL-II</td></tr>
<tr><td>Paper No.</td><td colspan="8">Elective – EC3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">T2PCHECC</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td><td colspan="2"></td></tr>
<tr><td>-</td><td>1</td><td colspan="3">3</td><td>4</td><td colspan="2"></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 construct suitable experimental setup for the organic preparations involving two stages.
• To experiment different purification and drying techniques for the compound processing.</td></tr>
<tr><td rowspan="2"></td><td colspan="8">UNIT-I: Estimations:

a) Estimation of Phenol (bromination)
b) Estimation of Aniline (bromination)
c) Estimation of Ethyl methyl ketone (iodimetry)
d) Estimation of Glucose (redox)
e) Estimation of Ascorbic acid (iodimetry)
f) Estimation of Aromatic nitro groups (reduction)
g) Estimation of Glycine (acidimetry)
h) Estimation of Formalin (iodimetry)
i) Estimation of Acetyl group in ester (alkalimetry)
j) Estimation of Hydroxyl group (acetylation)
k) Estimation of Amino group (acetylation)</td></tr>
<tr><td colspan="8">UNIT-II: Two stage preparations:
a) p-Bromoacetanilide from aniline
b) p-Nitroaniline from acetanilide
c) 1,3,5-Tribromobenzene from aniline
d) Acetyl salicyclic acid from methyl salicylate
e) Benzilic acid from benzoin
f) m-Nitroaniline from nitrobenzene
g) m-Nitrobenzoic acid from methyl benzoate</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 / TRB / NET/ UGC-CSIR / GATE /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. 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.</td></tr>
</table>

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.
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)

Students will be able:

CO1: To understand the crystal structure of inorganic solids.
CO2: To learn metaloorganic framework in organometalic system.
CO3: To learn various experimental method for studying solid state molecule.
CO4: To develop strategies to separate, analyze and prepare organic compounds.
CO5: To formulate a method of separation, analysis of organic mixtures and design suitable procedure for organic preparations.

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

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<table>
<tr><td>Title of the Course</td><td colspan="7">BIO-INORGANIC CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – EC4</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td>T2PCHECD</td></tr>
<tr><td>Semester</td><td>II</td><td>Total</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="2">-</td><td colspan="3">4</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 / TRB / NET/ UGC-CSIR / GATE /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. Williams,D.R. –Introdution to Bioinorganic chemistry. 2. F.M. Fiabre and D.R. Williams– The Principles of Bioinorganic Chemistry,RoyolSoceity of Chemistry, Monograph for Teachers-31 3. K.F. Purcell and Kotz., Inorganic chemistry, WB Saunders Co., USA. 4. G.N. Mugherjea and Arabinda Das, Elements of Bioinorganic Chemistry - 1993. 5. 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)

Students will be able:

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

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Title of the Course	**COSMETIC CHEMISTRY**						
Paper No.	**Skill Enhancement Course – SEC1**						
Category	**SEC - I**	**Year**	**I**	**Credits**	**2**	**Course Code**	**T2PCHS1**
		Semester	**II**				
	Lecture	**Lab Practice**	**Total**				
Instructional hours per week	4	-	4				
Prerequisites	Basics of Chemistry						
Objectives of the course	• To learn cosmeceuticals • To understand fragrances. • To know about lotions, makeup types and cosmetic chemicals.						
Course outline	**Unit I** **Cosmeceuticals:** Anti-ageing creams-ingredients, anti-wrinkle creams. Sunscreen-active ingredients adverse effects. Antiperspirants-deodorants.						
	Unit II **Fragrances:** Soap and hair fragrances. Perfumes, colognes, men perfumes, women beauty perfumes. Fabrics and fragrances.						
	Unit III **Lotions:** Face creams, hand creams and body lotions.						
	Unit IV **Makeup Types:** Lipstick, lipgloss, lipliner, face concealor, Rouge, bindi. Thanka creams, eyeliner, eye shadow.						
	Unit V **Common cosmetic chemicals:** Emulsifiers, ingredients, preservatives, thickeners, fragrance, pH stabilizers, colour.						
Extended Professional Component (is apart of internalcomponent only, Not to be includedin the externalexamination 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	1.Peter Elsner, Howard I. Maibiach and Marcel Dekker (ed),						

Text	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".
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

Question paper Pattern: Max mark - 75

PART: 'A' — (5×15=75) Answer any (5) Five Questions out of Eight Questions.

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<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 – CC7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">T3PCHC7</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>5</td><td>1</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>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, Linear Vs convergent synthesis. synthesis based on umpolung concepts of Seeback, regiospecific control elements. Use of protective groups, activating groups and bridging elements. Examples on retrosynthetic approach, calculation of yield, advantages of connvergent synthesis.</td></tr>
<tr><td></td><td colspan="8">UNIT-II: Organic Synthetic Methodology:
Retrosynthetic analysis; Alternate synthetic routes. Synthesis of organic mono and bifunctional compounds via disconnection approach. Key intermediates, available starting materials and resulting yields of alternative methods. Convergent and divergent synthesis. Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups. Illustration of protection and deprotection in synthesis. Control elements: Regiospecific control elements. Stereospecific control elements. Functional group alterations and transposition.</td></tr>
<tr><td></td><td colspan="8">UNIT-III: Pericyclic Reactions:
Woodward Hoffmann rules: The Mobius and Huckel concept, FMO, PMO 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), (3,3) and (5,5)-carbon</td></tr>
</table>

	migrations, degenerate rearrangements. Group transfer reactions. Regioselectivity, stereoselectivity and periselectivity in pericyclic reactions.
	UNIT-IV: Organic Photochemistry-I: 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 reductions; Paterno-Buchi reactions.
	UNIT-V: Organic Photochemistry-I: 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 / TRB / NET/ UGC-CSIR / GATE /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 4thedn, 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	**1. https://rushim.ru/books/praktikum/Monson.pdf**

Course Learning Outcomes (for Mapping with POs and PSOs)

Students will be able:

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

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<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 – CC8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td>Course Code</td><td>T3PCHC8</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td>5</td><td>1</td><td colspan="3">-</td><td>6</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="4">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 ions - characteristics of d-d transitions - charge transfer spectra - selection rules for electronic spectra - Orgel correlation diagrams - Sugano-Tanabe 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>
<tr><td colspan="7">UNIT-IV: Kinetics and mechanisms of substitution reactions of octahedral and square planar complexes: Inert and Labile</td></tr>
</table>

	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 / TRB / NET/ UGC-CSIR / GATE /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)
Students will be able:
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

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THANJAVUR - 613 005

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core – CC9</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">T3PCHC9</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>1</td><td colspan="3">-</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of physical chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• 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, hybridization using he concepts of group theory.</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="7">UNIT-I: 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="7">UNIT-II: 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. Hartrefock self-consistent field method, Hohenberg-Kohn theorem and Kohn-Sham equation, Helium atom-electron spin, paulis exclusion principle and Slater determination.</td></tr>
<tr><td colspan="7">UNIT-III: 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}, C_{2h}, C_{3v} and D_{2h} point groups</td></tr>
<tr><td colspan="7">UNIT-IV: 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</td></tr>
</table>

	function and LCAO methods. Electronic conjugated system:Huckel method to Ethylene butadiene, cyclopropenyl, cyclo butadiene and Benzene. Applications of group theory to molecular vibrations, electronic spectra of ethylene.
	UNIT-V: Surface Phenomena: Adsorption and free energy reaction relation at inter-phase – physisorption and chemisorptions – potential energy diagram – Lannard- Jones plot – BET isotherm – surface area determination – adsorption from solution – Gibbs adsorption isotherm- solid liquid inter face- wetting and contact angle- solid gas interfaces- soluble and insoluble films. Electrical phenomenon at interfaces including Electro kinetic – micelles and reverse micelles – solublisation – micro-emulsion or micelliar emulsions.
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 / TRB / NET/ UGC-CSIR / GATE /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.A.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

Course Learning Outcomes (for Mapping with POs and PSOs)

Students will be able:

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

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<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY PRACTICAL</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core – CC10</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">T3PCHC10</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>1</td><td colspan="2">5</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of physical chemistry Practical.</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To understand the principle of conductivity experiments through conductometric titrations.
• To evaluate the order of the reaction, temperature coefficient, and activation energy of the reaction by following pseudo first order kinetics.
• To construct the phase diagram of two component system forming congruent melting solid and find its eutectic temperatures and compositions.
• To determine the kinetics of adsorption of oxalic acid on charcoal.
• To develop the potential energy diagram of hydrogen ion, charge density distribution and Maxwell's speed distribution by computational calculation.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I: Conductivity Experiments
1. Determination of equivalent conductance of a strong electrolyte & the verification of DHO equation.
2. Verification of Ostwald's Dilution Law & Determination of pKa of a weak acid.
3. Verification of Kohlrausch's Law for weak electrolytes.
4. Determination of solubility of a sparingly soluble salt.
5. Acid-base titration (strong acid and weak acid vs NaOH).
6. Precipitation titrations (mixture of halides only).</td></tr>
<tr><td colspan="7">UNIT-II: Kinetics
1. Study the kinetics of acid hydrolysis of an ester, determine the temperature coefficient and also the activation energy of the reaction.
2. Study the kinetics of the reaction between acetone and iodine in acidic medium by half-life method and determine the order with respect to iodine and acetone.</td></tr>
<tr><td colspan="7">UNIT-III: Phase diagram
Construction of phase diagram for a simple binary system
1. Naphthalene-phenanthrene
2. Benzophenone- diphenyl amine
Adsorption
Adsorption of oxalic acid on charcoal & determination of surface area (Freundlich isotherm only).</td></tr>
<tr><td>Extended Professional</td><td colspan="7">Questions related to the above topics, from various competitive</td></tr>
</table>

Component (is a part of internal component only, Not to be included in the external examination question paper)	examinations UPSC / TRB / NET/ UGC-CSIR / GATE /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. Viswanathan and P.S.Raghavan, Practical Physical Chemistry, Viva Books, New Delhi, 2009. 2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996. 3. V.D. Athawale and Parul Mathur, Experimental Physical Chemistry, New Age International (P) Ltd., New Delhi, 2008. 4. E.G. Lewers, Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics, 2nd Ed., Springer, New York, 2011.
Reference Books	1. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001. 2. G.W. Garland, J.W. Nibler, D.P. Shoemaker, Experiments in Physical Chemistry, 8th edition, McGraw Hill, 2009. 3. J. N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987. 4. Shailendra K Sinha, Physical Chemistry: A laboratory Manual, Narosa Publishing House Pvt, Ltd., New Delhi, 2014. 5. F. Jensen, Introduction to Computational Chemistry, 3rd Ed., Wiley-Blackwell.
Website and e-learning source	https://web.iitd.ac.in/~nkurur/2015-16/Isem/cmp511/lab_handout_new.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)

Students will be able:

CO1: To recall the principles associated with various physical chemistry experiments.

CO2: To scientifically plan and perform all the experiments.

CO3: To observe and record systematically the readings in all the experiments.

CO4: To calculate and process the experimentally measured values and compare with graphical data.

CO5: To interpret the experimental data scientifically to improve 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

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<table>
<tr><td>Title of the Course</td><td colspan="7">MOLECULAR SPECTROSCOPY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective - EC 5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE-III</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">T3PCHECE</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td></td><td>Lecture</td><td>Lab Practice</td><td colspan="3">Total</td><td></td></tr>
<tr><td>Instructional hours per week</td><td>3</td><td>-</td><td colspan="5">3</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 UV-absorption spectra and Interpret IRspectra on basic values of IR-frequencies.
• To interpret the first and second order NMR spectra in terms of splitting and coupling patterns using correlation techniques such as COSY, HETCOR, and NOESY.
• To study the principle of ESR spectroscopy.
• To study the technique and fragmentation of Mass spectroscopy.
• To studyPrinciple of Mossbauer spectroscopy.</td></tr>
<tr><td>Course outline</td><td colspan="7">UNIT-I: Ultraviolet and visible Spectroscopy
Applications of UV- visible spectroscopy- Woodward Fischer Scott rules- applications to conjucated dienes, trienes and polyenes- unsaturated carbonyl compounds- conjugated cyclic ketones- actophenones – benzene and its substituted derivatives- other aromatic hydrocarbons- hetecyclic systems- differentiation of position isomers- stereo-chemical factors affecting electronic spectra of biphenyl and binaphthyls- cis trans isomers- angular distortion- cross conjugation.
Infrared Spectroscopy
Organic structure determination, finger print region - identification of functional groups- hydrogen bonding, intermolecular and intra molecular- conformational aspects in cyclic 1,2 diols and 1,3 diols- transannular interactions in UV and IR – determination of reaction rates and mechanisms of reactions involving IR and UV spectroscopy- (basic aspects).</td></tr>
<tr><td></td><td colspan="7">UNIT-II: NMR 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.</td></tr>
</table>

	UNIT-III: 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 and Kramer's degeneracy.
	UNIT-IV: Mass Spectrometry :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
	UNIT-V: Mossbauer Spectroscopy:. 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. I. N. Levine, *Molecular Spectroscopy*, John Wiley & Sons, New York, 1974. 3. A. Rahman, *Nuclear Magnetic Resonance-Basic Principles*, Springer-Verlag, New York,1986. 4. K. Nakamoto, *Infrared and Raman Spectra of Inorganic and*

	coordination Compounds, PartB: 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 factors affecting UV-absorption spectra, Interpret IR spectra On basic values of IR-frequencies.

CO2: To outline the NMR, ^{13}C NMR, 2D NMR – COSY, NOESY

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

CO4: To develop the knowledge on principle and structural elucidation of simple molecules using Mass Spectrometry.

CO5: To develop the knowledge on principle and structural elucidation of simple molecules using 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

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Title of the Course	CHEMISTRY IN EVERYDAY LIFE						
Paper No.	Skill Enhancement Course - SEC2						
Category	SEC	Year / Semester	II / III	Credits	2	Course Code	T3PCHS2
	Lecture	Lab Practice	Total				
Instructional hours per week	3	-	3				
Prerequisites	Basic concepts of Chemistry						
Objectives of the course	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.						
Course outline	**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.						
	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.						
	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, p-aminophenol derivatives-paracetamol, phenacetin (medicinal uses and structures only).						
	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.						
	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.						
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

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RAJAH SERFOJI GOVT. COLLEGE
THANJAVUR - 613 005

<table>
<tr><td>Title of the Course</td><td colspan="7">COORDINATION CHEMISTRY – II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core – CC11</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">T4PCHC11</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>1</td><td colspan="3">-</td><td colspan="2">6</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 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="4">Course Outline</td><td colspan="7">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 (example: 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 or Wade's rule.</td></tr>
<tr><td colspan="7">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), cyclo-oligomerisation of acetylenes using Reppe's catalysts.</td></tr>
<tr><td colspan="7">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 1H, 15N, 19F, 31P-NMR spectroscopy in structural identification of inorganic complexes, fluxional molecules, quadrupolar nuclei- effect in NMR spectroscopy.</td></tr>
<tr><td colspan="7">UNIT-IV: Inorganic spectroscopy-II: Introductory terminologies: g</td></tr>
</table>

	and A parameters-definition, explanation and factors affecting g and A; Applications of ESR to coordination compounds with one and more than one 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 and bis(salicylaldimine)copper(II).
	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.
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 / TRB / NET/ UGC-CSIR / GATE /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 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, Physical 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)

Students will be able:

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

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<table>
<tr><td>Title of the Course</td><td colspan="7">ANALYTICAL INSTRUMENTATION TECHNIQUE PRACTICAL</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core – CC12</td></tr>
<tr><td>Category</td><td>Core</td><td>Year
Semester</td><td>II
IV</td><td>Credits</td><td>5</td><td>Course Code</td><td>T4PCHC12</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>-</td><td>1</td><td colspan="3">5</td><td>6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of physical chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To understand the principle of conductivity experiments through conductometric titrations.
• To evaluate the order of the reaction, temperature coefficient, and activation energy of the reaction by following pseudo first order kinetics.
• To construct the phase diagram of two component system forming congruent melting solid and find its eutectic temperatures and compositions.
• To determine the kinetics of adsorption of oxalic acid on charcoal.
• To develop the potential energy diagram of hydrogen ion, charge density distribution and Maxwell's speed distribution by computational calculation.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I:
1. Determination of the equivalent conductance of a weak acid at different concentrations and verifying Ostwald dilution law. Calculation of the dissociation constant of the acid.
2. Determination of the equivalent conductance of a strong electrolyte at different concentrations and examining the validity of the Onsager's theory as limiting law at high dilutions.
3. Conductometric titration of a mixture of HCl and CH_3COOH Vs NaOH.
4. Conductometric titration of NH_4Cl Vs NaOH.
5. Conductometric titration of CH_3COONa Vs HCl.
6. Potentiometric titration of a mixture of HCl and CH_3COOH Vs NaOH
7. Determination of pK_a of weak acid by EMF method.
8. Potentiometric titration of FAS Vs $K_2Cr_2O_7$
9. Potentiometric titration of KI Vs $KMnO_4$.
10. Potentiometric titration of a mixture of Chloride and Iodide Vs $AgNO_3$.
11. Determination of the pH of buffer solution by EMF method using Quinhydrone and Calomel electrode.
12. Study of the inversion of cane sugar in the presence of acid by Polarimetric method.</td></tr>
<tr><td></td><td colspan="7">UNIT-II:
1. Estimation of Na and K by flame photometric method.
2. Determination of spectrophotometrically the mole ratio of the ferrithiocyanate complex and equilibrium constant for the</td></tr>
</table>

	complex formation. 3. Estimation of the amount of sulphate present in the given solution using Nephelometric turbidimeter. 4. Estimation of the amount of nitrate present in the given solution using spectrophotometric method. 5. Heavy metal analysis in textiles and textile dyes by AAS 6. Determination of caffeine in soft drinks by HPLC 7. Analysis of water quality through COD, DO, BOD measurements. 8. Assay of Riboflavin and Iron in tablet formulations by spectrophotometry 9. Estimation of chromium in steel sample by spectrophotometry 10. Separation of (a) mixture of Azo dyes by TLC (b) mixture of metal ions by Paper chromatography 11. Estimation of chlorophyll in leaves and phosphate in waste water by colorimetry.
	UNIT-III: Interpretation and identification of the given spectra of various organic compounds arrived at from the following instruments 1.UV-Visible 2.IR 3.Raman 4.NMR 5.ESR 6.Mass etc.,
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 / TRB / NET/ UGC-CSIR / GATE /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. Viswanathan and P.S.Raghavan, Practical Physical Chemistry, Viva Books, New Delhi, 2009. 2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996. 3.V.D. Athawale and Parul Mathur, Experimental Physical Chemistry, New Age International (P) Ltd., New Delhi, 2008. 4. E.G. Lewers, Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics, 2nd Ed., Springer, New York, 2011.
Reference Books	1. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001. 2. G.W. Garland, J.W. Nibler, D.P. Shoemaker, Experiments in Physical Chemistry, 8th edition, McGraw Hill, 2009. 3. J. N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987. 4. Shailendra K Sinha, Physical Chemistry: A laboratory Manual,

	Narosa Publishing House Pvt, Ltd., New Delhi, 2014. 5. F. Jensen, Introduction to Computational Chemistry, 3rd Ed., Wiley-Blackwell.
Website and e-learning source	https://web.iitd.ac.in/~nkurur/2015-16/Isem/cmp511/lab_handout_new.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)

Students will be able:

CO1: To recall the principles associated with various physical chemistry experiments.

CO2: To scientifically plan and perform all the experiments.

CO3: To observe and record systematically the readings in all the experiments.

CO4: To calculate and process the experimentally measured values and compare with graphical data.

CO5: To interpret the experimental data scientifically to improve 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

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TITLE OF THE COURSE	Project work						
Paper No.	Core – CC13						
Category	Core	Year / Semester	II / IV	Credits	7	Course Code	14PCHC13
	Lecture	Lab Practice	Total				
Instructional hours per week	2	8	10				
Prerequisites	Knowledge on research						
Objectives of the course	• To gain the depth knowledge in laboratory Field • To understand the basic principles of research • To study the methodology of the research work • To apply the various spectra for compound interpretation • To know the knowledge of presenting project work						

Course Outcomes (CO)

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

Course Learning Outcomes (for Mapping with POs and PSOs)

Students will be able:

CO1: Gain of background knowledge in specific area of chemical sciences
CO2: Learn the steps involved in solving a problem
CO3: Understand the formatting of table work
CO4: Enter in the first step of research aptitude
CO5: Visualize the steps of project work presentation

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

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TITLE OF THE COURSE	NANO AND COMPUTATIONAL CHEMISTRY						
Paper No.	Elective – EC6						
Category	EC	Year	II	Credits	3	Course Code	T4PCHECF
		Semester	IV				
	Lecture	Lab Practice	Total				
Instructional hours per week	4	-	4				
Prerequisites	Basic knowledge of Nano and Computational Chemistry						
Objectives of the course	• To learn the fundamental concepts of nano science and technology • To know the various classes of nanomaterials. • To learn the Carbon Clusters and Nanostructures • To gain the depth knowledge in computer with chemistry. • To know the system software and computer networks.						
Course outline	**Unit I :** What is nano –Why nano –Nanomaterials characteristic differences over bulk materials –Synthesis of nanomaterials, Bottom – up vs. top – down approaches – RF Plasma, Chemical methods, Thermolysis, Pulse laser methods- Micro Electro Mechanical Systems[MEMS] & Nano Electro Mechanical System (NEMS). **Unit II :** Different classes of nanomaterials- Metal and Semicondutor Nanomaterials. Quantum Dots, Wells and Wires, Characterization – Crystallography(XRD),Transmission Electron Microscopy(TEM), Scanning Microscopy (SEM,STM&AFM). **Unit III: Carbon Clusters and Nanostructures:** Nature of carbon bond – new carbon structures – carbon clusters – discovery of C60–alkali doped C60–superconductivity in C60–larger and smaller fullerenes.Carbon nanotubes – synthesis – single walled carbon nanotubes – structure and characterization – mechanism of formation – chemically modified carbon nanotubes –doping – functionalizing nanotubes – applications of carbon nanotubes. Nanowires –synthetic strategies – gas phase and solution phase growth – growth Control – properties. **Unit IV: Computational Chemistry:** What you can do with computational chemistry, The tools of computational chemistry,Putting it all together, The philosophy of computational chemistry. The concept of the Potential Energy Surface-Perspective, Stationry Points, The Born-Oppenheimer approximation, Geometry optimization, Stationary points and normal- mode vibrations: ZPE, Symmetry. **Unit V : Introduction to computers and computing**:basic organization of a computer-CPU- main memory-secondary storage-I /Odevices- software- system and application software-high and low level languages- computers- algorithms and flowcharts. **Introduction to networking**: computer networks-network components-hubs, switches, repeaters, routers, bridges-routers and gateways- network topologies- star, bus and ring-LAN, WAN,Intranet and Internet- worldwideweb-internet for chemists-online search of chemistry data bases- search engines for chemistry-chemweb-e-journals.						

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: Understand the various synthetic procedures of nanomaterials.
CO2: Understand the classification and characterization of nanomaterials.
CO3: Understand the tools and philosophy of nanomaterials.
CO4: Understand the basic organization of computer, network topologies, and internet sources.
CO5: Understand computer network and basic organization of a computer.

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

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<table>
<tr><td>Title of the Course</td><td colspan="7">INDUSTRIAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Professional Competitive Skill - PCS</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">PCS</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">T4PCHS3</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td></td><td>Lecture</td><td>Lab Practice</td><td colspan="3">Total</td><td></td></tr>
<tr><td>Instructional hours per week</td><td>4</td><td>-</td><td colspan="5">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of Industrial chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• 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>Course outline</td><td colspan="7">Unit I : Basic ideas about chemical industries: Flow charts- chemical conversion – Batch versus continuous processing – chemical process economics – market survey – plant location – Research and development and its role in chemical industries.
Water Treatment: pollution of water by fertilizer, detergent and pesticide industries – BOD, COD – Scales and Sludge formation-Alkalinity of water Hardness of water-Types of hardness-Removal of hardness of water – ion exchange, reverse osmosis, Lime soda process. Treatment of water for domestic use-Municipal water Treatment</td></tr>
<tr><td></td><td colspan="7">Unit II : Cement: Manufacture - Hot process and dry process – major constituents – setting of cement –Types of cement-Grading of cement-reinforced concrete – cement industries in India.
Glass: types – composition – manufacture of optical glass, colored glass and neutron absorbing glass
Fertilizers: Fertiliser industries in India – manufacture of ammonia – ammonia salt, urea, super phosphate, triple super phosphate, NPK and potassium salts.</td></tr>
<tr><td></td><td colspan="7">Unit III : Sugar: Manufacture, recovery of sugar from molasses, Cultivation of sugar -sugar industries in India.
Cleansing agents: Preparation of toilet and washing soaps- synthetic detergents – alkyl, aryl sulphonates, builders, Disinfectants and Antiseptics Types of cleansing agents. Criteria of selection
Paints: Primary constituents of paints – dispersion medium (solvent) – binders' pigments- oil based paints – latex paints – requirements of a good paint Types of paints. Difference between paints and varnishes</td></tr>
</table>

	Unit IV Rubber industries: Natural rubber – synthetic rubber – – Types of polymerization –Mechanism of polymerization-Preparation properties and uses of Buna-S-Rubber, styrene – neoprene – polyurethane rubber .Vulcanization of rubber **Plastics:** Manufacture – resin – Types of plastics-oligomers,High polymers Thermo plastics and Thermosetting plastics-preparation, properties and uses of nylon 6 ,nylon 66, polyester and terelene. .
	Unit V: Coal: Fossil fuels-Origin and imporatance of coal – types – composition –Classification of coal by grade Analysis of coal. Proximate and ultimate- coal gasification – carbonization – coal tar based chemicals - coal mines in India. **Petroleum:** Origin – refining Fractional distillation – cracking – knocking – octane and cetane numbers – LPG – synthetic gas and synthetic petrol. **Fuel gases:** Large scale production, storage, hazards and uses of coal gas, water gas, producer gas and oil gas.
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

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