

**J.J. College of Arts and Science (Autonomous)**  
**Department of Chemistry**

**Proposed Course Structure based on TANSCHÉ and UGC - LOCF**  
**(Choice Based Credit System)**  
**(Applicable for the Candidates admitted from academic year 2023-2024 Onwards)**

**M.Sc. Chemistry**

Sl.No.	Course Code	Course	Overall Credits	Total Contact Hours/Week	Marks		
					CIA	ESE	Total
<b>Semester I</b>							
1	P1R3CHCC1	Organic Reaction Mechanism-I	5	7	25	75	100
2	P1R3CHCC2	Structure and Bonding in Inorganic Compounds	5	7	25	75	100
3	P1R3CHCC3P	Organic Chemistry Practical	4	6	40	60	100
4	P1R3CHDSE 1:1 / 1:2	Pharmaceutical Chemistry/ Nanomaterials and Nanotechnology	3	5	25	75	100
5	P1R3CHDSE 2:1 / 2:2	Electrochemistry/ Molecular Spectroscopy	3	5	25	75	100
<b>Total</b>			<b>20</b>	<b>30</b>			<b>500</b>

Sl.No.	Course Code	Course	Overall Credits	Total Contact Hours/Week	Marks		
					CIA	ESE	Total
<b>Semester II</b>							
1	P2R3CHCC4	Organic Reaction Mechanism-II	5	6	25	75	100
2	P2R3CHCC5	Physical Chemistry-I	5	6	25	75	100
3	P2R3CHCC6P	Inorganic Chemistry Practical	4	6	40	60	100
4	P2R3CHDSE 3:1 / 3:2	Medicinal Chemistry / Green Chemistry	3	4	25	75	100
5	P2R3CHDSE 4:1 / 4:2	Bioinorganic Chemistry/ Material Science	3	4	25	75	100
6	P2R3CHSEC 1:1 / 1:2	Preparation of Consumer Products / Chemistry in Everyday life	2	4	25	75	100
<b>Total</b>			<b>22</b>	<b>30</b>			<b>600</b>

Title of the Course	<b>ORGANIC REACTION MECHANISM - I</b>	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core Course	Hrs/Week :07
Course Code	<b>PIR3CHCC1</b>	Total Inst. Hrs :105
Nature of the Course :	<b>Skill Development</b>	Sem: I Credit: 05

**Objectives of the course :**

- 1 To understand the feasibility and the mechanism of various organic reactions.
- 2 To comprehend the techniques in the determination of reaction mechanisms.
- 3 To understand the concept of stereochemistry involved in organic compounds.
- 4 To correlate and appreciate the differences involved in the various types of organic reaction mechanisms.
- 5 To design feasible synthetic routes for the preparation of organic compounds.

**UNIT-I: Methods of Determination of Reaction Mechanism: (21 Hours)**

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 stereochemical 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: (21 Hours)**

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: S<sub>E</sub>2 and S<sub>E</sub>i, S<sub>E</sub>1-Mechanism and evidences.

**UNIT-III: Aromatic and Aliphatic Nucleophilic Substitution: (21 Hours)**

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: (21 Hours)**

Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. Optical isomerism due to asymmetric and dissymmetric molecules with C, N, S based chiral centers. Optical purity, prochirality, enantiotopic and diastereotopic atoms, groups, faces, axial and planar chirality, chirality due to helical shape, methods of determining the configuration. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization, mutarotation. D, L system, Cram's and Prelog's rules: R, S-notations, proR, proS, side phase and re phase Cahn-Ingold- Prelog rules, absolute and relative configurations. Configurations of allenes, spiranes, biphenyls, cyclooctene, helicene, binaphthyls, ansa and cyclophanic compounds, 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.

**UNIT-V: Stereochemistry-II: (21 Hours)**

Conformation and reactivity of 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. Optical rotation and optical rotatory dispersion, conformational asymmetry, ORD curves, octant rule, configuration and conformation, Cotton effect, axial haloketone rule and determination of configuration.

## Recommended Text

1. J. March and M. Smith, Advanced Organic Chemistry, 5<sup>th</sup> 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, 8<sup>th</sup> edition, New Age International Publishers, 2015.
4. P. Y. Bruice, Organic Chemistry, 7<sup>th</sup> edn, Prentice Hall, 2013.
5. J. Clayden, N. Greeves, S. Warren, Organic Compounds, 2<sup>nd</sup> edition, Oxford University Press, 2014.

## Reference Books

1. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry Part-A and B, 5<sup>th</sup> 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-McGrawHill, 2000.
5. I. L. Finar, Organic chemistry, Vol-1 & 2, 6<sup>th</sup> edition, Pearson Education Asia, 2004.

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

Students will be able

- **CO1:** To recall the basic principles of organic chemistry.
- **CO2:** To understand the formation and detection of reaction intermediates of organic reactions.
- **CO3:** To predict the reaction mechanism of organic reactions and stereochemistry of organic compounds.
- **CO4:** To apply the principles of kinetic and non-kinetic methods to determine the mechanism of reactions.
- **CO5:** To design and synthesize new organic compounds by correlating the stereochemistry of organic compounds.

**CO-PO Mapping (Course Articulation Matrix)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO 1</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>
<b>CO 2</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
<b>CO 3</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>
<b>CO 4</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
<b>CO 5</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>

**Strong - 3**

**Medium-2**

**Low-1**

**Level of Correlation between PSO's and CO's**

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

**3 – Strong, 2 – Medium, 1 – Low**

<b>Title of the Course</b>	<b>STRUCTURE AND BONDING IN INORGANIC COMPOUNDS</b>	<b>Marks: CIA:25 + Ext:75=100</b>
<b>Category of the Course:</b>	<b>Core Course</b>	<b>Hrs/Week :07</b>
<b>Course Code</b>	<b>P1R3CHCC2</b>	<b>Total Inst. Hrs : 105</b>
<b>Nature of the Course :</b>	<b>Skill Development</b>	<b>Sem: I Credit: 05</b>

### Objectives of the course

1. To determine the structural properties of main group compounds and clusters.
2. To gain fundamental knowledge on the structural aspects of ionic crystals.
3. To familiarize various diffraction and microscopic techniques.
4. To study the effect of point defects and line defects in ionic crystals. To evaluate the structural aspects of solids.
5. To evaluate the structural aspects of solids.

### UNIT-I: Structure of main group compounds and clusters: (20 Hours)

VB theory – Effect of lone pair and electronegativity of atoms (Bent's rule) on the geometry of the molecules; Structure of silicates - applications of Pauling's 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.

### UNIT-II: Solid state chemistry – I: (22 Hours)

Ionic crystals: Packing of ions in simple, hexagonal and cubic close packing, voids in crystal lattice, Radius ratio, Crystal systems and Bravais lattices, Symmetry operations in crystals, glide planes and screw axis; point group and space group;

Solid state energetics: Lattice energy – Born-Landé equation - Kapustinski equation, Madelung constant

**UNIT-III: Solid state chemistry – II: (21 Hours)**

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.

**UNIT-IV: Techniques in solid state chemistry: (21 Hours)**

X-ray diffraction technique: Bragg's law, Powder diffraction method – Principle and Instrumentation; Interpretation of XRD data – JCPDS files, Phase purity, Scherrer formula, lattice constants calculation; Systematic absence of reflections; Electron diffraction technique – principle, instrumentation and application. Electron microscopy – difference between optical and electron microscopy, theory, principle, instrumentation, sampling methods and applications of SEM and TEM.

**UNIT-V: Band theory and defects in solids (21 Hours)**

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.

**Recommended Text**

1. A R West, Solid state Chemistry and its applications, 2nd Edition (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, 4<sup>th</sup> 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; 4<sup>th</sup> ed.; Harper and Row: New York, 1983.

**Reference Books**

1. D. E. Douglas, D.H. McDaniel and J. J. Alexander, Concepts and Models in Inorganic Chemistry, 3<sup>rd</sup> Ed, 1994.

2. R J D Tilley, Understanding Solids - The Science of Materials, 2<sup>nd</sup> edition, Wiley Publication, 2013.
3. C N R Rao and J Gopalakrishnan, New Directions in Solid State Chemistry, 2<sup>nd</sup> Edition, Cambridge University Press, 199.
4. T. Moeller, Inorganic Chemistry, A Modern Introduction; JohnWiley: New York, 1982.
5. D. F. Shriver, P. W. Atkins and C.H. Langford; InorganicChemistry; 3rd ed.; Oxford University Press: London, 2001.

### 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**

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

**3 – Strong, 2 – Medium, 1 - Low**

<b>Title of the Course</b>	<b>ORGANIC CHEMISTRY PRACTICAL</b>	<b>Marks: CIA:25 + Ext:75=100</b>
<b>Category of the Course:</b>	<b>Core Course</b>	<b>Hrs/Week :06</b>
<b>Course Code</b>	<b>P1R3CHCC3P</b>	<b>Total Inst. Hrs : 90</b>
<b>Nature of the Course</b>	<b>Skill Development</b>	<b>Sem: I Credit: 04</b>

### Objectives of the course

To understand the concept of

1. the separation, qualitative analysis of organic compounds
2. preparation of organic compounds.
3. 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.
4. To construct suitable experimental setup for the organic preparations involving two stages.
5. To experiment different purification and drying techniques for the compound processing.

**UNIT-I: Separation and analysis:** Two component mixtures.

Three component mixtures.

**UNIT-II: Estimations:**

**(50 Hours)**

- 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)

**UNIT-III: Two stage preparations:****(40 Hours)**

- a) *p*-Bromoacetanilide from aniline
- b) *p*-Nitroaniline from acetanilide
- c) 1,3,5-Tribromobenzene from aniline
- d) Acetyl salicylic acid from methyl salicylate
- e) Benzilic acid from benzoin
- f) *m*-Nitroaniline from nitrobenzene
- g) *m*-Nitrobenzoic acid from methyl benzoate

**Recommended Text**

1. A R West, Solid state Chemistry and its applications, 2nd Edition (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, 4<sup>th</sup> Edition, CRC Press, 2012.

**Reference Books**

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2. R J D Tilley, Understanding Solids - The Science of Materials, 2<sup>nd</sup> edition, Wiley Publication, 2013.
3. C N R Rao and J Gopalakrishnan, New Directions in Solid State Chemistry, 2<sup>nd</sup> Edition, Cambridge University Press, 199.

**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)**

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

3 – Strong, 2 – Medium, 1 - Low

**Level of Correlation between PSO's and CO's**

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

3 – Strong, 2 – Medium, 1 - Low

Title of the Course :	<b>PHARMACEUTICAL CHEMISTRY</b>	Marks: CIA:25 + Ext:75=100
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<b>Category of the Course:</b>	<b>Core Course</b>	<b>Hrs/Week :05</b>
<b>Course Code :</b>	<b>P1R3CHDSE1;1</b>	<b>Total Inst. Hrs 75</b>
<b>Nature of the Course :</b>	<b>Skill Development</b>	<b>Sem: I Credit: 03</b>

### Objectives of the course

1. To understand the advanced concepts of pharmaceutical chemistry.
2. To recall the principle and biological functions of various drugs.
3. To train the students to know the importance as well the consequences of various drugs.
4. To have knowledge on the various analysis and techniques.
5. To familiarize on the drug dosage and its structural activities.

#### **UNIT-I: Physical properties in Pharmaceuticals: (15 Hours)**

Physical properties of drug molecule: physical properties. Refractive index- Definition and importance, specific & molar refraction. Optical activity\rotation- monochromatic & polychromatic light, optical activity, angle of rotation, specific rotation examples, measurement of optical activity. Dielectric constant & Induced Polarization- Dielectric constant explanation & determination. Rheology of pharmaceutical systems: Introduction, Definition, Applications,

#### **UNIT-II: Isotopic Dilution analysis: (15 Hours)**

principle and applications, Neutron activation analysis: Principle, advantages and limitations, Scintillation counters: Body scanning. Introduction to radiopharmaceuticals. Properties of various types of radiopharmaceuticals, Radiopharmaceuticals as diagnostics, as therapeutics, for research and sterilization. Physico Chemical Properties and drug action. (a) Partition coefficient, (b) solubility (c) surface activity, (d) degree of ionization.

#### **UNIT-III: Drug dosage and product development: (15 Hours)**

Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms. Drug dosage and product development. Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies,

**UNIT-IV: Development of new drugs: (15 Hours)**

Introduction, procedure followed in drug design, Structure-Activity Relationship (SAR): Factors effecting bioactivity; theories of drug activity, occupancy theory, rate theory, induced-fit theory, Quantitative structure activity relationship (QSAR): Development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables

**UNIT-V: Computers in Pharmaceutical Chemistry: (15 Hours)**

Need of computers for chemistry. Computers for Analytical Chemists. Docking-Definition, methods- rigid and flexible methods, prediction of binding modes, protein-ligand binding free energies, docking score and validation, online ADMET properties.

**Recommended Text**

1. Physical Chemistry- Bahl and Tuli.
2. Text Book of Physical Pharmaceutics, IInd edition, Vallabh Prakashan-. C.V.S. Subramanyam.
3. Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.R Chatwal, Himalaya Publishing house.
4. Instrumental method of Analysis: Hubert H, Willard, 7th edition.  
Textbook of Pharmaceutical Chemistry by, Jayshree Ghosh, S. Chand & company Ltd.
5. Pharmaceutical Chemistry by Dr. S. Lakshmi, Sultan chand & Sons

**Reference Books**

1. Computers in chemistry, K.V. Raman, Tata Mc.Graw-Hill, 1993.
2. Computers for Chemists, S.K Pundir, Anshu bansal, A pragate prakashan., 2 nd edition, New age international (P) limited, New Delhi.
3. Physical Pharmacy and Pharmaceutical Sciences by Martins, Patrick J. Sinko, Lippincott. William and Wilkins.
4. Cooper and Gunn's Tutorial Pharmacy ,6th edition by S.J. Carter, CBS Publisher Ltd.
5. Ansel's pharmaceutical Dosage forms and Drug Delivery System by Allen Popvich and Ansel, Indian edition-B.I. Publication Pvt. Ltd.

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

Students will be able:

**CO1:** To identify the suitable drugs for various diseases.

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

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

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

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

**CO-PO Mapping (Course Articulation Matrix)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO 1</b>	S	S	S	S	M	S	S	S	S	M
<b>CO 2</b>	M	S	S	S	S	M	S	S	S	S
<b>CO 3</b>	S	S	M	S	S	S	S	M	S	S
<b>CO 4</b>	M	S	S	S	S	M	S	S	S	S
<b>CO 5</b>	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
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

**3 – Strong, 2 – Medium, 1 - Low**

<b>Title of the Course</b>	<b>NANO MATERIALS AND NANO TECHNOLOGY</b>	<b>Marks: CIA:25 + Ext:75=100</b>
<b>Category of the Course:</b>	<b>Discipline Specific Elective I</b>	<b>Hrs/Week :05</b>

<b>Course Code</b>	<b>P1R3CHDSE1:2</b>	<b>Total Inst. Hrs : 75</b>
<b>Nature of the Course</b>	<b>Skill Development</b>	<b>Sem: I Credit: 03</b>

### Objectives of the course

1. To understand the concept of nano materials and nano technology.
2. To understand the various types of nano materials and their properties. To understand the applications of synthetically important nano materials.
3. To correlate the characteristics of various nano materials synthesized by New technologies.
4. To design synthetic routes for synthetically used new nano materials
5. To know the applications of nano particles in different fields

#### **UNIT-I: (15 Hours)**

Introduction of nanomaterials and nanotechnologies, Introduction-role of size, classification-0D, 1D, 2D, 3D. Synthesis- Bottom-Up, Top-Down, consolidation of Nano powders. Features of nanostructures, Background of nanostructures. Techniques of synthesis of nanomaterials, Tools of the nanoscience. Applications of nanomaterials and technologies.

#### **UNIT-II: (15 Hours)**

Bonding and structure of the nanomaterials, Predicting the Type of Bonding in a Substance crystal structure. Metallic nanoparticles, Surfaces of Materials, Nanoparticle Size and Properties. Synthesis- Physical and chemical methods - inert gas condensation, arc discharge, laser ablation, sol-gel, solvo thermal and hydrothermal-CVD-types, metallo organic, plasma enhanced, and low-pressure CVD. Microwave assisted and electrochemical synthesis.

#### **UNIT-III: (15 Hours)**

Mechanical properties of materials, theories relevant to mechanical properties. Techniques to study mechanical properties of nanomaterials, adhesion and friction, thermal properties of nanomaterials Nanoparticles: gold and silver, metal oxides: silica, iron oxide and alumina - synthesis and properties.

#### **UNIT-IV: (15 Hours)**

Electrical properties, Conductivity and Resistivity, Classification of Materials based on Conductivity, magnetic properties, electronic properties of materials. Classification of magnetic phenomena. Semiconductor materials – classification-Ge, Si, GaAs, SiC, GaN, GaP, CdS, PbS. Identification of materials as p and n – type semiconductor-Hall effect - quantum and anomalous, Hall voltage - interpretation of charge carrier density. Applications of semiconductors: p-n junction as transistors and rectifiers, photovoltaic and photogalvanic cell

**UNIT-V:**

**(15 Hours)**

Nano thin films, nanocomposites. Application of nanoparticles in different fields. Core-shell nanoparticles - types, synthesis, and properties. Nanocomposites - metal-, ceramic- and polymer-matrix composites-applications. Characterization – SEM, TEM and AFM - principle, instrumentation and applications

**Recommended Text**

1. S.Mohan and V. Arjunan, Principles of Materials Science, MJ Publishers, 2016.
2. Arumugam, Materials Science, Anuradha Publications, 2007.
3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010
4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012.
5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6<sup>th</sup> ed., PEARSON Press, 2007

**Reference Books**

1. S.Mohan and V. Arjunan, Principles of Materials Science, MJ Publishers, 2016.
2. Arumugam, Materials Science, Anuradha Publications, 2007.
3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010
4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012.  
James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6<sup>th</sup> ed., PEARSON Press, 2007.

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

Students will be able:

**CO1:** To explain methods of fabricating nanostructures.

**CO2:** To relate the unique properties of nanomaterials to reduce dimensionality of the material.

**CO3:** To describe tools for properties of nanostructures.

**CO4:** To discuss applications of nanomaterials.

**CO5:** To understand the health and safety related to nanomaterial.

**CO-PO Mapping (Course Articulation Matrix)**

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

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

**3 – Strong, 2 – Medium, 1 - Low**

<b>Title of the Course</b>	<b>ELECTRO CHEMISTRY</b>	<b>Marks: CIA:25 + Ext:75=100</b>
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Category of the Course:	Discipline Specific Elective II	Hrs/Week :05
Course Code	PIR3CHDSE2;1	Total Inst. Hrs 75
Nature of the Course	Skill Development	Sem: I Credit: 03

### Objectives of the course

1. To understand the behavior of electrolytes in terms of conductance, ionic atmosphere, interactions.
2. To familiarize the structure of the electrical double layer of different models.
3. To compare electrodes between current density and over potential. To discuss the mechanism of electrochemical reactions.
4. To highlight the different types of over voltages and its applications in electroanalytical techniques.
5. To know about the Polarography, Cyclic voltammetry and Fuel cells

#### UNIT-I: Ionics:

(15 Hours)

Arrhenius theory -limitations, van't Hoff factor and its relation to colligative properties. Deviation from ideal behavior. Ionic activity, mean ionic activity and mean ionic activity coefficient-concept of ionic strength, Debye Huckel theory of strong electrolytes, activity coefficient of strong electrolytes Determination of activity coefficient ion solvent and ion-ion interactions. Born equation. Debye-Huckel Bjerrum model. Derivation of Debye-Huckel limiting law at appreciable concentration of electrolytes modifications and applications. Electrolytic conduction-Debye-Huckel Onsager treatment of strong electrolyte-qualitative and quantitative verification and limitations. Evidence for ionic atmosphere. Ion association and triple ion formations.

#### UNIT-II:

(15 Hours)

**Electrode-electrolyte interface:** Interfacial phenomena - Evidences for electrical double layer, polarizable and non-polarizable interfaces, Electrocapillary phenomena - Lippmann equation electrocapillary curves. Electro-kinetic phenomena electro-osmosis, electrophoresis, streaming and sedimentation potentials, colloidal and poly electrolytes. Structure of double

layer: Helmholtz -Perrin, Guoy-Chapman and Stern models of electrical double layer. Zeta potential and potential at zero charge. Applications and limitations.

### UNIT-III:

(15 Hours)

**Electrodics of Elementary Electrode Reactions:** Behavior of electrodes: Standard electrodes and electrodes at equilibrium. Anodic and Cathodic currents, condition for the discharge of ions. Nernst equation, polarizable and non-polarizable electrodes. Model of three electrode system, over potential. Rate of electro chemical reactions: Rates of simple elementary reactions. Butler-Volmer equation- significance of exchange current density, net current density and symmetry factor. Low and high field approximations. symmetry factor and transfer coefficient Tafel equations and Tafel plots

### UNIT-IV:

(15 Hours)

**Electrodics of Multistep Multi Electron System:** Rates of multi-step electrode reactions, Butler - Volmer equation for a multi-step reaction. Rate determining step, electrode polarization and depolarization. Transfer coefficients, its significance and determination, Stoichiometric number. Electro-chemical reaction mechanisms-rate expressions, order, and surface coverage. Reduction of  $I^{3-}$ ,  $Fe^{2+}$ , and dissolution of Fe to  $Fe^{2+}$ . Overvoltage - Chemical and electro chemical, Phase, activation and concentration over potentials. Evolution of oxygen and hydrogen at different pH. Pourbiax and Evan's diagrams.

### UNIT-V:

(15 Hours)

**Concentration Polarization, Batteries and Fuel cells:** Modes of Transport of electro active species - Diffusion, migration and hydrodynamic modes. Role of supporting electrolytes. Polarography- principle and applications. Principle of square wave polarography. Cyclic voltammetry- anodic and cathodic stripping voltammetry and differential pulse voltammetry. Sodium and lithium-ion batteries and redox flow batteries. Mechanism of charge storage: conversion and alloying. Capacitors- mechanism of energy storage, charging at constant current and constant voltage. Energy production systems: Fuel Cells: classification, alkaline fuel cells, phosphoric acid fuel cells, high temperature fuel cells.

### Recommended Text

1. D. R. Crow, Principles and applications of electrochemistry, 4th edition, Chapman & Hall/CRC, 2014.

2. J. Rajaram and J.C. Kuriakose, Kinetics and Mechanism of chemical transformations Macmillan India Ltd., New Delhi, 2011.
3. S. Glasstone, Electro chemistry, Affiliated East-West Press, Pvt.,Ltd., New Delhi, 2008.
4. B. Viswanathan, S. Sundaram, R. Venkataraman, K. Rengarajan and P.S. Raghavan, Electrochemistry-Principles and applications, S. Viswanathan Printers, Chennai, 2007.
5. Joseph Wang, Analytical Electrochemistry, 2<sup>nd</sup> edition, Wiley, 2004.

### Reference Books

1. J.O.M. Bockris and A.K.N. Reddy, Modern Electro chemistry, vol.1 and 2B, Springer, Plenum Press, New York, 2008.
2. J.O.M. Bockris, A.K.N. Reddy and M.G. Aldeco Morden Electrochemistry, vol. 2A, Springer, Plenum Press, New York, 2008.
3. Philip H. Rieger, Electrochemistry, 2<sup>nd</sup> edition, Springer, New York, 2010.
4. L.I. Antropov, Theoretical electrochemistry, Mir Publishers, 1977.
5. K.L. Kapoor, A Text book of Physical chemistry, volume-3, Macmillan, 2001.

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

Students will be able:

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

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

**CO3:** To study different thermodynamic mechanism of corrosion,

**CO4:** To discuss the theories of electrolytes, electrical double layer, electrostatic activity coefficient of electrolytes

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

### CO-PO Mapping (Course Articulation Matrix)

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
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CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

**Level of Correlation between PSO's and CO's**

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

3 – Strong, 2 – Medium, 1 - Low

Title of the Course	<b>MOLECULAR SPECTROSCOPY</b>	Marks: CIA:25 + Ext:75=100
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Category of the Course:	Discipline Specific Elective II	Hrs/Week :05
Course Code	P1R3CHDSE 2:2	Total Inst. Hrs : 75
Nature of the Course	Skill Development	Sem: I Credit: 03

### Objectives of the course

1. To understand the influence of rotation and vibrations on the spectra of the polyatomic Molecules.
2. To study the principle of Raman spectroscopy, ESR spectroscopy, EPR spectroscopy and fragmentation patterns in Mass spectroscopy.
3. To highlight the significance of Franck-Condon principle to interpret the selection rule, intensity and types of electronic transitions.
4. To interpret the first and second order NMR spectra in terms of splitting and coupling patterns using correlation techniques such as COSY, HETCOR, NOESY.
5. To carry out the structural elucidation of molecules using different spectral techniques.

#### UNIT-I: Rotational and Raman Spectroscopy: (15 Hours)

Rotational spectra of diatomic and polyatomic molecules. Intensities of rotational spectral lines, effect of isotopic substitution. Non-rigid rotators. Classical theory of the Raman effect, polarizability as a tensor, polarizability ellipsoids, quantum theory of the Raman effect, Pure rotational Raman spectra of linear and asymmetric top molecules, Stokes and anti-Stokes lines. Vibrational Raman spectra, Raman activity of vibrations, rule of mutual exclusion, rotational fine structure-O and S branches,.

#### UNIT-II: Vibrational Spectroscopy: (15 Hours)

Vibrations of molecules, harmonic and anharmonic oscillators- vibrational energy expression, energy level diagram, vibrational wave functions and their symmetry, selection rules, expression for the energies of spectral lines, computation of intensities, hot bands, effect of isotopic substitution. vibrational-rotational spectra of diatomic molecules, P, R branches, breakdown of the Born-Oppenheimer approximation. Vibrations of polyatomic molecules – symmetry properties, overtone and combination frequencies.

**UNIT-III: Electronic spectroscopy: (15 Hours)**

Electronic Spectroscopy: Electronic spectroscopy of diatomic molecules, Frank-Condon principle, dissociation and pre dissociation spectra.  $\pi \rightarrow \pi^*$ ,  $n \rightarrow \pi^*$  transitions and their selection rules. Photoelectron Spectroscopy: Basic principles, photoelectron spectra of simple molecules, X ray photoelectron spectroscopy (XPS). Lasers: Laser action, population inversion, properties of laser radiation, examples of simple laser systems

**UNIT-IV: NMR and ESR spectroscopy: (18 Hours)**

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, AX<sub>2</sub>, AB types. Vicinal, germinal and long-range coupling-spin decoupling. Nuclear Overhauser effect (NOE), Factors influencing coupling constants . <sup>13</sup>CNMR and structural correlations, Satellites. Brief introduction to 2D NMR – COSY, NOESY. Introduction to <sup>31</sup>P, <sup>19</sup>F NMR. ESR spectroscopy Characteristic features of ESR spectra, line shapes and line widths; ESR spectrometer. The g value and the hyperfine coupling parameter (A), origin of hyperfine interaction. Interpretation of ESR spectra and structure elucidation of organic radicals using ESR spectroscopy; Spin orbit coupling and significance of g-tensors, zero/non-zero field splitting, Kramer's degeneracy, application to transition metal complexes (having one to five unpaired electrons)

**UNIT-V: Mass Spectrometry, and Mossbauer Spectroscopy: (12 Hours)**

Ionization techniques- Electron ionization (EI), chemical ionization (CI), desorption ionization (FAB/MALDI), electrospray ionization (ESI), isotope abundance, molecular ion, fragmentation processes of organic molecules,. Effect of isotopes on the appearance of mass spectrum . 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.

**Recommended Text**

1. C. N. Banwell and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, 4<sup>th</sup> Ed., Tata McGraw Hill, New Delhi, 2000.
2. R. M. Silverstein and F. X. Webster, *Spectroscopic Identification of Organic Compounds*,

- 6<sup>th</sup> 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*, 4<sup>th</sup> 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*, 7<sup>th</sup> 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*, Part B: 5<sup>th</sup> 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.

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

Students will be able:

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

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

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

**CO4:** To outline the NMR, <sup>13</sup>C NMR, 2D NMR – COSY, NOESY, Introduction to <sup>31</sup>P, <sup>19</sup>F NMR and ESR spectroscopic techniques.

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

### CO-PO Mapping (Course Articulation Matrix)

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

3 – Strong, 2 – Medium, 1 - Low

#### Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

Title of the Course :	<b>ORGANIC REACTION MECHANISM II</b>	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core Courses	Hrs/Week : 06
Course Code :	<b>P2R3CHCC4</b>	Total Inst. Hrs: 90

Nature of the Course :	Skill Development	Sem: II	Credit: 05
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**Objectives: The course aims at giving an overall view of the**

1. concept of aromaticity in benzenoid, non-benzenoid, heterocyclic and annulene compounds.
2. the mechanism involved in various types of organic reactions with evidences.
3. the applications of synthetically important reagents.
4. correlate the reactivity between aliphatic and aromatic compounds
5. the reagents and synthetic reaction

**UNIT-I: Elimination and Free Radical Reactions: (18 hours)**

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

**UNIT-II: Oxidation and Reduction Reactions: (18 hours)**

Mechanisms: Direct electron transfer, hydride transfer, hydrogen transfer, displacement, addition-elimination, oxidative and reductive coupling reactions. Mechanism of oxidation reactions: Dehydrogenation by quinones, selenium dioxides, ferri cyanide, mercuric acetate lead tetra acetate, permanganate, manganese dioxide, osmium tetroxide, oxidation of saturated hydrocarbons, alkyl groups, alcohols, halides and amines. Reactions involving cleavage of C-C bonds - cleavage of double bonds, oxidative decarboxylation, allylic oxidation, oxidation by chromium trioxide-pyridine, DMSO-Oxalyl chloride (Swern oxidation) and Corey-Kim oxidation, dimethyl sulfoxide-dicyclohexyl carbodiimide (DMSO-DCCD). Mechanism of reduction reactions: Wolff-Kishner, Clemmenson, Rosenmund, reduction with Trialkyl and triphenyl tinhydrides, Mc-Fadyen-Steven's reduction, Homogeneous hydrogenation, Hydroboration with cyclic systems, MPV and Bouveault-Blanc reduction.

**UNIT-III: Rearrangements:****(18 hours)**

Rearrangements to electron deficient carbon: Pinacol-pinacolone and semi-pinacolone rearrangements -applications and stereochemistry, Wagner-Meerwein, Demjanov, Dienone-phenol, Baker-Venkataraman, Benzilic acid and Wolff rearrangements. Rearrangements to electron deficient nitrogen: Hofmann, Curtius, Schmidt, Lossen, Beckmann and abnormal rearrangements. Rearrangements to electron deficient oxygen: Baeyer-Villiger oxidation and Dakin rearrangements. Rearrangements to electron rich atom: Favorskii, Quasi-Favorskii, Stevens, [1,2]-Wittig and [2,3]-Wittig rearrangements. Fries and Photo Fries rearrangement. Intra molecular rearrangements—Claisen, abnormal Claisen, Cope, oxy-Cope Benzidine rearrangements

**UNIT-IV: Addition to Carbon Multiple Bonds:****(18 hours)**

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. Stereo chemical aspects of addition reactions. Addition to Carbon-Hetero atom Multiple bonds: Addition of Grignard reagents, organo zinc and organo lithium reagents to carbonyl and unsaturated carbonyl compounds. Mechanism of condensation reactions involving enolates Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

**UNIT-V: Reagents and Modern Synthetic Reactions:****(18 hours)**

Lithium di isopropylamine (LDA), Azobis iso butyryl nitrile (AIBN), Sodium cyanoborohydride ( $\text{NaBH}_3\text{CN}$ ), *meta*-Chloro perbenzoic acid (m-CPBA), Dimethyl aminio pyridine (DMAP),  $n\text{-Bu}_3\text{SnD}$ , Triethylamine (TEA), Diazobicyclo[5.4.0]undec-7-ene (DBU), Di isopropyl azo dicarboxylate (DIAD), Diethyl azo dicarboxylate (DEAD), *N*-bromo succinimide (NBS), Trifluoro acetic acid (TFA), Tetra methyl piperidin-1-oxyl (TEMPO), Phenyl trimethyl ammonium tribromide (PTAB). Diazomethane and Zn-Cu, Diethylmaleate (DEM), Copper diacetyl acetonate ( $\text{Cu}(\text{acac})_2$ ),  $\text{TiCl}_3$ ,  $\text{NaIO}_4$ , Pyridinium chloro chromate (PCC), Pyridinium dichromate (PDC), Meisenheimer complex. Suzuki coupling, Heck reaction, Negishi reaction,

Baylis-Hillman reaction.

### Recommended text

1. J. Marchand M. Smith, *Advanced Organic Chemistry*, 5<sup>th</sup> 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, *Stereo chemistry of carbon compounds*, 8<sup>th</sup> edn, New Age International Publishers, 2015.
4. P. Y. Bruice, *Organic Chemistry*, 7<sup>th</sup> edn., Prentice Hall, 2013.  
R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee *Organic Chemistry*, 7<sup>th</sup> edn., Pearson Education, 2010.

### Reference books

1. S. H. Pine, *Organic Chemistry*, 5<sup>th</sup> edn, McGraw Hill International Edition, 1987.
2. L. F. Fieser and M. Fieser, *Organic Chemistry*, Asia Publishing House, Bombay, 2000.
3. E. S. Gould, *Mechanism and Structure in Organic Chemistry*, Holt, Rinehart and Winston Inc., 1959.
4. T. L. Gilchrist, *Heterocyclic Chemistry*, Longman Press, 1989.
5. J. A. Joule and K. Mills, *Heterocyclic Chemistry*, 4<sup>th</sup> ed., John-Wiley, 2010.

### WEBSITE AND e-LEARNING COURSE

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
CO1	S	S	S	S	M	S	S	S	S	M
CO2	M	S	S	S	S	M	S	S	S	S

<b>CO3</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>
<b>CO4</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
<b>CO5</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>

**3– Strong, 2 –Medium,1-Low**

**Level of Correlation between PSO's and CO's**

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

**3 Strong, 2 Medium,1–Low**

<b>Title of the Course</b> :	<b>PHYSICAL CHEMISTRY-I</b>	<b>Marks: CIA:25 + Ext:75=100</b>
<b>Category of the Course:</b>	<b>Core Courses</b>	<b>Hrs/Week : 06</b>
<b>Course Code</b> :	<b>P2R3CHCC5</b>	<b>Total Inst. Hrs: 90</b>

Nature of the Course :	Skill Development	Sem: II	Credit: 04
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**Objectives:** The course aims at giving an overall view of the

1. fundamentals of thermodynamics and the composition of partial molar quantities.
2. the classical and statistical approach of the functions
3. the significance of Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein
4. correlate the theories of reaction rates for the evaluation of thermodynamic parameters.
5. the mechanism and kinetics of reactions.

**UNIT I: Classical Thermodynamics: (16 hours)**

Partial molar properties-Chemical potential, Gibb's- Duhem equation-binary and ternary systems. Determination of partial molar quantities. Thermodynamics of real gases - Fugacity-determination of fugacity by graphical method. Thermodynamics of ideal and non-ideal binary mixtures, Duhem - Margulus equation applications of ideal and non-ideal mixtures. Activity and activity coefficients-standard states - determination-vapour pressure, EMF and freezing point methods.

**UNIT-II: Statistical thermodynamics: (16 hours)**

Introduction of statistical thermodynamics concepts of thermodynamic and mathematical probabilities-distribution of distinguishable and non-distinguishable particles. Assemblies, ensembles, canonical particles. Maxwell - Boltzmann, Fermi Dirac & Bose-Einstein Statistics-comparison and applications. Statistical approach to Thermodynamic properties: pressure, internal energy, entropy, enthalpy, Gibb's function, Helmholtz function residual entropy, equilibrium constants and equi partiion principle.

**UNIT-III: Irreversible Thermodynamics: (12 hours)**

Theories of conservation of mass and energy entropy production in open systems by heat, matter and current flow, force and flux concepts. Onsager theory-validity and verification- Onsager reciprocal relationships. Electro kinetic and thermo mechanical effects-Application of irreversible thermodynamics to biological systems.

**UNIT-IV: Kinetics of Reactions: (16 hours)**

Theories of reactions-s-effect of temperature on reaction rates, collision theory of reaction rates, Uni molecular reactions -Lindeman and Christiansen hypothesis- 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 .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: (15 hours)**

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 - Poly condensation.

**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,Macmillan 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 References

1. <https://nptel.ac.in/courses/104/103/104103112/>
2. <https://bit.ly/3tL3GdN>
- 3) [http://www.ias.ac.in/initiat/sci\\_ed/resources/chemistry/Inorganic](http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic).
- 4) <https://swayarn.gov.in/course/64-atomic-structure-and-chemical-bonding>
- 5) <https://www.chemtube3d.com/>

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

#### Students will be able:

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

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

CO3: To discuss the various thermodynamic and kinetic determination.

CO4: To evaluate the thermodynamic methods for real gases and 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
CO1	S	S	S	S	M	S	S	S	S	M
CO2	M	S	S	S	S	M	S	S	S	S
CO3	S	S	M	S	S	S	S	M	S	S
CO4	M	S	S	S	S	M	S	S	S	S
CO5	M	S	M	S	S	M	S	M	S	S

#### 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

<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>
<b>Weighted Percentage of Course Contribution to Pos</b>	<b>3.0</b>	<b>3.0</b>	<b>3.0</b>	<b>3.0</b>	<b>3.0</b>

**3-Strong, 2- Medium, 1- Low**

<b>Title of the Course</b>	<b>:</b>	<b>INORGANIC CHEMISTRY PRACTICAL</b>	<b>Marks: CIA: 40 + Ext:60 =100</b>
		<b>Core Course</b>	<b>Hrs/Week : 06</b>
<b>Course Code</b>	<b>:</b>	<b>P2R3CHCC6P</b>	<b>Total Inst. Hrs: 90</b>
<b>Nature of the Course</b>	<b>:</b>	<b>Skill Development</b>	<b>Sem:II Credit: 04</b>

## Objectives of the course

1. To understand and enhance the visual observation as an analytical tool for the quantitative estimation of ions.
2. To recall the principle and theory in preparing standard solutions.
3. To train the students for improving their skill in estimating the amount of ion accurately present in the solution
4. To estimate metal ions, present in the given solution accurately without using instruments.
5. To determine the amount of ions, present in a binary mixture accurately

### UNIT-I: Analysis of mixture of cations

(30 Hours)

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

### UNIT-II: Preparation of metal complexes

(30 Hours)

Preparation of inorganic complexes:

- a. Preparation of trithiourea copper(I)sulphate
- b. Preparation of potassiumtrioxalate chromate(III)
- c. Preparation of tetrammine copper(II)sulphate
- d. Preparation of Reineck's salt
- e. Preparation of hexathiourea copper(I)chloridedihydrate
- f. Preparation of *cis*-Potassiumtrioxalatediaquachromate(III)
- g. Preparation of sodium trioxalato ferrate(III)
- h. Preparation of hexathiourea lead(II)nitrate

### UNIT-III: Complexometric Titration

(30 Hours)

1. Estimation of zinc, nickel, magnesium, and calcium.
2. Estimation of mixture of metal ions-pH control, masking and de masking agents.
3. Determination of calcium and lead in a mixture (pH control).

4. Determination of manganese in the presence of iron.

5. Determination of nickel in the presence of iron.

### Recommended Text

1. A. Jeya Rajendran, Micro analytical Techniques in Chemistry: Inorganic Qualitative Analysis, United global publishers, 2021.
2. V.V.Ramanujam, *Inorganic Semimicro Qualitative Analysis*; 3rd ed., The National Publishing Company, Chennai, 1974.
3. *Vogel's Text book of Inorganic Qualitative Analysis*, 4th ed., 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 Outcomes

Course Name: INORGANIC CHEMISTRY PRACTICAL		Course Code: P2R3CHCC4P	K-Level
On Successful completion of the course, students will be able to			
CO-1	To identify the anions and cations present in a mixture of salts.		K3
CO-2	To apply the principles of semi-micro qualitative analysis to categorize acid radicals and basic radicals.		K4
CO-3	To acquire the qualitative analytical skills by selecting suitable confirmatory tests and spot tests.		K4
CO-4	To choose the appropriate chemical reagents for the detection of anions and cations.		K3
CO-5	To synthesize coordination compounds in good quality		K3

### Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: INORGANIC CHEMISTRY PRACTICAL		Course Code: P2R3CHCC6P
	PO	PSO

Course Outcomes (COs)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

**3-Strong, 2-Medium, 1-Low**

Title of the Course :	<b>MEDICINAL CHEMISTRY</b>	Marks: CIA: 40 + Ext:60 =100
Category of the Course :	Core Course	Hrs/Week :04
Course Code :	<b>P2R3CHDSE:3:1</b>	Total Inst. Hrs: 60

Nature of the Course	:	<b>Skill Development</b>	<b>Sem:II</b>	<b>Credit: 03</b>
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<b>Objectives of the course</b>	<ol style="list-style-type: none"> <li>1.To study the chemistry behind the development of pharmaceutical materials.</li> <li>2.To gain knowledge on mechanism and action of drugs.</li> <li>3.To understand the need of antibiotics and usage of drugs.</li> <li>4.To familiarize with the mode of action of diabetic agents and treatment of diabetes.</li> <li>5.To identify and apply the action of various antibiotics.</li> </ol>
<b>Course Outline</b>	<b>UNIT-I: Introduction to receptors: 12hrs</b> Introduction, targets, Agonist, antagonist, partial agonist. Receptors, Receptor types, Theories of Drug – receptor interaction, Drug synergism, Drug resistance, physicochemical factors influencing drug action.
	<b>UNIT-II: Antibiotics: 12hrs</b> Introduction, Targets of antibiotics action, classification of antibiotics, enzyme-based mechanism of action, SAR of penicillins and tetracyclins, clinical application of penicillins, cephalosporin. Current trends in antibiotic therapy
	<b>UNIT-III: Antihypertensive agents and diuretics: 12hrs</b> Classification of cardiovascular agents, introduction to hypertension, etiology, types, classification of antihypertensive agents, classification and mechanism of action of diuretics, Furosemide, Hydrochlorothiazide, Amiloride.
	<b>UNIT-IV: Blood and heamotological agent : 12hrs</b> Blood–composition, grouping–physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, drythrombin; Anticoagulants–coumarins, citric acid and heparin; anti fibrinolytic agents–amino caproic acid and tranexamic acid.
	<b>UNIT-V: Analgesics, Antipyretics and Anti-inflammatory Drugs: 12 hrs</b> Introduction, Mechanism of inflammation, classification and mechanism of action and paracetamol, Ibuprofen, Diclofenac .Medicinal Chemistry of Antidiabetic

	Agents Introduction, Types of diabetics, Drugs used for the treatment, chemical classification, Mechanism of action, Treatment of diabetic mellitus.
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.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry,</li> <li>2. Wilson, Charles Owens: Beale, John Marlowe; Block, John H, Lipincott William, 12th edition, 2011.</li> <li>3. Graham L. Patrick, An Introduction to Medicinal Chemistry, 5th edition, Oxford University Press, 2013. Jaya shree Ghosh, A text book of Pharmaceutical Chemistry, S.ChandandCo.Ltd,1999,1999 edn.</li> <li>4. O.LeRoy, Natural and synthetic organic medicinal compounds,Ealemi,1976.</li> <li>5. S.Ashutosh Kar, Medicinal Chemistry, Wiley Eastern Limited, NewDelhi,1993, New edn.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Foye's Princlcs of Medicinal Chemistry, Lipincott Williams, Seventh Edition, 2012</li> <li>2. Burger's Medicinal Chemistry, Drug Discovery and Development, Donald J.</li> </ol>

	<p>Abraham, David P. Rotella, Alfred Burger, Academic press, 2010.</p> <p>3. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, John M.Beale Jrand JohnM. Block, Wolters Kluwer, 2011,12<sup>th</sup>edn.</p> <p>4. P.Parimoo, A Text book of Medical Chemistry, NewDelhi:CBSPublishers.1995.</p> <p>5. S.Ramakrishnan, K.G.Prasannan and R.Rajan, Text book of Medical Biochemistry, Hyderabad: OrientLongman.3<sup>rd</sup> edition,2001.</p>
<b>Website and e-learning source</b>	<p>1. <a href="https://www.ncbi.nlm.nih.gov/books/NBK482447/">https://www.ncbi.nlm.nih.gov/books/NBK482447/</a></p> <p>2. <a href="https://training.seer.cancer.gov/treatment/chemotherapy/types.html">https://training.seer.cancer.gov/treatment/chemotherapy/types.html</a></p> <p>3. <a href="https://www.classcentral.com/course/swayam-medicinal-chemistry-12908">https://www.classcentral.com/course/swayam-medicinal-chemistry-12908</a></p>
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p>Students will be able:</p> <p><b>CO1:</b> Predict a drugs properties based on its structure.</p> <p><b>CO2:</b> Describe the factors that affect its absorption, distribution, metabolism, and excretion, and hence the considerations to be made in drug design.</p> <p><b>CO3:</b> Explain the relationship between drug's chemical structure and its therapeutic properties.</p> <p><b>CO4:</b> Designed to give the knowledge of different theories of drug actions at molecular level.</p> <p><b>CO5:</b> To identify different targets for the development of new drugs for the treatment of infectious and GIT.</p>	

### CO-PO Mapping (Course Articulation Matrix)

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

3 – Strong, 2 – Medium, 1 – Low

#### Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

Title of the Course	:	<b>GREEN CHEMISTRY</b>	Marks: CIA: 25 + Ext:75 =100
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Category of the Course :	Core Course	Hrs/Week :05
Course Code :	P2R3CHDSE3:2	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem:II Credit: 04

**Objectives: Enable learners**

1. To discuss the principles of green chemistry.
2. To propose green solutions for chemical energy storage and conversion.
3. To Propose green solutions for industrial production of Petroleum and Petrochemicals.
4. To Propose solutions for pollution prevention in Industrial chemical and fuel production, automotive industry and Shipping industries.
5. To Propose green solutions for industrial production of Surfactants, Organic and inorganic chemicals.

**UNIT I: Introduction**

**(15hours)**

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.

**Unit II: Origin of Mater (18hours)**

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<sub>2</sub>. Green synthesis-adipic acid and catechol.

**Unit III: Pollution**

**(15hours)**

Environmental pollution, Green Catalysis-Acid catalysts, Oxidation catalysts, Basic catalysts, Polymer supported catalysts-Poly styrene aluminum chloride, polymeric super acid catalysts, Poly supported photosensitizers.

**UNIT IV : Green Synthesis (12 hours)**

Phase transfer catalysis in green synthesis-oxidation using hydrogen peroxide, crown ethers-esterification, saponification, anhydride formation, Elimination reaction, Displacement reaction.

Applications in organic synthesis.

**UNITV: Principle and Instrumentation (15 hours)**

Micro wave induced green synthesis-Introduction, Instrumentation, Principle and applications. Sono chemistry – Instrumentation, Cavitation theory - Ultra sound assisted green synthesis and Applications.

**Recommended Text :**

1. Ahluwalia, V.K. and Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005.
2. W.L.Mc Cabe, J.C. Smith and P. Harriott, Unit Operations of Chemical Engineering, 7th edition, McGraw-Hill, New Delhi, 2005.
3. J.M.Swan and D. St. C. Black, Organometallics in Organic Synthesis, Chapman Hall, 1974.
4. V.K.Ahluwalia and R. Aggarwal, Organic Synthesis: Special Techniques, Narosa Publishing House, New Delhi, 2001.
- 5 A.K.De, Environmental Chemistry, New Age Publications, 2017.

**Reference Books**

1. Anastas, P.T. and Warner, J.K. Oxford Green Chemistry -Theory and Practical, University Press, 1998
2. Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker, 2001
3. Cann, M.C. and Connely, M.E. Real-World Cases in Green Chemistry, American Chemical Society, Washington, 2000
4. Ryan, M.A. and Tinnes and, M., Introduction to Green Chemistry, American Chemical Society

Washington, 2002.

5. Chandra kanta Bandyopadhyay, An Insight into Green Chemistry, Books and Allied (P) Ltd, 2019.

**Web References:**

1. <https://www.organic-chemistry.org/>
2. [http://www.ias.ac.in/initiat/sci\\_ed/resources/chemistry/Inorganic](http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic).
3. <https://swayarn.gov.in/course/64-atomic-structure-and-chemical-bonding>
4. <https://www.chemtube3d.com/>

**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
CO1	S	S	S	S	M	S	S	S	S	M
CO2	M	S	S	S	S	M	S	S	S	S
CO3	S	S	M	S	S	S	S	M	S	S
CO4	M	S	S	S	S	M	S	S	S	S
CO5	M	S	M	S	S	M	S	M	S	S

**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

<b>Title of the Course</b> :	<b>BIO-INORGANIC CHEMISTRY</b>	<b>Marks: CIA: 25 + Ext:75 =100</b>
<b>Category of the Course</b> :	<b>Core Course</b>	<b>Hrs/Week :04</b>
<b>Course Code</b> :	<b>P2R3CHDSE4:1</b>	<b>Total Inst. Hrs: 60</b>
<b>Nature of the Course</b> :	<b>Skill Development</b>	<b>Sem:II Credit: 03</b>

**Objectives: The course aims at giving an overall view of the**

1. Role of trace elements.
2. biological significance of iron, sulphur and the toxicity of metals in medicines.
3. diagnostic agents.
4. Various metals in medicine
5. properties of enzymes

**UNIT-I: Essential trace elements:**

**(12 hours)**

Selective transport and storage of metal ions: Ferritin, Transferrin and siderophores; Sodium and potassium transport, Calcium signalling proteins. Metallo enzymes: Zinc enzymes–carboxypeptidase and carbonic anhydrase. Iron enzymes–catalase, peroxidase. Copper enzymes–super oxide dismutase, Plastocyanin, Ceruloplasmin, Tyrosinase. Coenzymes-Vitamin-B12 coenzymes

**UNIT-II: Transport Proteins:**

**(12 hours)**

Oxygen carriers-Hemoglobin and myoglobin - Structure and oxygenation Bohr Effect. Binding of CO, NO, CN<sup>-</sup> 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.

**UNIT-III: Nitrogen fixation**

**(12 hours)**

Introduction, types of nitrogen fixing microorganisms. Nitrogenase enzyme - Metal clusters in nitrogenase- redox property – Di nitrogen 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.

#### **UNIT-IV: Metals in medicine:**

**(12 hours)**

Metal Toxicity of Hg, Cd, Zn, Pb, As, Sb. Therapeutic Compounds: Vanadium-Based Diabetes Drugs; Platinum-Containing Anti cancer Agents. Chelation therapy; Cancer treatment. Diagnostic Agents: Technetium Imaging Agents; Gadolinium MRI Imaging Agents. temperature and critical magnetic Field.

#### **UNIT-V: Enzymes**

**(12 hours)**

-Introduction and properties-nomenclature and classification. Enzyme kinetics, free energy of activation and the effects of catalysis. Michaelis-Menten equation- Effect of pH, temperature on enzyme reactions. Factors contributing to the efficiency of enzyme. Baylis-Hillman reaction.

#### **Recommended text**

1. Williams, D.R.—Introduction to Bioinorganic chemistry.
2. F.M. Fiabre and D.R. Williams— The Principles of Bio inorganic Chemistry, Royal Society of Chemistry, Monograph for Teachers-31
3. K.F. Purcell and Kotz., Inorganic chemistry, WBSaunders 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 COURSE

1. <https://www.pdfdrive.com/instant-notes-in-inorganic-chemistry-the-instant-notes-chemistry-series-d162097454.html>  
<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 to:

**CO1** :analyses of trace elements.

**CO2**:explain the biological redox systems.

**CO3**: skill in analyzing the toxicity in metals.

**CO4**:experience in diagnosis.

**CO5**:nitrogen fixation and photosynthetic mechanism.

### CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	M
CO2	M	S	S	S	S	M	S	S	S	S
CO3	S	S	M	S	S	S	S	M	S	S
CO4	M	S	S	S	S	M	S	S	S	S
CO5	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
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<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

**3- Strong, 2 -Medium,1-Low**

<b>Title of the Course :</b>	<b>MATERIAL SCIENCE</b>	<b>Marks: CIA:25 + Ext:75=100</b>
<b>Category of the Course:</b>	<b>Discipline Specific Elective</b>	<b>Hrs/Week :04</b>
<b>Course Code :</b>	<b>P2R3CH DSE4:2</b>	<b>Total Inst. Hrs : 60</b>
<b>Nature of the Course :</b>	<b>Skill Development</b>	<b>Sem: II, Credit: 02</b>

### Objective of the course

1. To understand the crystal structure, growth methods and X-ray scattering.
2. To explain the optical, dielectric and diffusion properties of crystals.
3. To recognize the basis of semiconductors, superconductivity materials and magnets.
4. To study the synthesis, classification and applications of nanomaterial's.
5. To learn about the importance of materials used for renewable energy conversion.

### UNIT-I: Crystallography:

(12 hrs)

Symmetry-unit cell and Miller indices -crystal systems - Bravais lattices - point groups and space groups -X-ray diffraction-Laue equations-Bragg's law-reciprocal lattice and its application to geometrical crystallography. Crystal structure–powder and single crystal applications. Electron charge density maps, neutron diffraction-method and applications.

### UNIT-II: Crystal growth methods:

(12 hrs)

Nucleation–equilibrium stability and metastable state. Single crystal–Low and high temperature, solution growth–Gel and sol-gel. Crystal growth methods- nucleation– equilibrium stability and meta stable state. Single crystal–Low and high temperature, solution growth– Gel and sol-gel. Melt growth– Bridgeman-Stock barger, Czochralski methods. Flux technique, physical and chemical vapour transport. Lorentz and polarization factor –primary and secondary extinctions.

### UNIT-III: Properties of crystals:

(12 hrs)

Optical studies –Electro magnetic spectrum (qualitative) refractive index–reflectance–transparency, translucency and opacity. Types of luminescence – photo-, electro-, and injection luminescence, LEDs – organic, Inorganic and polymer LED materials - Applications. Dielectric studies- Polarisation - electronic, ionic, orientation, and space charge polarisation. Effect of temperature. Dielectric constant, dielectric loss. Types of dielectric breakdown–intrinsic, thermal, discharge, electro chemical and defect breakdown.

**UNIT-IV: Special Materials:****(12 hrs)**

Superconductivity: Meissner effect, Critical temperature and critical magnetic Field, Type I and II superconductors, BCS theory-Cooper pair, Applications. Soft and hard magnets – Domain theory Hysteresis Loop-Applications. Magneto and giant magneto resistance. Ferro, ferri and antiferromagnetic materials-applications, magnetic parameters for recording applications. Ferro-, Piezo-, and pyro electric materials – properties and applications. Shape memory Alloys-characteristics and applications, Non-linear optics-Second Harmonic Generators, mixing of Laser wavelengths by quartz, ruby and LiNbO<sub>3</sub>.

**UNIT-V: Materials for Renewable Energy Conversion:****(12 hrs)**

Solar Cells Organic, bilayer, bulk heterojunction, polymer, perovskite based. Solar energy conversion: lamellar solids and thin films, dye-sensitized photovoltaic cells, coordination compounds anchored onto semiconductor surfaces-Ru(II) and Os(II) poly pyridyl complexes. Photochemical activation and splitting of water, CO<sub>2</sub> and N<sub>2</sub>. Manganese based photo systems for water-splitting. Complexes of Rh, Ru, Pd and Pt-photochemical generation of hydrogen from alcohol.

**Recommended Text :**

1. S.Mohanand V.Arjunan, Principles of Materials Science, MJPPublishers,2016.
2. Arumugam, Materials Science,AnuradhaPublications,2007.
- 3.Giacavazzo et.al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications,2010
4. Woolfson, An Introduction to Crystallography, Cambridge UniversityPress,2012.
5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science forEngineers.6thed, PEARSON Press, 2007.

**Reference Books**

1. SuggestedReadings1.M.G.Arora,SolidStateChemistry,AnmolPublications,New Delhi, 2001.
2. R.K.Puriand V.K.Babbar, Solid State Physics, S.Chand and Company Ltd, 2001.
3. C. Kittel, Solid State Physics, John-Wiley and sons, NY, 1966.
4. H.P.Meyers, Introductory Solid State Physics, Viva Books PrivateLimited,1998.
5. A.R.West, Solid State Chemistry and Applications, John-Wiley and sons, 1987.

**Course Outcomes**

<b>Course Name: MATERIALSCIENCE</b>		<b>Course Code: P2R3CH DSE 4:2</b>	<b>K-Level</b>
On Successful completion of the course, students will be able to			
<b>CO-1</b>	To understand and recall the synthesis and characteristics of crystal structures, Semi conductors, magnets, nanomaterials and renewable energy materials.		<b>K4</b>
<b>CO-2</b>	To integrate and assess the structure of different materials and their properties.		<b>K3</b>
<b>CO-3</b>	To analyse and identify new materials for energy applications		<b>K4</b>
<b>CO-4</b>	To explain the importance of crystal structures, piezoelectric and pyroelectric materials, nanomaterials, hard and soft magnets, superconductors, solar cells, electrodes, LED uses, structures and synthesis		<b>K4</b>
<b>CO-5</b>	To design and develop new materials with improved property for energy applications.		<b>K5</b>

#### CO-PO Mapping (Course Articulation Matrix)

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

**3Strong, 2Medium, 1low**

Level of Correlation between  
PSO's and CO's

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

**3Strong, 2 –Medium, 1-Low**

<b>Title of the Course</b> :	<b>PREPARATION OF CONSUMER PRODUCTS</b>	<b>Marks: CIA:25 + Ext:75=100</b>
<b>Category of the Course:</b>	<b>Skill Enhancement Course</b>	<b>Hrs/Week :04</b>
<b>Course Code</b> :	<b>P2R3CH SEC 1:1</b>	<b>Total Inst. Hrs 60</b>
<b>Nature of the Course</b> :	<b>Entrepreneurship</b>	<b>Sem: II Credit: 02</b>

### Objective of the course

1. To understand the role of herbs as a source of natural and safe cosmetics.
2. To learn various herbal preparations of cosmetics.
3. Description of several ingredients involved in the production process
4. To increase the ideas of understanding of cosmetic product manufacturing.
5. To identify the Principles of Quality control and standardization of cosmetics

### UNITI: INTRODUCTION

**12 hrs**

Introduction to cosmetics, Botanicals in cosmetics, Need and advantages of Herbal cosmetics, Effect of chemical cosmetics, Cosmetics nomenclature: Emulsion, cream, lotion, face wash, face mask, sunscreen; oils and fats used in cosmetics, different bases and raw materials used in cosmetics.

### UNITII: HERBALPRODUCTS

**12 hrs**

Extraction of herbal products, A brief account of following herbals or herb extracts of cosmetic importance such as *Acacia concinnapods*, *Aloe Vera*, Almond oil, Neem, *Citrus aurantium peels*, Henna, Turmeric, Liquorice, Olive oil, tea tree oil and wheat germ oil with special emphasis on their source, active principles and cosmetic properties. Anti-aging herbs.

### UNITIII: PREPARATION METHODS

**12 hrs**

Face care: Face cleanser, Ache - pimple cream, Preparation of Face pack- any two, Skincare: Skin beauty through pancha karuma, Turmeric - Milk lotion, Aloe vera, Anti – wrinkle cream, Moisturizing cream, Preparation of Herbal Bathing powder, Hair care : Hair oil components and preparation of oil, Role of Karisalankanni, Amla in hair oil preparation, Henna uses, Herbal shampoo, hair dye, preparation of hair spray using essential oils, Foot Care Preparation of foot cream

#### **UNIT IV: NATURAL COLORANTS**

**12 hrs**

**Natural colorants: Biological Source,** coloring principles, chemical nature and usage of the following Annatto, Cochineal, Caramel, Henna, Indigo, Madder, Saffron, Turmeric Flavors and Perfumes: **Sandal wood oil, Orange oil, Lemon oil, Vanilla,** Palmarosa, geranium oil

#### **UNIT:V QUALITY CONTROL**

**12 hrs**

General Principles of Quality control and standardization of cosmetics-Raw material control, **Packaging material control, finished product** control, Shelf testing. quality control in cosmetic preparation and guidelines

#### **REFERENCE BOOKS:**

1. Andre O. Barel et al., (2009).Handbook of Cosmetic Science and Technology, Informa Health care USA.
2. Mitchell L.Schloss man (Ed.)(2002).The Chemistry and Manufacture of Cosmetics, Allured Publishing Corporation.
3. Meyer R. Rosen (Ed)(2015).Harry's Cosmeticology, 9<sup>th</sup> Ed. Chemical Publ. Co.Vimaladevi M. (2018).Text book of Herbal Cosmetics, CBS Publ.
4. International Cosmetic Ingredient Dictionary & Handbook-by The Personal Care Products Council.
5. P.P. Sharma (5<sup>th</sup> Ed., 2014).Cosmetics- Formulation, Manufacturing and Quality control.Vandana Publ.
5. H.Panda (2015).Herbal Cosmetics Hand Book, Asia Pacific Business PressInc.
6. P.K Chattopadhyay (2015). Herbal Cosmetics: NIIR. Project Consultancy Services.
7. H.Panda (2016).The Complete Technology Book on Herbal Perfumes and Cosmetics

### Course Outcomes

<b>Course Name: PREPARATION OF CONSUMER PRODUCTS</b>		<b>Course Code: P2R3CH SEC 1:1</b>	<b>K-Level</b>
On Successful completion of the course, students will be able to			
<b>CO-1</b>	Acquire knowledge about role of herbs as a source of natural and safe cosmetics		<b>K3</b>
<b>CO-2</b>	Learn the various herbal preparations of cosmetics.		<b>K4</b>
<b>CO-3</b>	Understand the preparation of cosmetic drugs.		<b>K4</b>
<b>CO-4</b>	: Know about Face care, skin care and hair care.		<b>K5</b>
<b>CO-5</b>	Students will learn about the raw materials used in herbal cosmetics and get exposed to various preparations herbal cosmetics.		<b>K3</b>

### CO-PO Mapping (Course Articulation Matrix)

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

**3 Strong, 2 medium, 1-Low**

**Level of Correlation between PSO's and CO's**

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

**3–Strong, 2 Medium,1-Low**

<b>Title of the Course</b> :	<b>CHEMISTRY OF EVERYDAY LIFE</b>	<b>Marks: CIA:25 + Ext:75=100</b>
<b>Category of the Course:</b>	<b>Skill Enhancement Course</b>	<b>Hrs/Week :04</b>
<b>Course Code</b> :	<b>P2R3CH SEC 1:2</b>	<b>Total Inst. Hrs 60</b>
<b>Nature of the Course</b> :	<b>Skill Development</b>	<b>Sem: II Credit: 02</b>

**Objectives: To make students understand**

1. *The characteristics of water*
2. *Properties the essential oils, perfumes, flavours*
3. *Cosmetics and their applications*
4. *The components of soap and their properties*
5. *The action of detergents*

#### **Unit-I: Water Chemistry**

**(15 Hrs)**

**Water-** Characteristics of water – Surface water- Ground Water- Atmospheric water -Soft water and Hard water. **Hardness of Water-** Temporary Hardness- Permanent Hardness- Removal of hardness- Ion exchange and reverse osmosis method **Water Quality Parameters and determination** - pH-Electrical Conductivity- Dissolved Oxygen- Chemical Oxygen demand- Biological oxygen demand-Total Dissolved Solids-Alkalinity-SAR.

#### **Unit-II: Building materials**

**:(12Hrs)**

cement, ceramics, glass and refractories - definition, composition and application only polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and only. and refractories - definition, composition and application only. Plastics -, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses

#### **Unit III:Cosmetics**

**(10 Hrs)**

Face cream, sun screen lotion, shaving cream-composition-formulation-uses and their hazard. Sprayer, hand lotion, nail lacquers; nail bleaches, hair oil, hair dyes– Composition, formulation-uses and their hazards.

#### **Unit-IV: Soaps**

**(10 Hrs)**

**Definition-** Types of Soap- Medicated soaps, Herbal soaps. Soft soaps. Shaving soaps - Mechanism of action of soap.-Manufacture of soaps- Saponification of oils and fats- Formulation of toilet soaps. Different ingredients used and their functions. Shaving soap and creams-ISI specifications. Testing procedures/limits.

**Unit-V: Detergents****(13 Hrs)**

**Anionic Detergents:** Manufacture of LAB(linear alkyl benzene). Sulphonation of LAB – preparation of acid slurry. Different ingredients in the formulation of detergent powders and soaps.

**Cationic detergents:** examples. Manufacture and applications. **Non-ionic detergents:** examples.

Manufacture of ethylene oxide condensate. **Mechanism of action of detergents.** Comparison of soaps and detergents.

**Text Books:**

1. Thangammal Jacob, A textbook of applied chemistry, Mcmillan Company Ind. Ltd, 1997.
2. K.Bagavathi Sundari, Applied Chemistry, MJP publishers Chennai, 1<sup>st</sup> Ed., 2006.

**Reference Books:**

1. B.K.Sharma, Industrial Chemistry, Goel Publishing House, 2011.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 1<sup>st</sup> Ed., S.Chand Company Ltd – New Delhi, 2010.

CO No.	CO-Statements	K-Level
On Successful completion of the course, students will be able to		
CO-1	learn about in chemistry in everyday life	K2
CO-2	set up as small entrepreneurs	K3
CO-3	Get awareness on effect of cosmetics, understand more about cosmetics and their uses	K3
CO-4	Understand the importance of fuels and fire protection	K1
CO-5	appreciate the medicinal uses of chemical products	K4

**Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes**

<b>Title of the Course: CHEMISTRY OF EVERYDAY LIFE</b>						<b>Course Code: U4R2CHSEC1:1</b>					
<b>Course Outcomes (Cos)</b>	<b>Programme Outcomes(POs)</b>					<b>Programme Specific Outcomes (PSOs)</b>					<b>Mean Score of Cos</b>
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	
<b>CO1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2.3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2.6</b>
<b>CO3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2.3</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2.5</b>
<b>CO5</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2.6</b>
	<b>Mean Overall Score</b>										<b>2.46</b>
	<b>Result</b>										<b>High</b>