

**JAYARAJ ANNAPACKIAM COLLEGE  
FOR WOMEN (AUTONOMOUS)**

**A Unit of the Sisters of St. Anne of Tiruchirappalli**

**Accredited with 'A' Grade (3<sup>rd</sup> Cycle) by NAAC**

**DST FIST Supported College**

**Affiliated to Mother Teresa Women's University,**

**Kodaikanal**

**PERIYAKULAM – 625 601, THENI DT.  
TAMIL NADU.**



**ACADEMIC COUNCIL**

**DEPARTMENT OF CHEMISTRY**

**09.09.2020**

## PG AND RESEARCH CENTRE OF CHEMISTRY

### P.G. PROGRAMME OUTCOMES

<b>PO. NO.</b>	<b>UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO</b>
1.	Endow with in-depth knowledge, analyze and apply the understanding of their discipline for the betterment of self and society.
2.	Synthesize ideas from various disciplines, enhance the interdisciplinary knowledge and extend it for research.
3.	Gain confidence and skills to communicate orally/ verbally in research platforms and state a clear research finding.
4.	Develop problem solving and computational skills and gain confidence to appear the competitive examination.
5.	Enhance knowledge regarding research by accumulating practical knowledge in specific areas of research.
6.	Achieve idealistic goals and enrich the values to tackle the societal challenges.

### P.G. PROGRAMME SPECIFIC OUTCOMES

<b>PSO. NO.</b>	<b>UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO</b>	<b>PO MAPPED</b>
1	Apply the in depth knowledge about the chemical reactions, mechanisms, theories and to appreciate their applications in organic, inorganic, physical chemistry and in research.	PO-1, PO-2
2	Utilize research skills for career in various sectors, academic or industry.	PO-1, PO-5, PO-6
3	Apply problem solving skills and analytical skills and analyse the spectro photometric, analytical, electrometric and chromatographic measurements of compounds.	PO-1, PO-2, PO-3
4	Assess the characteristics of organic and inorganic compounds by qualitative and quantitative skills.	PO-4, PO-5
5	Demonstrate small project works by applying their scientific knowledge and formulate the procedure for manuscript and dissertation writing.	PO-5, PO-6

**PG COURSE PATTERN (2020 - 2023) (UGC/ TANSCH/ MTU)**

Sem.	Code	Title of the paper	Hours	Credits
I	20PCH1C01	Organic Chemistry-I	6	5
	20PCH1C02	Physical Chemistry-I	6	5
	20PCH1C03	Inorganic Chemistry-I	6	5
	20PCH1P01	Practical: Organic Estimation and Analysis of Organic Mixture	6	3
	20PCH1E1A/ 20PCH1E1B/ 20PCH1E1C	Medicinal Chemistry/ Research Methodology/ Nano Chemistry and Green Synthesis	6	3
		<b>Total</b>	<b>30</b>	<b>21</b>
II	20PCH2C04	Organic Chemistry-II	5	4
	20PCH2C05	Physical Chemistry-II	5	4
	20PCH2C06	Inorganic Chemistry-II	5	4
	20PCH2P02	Practical: Inorganic Analysis and Estimation	5	3
	20PCH2E2A/ 20PCH2E2B/ 20PCH2E2C	Instrumental methods of Chemical Analysis/ Engineering Chemistry/ Bioinorganic Chemistry	4	3
	20PCH2GE1	Spectroscopy and Chromatography	4	3
	20PSE2S01	Soft Skills	2	1
		<b>Total</b>	<b>30</b>	<b>22</b>
III	20PCH3C07	Organic Chemistry-III	5	5
	20PCH3C08	Physical Chemistry-III	5	5
	20PCH3C09	Inorganic Chemistry-III	5	5
	20PCH3P03	Physical Chemistry Experiments	5	3
	20PCH3E3A/ 20PCH3E3B/ 20PCH3E3C	Advanced Materials Chemistry/ Food Chemistry Applications of IT skills in Chemistry	4	3
	20PCH3GE2	Usage of Chemicals in Food, Agro and Healthcare	4	3
20PSE3H02	Human Rights and Duties	2	1	
20PCH3IN1	Internship	-	2*	
		<b>Total</b>	<b>30</b>	<b>25+2*</b>
IV	20PCH4C10	Organic Chemistry-IV	6	6
	20PCH4C11	Physical Chemistry-IV	6	6
	20PCH4C12	Inorganic Chemistry-IV	6	6
	20PCH4R01	Project	12	4
	20PCH4SM1	MOOC'S	-	1*
	20PCH4S01	Comprehensive Examination	-	2*
		<b>Total</b>	<b>30</b>	<b>22+3*</b>
<b>Total for all semesters</b>			<b>120</b>	<b>90 + 5*</b>

**CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)****THEORY:**

<b>Component</b>	<b>Marks</b>	<b>Marks</b>
Internal Test I	40	Converted to 25
Internal Test II	40	
Seminar	10	
Term Paper	5	
Attendance	5	
<b>Total</b>	<b>100</b>	<b>25</b>

**CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)****Practical: 40 Marks****PASSING MINIMUM**

<b>Semester Examination</b>	
Theory	50% out of 75 Marks (i.e. 37.5 Marks)
Practical	50% out of 60 Marks (i.e. 30 Marks)

**PROJECT WORK**

The ratio of marks for Internal and External Examination is 50:50.

**THE INTERNAL COMPONENTS OF PROJECT**

<b>Components</b>	<b>Marks</b>
First Review	10
Second Review	10
Final Review (Internal Viva Voce)	30
<b>Total</b>	<b>50</b>

**EXTERNAL VALUATION OF PROJECT WORK**

<b>Components</b>	<b>Marks</b>
Project	25
External Viva Voce	25
<b>Total</b>	<b>50</b>

## **INTERNAL QUESTION PATTERN**

**(Maximum Marks - 40)**

### **PART - A**

10 Questions × 1Mark = 10 Marks

### **PART - B**

2 Questions × 5 Marks = 10 Marks

(Internal Choice and One Question from Each Unit)

### **PART - C**

2 Questions × 10 Marks = 20 Marks

(Open Choice, Two Questions out of Three)

## **EXTERNAL QUESTION PATTERN**

**(Maximum Marks - 75)**

### **PART - A**

10 Questions × 1Mark = 10 Marks

(Two Questions from each Unit)

### **PART - B**

5 Questions × 5 Marks = 25 Marks

(Internal Choice and one set of Question from each Unit)

### **PART - C**

5 Questions × 8 Marks = 40 Marks

(Open Choice Five Questions out of Seven

Atleast One Question from each Unit)

## **INTERNSHIP (EXTRA CREDITS)**

Internal : 50 Marks

External : 50 Marks

**Total : 100 Marks**

## **COMPONENTS**

### **Internal Components:**

Report Submission : 25 Marks

Presentation and viva(internal) : 25Marks

External(Awarded by the Industry) : 50 Marks

## ORGANIC CHEMISTRY - I

Semester: I

Hours: 6

Code : 20PCH1C01

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recognize the fundamental principles of bonding and reactivity	PSO-1	K, C
CO - 2	Illustrate the concept of aromaticity using Huckel's rule	PSO-3	An, E
CO - 3	Acquire knowledge on Reaction Mechanism	PSO-4	K,E
CO - 4	Analyse the synthetic uses of Reagents in Organic Synthesis	PSO-2	E, S
CO - 5	Apply the knowledge on Named Reactions and Rearrangements to solve the problems in competitive exams	PSO-4	K, Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I		ORGANIC CHEMISTRY - I										Hours: 6
Code : 20PCH1C01												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	3	3	3	3	4	3	3	3	3	3.27
CO - 2	3	4	3	2	3	3	3	3	4	4	3	3.18
CO - 3	3	4	4	3	3	3	4	3	3	3	4	3.36
CO - 4	3	3	4	3	3	3	4	3	3	3	3	3.18
CO - 5	3	4	3	3	3	4	4	3	4	4	4	3.36
<b>Overall Mean Score</b>											<b>3.27</b>	

**Result:** The Score for this Course is 3.27 (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## UNIT I

### **THEORETICAL CONCEPTS OF BONDING AND REACTIVITY:**

Types of bonding (ionic, covalent) - orbital theory - shapes - overlap of orbitals - formation of compounds - hybridization - factors influencing reactivity - inductive, electromeric, resonance, mesomeric, hyperconjugative and steric effect - hydrogen bonding - breaking and making of bonds - reaction intermediates :- generation, stability and reactivity of (carbocation, carbanion, carbene and nitrene) - energetics of reactions (exergonic and endergonic reactions) energy profile diagram - rate of reactions - difference between transition state and intermediate, methods of determining reaction mechanism (kinetic and non kinetic methods) - Linear free energy relationships - Hammett equation - physical significance of  $\sigma$ ,  $\rho$  - Taft equation **(18 Hours)**

## UNIT II

### **a. AROMATICITY:**

The concept of Aromaticity - aromatic, anti-aromatic and non aromatic compounds- Huckel's rule: Annulene, heterocyclic compounds, ions and polycyclic compounds

### **b. HETEROCYCLICS:**

Preparation and properties of indole-carbazole- purine- pyrimidine - antipyrine - pyrazole - thiazole - imidazole - isoxazole **(18 Hours)**

## UNIT III

### **SUBSTITUTION AND ELIMINATION REACTIONS**

#### **a. Aliphatic and aromatic nucleophilic substitutions:**

$S_N^1$ ,  $S_N^2$ ,  $S_N^i$  mechanism- effect of substrate, nucleophile, leaving group and solvent on aliphatic nucleophilic substitution. Aromatic nucleophilic substitution -  $S_N^{Ar}$ ,  $S_N^1$  and  $S_N^2$ . Effect of substrate, structure, nucleophile, leaving group and solvent on aromatic nucleophilic substitution -neighbouring group participation of (halogen, oxygen and C=C bond as neighbouring group)

#### **b. Aliphatic and aromatic electrophilic substitutions:**

$S_E^1$  and  $S_E^2$  and  $S_E^i$  mechanisms - effect of substrate structure, leaving group, attacking nucleophile and solvent. Aromatic electrophilic substitution - arenium ion mechanism - mechanisms of nitration, sulphonation, halogenation and Friedel craft alkylation reaction.

#### **C. Elimination reactions:**

$E_1$ ,  $E_2$  and  $E_{1CB}$  mechanisms. Effect of substrate, base, solvent and the leaving group on elimination reaction. Hofmann, Saytzeff and Bredt's rule. **(18 Hours)**

#### UNIT IV

##### a. REAGENTS IN ORGANIC SYNTHESIS:

- i) Oxidation reactions involving Aluminium isopropoxide- lead tetraacetate-peracids- chromyl chloride-NBS - DCC - DDQ - SeO<sub>2</sub>
- ii) Reduction reactions involving Raney Nickel - Sodamide - Lithium Aluminium Hydride - Sodium borohydride -Wilkinson catalyst- Baker's yeast- LDA

##### b. NAMED REACTIONS:

Acyloin condensation -Birch reduction - Dieckmann - Elbs reaction -Ene reaction - Hofmann elimination - Mannich - Michael- Oppenauer oxidation - Stork enamine reaction - Woodward Prevost hydroxylation reaction - Wittig reaction - Clemmensen reduction (18 Hours)

#### UNIT V

##### REARRANGEMENTS:

Orton - Lossen - Beckmann, Fries, Favorskii - Curtius - pinacol-pinacalone-Benzillic acid - Baeyer-Villiger oxidation- Cope, Wagner-Meerwein - Claisen - Wolff - Neber - Schmidt-Stevens-Wittig rearrangement (18 Hours)

#### BOOKS FOR REFERENCE:

1. V. K. Ahulvalia, Organic Reaction Mechanisms, Narosa publishing House Pvt. Ltd, 4<sup>th</sup> edition, 2007 **Unit I, II, III and V**
2. Peter Sykes, A guide book to mechanism in Organic chemistry, Pearson Education, 6<sup>th</sup> edition, 2007 **Unit I and II**
3. Jerry March, Advanced Organic Chemistry, Reaction mechanism and structure, Wiley Inter science Publications, 6<sup>th</sup> edition, 2013 **Unit I and II**
4. L. Finar, Organic chemistry, Vol - II, Pearson Education Ltd., 5<sup>th</sup> edition, 2012, **Unit V**
5. S. Renuga, Name Reactions and Reagents in Organic Synthesis, Vishal Publishing Co., 2016 **Unit III and IV**



## PHYSICAL CHEMISTRY - I

Semester: I

Hours: 6

Code : 20PCH1C02

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explain the concepts and applications of microwave spectroscopy	PSO-1, PSO-2	K, U
CO - 2	Outline the principles and applications of vibrational and Raman spectroscopy	PSO-2	U, Ap
CO - 3	Apply the concepts of electronic, ESR and Mossbauer spectroscopy	PSO-2, PSO-4	U, Ap
CO - 4	Summarize the physical aspects of NMR spectroscopy	PSO-4, PSO-5	K, U,
CO - 5	Analyse the concepts and techniques involved in photochemistry and radiation	PSO-1	U, An

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I		PHYSICAL CHEMISTRY - I										Hours: 6
Code : 20PCH1C02												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	3	4	4	3	3	4	4	3	4	4	3	3.54
CO - 2	4	3	3	3	3	4	3	3	3	4	3	3.27
CO - 3	4	4	3	4	4	4	3	4	3	4	4	3.72
CO - 4	3	3	3	4	4	4	3	3	4	4	3	3.45
CO - 5	3	4	4	4	3	4	3	4	3	5	4	3.45
<b>Overall Mean Score</b>											<b>3.48</b>	

**Result:** The Score for this Course is 3.48 (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

### **ROTATIONAL SPECTROSCOPY:**

Basic aspects of spectroscopy - characterization of electromagnetic radiation - quantization of energy - regions of the spectrum - signal to noise ratio - the width and intensity of spectral lines - Fourier transform - stimulated emission - lasers - Microwave spectroscopy: rotation of molecules - selection rule - diatomic molecules - rigid and non - rigid rotator - the effect of isotopic substitution - linear polyatomic, symmetric top and asymmetric top molecules - microwave oven

**(18 Hours)**

## **UNIT II**

### **VIBRATIONAL SPECTROSCOPY:**

Vibration of diatomic molecules - harmonic and anharmonic oscillators - zero point energy - force constant - fundamental absorption and overtones - Fermi resonance - vibration and rotation spectrum of carbon monoxide- vibrations of polyatomic molecules-fundamental vibrations and their symmetry-overtone and combination frequencies-influence of rotation on the spectra of polyatomic molecules - carbon dioxide - analysis by infra-red techniques

### **RAMAN SPECTROSCOPY:**

Raman and Rayleigh scattering - Quantum and classical theories of Raman effect - polarization of light and the Raman effect -mutual exclusion rule - techniques and instrumentation

**(18 Hours)**

## **UNIT III**

### **ELECTRONIC SPECTROSCOPY:**

Electronic spectra- electronic spectra of diatomic molecules - Born-Oppenheimer approximation-Franck-Condon principle-dissociation energy

### **ESR SPECTROSCOPY:**

Introduction - instrumentation- ESR spectrum of an unpaired electron - g factor - hyperfine structure of ESR absorption - double resonance in ESR - applications to hydrogen and methyl free radicals 1,4 benzosemiquinone radical anion, naphthalene anion, anthracene and bis-salicylaldimine Cu (II) complex

### **MOSSBAUER SPECTROSCOPY:**

Principles - instrumentation - the chemical shift - quadrupole effect - effect of a magnetic field-applications to iron and tin complexes

**(18 Hours)**

#### **UNIT IV: NMR**

Instrumentation-spin and applied field-nature of spinning particles-interaction between spin and a magnetic field-population of energy levels-Larmor precession-relaxation times-Fourier transform in NMR-spin-spin relaxation-spin-lattice relaxation-Hydrogen nuclei-chemical shift-coupling constant-coupling between several nuclei-chemical analysis by NMR technique- exchange phenomena-Nuclei other than Hydrogen-nuclei with spin  $\frac{1}{2}$  -  $^{13}\text{C}$  NMR spectroscopy- principles -Comparison between  $^1\text{H}$  and  $^{13}\text{C}$  - nuclei with spin greater than  $\frac{1}{2}$ -quadrapole effects- applications of NMR in medicine-MRI (18 Hours)

#### **UNIT V: PHOTOCHEMISTRY AND RADIATION CHEMISTRY:**

Physical properties of the electronically excited molecule: excited state dipole moments-excited state pKa, excited state redox potential - Jablonski diagram - Radiative and non radiative decays - Fluorescence, Phosphorescence - photosensitisation and chemiluminescence-factors affecting quantum yield- fluorescence quenching-Stern Volmer equation-Experimental techniques in photochemistry - Flash photolysis technique. Radiation chemistry - interaction of radiation with matter, primary effects due to charged particles, linear energy transfer-radiolysis of water-the hydrated electron and its reactions (18 Hours)

#### **BOOKS FOR REFERENCE:**

1. N. Colin Banwell and M. Elaine McCash Fundamentals of Molecular spectroscopy TATA McGraw Hill Co., 4<sup>th</sup> edition, 2007 **Unit I to IV**
2. K.K. Rohatgi - Mukherjee, Fundamentals of Photochemistry, Wiley Eastern Ltd., **Unit V**
3. B.R. Puri, L.R. Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 46<sup>th</sup> edition, 2012 **Unit I to V**
4. R.S. Drago, Physical Methods in Inorganic Chemistry, W.B. Saunders Company, 1992

## INORGANIC CHEMISTRY - I

Semester: I

Hours: 6

Code : 20PCH1C03

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Use the periodic table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity	PSO-2	K, C
CO - 2	Explain characteristics of main group elements and the concept of the chemistry of lanthanides and actinides	PSO-1	S, Ap
CO - 3	Describe the nature of bonding in different systems	PSO-2	U, C
CO - 4	Manipulate the octet rule and VSEPR theory	PSO-1	Ap, An
CO - 5	Identify the structure of solid state and recognize the crystal structure and metallic bonding	PSO-2 PSO-4	An, E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I		INORGANIC CHEMISTRY - I										Hours: 6
Code : 20PCH1C03												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	4	5	4	3	4	3	4	4	4	3.90
CO - 2	4	3	3	3	4	4	4	3	4	4	4	3.63
CO - 3	4	5	4	4	4	4	4	4	4	4	4	4.09
CO - 4	4	4	5	4	4	4	5	4	4	4	4	4.18
CO - 5	4	4	4	4	4	4	4	3	4	3	4	3.81
<b>Overall Mean Score</b>												<b>3.92</b>

**Result:** The Score for this Course is 3.92 (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## UNIT I

### a) MODERN PERIODIC TABLE:

Periodic law - extended long form of periodic table - groups and periods: general characteristics - classification of elements on the basis of electronic configuration

### b) ATOMIC PROPERTIES:

Periodicity of properties - size of atoms and ions - atomic radii and ionic radii - periodic trends in atomic radii and ionic radii - ionization energy - factors influencing ionization energy - electron affinity - periodic trends in electron affinity, electronegativity - factors influencing electronegativity

### c) GENERAL CHARACTERISTICS OF s AND p-BLOCK ELEMENTS:

Metallic character - polarizing power - melting point and boiling point - oxidizing and reducing properties - electrode potential - oxidation state - diagonal relationship

(18 Hours)

## UNIT II

### a) GENERAL CHARACTERISTICS OF d-BLOCK ELEMENTS:

Metallic character - polarizing power - melting point and boiling point - oxidizing and reducing properties - electrode potential - oxidation state - diagonal relationship - colored compounds - unusual magnetic behaviour - catalytic properties - formation of co-ordination compounds

### b) GENERAL CHARACTERISTICS OF f-BLOCK ELEMENTS:

**Lanthanides** - occurrence - electronic configuration - oxidation states - ionic radii - colour and absorption spectra - magnetic properties - oxidation potential - basic character - solubility - double salts - chemical reactivity - complexes - uses.

**Actinides** - occurrence - electronic configuration - oxidation states - ionic radii - colour - complexes - comparison between lanthanides and actinides - extraction and separation of lanthanides and actinides

(18 Hours)

## UNIT III

### IONIC BOND:

Nature of ionic bond - formation of ionic bond: NaCl - factors influencing ionic bonding - classification of Ionic structures: type AX (ZnS, NaCl, CsCl), AX<sub>2</sub> (CaF<sub>2</sub>, TiO<sub>2</sub>, SiO<sub>2</sub>) - radius ratio rules - calculation of radius ratio: coordination number 3 (Planar triangle), 4 (tetrahedral), 6 (Octahedral) - decreasing energy in ionic bond - properties: physical state - electrical conductivity - melting and boiling points - solubility - stability - crystal structure - highly brittle - density - ionic reactions - isomorphism - polarization of ions and Fajans's rule - percentage of ionic character in a polar covalent bond - Hanny Smyth equation, Born land equation

(18 hours)

## UNIT IV

### COVALENT BOND:

Lewis theory- Octet Rule (Shape of the Polyatomic molecule) - VSEPR theory-  $\text{BF}_3$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{PCl}_3$ ,  $\text{ClF}_3$ ,  $\text{SF}_4$ ,  $\text{I}^{3-}$ ,  $\text{SF}_6$  - hybridisation - isoelectronic molecules-covalent radii- MO theory and MO approach to covalent bonding (heteronuclear) diatomic CO, NO, HF-bond length, bond order and bond energy -bonding in (hetero nuclear) triatomic and polyatomic systems -  $\text{CO}_2$  and  $\text{NH}_3$ ,  $\text{BeH}_2$  (18 Hours)

## UNIT V

### SOLID STATE CHEMISTRY:

Space lattices - unit cells - crystal system - Bravais lattices-space group-translational symmetry - relationship between molecular and crystallographic symmetry - X-ray diffraction - Bragg's method-rotating crystal method and powder method of X-ray diffraction-indexing of crystal planes-structure of graphite and diamond - spinels - normal and inverse types. Crystal defects - point, line and plane defects in solids - stoichiometric and non-stoichiometric defects - Frenkel and Schotky defects

**METALLIC BONDING** - band theory-conductors-insulators-semiconductors - Intrinsic and extrinsic - superconductivity (18 Hours)

### BOOKS FOR REFERENCE:

1. James E. Huheey, Inorganic Chemistry, Dorling Kindersley Pvt. Ltd., 4<sup>th</sup> edition, 2012 **Unit I to V**
2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers and Distributor, Delhi, 31<sup>st</sup> edition, 2010 **Unit I to V**
3. A. Abdul Jameel, Applications of physical methods to inorganic Compounds, 2007 **Unit V**
4. R.D. Madan, Modern Inorganic Chemistry, S. Chand and Company Ltd., 2<sup>nd</sup> edition, 2002 **Unit I to V**
5. J.D. Lee, Concise Inorganic Chemistry, Blackwell publishing, 5<sup>th</sup> edition, 1996 **Unit III and IV**
6. Bodie Douglas, Darl McDaniel, John Alexander, Concepts and Models of Inorganic Chemistry, Wiley-India Publishing, 3<sup>rd</sup> edition, 2006 **Unit III and IV**

**PRACTICAL: ORGANIC ESTIMATION AND ANALYSIS OF ORGANIC MIXTURE**

(Microscale procedure is adopted)

**(Examination at the end of the I semester)****Semester: I****Hours: 6****Code : 20PCH1P01****Credits: 3****COURSE OUTCOMES:**

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Identify the organic compounds based on their characteristic qualities	PSO-1, PSO-2	An
CO - 2	Apply the knowledge of separation of organic mixture using different solvents	PSO-1, PSO-3	S
CO - 3	Demonstrate the quantitative estimation of organic compounds	PSO-3	Ap
CO - 4	Enumerate the empirical skills	PSO-3	E
CO - 5	Apply the methods for finding the functional nature of an organic compound	PSO-4, PSO-5	Ap

**RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

Semester: I		PRACTICAL: ORGANIC ESTIMATION AND ANALYSIS OF ORGANIC MIXTURE										Hours: 6
Code : 20PCH1P01												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	2	3	3	4	3	4	5	3	4	5	3.63
CO - 2	4	3	5	4	3	4	5	4	4	3	4	3.90
CO - 3	3	4	4	5	3	2	4	3	5	3	4	3.63
CO - 4	4	3	5	4	2	3	5	3	4	3	5	3.72
CO - 5	4	3	4	5	3	3	5	4	3	4	5	3.90
<b>Overall Mean Score</b>											<b>3.74</b>	

**Result:** The Score for this Course is 3.74 (High Relationship)**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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1. Separation of Organic Mixtures
2. Organic Analysis following microscale procedure:  
Reporting aliphatic or aromatic, saturated or unsaturated, detection of elements,  
identification of functional groups, preparation of derivatives
3. Organic Estimation
  - (a) Estimation of Phenol
  - (b) Estimation of Aniline
  - (c) Estimation of Glucose
  - (d) Estimation of Ethyl Methyl Ketone

### **BOOKS FOR REFERENCE**

1. Material prepared by the Chemistry Department
2. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry Lab Manual  
S. Viswanathan Printers and Publishers Pvt. Ltd., 2007



## MEDICINAL CHEMISTRY

**Semester: I**

**Hours: 6**

**Code : 20PCH1E1A**

**Credits: 3**

**COURSE OUTCOMES:**

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explain the various terminology used in drugs	PSO-1, PSO-3	K, C
CO - 2	Classify the drugs on the basis of its biological Function	PSO-2	K, An
CO - 3	Describe the action of drugs	PSO-1, PSO-4	K, Ap
CO - 4	Outline the importance of organic pharmaceutical Aids	PSO-1	K, C
CO - 5	Summarize the treatment for various illness with specified drugs	PSO-3	K, E

**RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

Semester: I		MEDICINAL CHEMISTRY										Hours: 6
Code : 20PCH1E1A												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	4	4	2	2	2	3	2	2	4	3
CO - 2	4	4	4	4	2	2	2	3	2	2	4	3
CO - 3	4	4	4	4	2	2	2	3	2	2	4	3
CO - 4	4	4	4	4	2	2	2	3	2	2	4	3
CO - 5	4	4	4	4	3	4	3	3	4	4	4	3.72
<b>Overall Mean Score</b>												<b>3.14</b>

**Result:** The Score for this Course is 3.14 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## UNIT I

### **SYNTHETIC DRUGS:**

Introduction: characteristics of drugs - development of synthetic drugs - nature and sources of drugs - some important terminology: pharmacy, pharmacology, medicinal chemistry, pharmacodynamics, pharmacokinetics, molecular pharmacology, pharmacophore, antimetabolites, actinomycetes, bacteria, virus, fungi, mutation, chemotherapy, pharmacopocia, pharmacognosy, toxicology, pharmacotherapeutics (18 Hours)

## UNIT II

### **a) BIOLOGICAL CLASSIFICATION OF DRUGS:**

Biological classification - drugs acting on central nervous system and peripheral nervous system - chemotherapeutic drugs - pharmacodynamic agents - metabolic disease and endocrine function - chemical classification of drugs

### **b) STEREOCHEMICAL NOMENCLATURE**

D and L system - R-S system - Z-E isomerism (18 Hours)

## UNIT III

### **DRUG ACTION**

Mechanism of action: extracellular site - cellular sites - drug receptors and biological responses - drug receptor binding-metabolism of drugs - phase I and phase II - biotransformation on the pharmacological activity - absorption of drugs - routes of administration - factors affecting absorption (18 Hours)

## UNIT IV

### **ORGANIC PHARMACEUTICALAIDS:**

Preservatives - antioxidants - emulsifying agents: colouring, flavouring and sweetening agents, stabilizing and suspending agents - ointment bases and related agents-solvents (18 Hours)

## UNIT V

### **THERAPEUTIC AGENTS:**

**a) ANTI - CANCER AGENTS:** Types of tumours - some common causes of cancer - spread of cancer - treatment of cancer-structure, uses and adverse effects of chlorambucil and methotrexat

**b) SULPHA DRUGS:** Preparation, properties and therapeutic uses of sulphanilamide, sulphadiazine and sulphapyridine

**c) ANTIBIOTICS:** Classification of antibiotics - chloroamphenicol: properties and therapeutic uses - penicillin - types - therapeutic uses - tetracyclines - types - therapeutic uses (18 Hours)

**BOOKS FOR REFERENCE:**

1. O.D Tyagi M. Yadav, A Text book of synthetic drugs, Anmol publications, 1<sup>st</sup> edition, 1990 **Unit II and V**
2. Jeyashree Ghosh, Text book of Pharmaceutical Chemistry, S. Chand Company Ltd., 1<sup>st</sup> edition, 1997 **Unit I, III and IV**

## RESEARCH METHODOLOGY

Semester: I

Code : 20PCH1E1B

COURSE OUTCOMES:

Hours: 6

Credits: 3

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Carry out literature survey for the proposed work	PSO-2	K
CO - 2	Investigate a research problem	PSO-2, PSO-5	K, An
CO - 3	Apply the separation and purification techniques to chemical compounds	PSO-1	K, Ap
CO - 4	Employ the analytical techniques to characterize the compounds	PSO-3, PSO-4	K, Ap
CO - 5	Interpret data using chem softwares	PSO-2	C, Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I		RESEARCH METHODOLOGY										Hours: 6
Code : 20PCH1E1B												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	2	3	3	4	3	4	5	3	4	5	3.63
CO - 2	4	3	5	4	3	4	5	4	4	3	4	3.90
CO - 3	3	4	4	5	3	2	4	3	5	3	4	3.63
CO - 4	4	3	5	4	2	3	5	3	4	3	5	3.72
CO - 5	4	3	4	5	3	3	5	4	3	4	5	3.90
<b>Overall Mean Score</b>												<b>3.74</b>

**Result:** The Score for this Course is 3.74 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

### **COLLECTION OF RESOURCES:**

Literature survey - sources of information primary- secondary and tertiary resources -chemical journal and journal abbreviations - web publishing- -web resources-Journal access through web-digitized and digital formats-E-journals-e-journals consortium-UGC-INFLIBNET - E-books - Online and digital libraries-useful web links- Search engines Alta vista, google , yahoo search -wikis-scifinder - scopus - scirus - science direct -citation index-impact factor, H-index

**(18 Hours)**

## **UNIT II**

### **METHODOLOGY OF SCIENTIFIC DOCUMENT WRITING:**

Introduction to technical writing -types of report, title and abstract, the text-style and conventions in writing. writing dissertation and thesis-title, abstract, introduction of the thesis, literature review, experimental methods, results and discussion, foot notes, figures, different methods of data presentation(graph, chart) - tables, sign conventions followed - conclusions and recommendations - bibliography

Preparation of manuscript and posters - writing review article and book reviews-Funding agencies and schemes available - preparing research proposals for grants - ethics in scientific publication - formats for some national and international journals - knowledge about publishers such as ACS, RSC, elsevier, springer - wiley inter science - Taylor and Francis etc - publications from national scientific institutions (CSIR, IASc, IISc)

**(18 Hours)**

## **UNIT III**

### **SEPARATION AND PURIFICATION METHODS**

Introduction - basic principles of separation techniques - crystallization - fractional crystallization - fractional precipitation - sublimation - solvent extraction - extraction from solids, extraction from liquids - distillation - simple distillation, fractional distillation, steam distillation - criteria of purity - melting point, boiling point

**(18 Hours)**

## **UNIT IV**

### **ANALYTICAL TECHNIQUES:**

Applications of UV, IR, NMR, and Mass spectra in structural elucidations - Principle, instrumentation and applications of XRD, SEM, TEM, EDAX, STM and AFM

**(18 Hours)**

## **UNIT V**

### **COMPUTATIONAL TECHNIQUES IN CHEMISTRY:**

#### **a) CHEMDRAW:**

Introduction- Tool Pallets- Construction of the molecule using Chem Draw - Naming IUPAC - Structure from Name and Name from Structure-Writing Chemical Equation and Schemes using Software - Editing - Transporting Picture to Word Document - Building of Molecules - Measurement of Bond Angles - Bond Energy and Bond Length

#### **b) DATA ANALYSIS USING ORIGIN:**

Format menu - analysis - linear and non linear graphs - UV - Visible spectral data - FT-IR spectral data - fitting linear graph for first order rate constant: ester hydrolysis- slope and Regression - fitting non-linear graph for conductometric titrations

**(18 Hours)**

### **BOOKS FOR REFERENCE:**

1. Web resources **Unit I and II**
2. Michael P. Marder, Research methods for science, 2011, 1<sup>st</sup> edition, Cambridge University press **Unit II**
3. R.P. Budhiraja, Separation Chemistry, 2007, 2<sup>nd</sup> edition, New age international Pvt. Ltd. **Unit III**
4. J Mendham, R.C. Denny, J.D. Barnes M J K Thomas, Vogel's textbook of quantitative chemical analysis, 2005, 6<sup>th</sup> edition, **Unit III**
5. Silverstein, S.M., Bassler, G.V. & Morrill, T.C. (2004). Spectrometric Identification of Organic Compounds. (6<sup>th</sup> ed.). New York: Wiley **Unit IV**
6. Kemp, W. (2011). Organic Spectroscopy. (3<sup>rd</sup>ed.).New York: Macmillan. **Unit IV**
7. Chatwal and Anand, Instrumental methods of chemical analysis, 1984, 2<sup>nd</sup> edition, Himalaya Publishing House **Unit III and IV**
8. Michael P. Marder, Research methods for science, 2011, 1<sup>st</sup> edition, Cambridge University press **Unit II**
9. Chem Draw and Origin manuals **Unit V**

## NANO CHEMISTRY AND GREEN SYNTHESIS

Semester: I

Code : 20PCH1E1C

Hours: 6

Credits: 3

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on fundamentals of Nanomaterials	PSO-1	K, C
CO - 2	Describe principles of nanoparticle preparation and modification	PSO-2	An, E
CO - 3	Evaluate nanotechnology, the necessary foundation for training in research	PSO-3	C, E
CO - 4	Recognize the impact of green chemistry on human health and environment	PSO-4,	An, S
CO - 5	Apply the principles of green chemistry to carry out synthesis of various compounds	PSO-3	Ap, S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I		NANO CHEMISTRY AND GREEN SYNTHESIS										Hours: 6
Code : 20PCH1E1C												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	4	5	4	3	4	3	4	4	4	3.90
CO - 2	4	3	3	3	4	4	4	3	4	4	4	3.63
CO - 3	4	5	4	4	4	4	4	4	4	4	4	4.09
CO - 4	4	4	5	4	4	4	5	4	4	4	4	4.18
CO - 5	4	4	4	4	4	4	4	3	4	3	4	3.81
<b>Overall Mean Score</b>												<b>3.92</b>

**Result:** The Score for this Course is 3.92 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

### **BASIC CONCEPTS OF NANOCHEMISTRY AND PROPERTIES OF NANOMATERIALS:**

Introduction to nanoscience and nanotechnology, discussion on various phenomenon at nanoscale - size, shape, surface, surface energy, surface stabilization, characteristic length, self-assembly, defects, size quantization, surface plasmon, conductivity, tunneling, magnetism, defects Formation of dangling bonds - atom like behaviour of nanoparticles - physicochemical properties - optical properties - electrical and electronic properties **(18 Hours)**

## **UNIT II**

### **SYNTHESIS OF NANOMATERIALS:**

Basics of nanofabrication method - top-down, bottom-up approaches, gas phase, liquid phase, solid phase synthesis, self-assembly, templated synthesis, sol-gel, electrodeposition, nanoparticle formation, thermodynamic approach, supersaturation, nucleation, growth, homo vs hetero nucleation. Synthesis of nanoparticles: metallic, semiconducting, quantum dots, oxides, hybrids, micelles and microemulsion as templates for synthesis. 0D, 1D and 2D nanoparticles, core shell nanoparticles, special nanoparticles, shaped nanoparticles **(18 Hours)**

## **UNIT III**

### **a) INTRODUCTION TO GREEN CHEMISTRY:**

Definition - introduction - industry efforts - green chemistry curriculum - objectives - demand for green chemistry - need for green chemistry - metathesis: example - principles of green chemistry

### **b) ATOMECONOMY:**

Concept of atom economy - pharmaceuticals - pesticides - polymers - computer chips - dry cleaning - avoiding waste - efficiency of reaction - atom economy in substitution and elimination reactions **(18 Hours)**

## **UNIT IV**

### **a) MATERIALS AND METHODS IN GREEN SYNTHESIS:**

Tools - green starting materials - characteristics of green catalysts - example - green reactions: oxidation reaction - ruthenium catalyst - palladium catalyst - nickel catalyst

### **b) APPLICATIONS OF GREEN CHEMISTRY:**

Green guidelines - suggestions - organic qualitative analysis - detection of elements - derivative of carboxylic acid - inorganic analysis - physical chemistry experiments - green chemistry in everyday life **(18 Hours)**



## **UNIT V**

### **GREEN SYNTHESIS/REACTIONS:**

Green Synthesis of adipic acid, catechol, disodium iminodiacetate - alternative to Strecker synthesis-Microwave assisted reactions in water:Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene, oxidation of alcohol-reactions in organic solvents:Diels-Alder reaction-Decarboxylation reaction-Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction - Ultrasonic alternative to bndine-Surfactants for carbon dioxide - replacing smog producing and ozone depleting solvents , cleaning and dry cleaning of garments Designing of Environmentally safe marine antifoulant- green synthesis of plastic (poly lactic acid)- Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification **(18 Hours)**

### **REFERENCES:**

1. B.Viswanathan, Nano materials, Narosa publishing house, New Delhi, 1<sup>st</sup> edition, 2009 **Unit I to III**
2. S. Shanmugam, Nanotechnology, MJP Publishers, 2016 **Unit I to III**
3. M. A. Shah and Tokeer Ahmad, Principles of Nanoscience and Nanotechnology, Narosa Publishing House, 2<sup>nd</sup> Reprint, 2013 **Unit I and II**
4. V. K Ahluwalia, Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005. **Unit IV and V**
5. A.S.Matlack, Introduction to Green Chemistry, Marcel Dekker, 2001 **Unit V**

## ORGANIC CHEMISTRY - II

Semester: II

Hours: 5

Code : 20PCH2C04

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recognize the concepts of Stereoisomerism	PSO-2	An, C
CO - 2	Acquire knowledge on Conformational Analysis	PSO-1	K,E
CO - 3	Explain the principles and uses of IR Spectroscopy and UV Spectroscopy	PSO-3	Ap,E
CO - 4	Analyze organic compounds using NMR Spectroscopy	PSO-2,	An, S
CO - 5	Apply the principles of spectroscopy to solve the problems in competitive exams	PSO-4	K,Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		ORGANIC CHEMISTRY - II										Hours: 5
Code : 20PCH2C04												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	3	4	4	3	2	3	4	3	3	3	3	3.18
CO - 2	3	4	3	4	3	3	3	4	4	4	4	3.54
CO - 3	4	3	4	3	3	4	3	3	4	3	3	3.36
CO - 4	3	4	3	3	4	3	3	3	3	3	3	3.18
CO - 5	3	4	3	3	4	3	4	4	3	4	4	3.36
<b>Overall Mean Score</b>											<b>3.32</b>	

**Result:** The Score for this Course is 3.32 (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## UNIT I

### STEREOISOMERISM:

Chirality-stereoisomerism - axial chirality - planar chirality and helicity - stereochemistry of molecules with axial chirality - atropisomerism - biphenyls, allenes, spiranes, ansa compounds and helicene - stereo specific and stereo selective synthesis - topocity and prostereo isomerism - topocity of ligands and faces - enantiotropic ligands and faces - diastereotopic ligands and faces- asymmetric synthesis-asymmetric induction (15 Hours)

## UNIT II

### CONFORMATIONAL ANALYSIS:

Conformations of ethane, n-butane, mono and disubstituted cyclohexanes - conformation and reactivity in acyclic systems - addition reactions - elimination reactions - anti elimination - syn elimination reactions. Conformation and reactivity in cyclic systems nucleophilic substitution reaction at ring carbon - addition reactions to double bonds - electrophilic addition and nucleophilic addition - elimination reactions -conformations of decalins mono and disubstituted decalins - conformations of perhydrophenanthrenes and perhydroanthracenes (15 Hours)

## UNIT III

### a) IR SPECTROSCOPY:

Molecular vibration, modes of vibration - factors influencing vibrational frequency - applications of IR - identity by finger printing - identification of functional groups

### b) UV SPECTROSCOPY:

Theory of electronic spectroscopy - application to conjugated dienes, trienes, polyenes,  $\alpha,\beta$  - unsaturated carbonyls and benzene and its substituted derivatives, heterocyclic system (15 Hours)

## UNIT IV

### $^1\text{H}$ NMR SPECTROSCOPY:

Larmor precession - relaxation process - interaction between spin and magnetic field - Chemical shift - factors influencing Chemical shift - spin- spin splitting - coupling constant - vicinal and geminal coupling - NMR shift reagents - Nuclear Over Hauser effect - FT NMR

$\text{C}^{13}$  NMR: Introduction - chemical classes and chemical shifts: aliphatic, olefinic, alkyne, aromatic and carbonyl compounds - coupling constant - structural applications to  $\text{C}^{13}$  NMR (15 Hours)

## **UNIT V**

### **MASS SPECTROMETRY**

Basic principles - theory - methods for generation of positively charged ions (electron impact, chemical ionization and fast atom bombardment) - the molecular ion - determination of molecular formula - McLafferty rearrangement - meta stable ions - nitrogen rule - fragmentation associated with functional groups  
Applications of IR, UV, NMR and Mass spectral techniques in structural elucidation of organic compounds **(15 Hours)**

### **BOOKS FOR REFERENCE:**

1. D. N. Nasipuri, Stereochemistry of organic compounds, New Age International, 2<sup>nd</sup> edition, 2008 **Unit I and II**
2. P. S. Kalsi, Stereochemistry: Conformation and Mechanism, New Age International, 6<sup>th</sup> edition, 2011 **Unit I**
3. P. Ramesh, Basic principles of organic stereochemistry, Meenu Publications, 1<sup>st</sup> edition, 2005 **Unit I and II**
4. Alex V Ramani, Leo A. Stanley, C. Mani, Stereochemistry MJP Publishers, 2012 **Unit I and II**
5. Jag Mohan, Organic Spectroscopy Principles and Applications, Narosa Publishing House 2<sup>nd</sup> edition, 2012 **Unit III to V**
6. Robert M. Silverstein, Francis X. Webster, Spectrometric identification of organic compounds - Wiley India, 6<sup>th</sup> edition, 2007 **Unit IV and V**

## PHYSICAL CHEMISTRY - II

Semester: II

Hours: 5

Code : 20PCH2C05

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Outline the various types of electrochemical reactions and their interactions	PSO-1, PSO-2	K, U
CO - 2	Explain the various features of molar conductance in electrochemistry	PSO-2	K, U
CO - 3	Apply the principles of electrochemistry to the kinetics of electrodeprocess	PSO-1 PSO-3	U, Ap
CO - 4	Summarize the principles of group theory	PSO-2 PSO-3	K, U
CO - 5	Apply group theory to determine hybridization and selection rule for electronic spectroscopy and vibrational spectra	PSO-4, PSO-5	U, Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		PHYSICAL CHEMISTRY - II										Hours: 5
Code : 20PCH2C05												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	4	3	3	4	4	3	4	4	3	3.63
CO - 2	4	3	3	3	3	4	3	3	3	4	3	3.27
CO - 3	4	4	3	4	3	3	3	4	3	4	4	3.54
CO - 4	3	3	3	4	4	4	3	3	4	3	3	3.36
CO - 5	3	4	4	4	4	4	3	4	3	5	4	3.81
<b>Overall Mean Score</b>											<b>3.52</b>	

**Result:** The Score for this Course is 3.52 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

### **ELECTROCHEMISTRY-I:**

The nature of electrolytes - ion activity - ion-ion and ion-solvent interactions - Debye Huckel theory: evidences of ionic atmosphere, asymmetric effect, electrophoretic effect, Debye Huckel equation: derivation and verification of the equation - Debye Huckel Limiting law derivation, applications of Debye Huckel equation - ion association Falkenhagen effect, Wein effect **(15 Hours)**

## **UNIT II**

### **ELECTROCHEMISTRY-II:**

Molar conduction, variation of molar conductivity with concentration, conductivity and ionic speeds, Relationship between molar conductivity and concentration: strong completely dissociated electrolytes, weak incompletely dissociated electrolytes, electrolyte systems showing ion pairing- electrical migration and transport numbers: Hittorf's method, moving boundary method. Electrode - electrolyte interfaces, Significance of interaction between conducting phases, Electrical double layer: Helmholtz, Gouy chapman, Stern models **(15 Hours)**

## **UNIT III**

### **ELECTROCHEMISTRY - III:**

Effect of electrolyte concentrations: Nernst equation, standard electrode potentials, emf of galvanic cells and feasible cell reactions - electrocapillarity - kinetics of electrode process: Butler-Volmer equation, dependence of current density on over voltage: The Tafel equation, polarized and non-polarized electrodes - fuel cells - electronically conducting polymers **(15 Hours)**

## **UNIT IV**

### **GROUP THEORY I:**

Symmetry elements - symmetry operations - properties of a group - Abelian, non - Abelian and cyclic groups - multiplication table  $C_{2v}$  - subgroups - class - products of symmetry operations-point groups - matrix representation for symmetry operations - reducible and irreducible representations - statement of orthogonality theorem - properties of irreducible representation - construction of character table ( $C_{2v}$  and  $C_{3v}$ ) **(15 Hours)**

## **UNIT V**

### **GROUP THEORY II:**

The relationship between reducible and irreducible representations- hybridization of atomic orbitals in molecules of different geometry -  $AB_4$

tetrahedral,  $AB_3$  triangular, AB linear molecules-symmetries of vibrational modes in non-linear molecules ( $H_2O$ ,  $NH_3$  and  $BF_3$ ) - symmetries of vibrational modes in linear molecules (HCN) - selection rules for vibrational transitions-pyramidal  $AB_3$ (excluding G and F matrices) - trans  $N_2F_2$  - Mutual exclusion rule for molecules with centre of symmetry-use of group theory in determining the selection rules for the  $n-\pi^*$  and  $\pi-\pi^*$  transitions in formaldehyde - HMO energy calculation for ethylene and butadiene **(15 Hours)**

**BOOKS FOR REFERENCE:**

1. D.R.Crow, Principles and applications of Electrochemistry, Chapman and Hall, London, 2<sup>nd</sup> edition, 1984 **Unit I and II**
2. Atkins, Physical Chemistry, Oxford University Press, 7<sup>th</sup> edition, 2006 **Unit II**
3. Raman, K.V. Group theory and its applications to Chemistry, TATA McGraw Hill Co, 4<sup>th</sup> edition, 2007 **Unit IV and V**
4. F.Albert Cotton, Chemical applications of Group theory, Wiley Eastern Ltd, 3<sup>rd</sup> edition, 2004 **Unit V**
5. B.R. Puri, L.R. Sharma S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co. New Delhi 46<sup>th</sup> edition, 2012 **Unit I to V**

## INORGANIC CHEMISTRY - II

Semester: II

Hours: 5

Code : 20PCH2C06

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explain the concepts of acids, bases and non-aqueous Solvents	PSO-1	K, An
CO - 2	Recognize the inorganic polymers, phosphates, related structure with bis chelating agents	PSO-1	Ap, An
CO - 3	Describe the concept of boranes and silicates and associate the chemistry of P-N and S-N heterocycles with inorganic chains, rings, cages and clusters	PSO-2, PSO-3	K, E
CO - 4	Explaining the structures of metal clusters and recognize supra molecular chemistry	PSO-1, PSO-4	C, Ap, E
CO - 5	Discuss nuclear energy and its applications	PSO-1	An, Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		INORGANIC CHEMISTRY - II										Hours: 5
Code : 20PCH2C06												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	4	3	3	4	4	5	4	4	4	3	3.90
CO - 2	4	4	4	5	4	4	4	3	4	4	4	4
CO - 3	4	4	4	5	4	4	4	3	4	4	4	4
CO - 4	5	4	4	4	4	4	4	4	3	4	4	4
CO - 5	4	4	4	4	4	4	4	4	4	3	4	3.90
<b>Overall Mean Score</b>												<b>3.96</b>

**Result:** The Score for this Course is 3.96 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## UNIT I

### a) ACIDS AND BASES:

Introduction - Concepts of acids and bases - Arrhenius concept - Lowry-Bronsted - relative strengths of acids and bases - Lewis concepts - effect of solvent on acid strength and base strength - leveling effect on the basis of solvent system concept - hard and soft acids and bases - Pearson concept - HSAB principles and applications (15 Hours)

### b) NON-AQUEOUS SOLVENTS:

Classification of solvents - protonic solvents - liquid ammonia and anhydrous hydrogen fluoride - chemical reactions - aprotic solvents - liquid sulphur dioxide and liquid dinitrogen tetroxide - chemical reactions (15 Hours)

## UNIT II

### INORGANIC POLYMERS:

General properties of Inorganic polymers - classification - homoatomic - heteroatomic condensation - addition polymers - coordination polymers - glass transition temperature - phosphorus based polymers - polydiethoxyphosphazines - polyphosphoryl chlorides - polyphosphates - metaphosphates - polyphosphates cross linked phosphates - ultraphosphate glasses - borophosphate glasses-uses of phosphorus polymers-polymeric sulphurnitride - chalcogenide glasses-coordination polymers-chain polymers-two dimensional polymers - synthetic coordination polymers - polymers having phthalocyanine and related structure-polymers with bischelating agents (15 Hours)

## UNIT III

### INORGANIC CHAINS, RINGS AND CAGES:

a) BORANES AND SILICATES: Borates - types of borates - structure of diborane - boranes - styx numbers - boranes and carboranes - Wades rule - boron nitride - borazines - silicates -types - beryl, talc, mica, zeolites, feldspar, ultramarine - preparation, properties and uses of silicones

b) P - N HETEROCYCLES: Synthesis of P-N skeleton - reactions of halo phosphazenes - hydrolysis - aminolysis - metathetical reactions - reactions with organo metallic reagents

c) S - N HETEROCYCLES: S - N heteroatom system-synthesis, properties and structure of sulphur nitrides (15 Hours)

## UNIT IV

### **METAL CLUSTERS AND SUPRA MOLECULAR CHEMISTRY:**

Introduction - carbonyl clusters - low and high nuclearity carbonyl clusters- electron counting scheme for HNCCs - halide type clusters - di, tri, tetra and hexa nuclear halide clusters - poly atomic zintl anions and cations - chelate phases - introduction - host - guest interaction - molecular and supra molecular self-assembly - molecular recognition and complexation - supramolecular structures formed through coordination chemistry - the directional bonding approach - advantages and limitations - dinuclear macrocycles - molecular triangles, rectangles and molecular cages (Pd and Pt based) **(15 Hours)**

## UNIT V

### **NUCLEAR CHEMISTRY:**

General characteristics of radioactive decay, decay kinetics - nuclear model - nuclear shell model- nuclear liquid drop model - nuclear fusion-nuclear fission- neutron evaporation and spallation- nuclear reactors- thermal reactors-breeder reactor-reprocessing of spentfuels-recovery of uranium and plutonium- nuclear waste management- radio isotopes in analytical applications- direct isotope dilution analysis- neutron activation analysis- radiation energy for chemical synthesis **(15 Hours)**

### **BOOKS FOR REFERENCE:**

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers and Distributor, Delhi, 31<sup>st</sup> edition, 2010 **Unit I to V**
2. James E. Huheey, Inorganic Chemistry, Dorling Kindersley Pvt.Ltd., 4<sup>th</sup> edition, 2012. **Unit I, II and IV**
3. R.D. Madan, Modern Inorganic Chemistry, S. Chand and Company Ltd, 2<sup>nd</sup> edition, 2002
4. H.R. Allcock, Phosphorous and Nitrogen compounds **Unit III**
5. E. Douglas, H.Mc Daniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3<sup>rd</sup> edition, 2006 **Unit I, IV and V**
6. Bradley, J.Hollidy, Chad. A. Mirkin. Supra Molecular Coordination Chemistry review-Strategies for the Construction of Supramolecular compounds through coordination chemistry, Angew.Chem.Int.ed.2001,14,2022 to 2043 **Unit IV**
7. H. J. Arnikaar, Essentials of Nuclear Chemistry, New Age international, 4<sup>th</sup> edition, 2007 **Unit V**
8. R.L. Madan, G.D. Tuli, Inorganic Chemistry, S.Chand's publishing 1999 **Unit I to V**

## PRACTICAL: INORGANIC ANALYSIS AND ESTIMATION

(Examination at the end of semester II)

Semester: II

Hours: 5

Code : 20PCH2P02

Credits: 3

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Identify the common and less common metal ions present in the given mixture	PSO-1, PSO-3	An
CO - 2	Acquire knowledge on EDTA titrations	PSO-3	K
CO - 3	Estimate the hardness of the given sample of water	PSO-1	E
CO - 4	Apply Beer-Lamberts' law in colorimetric estimation of metal ions	PSO-4, PSO-5	Ap
CO - 5	Adopt safety measures in handling chemicals	PSO-5	Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		PRACTICAL: INORGANIC ANALYSIS AND ESTIMATION										Hours: 5
Code : 20PCH2P02												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	3	4	4	3	4	4	4	4	3	3.72
CO - 2	4	4	4	4	4	3	4	4	4	3	4	3.81
CO - 3	4	3	4	4	4	3	4	4	3	4	4	3.72
CO - 4	4	4	4	4	4	3	4	4	4	3	4	3.81
CO - 5	4	4	4	4	4	3	4	4	4	3	4	3.81
<b>Overall Mean Score</b>											<b>3.79</b>	

**Result:** The Score for this Course is 3.79 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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1. Analysis of mixture of cations including less familiar cations such as Lithium, Thallium, Molybdenum, Thorium, Selenium, Tellurium, Uranium, Vanadium, Cerium and Zirconium
2. EDTA Titration: Estimation of Magnesium, Zinc and Hardness of water
3. Colorimetry: Estimation of Iron and Copper

**COURSE BOOKS:**

1. V. Venkateswaran, R. Veeraswamy and A. R. Kulandaivelu , Basic principles of Practical chemistry Sultan Chand and sons, 2<sup>nd</sup> edition, 2012
2. V.V. Ramanujam, Inorganic Semimicro Qualitative Analysis , The National publishing Co., 3<sup>rd</sup> edition, 2012
3. Dr. A. Abdul Jameel, Associate Professor and Head, PG and Research Department of Chemistry, Jamal Mohamed College (Autonomous) Tiruchirapalli, Inorganic Chemistry Practical (Manual for M.Sc.)

## INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

**Semester: II**

**Hours: 4**

**Code : 20PCH2E2A**

**Credits: 3**

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on various analytical techniques	PSO-1	K, C
CO - 2	Describe principles of EDTA titrations	PSO-3	Ap, E
CO - 3	Evaluate various separation techniques	PSO-2	C, E
CO - 4	Recognize the importance of various thermal analysis techniques	PSO-4,	Ap, S
CO - 5	Apply the principles of various electro analytical techniques	PSO-3	Ap, S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS										Hours: 4
Code : 20PCH2E2A												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	4	4	2	2	2	4	2	3	3	3.09
CO - 2	4	4	4	3	3	4	2	2	4	4	4	3.45
CO - 3	4	4	4	3	3	4	2	2	4	4	4	3.45
CO - 4	4	4	4	3	3	4	2	2	4	4	4	3.45
CO - 5	4	4	4	3	3	4	2	2	4	4	4	3.45
<b>Overall Mean Score</b>											<b>3.38</b>	

**Result:** The Score for this Course is 3.38 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

### **COLORIMETRY AND SPECTROPHOTOMETRY:**

Theory of spectrophotometry and colorimetry - determinations with UV/visible spectrophotometers - colorimetry - photoelectric colorimeter - colorimetric determination of iron and nickel - spectrophotometry - description of apparatus - spectrophotometric titration **(12 Hours)**

## **UNIT II**

### **EDTA TITRATIONS:**

EDTA structure - types of EDTA titrations - indicators used in EDTA titrations - metal-ion indicators - standard EDTA solutions - EDTA titrations of iron and nickel - determination of temporary and permanent hardness of water using EDTA - stability of metal EDTA complexes - titration of mixtures - masking and demasking agents.

Atomic absorption spectroscopy - elementary theory - instrumentation **(12 Hours)**

## **UNIT III**

### **SEPARATION TECHNIQUES:**

Ion-exchange process-introduction-action of ion exchange resins-ion exchange chromatography-chelating ion exchange resins-applications in analytical chemistry: separation of zinc and magnesium on an anion exchanger, determination of fluoride with the aid of a cation exchanger- Gas chromatography - principles and applications - High performance liquid chromatography - principle, instrumentation - modes-procedure- applications **(12 Hours)**

## **UNIT IV**

### **THERMAL ANALYSIS:**

Thermo analytical methods - thermal methods - thermo gravimetric analysis-apparatus - factors affecting thermogram- applications of TGA - Differential thermal analysis (DTA) - apparatus - applications - comparison of TGA and DTA - principles of thermometric titrations - apparatus - applications -Differential scanning colorimetry **(12 Hours)**

## **UNIT V**

### **ELECTRO ANALYTICAL TECHNIQUES:**

Voltammetry - polarography - basic principles - direct current polarography - commercial polarographs -determination of lead and copper in steel- cyclic voltammetry- principle and applications - Amperometry - Amperometric titrations - technique of amperometric titrations with dropping mercury electrode - determination of lead with standard potassium dichromate solution **(12 Hours)**

**BOOKS FOR REFERENCE:**

1. Vogel's Textbook of Quantitative Inorganic Chemical analysis, 7<sup>th</sup> edition ELBS with Longmann Publication, 2005 **Unit I to V**
2. Williard D. Merit, Instrumental methods of Analysis, 7<sup>th</sup> edition, CBS publishers 2007 **Unit V**

**FURTHER READING:**

1. P. C. Jain & Monica Jain, Engineering Chemistry, 17<sup>th</sup> edition. Dhanpat Rai Publishing Company, 2008.
2. Chatwal Anand, Instrumental methods of Chemical Analysis, 2<sup>nd</sup> edition, Himalaya Publishing House, 1984.

## ENGINEERING CHEMISTRY

**Semester: II**

**Hours: 4**

**Code : 20PCH2E2B**

**Credits: 3**

**COURSE OUTCOMES:**

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Develop skills in water treatment	PSO-1,3	K
CO - 2	Outline the types of corrosion and its prevention	PSO-2	K, An
CO - 3	Summarize the chemistry of explosives and Propellants	PSO-1, PSO-3	K, C
CO - 4	Explain the characteristics of refractories	PSO-2	K, C
CO - 5	Apply the chemistry of lubricants and adhesives in day to day life	PSO-2	U, Ap,

**RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES  
AND PROGRAMME SPECIFIC OUTCOMES**

Semester: II		ENGINEERING CHEMISTRY										Hours: 4
Code : 20PCH2E2B												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	4	3	3	4	4	5	4	4	4	3	3.90
CO - 2	4	4	4	5	4	4	4	3	4	4	4	4
CO - 3	4	4	4	5	4	4	4	3	4	4	4	4
CO - 4	5	4	4	4	4	4	4	4	3	4	4	4
CO - 5	4	4	4	4	4	4	4	4	4	3	4	3.90
<b>Overall Mean Score</b>												<b>3.96</b>

**Result:** The Score for this Course is 3.96 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

### **WATER TREATMENT:**

Effect of water on rocks and minerals - hard and soft water- units of hardness - scale and sludge formation in boilers - disadvantages of scale formation - prevention of scale formation - caustic embrittlement- boiler corrosion - priming and foaming - chemical coagulants used in drinking water- desalination of brackish water **(12 Hours)**

## **UNIT II**

### **CORROSION:**

Corrosion of metals-disadvantages-various forms of corrosion:Underground or soil corrosion, pitting corrosion, waterline corrosion, stress corrosion , microbiological corrosion, erosion corrosion- factors influencing corrosion - metal cladding, metal spraying and cementation - chemical conversion coatings. methods of preventing corrosion: metallic coatings, electroplating and cathodic protection **(12 Hours)**

## **UNIT III**

### **EXPLOSIVES AND PROPELLANTS:**

Explosives -characteristics- classification of explosives - example and properties of the various classes (primary explosives, low explosives, high explosives, plastic explosives) uses of explosives- precautions during storage of explosives, blasting fuses - safety fuse and detonating fuse - rocket propellants - characteristics of a good propellant - classification of propellants - biopropellants **(12 Hours)**

## **UNIT IV**

### **REFRATORIES:**

Introduction - characteristics - classification of refractories - properties of refractories - manufacture of refractories - conditions leading to failure of a refractory material - common refractory bricks - classification, example and properties - insulating refractories - cermets **(12 Hours)**

## **UNIT V**

### **LUBRICANTS AND ABRASIVES:**

Introduction - function of a lubricant - mechanism of lubrication - classification of lubricants - synthetic lubricants - cutting fluids abrasives - natural and artificial abrasives **(12 Hours)**

### **BOOKS FOR REFERENCE:**

1. P. C. Jain and Monica Jain, Engineering Chemistry, 1998, 12<sup>th</sup> edition, Dhanpat Rai Publishing Company **Unit I to V**
2. R. Gopalan, D. Vengappayya, S. Nagarajan, Engineering Chemistry, 1999, Vikas Publishing House Pvt.Ltd. **Unit I to V**

## BIOINORGANIC CHEMISTRY

**Semester: II**

**Hours: 4**

**Code : 20PCH2E2C**

**Credits: 3**

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Outline the role of metals and non-metals in biological system	PSO-1	K
CO - 2	Explain the mechanism of transport and storage of metals in biological system	PSO-1,2	K, C
CO - 3	Appreciate the importance of heme proteins as oxygen carriers	PSO-1,3	K, Ap
CO - 4	Familiarize the role of Ferredoxins and Fe-Cu proteins	PSO-1,4	K,C
CO - 5	Summarize the various aspects of metallo enzymes and their action	PSO-2	C, Ap,

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		BIOINORGANIC CHEMISTRY										Hours: 4
Code : 20PCH2E2C												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	4	4	2	2	2	4	2	3	3	3.09
CO - 2	4	4	4	3	3	4	2	2	4	4	4	3.45
CO - 3	4	4	4	3	3	4	2	2	4	4	4	3.45
CO - 4	4	4	4	3	3	4	2	2	4	4	4	3.45
CO - 5	4	4	4	3	3	4	2	2	4	4	4	3.45
<b>Overall Mean Score</b>											<b>3.38</b>	

**Result:** The Score for this Course is 3.38 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

### **ROLE OF METALS AND NON-METALS IN BIOLOGICAL SYSTEM:**

Role of metals in biological systems - Non - protein Metallobiomolecules - Photoredox - Non - protein Metal Transport and Structural Metallobiomolecules - Proteins - Transport and storage Protein Metallobiomolecules - Protein - Enzyme Metallobiomolecules - Role of Non metals in Biological Systems - C, H, N, O, Cl, P.

**(12 Hours)**

## **UNIT II**

### **TRANSPORT AND STORAGE OF METALS:**

The Transport Mechanism- Transport and Storage of Alkali and Alkaline Earth Metals - Ionophores - Sodium/Potassium Pump - the biochemistry of Iron-transport of Iron- Storage of Ferritin and transferrin - Transport and Storage of Copper and Zinc.

**(12 Hours)**

## **UNIT III**

### **TRANSPORT AND STORAGE OF PROTEINS:**

Introduction - Metalloporphyrins - Iron Porphyrins - Oxygen carriers -Structure and function of Haemoglobin and Myoglobin - Haemerythrin - Haemocyanin

**(12 Hours)**

## **UNIT IV**

### **ELECTRON CARRIERS:**

Electron carrier - cytochromes classification - P450- Photosynthesis - Iron-Sulfur protein-Rubredoxin-Ferredoxins-Blue Copper Proteins - Plastocyanin

**(12 Hours)**

## **UNIT V**

### **METALLO ENZYMES:**

Introduction - Mechanism of Enzyme Action - Zinc enzyme (Carboxy peptidase)- Iron enzymes - cytochromes - peroxidases - Copper enzyme - superoxide dismutase (CuZn SOD) - Molybdenum enzyme - Nitrogenase.

**(12 Hours)**

## **BOOKS FOR REFERENCE:**

1. K. Hussain Reddy, Bioinorganic chemistry, 1<sup>st</sup> edition ,2007, New age nternational publishers **Unit I and II**
2. Ajay Kumar Bhagi and G.R. Chatwal, Bio inorganic and supramolecular chemistry, I edition, 2003, Himalaya Publishing house **Unit I to V**

## SPECTROSCOPY AND CHROMATOGRAPHY

Semester: II

Hours: 4

Code : 20PCH2GE1

Credits: 3

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Gain knowledge on basic principles of spectroscopy	PSO-1, PSO-2	K, An
CO - 2	Explain the fundamentals of Infra-red and vibrational spectroscopy	PSO-1, PSO-2	Ap, An
CO - 3	Describe the basic concepts in NMR	PSO-2, PSO-3	K, E
CO - 4	Illustrate the basics of mass spectroscopy and its Applications	PSO-1, PSO-4	C, Ap, E
CO - 5	Discuss about the analytical techniques and Chromatography	PSO-1 PSO-4	An, Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		SPECTROSCOPY AND CHROMATOGRAPHY										Hours: 4
Code : 20PCH2GE1												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	4	4	4	2	3	4	4	2	3	3.45
CO - 2	4	4	4	4	4	2	3	4	4	2	3	3.45
CO - 3	4	4	4	4	4	2	3	4	4	2	3	3.45
CO - 4	4	4	4	4	4	2	3	4	4	2	3	3.45
CO - 5	4	3	3	3	3	2	4	3	4	4	3	3.27
<b>Overall Mean Score</b>												<b>3.41</b>

**Result:** The Score for this Course is 3.41 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

### **a) INTRODUCTION:**

Introduction - Electromagnetic radiations - units - Electromagnetic spectrum - absorption and emission spectra - atomic and molecular spectra - Types of molecular spectroscopy

### **b) INFRARED SPECTROSCOPY:**

Introduction - principle of Infra-red spectroscopy - Theory- Molecular vibrations - vibrational frequency - number of fundamental vibration - selection rules - factors influencing vibrational frequencies - identification of functional groups - finger print region - applications of IR spectroscopy: distinction between two types of hydrogen bonding - study of keto-enol tautomerism and conformational analysis

**(12 Hours)**

## **UNIT II**

### **UV - VISIBLESPECTROSCOPY:**

Introduction - the absorption laws - theory of transitions - the chromophore concept - auxochrome - types of absorption bands - effect of conjugation - Woodward Fishers rules for calculating absorption maximum ( $\lambda_{max}$ ) in dienes and  $\alpha,\beta$  unsaturated carbonyl compounds - applications of UV spectroscopy

**(12 Hours)**

## **UNIT III**

### **H<sup>1</sup>NMR SPECTROSCOPY:**

Introduction - Larmor precession - relaxation, process - Interaction between- spin and magnetic field - chemical shift - factors influencing chemical shift - spin- spin splitting - NMR shift reagent - applications of NMR spectroscopy - simple problems of nuclearmagnetic resonance

**(12 Hours)**

## **UNIT IV**

### **MASS SPECTROSCOPY:**

Basic principles - theory - molecular ion - determination of molecular formula - McLafferty rearrangement - metal stable ions - nitrogen rule - general fragmentation modes - simple problems in mass spectroscopy.

Applications of IR, UV, NMR and Mass spectral techniques in structural elucidation of simple organic compounds

**(12 Hours)**

## **UNIT V**

### **CHROMATOGRAPHY:**

Definition - classification - applications of chromatography- thin layer chromatography (TLC): principle, choice of adsorbent and solvents, developing of chromatoplates, applications- Column chromatography(CG): Principle, choice of adsorbent and solvents, packing and developing of column, applications-paper chromatography: Principle, choice of adsorbent and solvents, application of sample, development of chromatogram:ascending, descending, radial techniques- $R_f$  value-Applications-High Performance Liquid Chromatography - Gas chromatography - Gas Chromatography mass spectrometry:IntroductionandInstrumentation **(12 Hours)**

### **BOOKS FOR REFERENCE:**

1. Y.R Sharma, Elementary Organic Spectroscopy, Reprint, Sultan Chand and Sons, 1<sup>st</sup> edition, 2011 **Unit I to IV**
2. V.K. Srivastava, K.K. Srivastava, Introduction to Chromatography, S. Chand and Company Ltd., 3<sup>rd</sup> edition, 1985 **Unit V**

## SOFT SKILLS

Semester: II

Hours: 2

Code : 20PSE2S01

Credit: 1

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Develop their social, interpersonal, cognitive, ethical, professional, reading and communication skills	PSO-1	K
CO - 2	Increase their self-esteem and confidence.	PSO-2,4	Ap
CO - 3	Achieve their short and long term goals.	PSO-3	Sy
CO - 4	Prepare and formulate their resumes wisely.	PSO-4	Ap
CO - 5	Face the mock group discussions and interviews with a challenge and choose their right career.	PSO-5	Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		SOFT SKILLS										Hours: 2
Code : 20PSE2S01												Credit: 1
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO1	4	4	4	4	4	5	4	4	4	4	5	4.18
CO2	4	4	4	4	4	5	4	4	4	4	5	4.18
CO3	4	4	4	4	4	5	4	4	4	4	5	4.18
CO4	4	4	4	4	4	5	4	4	4	4	5	4.18
CO5	4	4	4	4	4	5	4	4	4	4	5	4.18
<b>Overall Mean Score</b>												<b>4.18</b>

**Result:** The Score for this Course is 4.18 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I: SOFT SKILLS**

Introduction - Soft skills - Importance of soft skills - Selling your soft skills - Attributes regarded as soft skills - Soft skills - Social - Soft skills - Thinking - Soft skills - Negotiating - Exhibiting your soft skills - Identifying your soft skills - Improving your soft skills - will formal training enhance your soft skills - Soft Skills training - Train yourself - Top 60 soft skills - Practicing soft skills - Measuring attitude. **(6 Hours)**

## **UNIT II: CAREER PLANNING**

Benefits of career planning - Guidelines for choosing a career - Myths about choosing a career - Tips for successful career planning - Developing career goals - Final thoughts on career planning - Things one should know while starting career and during his/her career. **(6 Hours)**

## **UNIT III: ART OF LISTENING AND SPEAKING**

Two ears, one mouth - Active listening - Kinds of Listening, Common - poor listening habits - Advantages of listening - Listening Tips. Special features of Communication - Process - Channels of Communication - Net Work - Barriers - Tips for effective communication and Powerful presentation - Art of public speaking - Public Speaking tips - Over coming fear of public speaking. **(6 Hours)**

## **UNIT IV: ART OF READING AND WRITING**

Good readers - Benefits - Types - Tips - The SQ3R Technique - Different stages of reading - Rates of Reading - Determining a student's reading rate - Increasing reading rate - Problems with reading - Effective reader - Importance of writing - Creative writing - Writing tips - Drawbacks of written communication. **(6 Hours)**

## **UNIT V: PREPARING CV / RESUME**

Meaning - Difference among Bio-data, CV and Resume - The terms - The purpose of CV writing - Types of resumes - Interesting facts about resume - CV writing tips - CV/Resume preparation - the dos - CV/Resume preparation - the don'ts - Resume check up - Design of a CV - Entry level resume - The content of the resume - Electronic resume tips - References - Power words - Common resume blunders - Key skills that can be mentioned in the resume - Cover letters - Cover letter tips. **(6 Hours)**

## **COURSE BOOK:**

- ❖ Dr. K. Alex, Soft Skills, Chand & Company Pvt. Ltd., New Delhi.



**REFERENCE BOOK:**

1. Dr. T. Jeya Sudha & Mr. M.R. Wajida Begum : Soft Skills/Communication Skills, New Century Book House (P) Ltd., Chennai.
2. S. Hariharen, N. Sundararajan & S.P. Shanmuga Priya : Soft Skills, MJP Publishers, Chennai.

**CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)****THEORY:**

<b>COMPONENT</b>	<b>MARKS</b>
Internal test I	40
Internal test II	40
Seminar	10
Term Paper	5
Attendance	5
<b>Total</b>	<b>100</b>

**CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)****Passing Minimum: 50% out of 100****INTERNAL QUESTION PATTERN****(Maximum Marks-40)****Part - A**

10 Questions × 1Mark = 10 Marks

**Part - B**

2 Questions × 5 Marks = 10 Marks

(Internal Choice and One Question from Each Unit)

**Part - C**

2 Questions × 10 Marks = 20 Marks

(Open Choice, Two Questions out of Three)