JAYARAJ ANNAPACKIAM COLLEGE FOR WOMEN (AUTONOMOUS)

A Unit of the Sisters of St. Anne of Tiruchirappalli
Accredited with 'A^{+}' Grade (Cycle 4) by NAAC
DST FIST Supported College
Affiliated to Mother Teresa Women's University, Kodaikanal

PERIYAKULAM – 625 601, THENI DT. TAMIL NADU.

SYLLABUS 2020 - 2023

M. SC. CHEMISTRY

PG AND RESEARCH CENTRE OF CHEMISTRY

P.G. PROGRAMME OUTCOMES

PO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO
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

PSO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO	PO MAPPED
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/ TANSCHE/ MTU)

Sem.	Code	Title of the Course	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
		Total	**30**	**21**
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	IDC: Spectroscopy and Chromatography	4	3
	20PSE2S01	Soft Skills	2	1
		Total	**30**	**22**
III	20PCH3C07	Organic Chemistry-III	5	5
	20PCH3C08	Physical Chemistry-III	5	5
	20PCH3C09	Inorganic Chemistry-III	5	5
	20PCH3P03	Practical: Physical Chemistry Experiments	5	3
	20PCH3E3A/ 20PCH3E3B/ 20PCH3E3C	Chemistry of Materials/ Applications of IT skills in chemistry/ Soil and Agriculture Chemistry	4	3
	20PCH3GE2	IDC: Nutritional Chemistry	4	3
	20PSE3H02	Human Rights and Duties	2	1
	20PCH3IN1	Internship	-	2*
		Total	**30**	**25+2***
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*
		Total	**30**	**22+3***
Total for all semesters			**120**	**90 + 5***

CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)

THEORY:

Component	Marks	Marks
Internal Test I	40	Converted to 25
Internal Test II	40	
Seminar	10	
Term Paper	5	
Attendance	5	
Total	**100**	**25**

CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)

Practical: 40 Marks

PASSING MINIMUM

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

PROJECT WORK (Individual Project)

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

THE INTERNAL COMPONENTS OF PROJECT

Components	Marks
First Review	10
Second Review	10
Final Review (Internal Viva Voce)	30
Total	**50**

EXTERNAL VALUATION OF PROJECT WORK

Components	Marks
Project	25
External Viva Voce	25
Total	**50**

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) : 25 Marks

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
Overall Mean Score												**3.27**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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 - Hammet equation - physical significance of σ , ρ - 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_2

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- Oppennauer 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 - Schimidt-Stevens-Wittig rearrangement **(18 Hours)**

BOOKS FOR REFERENCE:

1. V. K. Ahulvalia, Organic Reaction Mechanisms, Narosa publishing House Pvt. Ltd, 4th edition, 2007 **Unit I, II, III and V**
2. Peter Sykes, A guide book to mechanism in Organic chemistry, Pearson Education, 6th edition, 2007 **Unit I and II**
3. Jerry March, Advanced Organic Chemistry, Reaction mechanism and structure, Wiley Inter science Publications, 6th edition, 2013 **Unit I and II**
4. L. Finar, Organic chemistry, Vol - II, Pearson Education Ltd., 5th 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
Overall Mean Score												**3.48**

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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos = Total of Mean Scores / Total No. of Cos

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 spin½ -C^{13} NMR spectroscopy- principles -Comparison between ^{1}H and ^{13}C - nuclei with spin greater than ½-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, Phosporescence - 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., 4th edition, 2007 **Unit I to IV**
2. K.K. Rohatgi - Mukherjee, Fundamentals of Photochemistry, Wiely Eastern Ltd., **Unit V**
3. B.R. Puri, L.R. Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 46th 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
Overall Mean Score												**3.92**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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_2 (CaF_2, TiO_2, SiO_2) - 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- BF_3, NH_3, H_2O, PCl_3, ClF_3, SF_4, I^{3-}, 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 - CO_2 and NH_3, BeH_2 **(18 Hours)**

UNIT V

SOLID STATECHEMISTRY:

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., 4thedition, 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, 31stedition, 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., 2nd edition, 2002 **Unit I to V**
5. J.D. Lee, Concise Inorganic Chemistry, Blackwell publishing, 5thedition, 1996 **Unit III and IV**
6. Bodie Douglas, Darl McDaniel, John Alexander, Concepts and Models of Inorganic Chemistry, Wiley-India Publishing, 3rd 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
Overall Mean Score												**3.74**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

1. Separation of OrganicMixtures
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 MethylKetone

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
Overall Mean Score												**3.14**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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 FORREFERENCE:

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

RESEARCH METHODOLOGY

Semester: I **Hours: 6**
Code : 20PCH1E1B **Credits: 3**
COURSE OUTCOMES:

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
Overall Mean Score												**3.74**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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, 1st edition, Cambridge University press **Unit II**
3. R.P. Budhiraja, Separation Chemistry, 2007, 2nd 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, 6th edition, **Unit III**
5. Silverstein, S.M., Bassler, G.V. & Morril, T.C. (2004). Spectrometric Identification of Organic Compounds. (6th ed.). New York: Wiley **Unit IV**
6. Kemp, W. (2011). Organic Spectroscopy. (3rded.).New York: Macmillam. **Unit IV**
7. Chatwal and Anand, Instrumental methods of chemical analysis, 1984, 2nd edition, Himalaya Publishing House **Unit III and IV**
8. Michael P. Marder, Research methods for science, 2011, 1st edition, Cambridge University press **Unit II**
9. Chem Draw and Origin manuals **Unit V**

NANO CHEMISTRY AND GREEN SYNTHESIS

Semester: I **Hours: 6**

Code : 20PCH1E1C **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 humanhealth 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
Overall Mean Score												3.92

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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, electrodepostion, 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) ATOM ECONOMY:

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 Iodine-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, 1st 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, 2nd 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 Spectorscopy	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
Overall Mean Score												**3.32**

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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos = Total of Mean Scores / Total No. of Cos

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, α,β - unsaturated carbonyls and benzene and its substituted derivatives, heterocyclic system **(15 Hours)**

UNIT IV

^{1}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

C^{13} NMR: Introduction - chemical classes and chemical shifts: aliphatic, olefinic, alkyne, aromatic and carbonyl compounds - coupling constant - structural applications to 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, 2nd edition, 2008 **Unit I and II**
2. P. S. Kalsi, Stereochemistry: Conformation and Mechanism, New Age International, 6th edition, 2011 **Unit I**
3. P. Ramesh, Basic principles of organic stereochemistry, Meenu Publications, 1st 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 2nd edition, 2012 **Unit III to V**
6. Robert M. Silverstein, Francis X. Webster, Spectrometric identification of organic compounds - Wiley India, 6th 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
Overall Mean Score												**3.52**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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 paring- 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 - electrocapilllarity - 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-π* and π-π* 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, 2nd edition, 1984 **Unit I and II**
2. Atkins, Physical Chemistry, Oxford University Press, 7th edition, 2006 **Unit II**
3. Raman, K.V. Group theory and its applications to Chemistry, TATA McGraw Hill Co, 4th edition, 2007 **Unit IV and V**
4. F.Albert Cotton, Chemical applications of Group theory, Wiley Eastern Ltd, 3rd edition, 2004 **Unit V**
5. B.R. Puri, L.R. Sharma S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co. New Delhi 46th 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
Overall Mean Score												3.96

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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos = Total of Mean Scores / Total No. of Cos

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 - chalogenide 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 zintil anions and cations - cherel 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 mangement- radio isotopes in analytical applications- direct isotope dilution analysis- nuetron 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, 31stedition, 2010 **Unit I to V**
2. James E. Huheey, Inorganic Chemistry, Dorling Kindersley Pvt.Ltd., 4th edition, 2012. **Unit I, II and IV**
3. R.D. Madan, Modern Inorganic Chemistry, S. Chand and Company Ltd, 2ndedition, 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, 3rdedition, 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. Arnikar, Essentials of Nuclear Chemistry, New Age international, 4th edition, 2007 **Unit V**
8. R.L. Madan, G.D. Tuli, Inorganic Chemistry, S.Chand's puplishing 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
Overall Mean Score												**3.79**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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 , Basicprinciples of Practical chemistry Sultan Chand and sons, 2nd edition, 2012
2. V.V. Ramanujam, Inorganic Semimicro Qualitative Analysis , The National publishing Co., 3rd 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 forM.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
Overall Mean Score												3.38

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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 - Ampherometry - Ampherometric titrations - technique of ampherometric 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, 7th edition ELBS with Longmann Publication, 2005 **Unit I to V**
2. Williard D. Merit, Instrumental methods of Analysis, 7th edition, CBS publishers 2007 **Unit V**

FURTHER READING:

1. P. C. Jain & Monica Jain, Engineering Chemistry, 17th edition. Dhanpat Rai Publishing Company, 2008.
2. Chatwal Anand, Instrumental methods of Chemical Analysis, 2nd 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
Overall Mean Score												**3.96**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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

REFRACTORIES:

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, 12th 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	Familarize the role of Ferrodoxins 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
Overall Mean Score												**3.38**

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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos = Total of Mean Scores / Total No. of Cos

UNIT I

ROLE OF METALS AND NON-METALS IN BIOLOGICAL SYSTEM:

Role of metals in biological systems - Non - protein Metallobiomolecles - Photoredox - Non - protein Metal Transport and Structural Metallobiomelecules - 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 transferriin - 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, 1st 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 ANDCHROMATOGRAPHY

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 ANDCHROMATOGRAPHY							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
Overall Mean Score												3.41

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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos = Total of Mean Scores / Total No. of Cos

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 (λ_{max}) in dienes and α,β unsaturated carbonyl compounds - applications of UV spectroscopy

(12 Hours)

UNIT III

H^1NMR SPECTROSCOPY:

Introduction - Larmor precision - 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, decending, radial techniques-R_f value-Applications-High Performance Liquid Chromatography - Gas chromatography - Gas Chromatography mass spectrometry: Introduction and Instrumentation **(12 Hours)**

BOOKS FOR REFERENCE:

1. Y.R Sharma, Elementary Organic Spectroscopy, Reprint, Sultan Chand and Sons, 1st edition, 2011 **Unit I to IV**
2. V.K. Srivastava, K.K. Srivastava, Introduction to Chromatography, S. Chand and Company Ltd., 3rd 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											**Hours: 2**
Code : 20PSE2S01				**SOFT SKILLS**							**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
Overall Mean Score												**4.18**

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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

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.

BOOKS REFERENCE:

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:

COMPONENT	MARKS
Internal test I	40
Internal test II	40
Seminar	10
Term Paper	5
Attendance	5
Total	**100**

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)

ORGANIC CHEMISTRY - III

Semester: III **Hours: 5**

Code : 20PCH3C07 **Credits: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on photochemistry vision and photo dynamic therapy	PSO-1	K,U
CO - 2	Illustrate the concept of pericyclic reaction in organic synthesis	PSO-4	Ap, An
CO - 3	Gain knowledge about the mechanistic pathways of pericyclic reactions	PSO-5	U, E
CO - 4	Apply the knowledge on photochemistry and pericyclic reactions to solve the problems in competitive exams	PSO-1	K
CO - 5	Discuss about the importance of Bioorganic Chemistry	PSO-5	U, E

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

Semester: III				**ORGANIC CHEMISTRY - III**							**Hours: 5**
Code : 20PCH3C07											**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	3	4	3	3	3	4	3	3	4	3	3.27
CO - 2	3	3	3	4	3	4	3	3	4	3	4	3.36
CO - 3	3	4	3	4	3	3	3	4	4	4	4	3.54
CO - 4	3	3	4	3	4	3	3	4	3	4	3	3.36
CO - 5	3	.4	3	3	4	2	4	4	3	2	4	3.27
Overall Mean Score												**3.36**

Result: The score for this course is **3.36** (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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos = Total of Mean Scores / Total No. of Cos

UNIT I

PHOTOCHEMISTRY-I:

Introduction - energy of molecule - thermal and photochemical energy - electronic transitions - electronic excitation and molecular orbital view of excitation - Jablonski diagram - organic photosensitisers - quenchers - photochemical reactions of carbonyl compounds: Norrish type I, Norrish type II reactions - α and β cleavage of acyclic and cyclic compounds - intramolecular hydrogen abstraction - intermolecular photo reduction - photo cycloaddition of ketones with unsaturated compounds (Paterno-Buchi reaction) - photo dimerisation of α, β - unsaturated ketones **(15 Hours)**

UNIT II

PHOTOCHEMISTRY-II:

Photo rearrangement of enones, dienones, epoxy - ketone - photo Fries rearrangement - di -π methane rearrangement of 1,4 - pentadienes, 3- phenyl alkenes - oxa-di - π methane rearrangement - photo reduction of naphthalene - photo oxidation of butene - cis - trans isomerisation of alkenes (trans-stilbene) - sensitized cis-trans isomerisation - dimerisation of alkenes (norborane-1, 5-dienes) - photoisomerisation of aromatic compounds (benzene, o-xylene) - Barton reaction - Hofmann - Loffler - Freytag reaction - photochemistry of vision - photo dynamic therapy **(15 Hours)**

UNIT III

PERICYCLIC REACTIONS-I:

Introduction - molecular orbitals of conjugated polyenes, ions and radicals - theory of pericyclic reactions (Frontier molecular orbital method) - stereochemistry (con - dis rotatory motion) - electrocyclic reactions of $4n\pi$ (1, 3 - butadiene) and $(4n + 2)\ \pi$ {1, 3, 5 - hexatriene} systems - correlation diagram - Woodward - Hoffmann rule - Huckel-Mobius method **(15 Hours)**

UNIT IV

PERICYCLIC REACTIONS-II:

Cycloaddition - theory (FMO method) - (2+2), (4+2) cycloadditions (thermal and Photo induced) - selection rule - Diels-Alder reactions - correlation diagram - Woodward -Hoffmann rule - Huckel-Mobius method - cyclo reversion - 1,3 - dipolar cycloadditions - (4+2) cycloadditions of cations and anions - sigmatropic rearrangement: [1,3], [3,3] - mechanism - selection rule - Cope rearrangement - Claisen rearrangement **(15 Hours)**

UNIT V

CHEMISTRY OF PEPTIDES AND NUCLEIC ACID:

a) POLYPEPTIDES: Occurrence - nomenclature - general principles of polypeptide synthesis: protection of the amino and carboxyl groups - Bergmann's synthesis - azide, Trityl and Sheehan's methods - protection of side chains of amino acids - activation of carboxyl group - determination of structure of peptides: 'C' and 'N' terminals of amino acids - structural elucidation of glutathione, thyroxin and oxytocin

b) NUCLEOSIDES, NUCLEOTIDES AND NUCLEIC ACIDS: Structure of nucleosides and nucleotides - biosynthesis of pyrimidine and purine - elementary treatment on the structure of DNA and RNA

(15 Hours)

BOOKS FOR REFERENCE:

1. Jagdamba Singh and Jaya Singh, Photochemistry and Pericyclic reactions, New age International Pvt. Ltd., 2nd edition, 2008, **Unit I-IV**
2. P. S. Kalsi and J. P. Kalsi, Bioorganic and Supramolecular Chemistry, New Age international, 4thedition, 2008, **Unit V**
3. Gurdeep R. Chatwal, Organic Chemistry of Natural Product, Himalaya Publishing House, Volume I, 4th edition, 2008, **Unit V**
4. I.L. Finar, Organic Chemistry, volume II, Dorling Kindersley, 5th edition, 2008, **Unit V**

PHYSICAL CHEMISTRY - III

Semester: III **Hours: 5**

Code : 20PCH3C08 **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 concepts of quantum chemistry	PSO-1	K, U
CO - 2	List the postulates of quantum mechanics and explain their importance	PSO-1	U, C
CO - 3	Apply quantum mechanical treatment to solve Schrodinger equation for multi electron atom	PSO-3	Ap, An
CO - 4	Explain the thermodynamics of open systems based on related derivations	PSO-1	U, C
CO - 5	Discuss the determination of activity and realize the non equilibrium thermodynamics	PSO-1, 5	U, Ap

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

Semester: III												**Hours: 5**
Code : 20PCH3C08							**PHYSICAL CHEMISTRY - III**					**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	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	4	3.45
CO - 5	3	4	4	4	4	4	3	4	3	4	4	3.72
Overall Mean Score												**3.52**

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= $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

UNIT I

QUANTUM CHEMISTRY-I:

Introduction - wave and particle nature of radiation - de Broglie equation - wave equation - Heisenberg's principle of uncertainty - Schrodinger wave equation derivation - wave function - properties of ψ - conditions of normalization and orthogonality - orthonormal set - Eigen function and Eigen values - operators: addition, subtraction, multiplication, commutator, linear operator, vector operator, Laplacian operator, Hermitian operator and Hamiltonian operator.

(15 Hours)

UNIT II

QUANTUM CHEMISTRY-II:

Schrodinger equation for solving a particle in a 1D box and 3D box - normalization and orthogonality - characteristics of wave function- one dimensional harmonic oscillator - rigid rotor - hydrogen atom - hydrogen atomic orbital - energy of the hydrogen atom and the iso electronic ions. **(15 Hours)**

UNIT III

QUANTUM CHEMISTRY-III:

Postulates of quantum mechanics - theorems relating to basic postulates - approximation methods for solving the Schrodinger equation for multi electron atoms : time independent perturbation theory - first order perturbation theory to helium atom - variation theorem - application of variation method to helium atom - Hartree and Hartree - Fockself consistent field method. **(15 Hours)**

UNIT IV

CHEMICAL THERMODYNAMICS I:

Thermodynamics of open systems-molarity and mole fraction-molality and mole fraction-partial molal properties-chemical potential-Gibbs-Duhem equation-Duhem Margules equation-variation of chemical potential with temperature and pressure-determination of partial molar quantities-chemical potential and phase equilibria-The Clausiusn-Clapeyron equation - applications to various equilibria- - Electrolytes and Non-Electrolytes- Equilibrium thermodynamics- Gibbs phase rule and its application to three component systems- quantitative treatment of Le Chatlier principle - equilibria respond to pressure and temperature. **(15 Hours)**

UNIT V

CHEMICAL THERMODYNAMICS II:

Fugacity - methods of determining the fugacity of a real gas-activity - choice of standard states - determination of activity and activity coefficients of electrolytes and non - electrolytes by vapor pressure measurement - determination of activity of electrolytes by cryoscopic method - determination of activity coefficients from solubility measurements - introduction to irreversible thermodynamics - phenomenological laws and Onsager's reciprocal relations - conservation of mass and energy in closed and open systems - microscopic reversibility and Onsager reciprocal relations. **(15 Hours)**

BOOKS FOR REFERENCE:

1. A.K. Chandra, Introductory Quantum Chemistry, TATA McGraw Hill Publishing Company Ltd., New Delhi, 4th edition**,** 1997, **Unit I-III**
2. R.K.Prasad, Quantum Chemistry, New Age International Pvt. Ltd. Publishers, 4th revised edition, 2010 **Unit I-III**
3. Kuriacose and Rajaram, Thermodyamics, Jalandar ShobanLal Co,1993 **Unit IV and V**
4. B.R. Puri, L.R.Sharma and Madan S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co, 47th edition, 2016. **Unit I - V**

FOR FURTHER REFERENCE:

1. N. Levine, Quantum Chemistry, Prentice Hall of India, Pvt. Ltd., 4th edition, 1994.
2. D.A. McQuarrie, Quantum Chemistry, Viva Books Pvt. Ltd., 2007.
3. S. Glasstone, Text book of Physical Chemistry, McMillan India Ltd., 1999
4. S. Glasstone, Thermodynamics for Chemists, Eastern Wiley publications, 2002

INORGANIC CHEMISTRY-III

Semester: III **Hours: 5**

Code : 20PCH3C09 **Credits: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Apply theories of bonding and magnetic properties to co-ordination compounds	PSO-3	U, Ap
CO - 2	Describe the reactions, kinetics and mechanisms of co-ordination compounds	PSO-7	U, S
CO - 3	Explain the different types of magnetic behaviour and their measurement	PSO-4	U, C
CO - 4	Gain knowledge about the spectral properties and application of co-ordination compounds	PSO-1	K
CO - 5	Explain the physical methods to inorganic Compounds	PSO-4	U, E

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

Semester: III				**INORGANIC CHEMISTRY-III**					**Hours: 5**		
Code : 20PCH3C09									**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	5	4	3	4	4	3	5	4	3	3	4	3.81
CO - 2	4	3	3	4	4	4	4	3	4	4	3	3.63
CO - 3	5	4	3	4	4	3	4	4	4	3	4	3.81
CO - 4	5	4	4	4	3	4	4	3	4	4	3	3.81
CO - 5	4	4	4	4	3	4	4	4	3	3	4	3.72
Overall Mean Score												**3.76**

Result: The score for this course is **3.76** (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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos= Total of Mean Scores / Total No. of Cos

UNIT I

CO-ORDINATION COMPOUNDS-I:

Co-ordination numbers - co-ordination geometries - isomerism - chelate effect - bonding in co-ordination compounds - crystal field theory - crystal field effect on O_h, T_d and Square planar - factors affecting the magnitude of Δ - spectrochemical series - applications of crystal field theory - Nephelauxetic series - Jahn - Teller effect -ligand field theory - molecular orbital theory - sigma bonding - Pi bonding

(15 Hours)

UNIT II

CO-ORDINATION COMPOUNDS-II:

Reactions, kinetics and mechanisms: Rate of reaction - rate law - inert and labile complexes - thermodynamic and kinetic stability - mechanism of substitution reactions in octahedral complexes - anation - aquation - acid and base hydrolysis - substitution reactions in square planar complexes - the trans effect -mechanism of redox reactions - outer sphere mechanism -inner sphere mechanism **(15 Hours)**

UNIT III

CO-ORDINATION COMPOUNDS-III:

Electronic spectroscopy: Electronic configuration - term symbols - effect of distortion and spin orbit coupling on electronic spectra - spin multiplicity - derivation of term symbols - term symbols for p^2 and d^2 systems - calculation of microstates - electronic spectra of transition metal complexes - selection rules - splitting of orbitals in O_h field - ground states of free ions for d^n system and energy level diagrams - Orgel diagram - Tanabe - Sugano diagram - difference between orgel and Tanabe Sugano diagram- calculation of B and 10 Dq - Charge transfer spectra **(15 Hours)**

UNIT IV

PHYSICAL METHODS TO INORGANIC COMPOUNDS:

IR and Raman spectroscopy: Introduction-selection rules (combination and hot bands) - mutual exclusion principle - difference between Raman and IR spectroscopy - application in structural elucidation of simple molecules: H_2O, N_2O, N_2F_2, ClF_3, NO_3^-, ClO_3^-,ClO_4^- - vibrational spectra of metal carbonyl complexes - geometry and number of stretching vibrations

EPR Spectroscopy: g - value - Zero - field splitting - Krammer's degeneracy - applications to VO (II), Co (II), Ni (II) and Cu (II) complexes **(15 Hours)**

UNIT V

NMR SPECTROSCOPY:

Nuclear spin -Larmor frequency - relaxation process in NMR- chemical shift- factors influencing chemocal shift- spin-spin coupling- coupling constant-^{1}H NMR- ^{13}C NMR -comparison of ^{1}H and ^{13}C NMR - ^{31}P NMR -^{19}F NMR- lanthanide shift reagents- fluxional behavior of molecules- fluxional behavior in tryheptoallyl system,tetramethylalleneirontetracarbonyl,ferrocenophane,cyclopentadienyl mercury, and cyclooctatetraeneirontricarbonyl

MAGNETO CHEMISTRY OF TRANSITION METAL COMPEXES:

Introduction - orbital magnetic moment - spin magnetic moment - diamagnetism - paramagnetism - measurement of magnetic susceptibility: Guoy's method - Faraday's method - ferromagnetism and antiferromagnetism **(15 Hours)**

BOOKS FOR REFERENCE:

1. E. Huheey James, Inorganic Chemistry, Principles of structure and reactivity, Dorling Kindersley India Pvt. Ltd., 4th edition, 2007, **Unit I-III**
2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers and Distributor, Delhi, 32nd edition, 2015, **Unit III and IV**
3. A. Abdul Jameel, Applications of physical methods to inorganic compounds, 2007, **Unit III and V**

PRACTICAL: PHYSICAL CHEMISTRY EXPERIMENTS

Semester: III **Hours: 5**

Code : 20PCH3P03 **Credits: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Develop the ability to apply the knowledge and skills in conductometric and potentiometric titrations and equivalent conductance studies	PSO - 4	U, An
CO - 2	Evaluate heat of solution, adsorption characteristics and Arrehenius parameters for kinetic study	PSO - 1	U, An
CO - 3	Estimate nickel by colorimetry	PSO - 3	U, Ap, An
CO - 4	Recognize the link between theory and practical	PSO - 3	U, An
CO - 5	Undertake hands on lab work which develop problem solving skills in project and for their successful career	PSO - 5	Ap, An, S

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

Semester: III				**PRACTICAL: PHYSICAL CHEMISTRY EXPERIMENTS**							**Hours: 5**
Code : 20PCH3P03											**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	3	4	4	3	3	4	4	3	4	4	3	3.54
CO - 2	4	3	4	4	3	4	3	3	3	4	3	3.45
CO - 3	4	4	3	4	3	3	3	4	3	4	4	3.54
CO - 4	3	3	3	4	4	4	4	3	4	5	4	3.72
CO - 5	3	4	4	4	4	4	3	4	3	4	5	3.81
Overall Mean Score												**3.61**

Result: The score for this course is **3.61** (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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos= Total of Mean Scores / Total No. of Cos

LIST OF PRACTICALS:

1. Conductometric Titration (Mixture of acids Vs Strong base)
2. Verification of Ostwald's dilution law and determination of dissociation constant of weak acid
3. Determination of equivalent conductance of a strong electrolyte at infinite dilution
4. Potentiometry - Precipitation titrations
5. Kinetics of Iodination of acetone
6. Adsorption characteristics of oxalic acid on charcoal
7. Determination of Arrhenius Parameters - Hydrolysis of methyl acetate by acid
8. Estimation of nickel by colorimetry
9. Enthalpy of solution by Thermometric method
10. Verification of Beer Lambert's law by UV - visible spectrophotometric method (Demo only)

BOOKS FOR REFERENCE:

1. V.Venkateswaran, R. Veeraswamy and A. R. Kulandaivelu, Basic principles of Practical chemistry, Sultan Chand and Sons, 2nd edition, 1997.
2. B. Viswanathan, P.S. Raghavan, Practical Physical Chemistry, Viva Books Pvt. Ltd., Ist edition, 2014.

CHEMISTRY OF MATERIALS

Semester: III **Hours: 4**

Code : 20PCH3E3A **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 materials and composites	PSO-2	K, U
CO - 2	Realize the applications of biomaterials and nonlinear materials	PSO-4	K, U, An
CO - 3	Interpret the usage of conducting materials	PSO-4	U, Ap, An
CO - 4	Recognize the usage of optical materials	PSO-4	U, Ap, An
CO - 5	Analyze the modern engineering materials	PSO-3	U, Ap, An, E

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

Semester: VI				**CHEMISTRY OF MATERIALS**							**Hours: 4**
Code : 20PCH3E3A											**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	4	3	4	4	4	3	3.73
CO - 2	3	3	4	3	3	3	4	4	3	4	3	3.36
CO - 3	4	3	4	4	3	3	3	4	3	4	4	3.55
CO - 4	4	3	4	3	3	3	3	4	3	4	4	3.45
CO - 5	4	3	4	4	3	3	3	4	3	4	3	3.45
Overall Mean Score												**3.51**

Result: The score for this course is **3.51** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

UNIT I

a) EVOLUTION OF MATERIALS:

Introduction - early materials - birth of modern chemistry - new metals on demand - future of materials research

b) COMPOSITES:

Introduction - nature of composites - composites in nature - composites in human history - advanced composites - applications of advanced composites

(12 Hours)

UNIT II

a) BIOMATERIALS:

Introduction - metals and alloys - polymers - ceramics - replacements parts - synthetic blood vessel - artificial bone

b) NONLINEAR MATERIALS:

some important nonlinear materials and their properties: lithium niobate - lithium tantalate - barium sodium niobate **(12 Hours)**

UNIT III

CONDUCTING MATERIALS:

Different types of conducting materials: zero resistivity materials - low resistivity materials - high resistivity materials: properties - uses - difference between high temperature superconductor and low temperature superconductor - semi conducting materials - conducting polymers - commercial applications - advanced ceramics: introduction - applications of ceramics and cermets

(12 Hours)

UNIT IV

OPTICAL MATERIALS:

Introduction - optical properties of metals, insulators and semiconductors - excitons, traps, colour centres - F-centre, V-centre - display devices and display materials - fluorescence - phosphorescence - differences - different phosphors used in CRT screens - LED: principle of working - requirements - advantages - disadvantages - LCD: general properties - advantages - disadvantages - comparison between LCD and LED **(12 Hours)**

UNIT V

MODERN ENGINEERING MATERIALS:

Introduction to metallic glasses - properties - manufacturing process - examples - applications - metallic glasses as transformer core material - nanophase materials: introduction - preparation - properties - applications - inter metallic compounds - applications - shape memory alloys: introduction - classification - working principles - basic components - thermoelastic based shape alloys - applications

(12 Hours)

BOOKS FOR REFERENCE:

1. David E. Newton, The New Chemistry, Chemistry of New Materials, 1st Indian edition, 2010, **Unit I and II**
2. Dr. M. Arumugam, Materials Science, Anuradha Agencies, Sangar Printers Pvt. Ltd., Chennai, 2002, **Unit II-V**

FOR FURTHER REFERENCE:

1. Bradley D. Fahlman, Materials Chemistry, 3rd edition, Springer.
2. Harry R Allcock, Introduction to Materials Chemistry, 2nd edition, Wiley.

APPLICATIONS OF IT SKILLS IN CHEMISTRY

Semester: III **Hours: 4**

Code : 20PCH3E3B **Credits: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Associate the importance of C programming with chemistry.	PSO - 3, PSO - 5	K, U, An
CO - 2	Develop knowledge on arrays and string.	PSO - 1, PSO - 3	U, K, Ap
CO - 3	Realize the importance of cheminformatics.	PSO - 2, PSO - 3	K, Ap
CO - 4	Evaluate the drug likeliness of molecules	PSO - 3, PSO - 5	U, E, An
CO - 5	Gain knowledge on problem solving using C programming in chemistry.	PSO - 1	K, U, Ap

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

Semester: III				**APPLICATIONS OF IT SKILLS IN CHEMISTRY**							**Hours: 4**
Code : 20PCH3E3B											**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	3	4	4	4	3	3	4	4	4	3	3	3.54
CO - 2	4	3	4	4	3	3	3	4	4	3	3	3.45
CO - 3	4	4	3	3	4	3	3	4	4	3	3	3.45
CO - 4	4	3	4	4	3	3	3	4	4	3	3	3.45
CO - 5	4	3	3	4	4	3	4	4	4	3	3	3.54
Overall Mean Score												**3.49**

Result: The score for this course is **3.49** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

UNIT I

TERMS IN 'C' PROGRAM:

Importance of C - basic structure of C program - character set - key words and identifiers, variables - data types - declaration of variables - assigning values to variables - defining symbolic constants - operators - expression - type conversions in expression - hierarchy of operations - input and output operations - reading a character- writing a character. **(12 Hours)**

UNIT II

a) DECISION MAKING AND BRANCHING:

Control statements: if statement - **if...else** statement - switch statement - **goto** statement.

Decision making and looping: while statement - **do** statement - **for** statement - jumps in loops.

b) ARRAYS AND STRINGS:

Arrays - introduction - one dimensional array - declaration and initialization.

Arrays in Strings: declaring and initializing string variables - reading strings from terminal - writing strings to screen-putting strings together- comparison of two strings - string handling functions. **(12 Hours)**

UNIT III

INTRODUCTION TO CHEMINFORMATICS:

Introduction - objectives - applications - computer representations of chemical structures - graph theoretic representations of chemical structure - connection tables and linear notations - canonical representations of molecular structures - structure searching - substructure searching - screening methods- algorithms for sub graph isomorphism - practical aspects of structure searching. **(12 Hours)**

UNIT IV

ANALYSIS OF HIGH-THROUGHPUT SCREENING DATA:

Introduction - data visualization - nonlinear mapping - data mining methods - virtual screening - drug-likeliness and compound filters - structure based virtual screening - protein ligand docking - scoring functions for proteins - ligand docking **(12 Hours)**

UNIT V

C PROGRAMMING IN CHEMISTRY:

1. Calculation of pH of a solution
2. Calculation of molecular weight of organic compounds
3. Calculation of normality, molarity and molality of a given solution
4. Calculation of number of vibrational modes of linear and non-linear molecules
5. Calculation of RMS, Average and Most probable velocity
6. Conversion of centigrade to Fahrenheit and vice versa
7. Calculation of the rate constant and half-life period of a first order reaction
8. Finding the ionic mobility of electrolytes **(12 Hours)**

BOOKS FOR REFERENCE :

Study material prepared by the Department of Chemistry

FOR FURTHER REFERENCE:

1. K. V. Raman Computers in Chemistry, Tata McGraw-Hill Publishing Company Ltd., 4thedition, 2007.
2. E. Balagurusamy, Programming in ANCI C, Tata McGraw-Hill Publishing Company Ltd., 3rd edition, 2004.
3. Polanski. J, Cheminformatics, Poland: Elsevier Publications, 2009.

SOIL AND AGRICULTURE CHEMISTRY

Semester: III **Hours: 4**

Code : 20PCH3E3C **Credits: 3**

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Realize the composition of soil and its importance to agriculture	PSO - 2	K
CO - 2	Demonstrate the properties of soil	PSO - 3	U, Ap
CO - 3	Discuss the various types of micronutrients needed to the soil	PSO - 3	U, C
CO - 4	Analyze the chemical composition of fertilizer and soil	PSO - 4	U, An
CO - 5	Formulate the methods of analyzing the soil	PSO - 5	Ap, An, S

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

Semester: III				**SOIL AND AGRICULTURE CHEMISTRY**					**Hours: 4**		
Code : 20PCH3E3C									**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	3	3	3	3	4	4	4	3	3.54
CO - 2	4	4	4	3	3	4	3	3	3	4	4	3.54
CO - 3	3	4	3	4	3	3	3	4	4	4	4	3.54
CO - 4	3	4	4	3	4	4	4	3	3	4	4	3.63
CO - 5	3	4	4	3	4	3	4	4	3	4	3	3.54
Overall Mean Score												**3.56**

Result: The score for this course is **3.56** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

UNIT I

SOIL COMPONENTS:

Definition - volume, composition - uses - mineral soil - chemical ions - soil colloids - importance - nature - properties of inorganic and organic soil colloid - general characteristics - properties and importance - types - silicate clays - silicates - silicon oxygen tetrahedron. **(12 Hours)**

UNIT II

SOIL SALINITY AND ALKALINITY:

Saline and alkaline soil - nature - classification - characteristics - formation of saline and alkaline soil - effects - quality of irrigation water: introduction - criteria -irrigation water resources - water quality - classification of water. **(12 Hours)**

UNIT III

FERTILIZERS:

Introduction - methods of applying fertilizers - application of fertilizer in solid form - liquid fertilizer - nitrogenous fertilizer - types - phosphatic fertilizers: forms - classification- potassic fertilizers: Potassium sulphate: production - properties. **(12 Hours)**

UNIT IV

BIOFERTILIZERS:

Soil biota in sustainable agriculture - biodiversity - management strategies - comparison of chemical fertilizer and biofertilizer.

Vermicomposting - economic implications - materials - preliminary treatment - types of vermicomposting - requirements for vermicomposting.

Eco-Friendly Farming System: organic farming- concept-options **(12 Hours)**

UNIT V

ANALYSIS OF SOIL:

i) Estimation of Ca, Mg, K and nitrate
ii) Analysis of soluble salt
iii) Analysis of NPK in fertilizer
iv) Determination of soil pH and electrical conductivity
v) Estimation of organic matter content of soil **(12 Hours)**

BOOKS FOR REFERENCE:

1. Shivanand Tolanur, Soil Chemistry, International Book Distributing Co, 1st edition, 2006, **Unit I and II**
2. P.K.Gupta, A Handbook of Soil, Fertilizer and Manure, Agrobios (India), 2nd edition, 2012, **Unit III and IV**
3. A. K. Mani, R. Santhi and M. Sellamuthu, A Handbook of Laboratory Analysis, AE Publication, Coimbatore, 2007, **Unit V**

FOR FURTHER REFERENCE:

1. S. P. Majumdar and R. A. Singh, Analysis of Soil Physical Properties, Agrobios (India), 2012.
2. Pooja Kashyap, Agricultural Chemistry, Rajat Pubublications, New Delhi, 1st edition, 2009.

NUTRITIONAL CHEMISTRY

Semester: III **Hours: 4**

Code : 20PCH3GE2 **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 role and importance of various constituents of food.	PSO - 2	K,U
CO - 2	Categorize about the spoilage of various food products.	PSO - 2	K, C
CO - 3	Apply the different methods of and food additives and safety measures in our life.	PSO - 1	U, Ap
CO - 4	Communicate and create awareness among the public about the food adulteration and its detection.	PSO - 3	K, An
CO - 5	Develop the skill to identify the constituents of food and its nutritional values.	PSO - 5	U,Ap

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

Semester: III				**NUTRITIONAL CHEMISTRY**							**Hours: 4**
Code : 20PCH3GE2											**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	3	3	3	4	2	2	3	3.27
CO - 2	4	4	4	4	3	3	3	4	2	2	3	3.27
CO - 3	4	4	3	4	4	2	4	4	3	3	3	3.45
CO - 4	4	4	3	4	4	2	4	4	3	4	3	3.54
CO - 5	4	4	3	4	4	3	4	4	3	3	2	3.45
Overall Mean Score												**3.40**

Result: The score for this course is **3.40** (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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos= Total of Mean Scores / Total No. of Cos

UNIT I

FOOD NUTRITION AND HEALTH:

The meaning of food - nutrients - classification of food - nutritional status and care: malnutrition - global problems of nutrition - the body composition and the nutrients - amount of nutrients in the body - functions of food - metabolism - cell as a functional unit - digestion : digestion in the mouth, stomach and intestine - absorption: intermediary metabolism - the science of nutrition. **(12 Hours)**

UNIT II

FOOD PROCESSING:

Introduction - cooking : cooking methods - effect of cooking on nutrients and various foodstuff - food spoilage - food preservation: refrigeration and freezing - canning - dehydration - experiment n freeze - drying. **(12 Hours)**

UNIT III

FOOD ADDITIVES:

Introduction - the chemistry of sweeteners: intense and bulk sweeteners - chemistry of food colours: natural, nature and synthetic colours - how much colours should be in food safety - flavouring agents - antioxidants - emulsifiers - food stuff containg emulsifiers - types of emulsions - functions of emulsifiers in food - acidulants : acetic, citric, lactic, malic, phosphoric, tartaric acid.

(12 Hours)

UNIT IV

FOOD ADULTERATION AND TESTING:

Introduction - legal aspect of food adulteration and prevention - common food adulterants - analysis of various food adulterants: analysis of adulterants in edible oils, ghee, coffee powder, chilly powder, turmeric powder, meat, milk-harmful effects of the adulterants-food additives: sweeteners - preservatives - flavours - colourants -pesticide contaminants - toxicants. **(12 Hours)**

UNIT V

FOOD PRODUCTS:

Introduction - wheat and wheat products: classification of wheat- wheat flour - wheat products-wheat products- analysis of wheat and products - milk and milk products : composition of milk - milk grades - some commercial milk products - analysis of milk and milk products - meat poultry and fish : composition of meat - grades of meat - composition of poultry - analysis of poultry - composition of sea foods - analysis of fish. **(12 Hours)**

BOOK FOR REFERENCE:

Alex V. Ramani, food chemistry, MJP Publishers, **Unit I - V**

FOR FURTHER REFERENCE:

1. M.R. Adams and M.O. Moss, Food Microbiology, New Age International Publishers, 1st edition, 1996.
2. Seemayadav, Food Chemistry, Anmol Publications Pvt. Ltd., New Delhi, 1st edition, 1997.
3. James M. Jay, Modern Food Microbiology, CBS Publishers and Distributors, 4th edition, 2003.
4. George J. Banwart, Basic Food Microbiology, CBS Publishers and Distributors, 2nd edition, 1998.

HUMAN RIGHTS AND DUTIES

Semester: III **Hours: 2**

Code : 20PSE3H02 **Credit: 1**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Discuss the Meaning and Definitions of Human Rights and Historical Evolution of Human Rights.	PSO - 5	K, A, E
CO - 2	Explain the Human Rights Education and Constitutional Provision for protection of Human Rights in India.	PSO - 5	K, A, E
CO - 3	Assess the Human Rights Activities in India	PSO - 5	K, A, E
CO - 4	Analyse the Welfare Acts of Women in India.	PSO - 5	K, A, E
CO - 5	Evaluate the need of Welfare Acts for the protection of Human Rights in India.	PSO - 5	K, A, E

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

Semester: III			**HUMAN RIGHTS AND DUTIES**								**Hours: 2**
Code : 20PSE3H02											**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**	
CO-1	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-2	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-3	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-4	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-5	5	5	5	5	5	3	2	3	3	2	5	3.90
Overall Mean Score												**3.90**

Result: The score for this course is **3.90** (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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos = Total of Mean Scores / Total No. of Cos

UNIT I

Introduction - Meaning and Definitions of Human Rights - Historical Evolution of Human Rights - Universal Declaration of Human Rights 1948-Human Rights Day. **(6 Hours)**

UNIT II

Human Rights Education - Constitutional Provision for protection of Human Rights in India - Fundamental Rights and Directive principles of State Policy - Fundamental Duties - Protection of Human Rights Act of 1993. **(6 Hours)**

UNIT III

Human Rights Activities in India - National Human Rights Commission - State Human Rights Commission - Structure - functions - Human Rights courts - Role of NGOs - Amnesty - People's Watch. **(6 Hours)**

UNIT IV

The Child Marriage Restraint Act, 1929 - Amended in 1978 - The Special Marriage Act, 1954 - The Hindu Marriage Act, 1955 - The Hindu Adoption and Maintenance Act, 1956 - The Hindu Succession Act, 1956 - The Hindu Minority and Guardianship Act, 1956 - Suppression of Immoral Traffic in Women and Girls Act, 1956 - Devadasis Abolition Act, 1958 - The Hindu Widow Remarriage Act, 1959 - The Dowry Prohibition Act, 1961 - The Maternity Benefit Act, 1961. **(6 Hours)**

UNIT V

The Medical Termination of Pregnancy Act, 1971 - Criminal Law (Amendment) Act, 1983 - The Family Courts Act, 1984. Indecent Representation of Women Prohibition Act, 1986 - Dissolution of Muslim Marriage Act, 1939 and Muslim Women's (Protection of Rights in Divorce) Act, 1986 - Prohibition of Sati Act and Sati Prevention Act, 1987 - Abolition of Female Infanticide - Self Respect Marriage Act - Hindu Women's Property Act - The Tamil Nadu Prohibition of Harassment of Women Act, 1998 - (Protection of Children from Sexual Offences) POCSO Act 2012. **(6 Hours)**

COURSE BOOK:

- Human Rights and Duties - Dr. P. Floras Mary & Dr. V. Santhi, Pandiyanadu Cultural Foundation, 3/26, Nellaiyappa Puram, 1st Street, Thirunagar, Madurai, 2021.
- Website: pandiyanadu.in.

BOOKS FOR REFERENCE

1. Justice Iyer, Dr. Ambedkar and The Dalit Future, B.R. Publishing Co, New Delhi. 1990
2. Bajwa, G.S, Human Rights in India, Anmol Publications Pvt. Ltd., New Delhi, 1995.
3. Paramasivam Sivagami, Human Rights - A Study, Sriram Computer Printer & offset, Salem, Tamilnadu, 1998.
4. Rajendar Mangari The Protection Of Human Rights Act and Relating Laws, Book Agency, Hyderabad - 1., 1999.
5. Jayapalan, N, Women and Human Rights, Atlantic Publishers and Distributors, New Delhi. , 2001.

ORGANIC CHEMISTRY - IV

Semester: IV **Hours: 6**

Code : 20PCH4C10 **Credits: 6**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Apply the knowledge on retro synthesis and disconnection approach to solve the problems in competitive exams.	PSO - 3	U, C, An
CO - 2	Predict the synthesis of complex molecules.	PSO - 5	An, E
CO - 3	Analyse the structure of terpenoids and alkaloids.	PSO - 1	K
CO - 4	Discuss about the structure and functions of steroids.	PSO - 1	U, Ap
CO - 5	Elucidate the structure of flavones and carotenoids.	PSO - 5	U, Ap

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

Semester: IV				**ORGANIC CHEMISTRY - IV**							**Hours: 6**
Code : 20PCH4C10											**Credits: 6**
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	3	4	4	4	4	4	4	3	3	3	3.54
CO - 2	3	4	3	4	3	3	3	4	4	4	4	3.54
CO - 3	4	4	4	3	4	3	4	3	3	4	3	3.54
CO - 4	3	3	4	3	4	3	3	4	3	4	3	3.36
CO - 5	4	.4	3	3	4	4	4	4	3	4	4	3.72
Overall Mean Score												**3.54**

Result: The score for this course is **3.54** (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= $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

UNIT I

RETROSYNTHESIS-I:

Types of synthesis: linear and convergent synthesis - synthons and synthetic equivalents - nucleophilic and electrophilic synthons - Umplong reactions - routine functional group transformations and interconversions of simple functionalities - formation of C-C, C-O and C-N bonds -principles of disconnections in aromatic target molecules-order of events- guidelines to a good disconnection- one group and two group C-X disconnection and synthetic strategies - one group C-C disconnections in carbonyl compounds - two group disconnections I - Diels-Alder reactiion - protection and deprotection of groups

(18 Hours)

UNIT II

RETROSYNTHESIS-II:

Chemoselectivity - stereoselectivity- regioselectivity - uses of aliphatic nitro compounds and acetylene in organic synthesis- synthesis of amines and alkenes- protection and deprotection of groups- strategy of ring synthesis - small rings such as three and four membered rings - Robinson annulation reaction retrosynthetic analysis of simple and complex organic molecules: saccharine, paracetmol, salbutamol, indomethacin and multistriatin **(18 Hours)**

UNIT III

a) TERPENOIDS:

Introduction- occurrence- isolation- classification- isoprene rule- determination of structure of terpenoids- cyclisation reactions of acyclic monoterpenoids: citral to p-cymene, geraniol to α -terpineol- structural elucidation of menthol, piperitone, α - pinene and zingiberne-biosynthesis of citral, myrcene and α -terpineol

b) ALKALOIDS:

Introduction- occurrence- isolation - classification- determination of structure of alkaloids-structural elucidation of coniine, atropine, nicotine and papaverine - biosynthesis of coniine, cocaine and nicotine **(18 Hours)**

UNIT IV

STEROIDS AND HORMONES:

Steroids - Introduction - function of steroids and sterols - isolation and biological function of bile acids - source, properties and colour reactions of cholesterol. Hormones - introduction - differences between hormones and vitamins - classification of hormones - sex hormones - oestrogens - gestrogens, progesterone and testosterone - structure and functions (no structural elucidation) - adrenocortical hormones - relationship to physiological activity - non - steroid hormones - adrenaline, thyroxine - biosynthesis of oestrogens and progesterone

(18 Hours)

UNIT V

a) FLAVONES AND FLAVONOLS:

Introduction - occurrence - isolation, general properties and basic unit in flavones and flavonols - general methods for determination of the structure offlavones taking flavone as an example - constitution of quercetin - structural relationship between flavonols (queretin), anthocyanidins (cyaniding chloride) and catechins - biogenetic relationship between flavonols, anthocyanidins and catechins

b) CAROTENOIDS:

Introduction - classification - isolation and separation - characteristics of carotenoids - principal methods in elucidating the constitution of carotenoids - functions of carotenoids - constitution of γ - carotene and Xanthophyll **(18 Hours)**

BOOKS FOR REFERENCE:

1. Stuart Warren, Organic Synthesis: The Disconnection Approach, Wiley India Pvt. Ltd., Reprint, 2016, **Unit I and II**
2. Francis A. Carey and Richard J. Sundberg Advanced Organic Chemistry Part B: Reactions and Synthesis, Springer Science, 5th edition, 2007, **Unit I and II**
3. W. Carruthers, Some modern methods of organic synthesis, Cambridge University Press, 3rd edition, 1986, **Unit I and II**
4. O.P. Agarwal, Chemistry of Organic Natural products-volume II, Prentice Hall, 33rd edition, 2008, **Unit III-V**
5. I.L. Finar, Organic Chemistry, volume II, Dorling Kindersley, 5th edition, 2008, **Unit III-V**
6. Gurdeep R Chatwal, Organic Chemistry of natural products-volume II, Himalaya Publishing house, New Delhi, 4th edition, 2006, **Unit III-V**

PHYSICAL CHEMISTRY - IV

Semester: IV **Hours: 6**

Code : 20PCH4C11 **Credits: 6**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Formulate the theories of reaction rates in chemical kinetics and apply the theories to decomposition of acetaldehyde and N_2O_5	PSO - 1	K, U
CO - 2	Apply the principles of catalysis and adsorption for their practicals and research projects	PSO - 3	U, C
CO - 3	Recall the kinetics of different types polymerization and applications of industrially important polymers	PSO - 3	Ap, An
CO - 4	Formulate the distribution of molecules by Maxwell Boltzmann and to derive the thermodynamic properties in terms of partition function	PSO - 1	U, C
CO - 5	Realize the distribution of molecules by Fermi Dirac and Bose Einstein and explain Debye and Einstein model of heat capacity of solids	PSO - 1, PSO - 3	U, C, Ap

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

Semester: IV				**PHYSICAL CHEMISTRY - IV**							**Hours: 6**
Code : 20PCH4C11											**Credits: 6**
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	3	4	3	4	3	3	3	4	3	4	4	3.45
CO - 4	3	3	3	4	4	3	3	3	4	3	4	3.36
CO - 5	3	3	4	4	4	4	3	3	3	4	4	3.54
Overall Mean Score												**3.43**

Result: The score for this course is **3.43** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

UNIT I

THEORIES OF REACTION RATES:

Kinetic theory of collisions - steric factor - theory of absolute reaction rate - statistical mechanical derivation of rate constant of a bimolecular reaction- theory of unimolecular reactions: Lindemann - Christianson hypothesis - limitations, Hinshelwood's treatment - objections to Hinshelwood's treatment- Rice - Rampsberger- Kassel (RRK) treatment - limitations - Marcus extension of RRK treatment (RRKM) - reactions in solutions: transition state theory - substituent and correlation effects - Hammett equation - chain reactions: general characteristics - study of kinetics of chain reactions:decomposition of acetaldehyde - decomposition of N_2O_5 s **(18 Hours)**

UNIT II

CATALYSIS AND SURFACE CHEMISTRY:

Homogeneous Catalysis: mechanism of acid base catalysis - acidity function - catalysis by enzyme - Michaelis - Menten kinetics - reactions in flow systems: techniques for very fast reaction -stopped flow method- relaxation methods - T - jump and P- jump methods - surface active agents -classification of surface active agents - hydrophile-lipophile balance - micelle formation - shape and structure of micelles - micellar aggregation numbers - critical micelle concentration - micellar catalysis- reactions on surface: physical and chemical adsorption - Langmuir and BET adsorption isotherm - Gibbs adsorption isotherm. **(18 Hours)**

UNIT III

POLYMER CHEMISTRY:

Introduction, classification based on tacticity-addition,co polymerization and condensation polymerization, co-ordination polymerization - Ziegler - Natta catalyst - kinetics of polymerization: free radical chain polymerization, equation for kinetic chain length, degree of polymerization, cationic polymerization, anionic polymerization - micro structures based on chemical structure and geometrical structure-number average and weight average molecular weight - problems -molecular weight and degree of polymerization-polydispersity and molecular weight distribution in polymers - Molecular weight determination: end group analysis - viscometry - sedimentation velocity method - Industrially important polymers - preparation, properties and uses of LDPE and HDPE, Polystyrene, polyester, acrylo polymer, Teflon, PET, Polyvinyl chloride, Polyvinyl acetate, Phenolic resins, composites of Resins-ABS -Biopolymers: Definition, examples and applications **(18 Hours)**

UNIT IV

STATISTICAL THERMODYNAMICS-I:

Probability and most probable distribution - ensemble averaging - permutations - combinations - Maxwell - Boltzmann statistics - negative temperature - partition functions:translational, rotational, vibrational and electronic partition functions - thermodynamic properties in terms of partition function: internal energy, entropy, enthalpy and free energy - equilibrium constant of an ideal gas in terms of partition function. **(18 Hours)**

UNIT V

STATISTICAL THERMODYNAMICS-II:

Quantum statistics - Fermi Dirac and Bose Einstein statistics - Heat capacities of diatomic gas - quantum statistical theory of specific heat - rotational partition function of hydrogen molecule and nuclear spin - statistical thermodynamics of ortho and para hydrogen - application of Bose - Einstein statistics to black body radiation - heat capacity of solids - Einstein and Debye models of heat capacity of solids. **(18 Hours)**

BOOKS FOR REFERENCE:

1. K.J. Laidler, Chemical Kinetics, Pearson Education Inc., 3rd edition, 2007, **Unit I-II**
2. V.R. Gowarikar, N.V. Viswanathan and Jayadev Sreedhar, Polymer Science, New Age International, Reprint 2005, **Unit III**
3. Kuriacose and Rajaram, Thermodyamics, Jalandar Shoban Lal Co,1993 **Unit IV and V**
4. B.R. Puri, L.R. Sharma and Madan S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co, 47thedition, 2016, **Unit I-V**

FOR FURTHER REFERENCE:

1. M.C. Gupta, Statistical Thermodynamics, Wiley-Eastern Limited, Madras 1997.
2. G. S. Misra, Introductory Polymer Chemistry, Wiley Eastern Ltd., 1993.
3. Rajaram and Kuriacose, Kinetic and mechanism of chemical transformation, Macmillan, India, 1993.

INORGANIC CHEMISTRY - IV

Semester: IV **Hours: 6**

Code : 20PCH4C12 **Credits: 6**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explain the role of inorganic substances in living systems and the use of metal ions in medicinal therapy and diagnosis.	PSO - 4	U, C
CO - 2	Acquire knowledge in organometallic compounds.	PSO - 1	K, U
CO - 3	Apply the organometallic catalysts in industrial sector.	PSO - 2	Ap
CO - 4	Classify the toxification and detoxification of metal.	PSO - 5	U, C
CO - 5	Explain the principles involved in inorganic photochemistry.	PSO - 4	K

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

Semester: IV				**INORGANIC CHEMISTRY - IV**							**Hours: 6**
Code : 20PCH4C12											**Credits: 6**
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	4	3	4	4	4	3	3.81
CO - 2	4	3	4	4	4	3	4	3	4	4	4	3.81
CO - 3	4	4	4	4	4	4	3	4	3	4	4	3.81
CO - 4	4	4	4	4	3	4	4	4	3	4	3	3.81
CO - 5	4	4	4	3	4	4	4	3	4	3	4	3.81
Overall Mean Score												**3.81**

Result: The score for this course is **3.81** (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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos= Total of Mean Scores / Total No. of Cos

UNIT I

BIOINORGANIC CHEMISTRY-I:

Introduction - role of Na, K(sodium pump), Mg , Ca(calcium pump), V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, Pt, Hg and Pb metal ions in biological systems - metalloenzymes: Zn enzymes - carboxy peptidase A and carbonic anhydrase - vitaminB_{12} - photosynthesis - chlorophyll - nitrogen fixation - metal toxification, detoxification and chelate therapy - anticancer drug: cis-platin **(18 Hours)**

UNIT II

BIOINORGANIC CHEMISTRY-II:

Energy sources for life - metalloporphyrins and respiration: cytochrome P450 - dioxygen binding, transport and utilization: interaction between heme and dioxygen - binding of dioxygen to myoglobin - structure and function of hemoglobin - other biological dioxygen carriers: hemerythrin - hemocyanine - electron carriers: Fe-S proteins (rubredoxin and ferridoxin) - blue copper proteins - iron storage and transport: ferritin and transferring **(18 Hours)**

UNIT III

ORGANO METALLIC CHEMISTRY-I:

The 18 electron rule - metal carbonyl complexes - structures of mono and poly nuclear metal carbonyls - concept of isolobality and isolobal analogies - nitrosyl complexes - dinitrogen complexes - metal alkyls - carbenes- carbines - carbides - non - aromatic alkene- alkyne complexes - allyl and pentadienyl complexes - metallocenes - molecular orbital of metallocenes - structure of cyclopenta dienyl complexes - synthesis of cyclopentadienyl complexes-arene complexes **(18 Hours)**

UNIT IV

ORGANO METALLIC CHEMISTRY-II:

Reactions of organo metallic compounds: Substitution reactions in carbonyl complexes - oxidative addition and reductive elimination-insertion and elimination - nucleophilic and electrophilic attack of coordinating ligands.

Catalysis by organometallic compounds: homogenous and heterogenous catalysts - alkene hydrogenation- synthesis gas - hydroformaylation - wacker process - Zeigler - Natta catalyst. **(18 Hours)**

UNIT V

INORGANIC PHOTOCHEMISTRY:

Electronic transitions in metal complexes: metal - centred, intra ligand and charge transfer transitions - photophysical processes of coordination compounds - Jablonski diagram - photochemical reactions of coordination compounds: oxidation - reduction, photo isomerisation, photo substitution, photoanation, unimolecular charge transfer reactions - photochemistry of cobalt(III) complexes - ligand field photochemistry of chromium(III) complexes - Adamson's rules - photochemistry of ruthenium - polypyridine complexes, organometallic compounds and metal carbonyl compounds - bimolecular reactions - unimolecular reactions - photochemistry of compounds with metal - metal bonding **(18 Hours)**

BOOKS FOR REFERENCE:

1. E. Huheey James, Inorganic Chemistry, Principles of structure and reactivity, Dorling Kindersley India Pvt. Ltd., 4th edition, 2007, **Unit I-IV**
2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers 32nd edition, 2015, **Unit I-IV**
3. A. Abdul Jameel, Applications of Physical methods to Inorganic compounds, 2007, **Unit V**
4. S. Arunachalam, Inorganic Photochemistry, Kala Publications, 2002, **Unit V**
5. E. Douglas, H.Mc Daniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd edition, 2006, **Unit V**

PROJECT

Semester: IV **Hours: 12**

Code : 20PCH4R01 **Credits: 4**

COURSE OUTCOMES :

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Identify the thrust areas in Research.	PSO - 1	U,C, An
CO - 2	Demonstrate the different analytical skills used in characterization of compounds.	PSO - 3	C, Ap
CO - 3	Compile the project work.	PSO - 5	Ap, E
CO - 4	Develop the presentation skills through reviews.	PSO - 4	Ap
CO - 5	Provide confidence to take up a task.	PSO - 1	An

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

Semester: IV				**PROJECT**							**Hours: 12**
Code : 20PCH4R01											**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	4	5	4	4	4	4	4	4	3	4.09
CO - 2	4	3	4	4	4	3	4	3	4	4	4	3.72
CO - 3	4	4	4	4	4	4	4	3	4	4	5	4.00
CO - 4	4	4	4	4	3	4	4	4	4	4	3	3.81
CO - 5	3	4	4	3	4	4	4	4	4	3	4	3.72
Overall Mean Score												**3.87**

Result: The score for this course is **3.87** (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 = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos= Total of Mean Scores / Total No. of Cos

COMPREHENSIVE EXAMINATION

Semester: IV

Code : 20PCH4S01 **Credits: 2***

COURSE OUTCOMES :

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Gain in depth knowledge in chemistry.	PSO - 1	U, C, An
CO - 2	Develop problem solving skills in organic, inorganic, physical and interdisciplinary chemistry.	PSO - 3	U, C, Ap
CO - 3	Discuss the different aspects of learning.	PSO - 5	U, Ap, E
CO - 4	Gain confidence to take up CSIR- NET/ SET examinations.	PSO - 4	U, Ap
CO - 5	Appear for various competitive examinations.	PSO - 1	Ap, An

***Extra Credit**

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

Semester: IV				**COMPREHENSIVE EXAMINATION**							**Credits: 2***
Code : 20PCH4S01											
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	4	3	3	4	4	4	3	3	3.64
CO - 2	4	3	4	5	4	3	4	3	5	3	3	3.73
CO - 3	4	4	4	3	4	4	4	5	3	4	4	3.91
CO - 4	4	4	5	4	4	4	4	5	4	4	3	4.09
CO - 5	4	4	5	4	4	3	4	4	3	3	3	3.73
Overall Mean Score												**3.82**

Result: The score for this course is **3.82** (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= $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$