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.

M.Sc. CHEMISTRY

(2023-2026)

PG AND RESEARCH CENTER OF CHEMISTRY

PG PROGRAMME OUTCOMES (2023-2026)

PO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO
1.	Instill knowledge and evaluate analytically in their specific disciplines.
2.	Analyze and apply the acquired knowledge to solve the complex problems in professional and social life.
3.	Evolve new technologies in the specific discipline leading to innovation and employability.
4.	Develop critical thinking required to pursue research.
5.	Apply the computational skills, life skills to the challenging problems in life.
6.	Design and develop independent projects

PG PROGRAMME SPECIFIC OUTCOMES

PSO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO	PO MAPPED
1	Explore in-depth knowledge about the chemical reactions, mechanisms, theories of Chemistry and appreciate their applications in research and in fields such as organic, inorganic, physical, biochemical and industrial chemistry	PO-1
2	Analyse and assess, the qualitative characteristics and quantitative measurements of organic and inorganic compounds	PO-2
3.	Apply problem solving, computational and analytical skills to interpret the Spectrophotometric, analytical, electrometric and chromatographic measurements of compounds.	PO-5
4	Utilize the practical skills and research ideas, cheminformatic tools to focus on their innovative Research and career selection in related sectors, academic or industry.	PO-3
5	Demonstrate small project works utilizing their scientific knowledge and formulate the procedure for manuscript and dissertation writing.	PO-4, PO-6

M.SC. CHEMISTRY COURSE PATTERN (2023 - 2026) (UGC/ TANSCHE/ MTU)

Sem.	Part	Code	Title of the Course	Hours	Credit
I	A	23PCH1C01	Organic Chemistry-I	5	4
		23PCH1C02	Physical Chemistry-I	5	4
		23PCH1C03	Inorganic Chemistry-I	5	4
		23PCH1P01	Organic Chemistry practical	5	3
		23PCH1E1A/ 23PCH1E1B/ 23PCH1E1C	Research methodology / Pharmaceutical Chemistry/ Nanomaterials and Green Synthesis	4	3
	B	23PCH1SE1	**SEC - 1:** Chemistry of Herbal Cosmeceuticals	4	2
		23PAE1SK1	**AEC - 1:** Soft Skill	2	2
			Total	**30**	**22**
II	A	23PCH2C04	Organic Chemistry-II	5	4
		23PCH2C05	Physical Chemistry-II	4	4
		23PCH2C06	Inorganic Chemistry-II	4	4
		23PCH2P02	Inorganic Chemistry Practical	5	3
		23PCH2ID1	Chemistry of Consumer Products	6	3
	B	23PCH2SE2	**SEC - 2:** Graphical Interpretation using Origin	4	2
		23PAE2SK2	**AEC- 2:** Cyber Security	2	2
	C	23PSL2EX1	Extension Activity (Can be carried outside the class hours)	-	1
			Total	**30**	**23**
III	A	23PCH3C07	Organic Chemistry-III	5	4
		23PCH3C08	Physical Chemistry-III	5	4
		23PCH3C09	Inorganic Chemistry-III	5	4
		23PCH3P03	Physical Chemistry Practical	5	3
		23PCH3E2A/ 23PCH3E2B/ 23PCH3E2C	Applications of IT skills in Chemistry / Biomolecules and Heterocyclic compounds / Soil and agriculture Chemistry	5	4
	B	23PCH3SE3	**SEC- 3:** Industrial Chemistry	5	3
		23PCH3IN1/ 23PCH3IT1	Internship/Industrial Activity (Carried out in summer vacation at the end of Semester II)/(at least 10 Days)	-	2
			Total	**30**	**24**
IV	A	23PCH4C10	Organic Chemistry-IV	5	5
		23PCH4C11	Physical Chemistry-IV	6	5
		23PCH4C12	Inorganic Chemistry-IV	6	5
		23PCH4E3A/ 23PCH4E3B/ 23PCH4E3C	Instrumental methods of Chemical analysis / Polymer Chemistry / Forensic Chemistry	5	3
		23PCH4R01	Project with Viva Voce	6	3
	B	23PCH4SE4	**SEC -4:** Training for Competitive Examinations	2	1
			Total	**30**	**22**
			Total for All Semesters	**120**	**91**

CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA) - 2023-2026

CIA components for Practical can be decided by the respective Departments.

Passing Minimum in the Continuous Internal Assessment is Compulsory for appearing the External Semester Examination

THEORY:

Component	**Marks**	**Marks**
Internal test I	40	Converted to 25
Internal test II	40	
Seminar	10	
Assignment/Term paper	5	
Attendance	5	
Total	**100**	**25**

PRACTICAL:

Continuous Internal Assessment (CIA) - 40 Marks

External Practical Exam - 60 Marks

Passing Minimum for External Semester Examination - PG

Passing Minimum

Semester Examination		
Theory	50% out of 75 Marks (i.e., 37.5 Marks)	50% out of 100 Marks (i.e. 50 Marks)
Practical	50% out of 60 Marks (i.e. 30 Marks)	

PG - INTERNAL QUESTION PATTERN

Max. Marks - 40; Duration - 2 Hours

Section	Bloom's level	Course Outcome	Questions
A MCQs (10×1=10)	K1	CO1	1.
		CO1	2.
		CO1	3.
		CO1	4.
		CO1	5.
		CO1	6.
		CO1	7.
		CO1	8.
		CO1	9.
		CO1	10.
B Answer all the Questions (2×5=10)	K2	CO2	11. a) (or) 11. b)
	K3	CO3	12. a) (or) 12. b)
C Answer all the questions (2×10=20)	K4	CO4	13. a) (or) 13. b)
	K5, K6	CO5	14. a) (or) 14. b)

PG - INTERNAL QUESTION PATTERN (FULLY INTERNAL PAPERS)

Max. Marks - 40; Duration - $1\frac{1}{2}$ Hours

Section	Bloom's level	Course Outcome	Questions
A MCQs (10×1=10)	K1	CO1	1.
		CO1	2.
		CO1	3.
		CO1	4.
		CO1	5.
		CO1	6.
		CO1	7.
		CO1	8.
		CO1	9.
		CO1	10.
B Answer all the Questions (2×5=10)	K2	CO2	11. a) (or) 11. b)
	K3	CO3	12. a) (or) 12. b)
C Answer all the questions (2×10=20)	K4	CO4	13. a) (or) 13. b)
	K5, K6	CO5	14. a) (or) 14. b)

PG - EXTERNAL QUESTION PATTERN

For Credits 5 and above

Sections	Bloom's level	Course Outcome	Questions
A MCQs 15×1=15	K1	CO1	1
			2
			3
			4
			5
			6
			7
			8
			9
			10
			11
			12
			13
			14
			15
B Answer All the Questions 5×2=10	K2	CO2	16
			17
			18
			19
			20
C Answer ALL the Questions 5×5=25	K1	CO1	21. a)
			Or
			21. b)
	K2	CO2	22. a)
			Or
			22. b)
	K3	CO3	23. a)
			Or
			23. b)
	K4	CO4	24. a)
			Or
			24. b)
	K5	CO5	25. a)
			Or
			25. b)

D Answer All the Questions 5×10=50	K2	CO2	26. a)
			Or
			26. b)
	K3	CO3	27. a)
			Or
			27. b)
	K4	CO4	28. a)
			Or
			28. b)
	K5	CO5	29. a)
			Or
			29. b)
	K6	CO5	30. a)
			Or
			30. b)

PG - EXTERNAL QUESTION PATTERN

For Below 5 Credits

Sections	Bloom's level	Course Outcome	Questions
A MCQs 15×1=15	K1	CO1	1
			2
			3
			4
			5
			6
			7
			8
			9
			10
			11
			12
			13
			14
			15
B Answer ALL the Questions 5×6=30	K2	CO2	16. a)
			Or
			16. b)
	K3	CO3	17. a)
			Or
			17. b)
	K4	CO4	18. a)
			Or
			18. b)
	K5	CO5	19. a)
			Or
			19. b)
	K6	CO5	20. a)
			Or
			20. b)
C Answer All the Questions 3×10=30	K2	CO2	21. a)
			Or
			21. b)
	K4	CO4	22. a)
			Or
			22. b)
	K5	CO5	23. a)
			Or
			23. b)

Note: Revised Bloom's Taxonomy Levels

Remembering- K1; Understanding- K2; Applying- K3; Analyzing- K4; Evaluating- K5; Creating- K6

Components for Training for Competitive Examinations can be decided by the respective Departments.

Passing Minimum is 50%

Component		Marks
Component- I	:	20
Component- II	:	20
Component- III	:	20
Component- IV	:	20
Component- V	:	20
Total	**:**	**100**

TRAINING FOR COMPETITIVE EXAMS (INTERNAL ONLY)

COMPONENTS	MAXIMUM MARKS
Test 1	40
Test 2	40
Panel Discussion	15
Class Activity	05

TEST TYPE	K LEVEL	NO OF QUESTIONS
Objective type questions	KI	15
Objective type questions	K2	15
Objective type questions	K3	10

ORGANIC CHEMISTRY-I

Semester: I **Hours: 5**

Code : 23PCH1C01 **Credit: 4**

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on bonding, aromaticity, heterocyclic compounds, organic reactions, reagents in organic synthesis and rearrangements	PSO-1	K1
CO - 2	Recognize the fundamental principles of bonding, aromaticity, heterocyclic compounds, organic reactions, reagents in organic synthesis and rearrangements	PSO-2	K2
CO - 3	Illustrate the concept of bonding, aromaticity, properties of heterocyclic compounds, organic reactions, reagents in organic synthesis and rearrangements	PSO-3	K3
CO - 4	Analyse the importance of bonding, aromaticity, heterocyclic compounds, organic reactions, reagents in organic synthesis and rearrangements	PSO-4	K4
CO - 5	Solve the problems in competitive exams on bonding, aromaticity, heterocyclic compounds, organic reactions, reagents in organic synthesis and rearrangements	PSO-5	K5, K6

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

Semester: I							**ORGANIC CHEMISTRY - I**					**Hours: 5**
Code : 23PCH1C01												**Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	3	2	4	2	3	5	4	3	2	3.27
CO - 3	3	3	4	3	5	3	3	3	5	4	3	3.55
CO - 4	3	3	5	3	3	3	3	3	3	5	3	3.63
CO - 5	3	4	2	5	3	5	3	4	3	2	5	3.55
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: BONDING AND REACTIVITY

Types of bonding (ionic, covalent) - orbital theory - shapes - overlap of orbitals - formation of compounds - hybridization -factors influencing reactivity - inductive, electromeric, resonance, mesomeric, hyperconjugative and steric effect - hydrogen bonding - breaking and making of bonds - reaction intermediates :- generation, stability and reactivity of (carbocation, carbanion, carbene and nitrene) - energetics of reactions (exergonic and endergonic reactions) energy profile diagram - rate of reactions - difference between transition state and intermediate, methods of determining reaction mechanism (kinetic and non kinetic methods) - Linear free energy relationships - Hammett equation - physical significance of σ , ρ - Taft equation **(15 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 **(15 Hours)**

UNIT III: SUBSTITUTION AND ELIMINATION REACTIONS

a) Aliphatic and aromatic nucleophilic substitutions: S_N1, S_N2, S_Ni mechanism- effect of substrate, nucleophile, leaving group and solvent on aliphatic nucleophilic substitution. Aromatic nucleophilic substitution - S_NAr, S_N1 and S_N2. 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:

$S_E1$and S_E2 and S_Ei 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**.** **(15 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 - Ene reaction - Hofmann elimination - Mannich - Michael- Oppennauer oxidation - Stork enamine reaction - Wittig reaction - Clemmensen reduction **(15 Hours)**

UNIT V: REARRANGEMENTS

Lossen - Beckmann, Fries, Favorskii - Curtius - pinacol-pinacolone-Benzillic acid - Baeyer-Villiger oxidation- Cope, Wagner-Meerwein - Claisen -Wolff - Neber - Schimidt-Stevens-Wittig rearrangement **(15 Hours)**

BOOKS FOR REFERENCE:

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

PHYSICAL CHEMISTRY - I

Semester: I **Hours: 5**

Code : 23PCH1C02 **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire the knowledge about the fundamentals of molecular spectroscopy and photochemistry	PSO-1	K1
CO - 2	Explain the principles of microwave, FT-IR, UV-visible, Raman, NMR, ESR and Mossbauer spectroscopy and photochemistry	PSO-2	K2
CO - 3	Apply the concepts of microwave, FT-IR, electronic, ESR and Mossbauer spectroscopy and photochemical reactions to understand the spectral data	PSO-3	K3
CO - 4	Analyse the stretching frequencies of molecules, Frank Condon Principle, Hyperfine splitting in ESR, Chemical shift in NMR and Mossbauer spectra, radiative and non-radiative decays	PSO-4	K4
CO - 5	Evaluate the given spectral data to relate the structure of compounds	PSO-5	K5, K6

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

Semester: I							**PHYSICAL CHEMISTRY - I**					**Hours: 5**
Code : 23PCH1C02												**Credit: 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	3	4	3	5	4	4	4	3	3.91
CO - 2	4	5	3	3	3	3	4	5	3	3	3	3.55
CO - 3	3	3	4	3	5	3	3	3	5	4	3	3.55
CO - 4	3	3	5	4	4	4	3	3	4	5	4	3.82
CO - 5	3	3	4	5	4	5	3	3	4	4	5	3.91
Overall Mean Score												**3.75**

Result: The score for this course is **3.75** (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: 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 - 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. **(15 Hours)**

UNIT II: a) 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

b) 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 **(15 Hours)**

UNIT III: a) ELECTRONIC SPECTROSCOPY:

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

b) 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 benzo semiquinone radical anion, naphthalene anion, anthracene and bis-salicylaldimine Cu(II) complex

c) MOSSBAUER SPECTROSCOPY:

Principles - instrumentation - the chemical shift - quadrupole effect - effect of a magnetic field - applications to iron and tin complexes (**15 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 - Hydrogen nuclei- mechanism of shielding and deshielding - chemical shift-coupling constant - spin-spin interactions of AX, A_3X_2, AMX, A_6X- chemical analysis by NMR technique - exchange phenomena - Nuclei other than Hydrogen - nuclei with spin ½ - C^{13} NMR spectroscopy-principles - Comparison between ^1H and ^{13}C - nuclei with spin greater than ½ - quadrapole effects- applications of NMR in medicine – MRI. **(15 Hours)**

UNIT V: a)PHOTOCHEMISTRY

Physical properties of the electronically excited molecule: excited state dipole moments - excited state pKa, excited state redox potential - Jablonski diagram - Radiative and non-radiative decays - Fluorescence, Phosphorescence - photosensitization and chemiluminescence - factors affecting quantum yield - fluorescence quenching - Stern Volmer equation - Experimental techniques in photochemistry - Flash photolysis technique.

b) 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 **(15 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-IV**
2. K.K. Rohatgi-Mukherjee, Fundamentals of Photochemistry, Wiley Eastern Ltd., **Unit V**
3. B.R. Puri, L.R. Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 46th edition, 2012 **Unit I -V**
4. R.S.Drago, Physical Methods in Inorganic Chemistry, W.B.Saunders Company, 1992 **Unit III**

INORGANIC CHEMISTRY-I

Semester: I **Hours: 5**

Code : 23PCH1C03 **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the concepts of acids, bases, non-aqueous solvents, ionic structures, VSEPR theory, orbital and spin magnetic moment and nuclear chemistry	PSO-1	K1
CO - 2	Explain the acids, bases concepts, properties of non aqueous solvents, chemical bonding in different systems, MO theory, structure of solid state and characteristics of nuclear reactions	PSO-3	K2
CO - 3	Illustrate the leveling effects of acids, bases, chemical reactions in protic and aprotic solvents, MO diagram and explain the magnetic behaviour, metallic bonding and nuclear reactions	PSO-2	K3
CO - 4	Analyse the various concepts of acids, bases, properties of non aqueous solvents, properties of ionic bond, VSEPR and MO theories, magnetic behaviour, crystal structure and application of nuclear chemistry reactions	PSO-4	K4
CO - 5	Evaluate the strength of acids, bases, properties of protic and aprotic solvents, ionic structures, bonding in triatomic and polyatomic systems, measurement of magnetic susceptibility, crystal defects and nuclear energy and its applications	PSO-5	K5, K6

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

Semester: I				**INORGANIC CHEMISTRY - I**					**Hours: 5**			
Code : 23PCH1C03												**Credit: 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	3	3	5	4	3	3	3	3.55
CO - 2	4	3	3	3	5	3	4	3	5	3	3	3.55
CO - 3	3	5	3	3	3	3	3	5	3	3	3	3.36
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
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) ACIDS AND BASES:

Introduction - Concepts of acids and bases - Arrhenius concept - Lowry- Bronsted - relative strengths of acids and bases and 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

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: ELECTROVALENT BOND:

Introduction - Ionic structures: ZnS, NaCl, CsCl (AX type), CaF_2, TiO_2, SiO_2 (AX_2 type) - radius ratio rules - calculation of radius ratio: Planartriangle, tetrahedral, Octahedral - Limitations of radius ratio rule - Medlung constant - Born lande equation - decreasing energy in ionic bond - properties of ionic bond - polarization of ions and Fajans's rule - percentage of ionic character in a polar covalent bond - Hanny Smyth equation. **(15 Hours)**

UNIT III: a) MOLECULAR BOND:

Introduction - hybridization: types of hybridization (sp^3d, sp^3d^2, sp^3d^3) Lewis theory - Octet Rule - VSEPR theory- BF_3, NH_3, H_2O, PCl_3, ClF_3, SF_4, I^{3-}, SF_6^- - isoelectronic molecules - covalent radii - MO theory and MO approach to CO, NO, HF - bond length, bond order and bond energy - bonding in triatomic and polyatomic systems - BeH_2, CO_2 and NH_3.

b) 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)**

UNIT IV: a) SOLID STATE CHEMISTRY:

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

b) METALLIC BONDING: band theory - conductors - insulators - semiconductors - Intrinsic and extrinsic - superconductivity. **(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 spent fuels - recovery of uranium and plutonium - nuclear waste management - radio isotopes in analytical applications - direct isotope dilution analysis- neutron activation analysis - radiation energy for chemical synthesis. **(15 Hours)**

BOOKS FOR REFERENCE:

1. James E. Huheey Inorganic Chemistry, Dorling Kindersley Pvt. Ltd., 4thedition, 2012 **Unit I -V**
2. J.D. Lee, Concise Inorganic Chemistry, Blackwell publishing, 5thedition, 1996 Units **III - IV**
3. Bodie Douglas, Darl McDaniel, John Alexander, Concepts and Models of Inorganic Chemistry, Wiley-India Publishing, 3rdedition, 2006 **Unit III - IV**
4. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers and Distributor, Delhi, 31stedition, 2010 **Unit I - V**
5. R.D. Madan, Modern Inorganic Chemistry, S. Chand and Company Ltd., 2nd edition, 2002 **Unit I - V**
6. H. J. Arnikar Essentials of Nuclear Chemistry, New Age international, 4th edition, 2007. **Unit V**
7. R.L.Madan, G.D.Tuli, Inorganic Chemistry, S.Chand's publishing 1999. **Unit I - V**

ORGANIC CHEMISTRY PRACTICAL

Semester: I **Hours: 5**

Code : 23PCH1P01 **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the basic principles of organic qualitative and quantitative analysis	PSO-1	K1
CO - 2	Describe the separation process of the organic mixture into individual components and the reactions of organic substance	PSO-2	K2
CO - 3	Apply a suitable experimental *procedure for double stage organic compound* preparations and analysis of organic substance	PSO-3	K3
CO - 4	Analyse the given organic mixture and determine the quantity of the substance present in the given sample	PSO-4	K4
CO - 5	Develop analytical skills in using various chemical reagents and adopt safety measures	PSO-5	K5, K6

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

Semester: I				**ORGANIC CHEMISTRY PRACTICAL**							**Hours: 5**
Code : 23PCH1P01											**Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	4	3	3	3	3	5	3	4	3	3.55
CO - 3	3	4	3	4	5	4	3	4	5	3	4	3.82
CO - 4	4	3	5	3	4	3	4	3	4	5	3	3.73
CO - 5	3	4	4	5	3	5	3	4	3	4	5	3.91
Overall Mean Score												**3.71**

Result: The score for this course is **3.71** (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= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

ANALYSIS OF ORGANIC MIXTURES:

Separation of two component mixtures into individual components and systematic analysis.

ESTIMATIONS:

a) Estimation of Aniline (bromination)

b) Estimation of Glucose (redox)

c) Estimation of Glycine (acidimetry)

TWO STAGE PREPARATIONS:

a) *p*-Bromoacetanilide from aniline

b) Acetyl salicyclic acid from methyl salicylate

BOOKS FOR REFERENCE:

1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry Lab Manual, S. Viswanathan Printers and Publishers Pvt. Ltd., 2007
2. Vogel's Text book of organic Qualitative Analysis, 4th edition, ELBS,London.

RESEARCH METHODOLOGY

Semester: I **Hours: 4**

Code : 23PCH1E1A **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the concepts of literature survey, separation and purification techniques and analytical techniques to chemical compounds	PSO-1	K1
CO - 2	Explain collection of resources and the methodology to research problems, purification and analytical technique to chemical compounds	PSO-2	K2
CO - 3	Apply the various journal resources to write research proposal, spectral techniques for structure elucidation, data interpretation using chem software,	PSO-3	K3
CO - 4	Infer the analytical techniques to characterize the compounds and experimental data using chem software	PSO-4	K4
CO - 5	Interpret research problems and methodology and experimental data using chem software	PSO-5	K5, K6

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

Semester: I												**Hours: 4**
Code : 23PCH1E1A							**RESEARCH METHODOLOGY**					**Credit: 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	3	4	4	3	4	5	3	3	4	4	3.82
CO - 2	4	5	3	4	4	4	4	5	4	3	4	4.00
CO - 3	4	3	3	4	5	4	4	3	5	3	4	3.82
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
Overall Mean Score												**3.75**

Result: The score for this course is **3.75** (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- sci finder - Scopus - Scirus - science direct - citation index-impact factor, H-index. **(12 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). **(12 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. **(12 Hours)**

UNIT IV: ANALYTICAL TECHNIQUES AND PATENT RIGHTS:

Applications of UV, IR, NMR, and Mass spectroscopies - structure elucidation of organic compounds with spectral techniques (simple problems) - Principle, instrumentation and applications of XRD, SEM, TEM, EDAX, STM and AFM- patent: origin - Meaning of Patent - Types - Inventions which are not patentable - Registration Procedure - Rights and Duties of Patentee - Assignment and licence.

(12 Hours)

UNIT V: COMPUTATIONAL TECHNIQUES IN CHEMISTRY:

a) CHEM DRAW:

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. **(12 Hours)**

BOOKS FOR REFERENCE:

1. Web resources **Unit I - II**
2. Michael P. Marder, Research Methods for Science, Cambridge University press, 1st edition, 2011 **Unit II**
3. R.P. Budhiraja, Separation Chemistry, New age international Pvt. Ltd., 2nd edition, 2007 **Unit III**
4. J Mendham, R.C. Denny, J.D. Barnes M Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th edition, 2005 **Unit III**
5. S. M. Silverstein, G.V. Bassler, & T. C. Morril, Spectrometric Identification of Organic Compounds, New York: Wiley, 6th edition, 2004 **Unit IV**
6. W. Kemp, Organic Spectroscopy, New York: Macmillan, 3rdedition, 2011 **Unit IV**
7. Chatwal and Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House, 2nd edition, 1984 Unit **III - IV**
8. Michael P. Marder, Research Methods for Science, Cambridge University press, 1st edition, 2011 **Unit II**
9. Chem Draw and Origin manuals Unit **V**

PHARMACEUTICAL CHEMISTRY

Semester: I **Hours: 4**

Code : 23PCH1E1B **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the role of chemistry in treatment of diseases	PSO-1	K1
CO - 2	Write the first aid materials, botanical name of medicinal plants, drugs containing sulphonamides, activity of groups	PSO-2	K2
CO - 3	Apply the chemistry knowledge to First aid, treatment of common illness, cardio vascular diseases with the concept of structure activity relation	PSO-3	K3
CO - 4	List the antidotes, antibiotics, cardio vascular drugs, herbal extracts, physiological effect of various functional groups	PSO-4	K4
CO - 5	Evaluate first aid for various injuries, pharmacological activity of Indian medicinal plants, activity of sulphonamides and formulate structure activity relationship	PSO-5	K5, K6

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

Semester: I							**PHARMACEUTICAL CHEMISTRY**					**Hours: 4**
Code : 23PCH1E1B												**Credit: 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	3	3	5	4	3	3	3	3.55
CO - 2	4	5	3	3	3	3	4	5	3	3	3	3.55
CO - 3	3	3	3	4	5	4	3	3	5	3	4	3.64
CO - 4	3	3	5	4	4	4	3	3	4	5	4	3.82
CO - 5	3	3	4	5	4	5	3	3	4	4	5	3.91
Overall Mean Score												**3.69**

Result: The score for this course is **3.69** (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: FIRST AID FOR ACCIDENTS:

Rules - first aid box - causes and first aid: cuts, abrasions and bruises, bleeding, fractures, burns, fainting and poisonous bites - antidotes for poisoning - some common poisons and their antidotes. **(12 Hours)**

UNIT II: INDIAN MEDICINAL PLANTS AND TREES:

Occurrence, botanical name and therapeutic uses: Adathoda Vasica- Ocimum Sanctum- Hibiscus Rosa Sinensis- Mangifera Indica- Azadirachta Indica- Ficus-Solanum trilobatum- Phyllanthus niruri- grasses and greens - alkaloids: structure - properties and therapeutic uses of quinine and morphine. **(12 Hours)**

UNIT III: TREATMENT FOR COMMON ILLNESS:

Common diseases and treatment: tuberculosis - asthma - jaundice - piles - leprosy - epilepsy - typhoid - malaria - cholera and filaria - medicinally important compounds: alum, phosphoric acid, arsenous anhydride, ferrous fumarate and yellow mercuric oxide. **(12 Hours)**

UNIT IV: CARDIO VASCULAR DRUGS AND SULPHONAMIDES:

a) CARDIO VASCULAR DRUGS:

cardiac glycosides, antiarrhythmic drugs, antihypertensive agents, anti anginal agents, vasodilator: therapeutic uses.

b) SULPHONAMIDES:

sulphanilamide - sulphadiazine - cibazole - prontosil - Vitamins: definition - classification - sources - functions & deficiencies of Vitamin B1, B2, B3 and B6-folic acid (Vitamin B9) - cyanocobalamin (Vitamin B12) - therapeutic uses. **(12 Hours)**

UNIT V: CHEMICAL STRUCTURE AND PHARMACOLOGICAL ACTIVITY:

Physiological effect: unsaturation, chain length, isomerism, halogens, amino group, nitro and nitrite compound, nitrile group, acidic group, aldehyde and ketone groups, hydroxyl group, alkyl group. **(12 Hours)**

BOOKS FOR REFERENCE:

1. G. Jayashree, A Text book of Pharmaceutical Chemistry, S. Chand & Co., New Delhi, 2014 **Unit I-V**

2. G.R. Chatwal, Medicinal Chemistry, Himalaya Publishing House. **Unit III**

NANO MATERIALS AND GREEN SYNTHESIS

Semester: I **Hours: 4**

Code : 23PCH1E1C **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall basic knowledge on fundamentals of nanomaterials and green chemistry	PSO-1	K1
CO - 2	Summarize the properties of nanomaterials, synthesis of nanomaterials, principles of green chemistry, green catalysts, concepts involved in green synthesis	PSO-2	K2
CO - 3	Apply the facts about nanommaterials and green chemistry principles in research	PSO-3	K3
CO - 4	Categorise the physico chemical properties, different synthetic approaches of nanomaterials, efficiency of reaction, green catalysts and green reactions	PSO-4	K4
CO - 5	Evaluate the need for use of nanomaterials in day today life and green chemistry principles in industries for sustainable development	PSO-5	K5, K6

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

Semester: I				NANO MATERIALS AND GREEN SYNTHESIS								Hours: 4
Code : 23PCH1E1C												Credit: 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	3	4	4	4	4	5	3	4	4	4	4.00
CO - 2	3	5	4	3	3	3	3	5	3	4	3	3.55
CO - 3	4	4	4	3	5	3	4	4	5	4	3	3.91
CO - 4	3	4	5	3	3	3	3	4	3	5	3	3.55
CO - 5	3	3	4	5	3	5	3	3	3	4	5	3.73
Overall Mean Score												3.75

Result: The Score for this Course is **3.75** (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: BASIC CONCEPTS 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. **(12 Hours)**

UNIT II: SYNTHESIS OF NANOMATERIALS:

Basics of nanofabrication method - top-down, bottom-up approaches, gas phase, liquid phase, solid phase synthesis, self-assembly, templated synthesis, sol-gel, electrodeposition, nanoparticle formation, thermodynamic approach, supersaturation, nucleation, growth, homo vs hetero nucleation. Synthesis of nanoparticles: metallic, semiconducting, quantum dots, oxides, hybrids, micelles and microemulsion as templates for synthesis. 0D, 1D and 2D nanoparticles, core shell nanoparticles, special nanoparticles, shaped nanoparticles. **(12 Hours)**

UNIT III: a) CONCEPTS OF GREEN CHEMISTRY:

introduction - Definition - 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. **(12 Hours)**

UNIT IV: a) GREEN CATALYSTS:

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. **(12 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 benzoicacid, 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 - dry cleaning - environmentally safe marine antifoulant- green synthesis of plastic:poly lactic acid **(12 Hours)**

BOOKS FOR REFERENCE:

1. B.Viswanathan, Nano materials, Narosa publishing house, New Delhi, 1st edition, 2009 **Unit I - III**

2. S. Shanmugam, Nanotechnology, MJP Publishers, 2016 **Unit I - III**

3. M. A. Shah and Tokeer Ahmad, Principles of Nanoscience and Nanotechnology, Narosa Publishing House, 2nd Reprint, 2013 **Unit I - II**

4. V. K Ahluwalia, Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005. **Unit IV - V**

5. A.S.Matlack, Introduction to Green Chemistry, Marcel Dekker, 2001 **Unit V**

CHEMISTRY OF HERBAL COSMECEUTICALS

Semester: I **Hours: 4**

Code : 23PCH1SE1 **Credit: 2**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the knowledge on the fundamentals of cosmetics	PSO-1	K1
CO - 2	Discuss the quality control and the importance of plant based medicinal industry	PSO-2	K2
CO - 3	Apply the importance of healthcare in cosmetics	PSO-3	K3
CO - 4	Illustrate the cosmetics derived from natural products for skin and hair care	PSO-4	K4
CO - 5	Develop entrepreneurial skills in cosmetics and prepare some herbal cosmetics	PSO-5	K5, K6

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

Semester: I				**CHEMISTRY OF HERBAL COSMECEUTICALS**							**Hours: 4**
Code : 23PCH1SE1											**Credit: 2**
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	3	4	4	4	4	5	3	4	4	4	4.00
CO - 2	4	5	3	4	3	4	4	5	3	3	4	3.82
CO - 3	3	4	3	4	5	4	3	4	5	3	4	3.82
CO - 4	4	3	5	3	4	3	4	3	4	5	3	3.73
CO - 5	4	3	3	5	3	5	4	3	3	3	5	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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I: INTRODUCTION TO COSMETICS:

History of cosmetics - cosmetic formulation - skin care - hair care - deodorants and antiperspirants - colour cosmetics - mascara, eye shadow and eyebrow pencils - sun protection - aerosols - nail cosmetics - mouth cosmetic - perfumes and fragrances. **(12 Hours)**

UNIT II: QUALITY CONTROL OF COSMETICS:

General principles of quality control - standardization of cosmetics - raw material control - packaging material control, finished product control, shelf testing - WHO guidelines - herbal cosmetics in ancient India - future prospects of herbal cosmetics and medicines - global overview of medicinal plants - medicinal and aromatic plant based industries and institutions in India. **(12 Hours)**

UNIT III: HERBAL PRODUCTS:

Cosmetic importance: Quality, safety and efficacy of herbal cosmetics - advantages of cosmetics over synthetic: natural products - compatible with all skin types - fits budget - natural colorants: Biological source, coloring principles, chemical nature and usage of the following: annato, cochineal, caramel, indigo, madder, saffron and turmeric, flavors and perfumes: sandal wood oil, orange oil, lemon oil, vanilla, palmarosa, geranium oil. **(12 Hours)**

UNIT IV: SKIN CARE AND HAIR CARE:

Skin care: coconut oil - sunflower oil - jojoba oil - olive oil - aloe vera - antiaging herbs: rhodiola rosea - carrot - gingko - skin protection: green tea - calendula - turmeric - Hair care: amla - rose - eucalyptus oil - grape seeds - ginkobiloba - aloe - Method of preparation of hair dyes, creams, Lotions, Jells, oils and Shampoos - dandruff treatment: henna - neem. **(12 Hours)**

UNIT V: COSMETIC PREPARATION FROM HERBS:

1. Hair pack for dandruff
2. Hair pack for healthy hair
3. Face pack
4. Hair dye **(12 Hours)**

BOOKS FOR REFERENCE:

1. E.G. Thomssen, Modern Cosmetics, Universal publishing corporation Bombay, Reprinted in India, 1985. **Unit I -V**

SOFT SKILL

Semester: I **Hours: 2**

Code : 23PAE1SK1 **Credit: 2**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	State their short and long term goals	PSO - 1	K1
CO - 2	Associate their social, interpersonal, cognitive, ethical, professional, reading and communication skills	PSO-5	K2
CO - 3	Administer their self - esteem and confidence	PSO - 4	K3
CO - 4	Formulate their resumes wisely	PSO - 2	K4
CO - 5	Assess the mock group discussions and interviews with a challenge to choose their right career	PSO - 3	K5, K6

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

Semester: I				SOFT SKILL								Hours: 2
Code : 23PAE1SK1												Credit: 2
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	2	5	2	4	5	2	2	2	4	3.09
CO - 2	5	4	4	3	4	5	3	4	4	4	5	4.09
CO - 3	4	2	5	2	2	4	2	2	2	5	4	3.09
CO - 4	4	2	2	2	5	4	2	5	2	2	4	3.09
CO - 5	4	5	3	2	2	4	2	2	5	3	4	3.27
Overall Mean Score												3.33

Result: The score for this course is **3.33** (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: SOFT SKILLS-INTRODUCTION

What are soft skills? - Importance of Soft skills-Difference between hard skills and soft skills-Top 60 soft skills. SWOC analysis-Self-Discovery-Advantages of SWOC analysis-Identifying your soft skills. **(6 Hours)**

UNIT II: ATTITUDE AND PERCEPTION

what is attitude? -formation of attitudes-positive and negative attitudes -power of positive attitude-developing positive attitude-obstacles in developing positive attitudes-results of positive attitude-overcoming negative attitude and its impacts. Perception - factors influencing perception-changing and improving perception towards positive attitude. **(6 Hours)**

UNIT III: TIME AND STRESS MANAGEMENT

Value of time-Sense of time management-Difficulties in time management-Evils of not planning-Reasons for procrastination-Overcoming procrastination- Effective scheduling-Steps to and Tips for Time Management-Deciding upon priorities-Grouping activities. Stress-Definition -Causes of Stress-Effects of Stress-Signs of stress-Stress as appositive and negative reinforcer-spotting stress in you-Behaviours identified with stress- for stress management. **(6 Hours)**

UNIT IV: EMOTIONAL BALANCE-TEAM BUILDING AND LEADERSHIP QUALITIES

What is Emotional Intelligence? -Emotional IQ-Intellectual IQ-Why emotional balance is important-Benefits of Emotional IQ-Four important Elements of Emotional IQ-Control of your reaction to situation. Skills needed for teamwork-Role of a team leader-challenges faced in collaboration-advantages of team-spirit. **(6 Hours)**

UNIT V: INTERVIEW SKILLS, GROUP DISCUSSION, PREPARING RESUME/CV

Types of interview-One to one Interview-Interview panel-Dress code at interview-punctuality-interview etiquettes-Group Discussion- Why group discussion-Types of group discussion-Skills required-GD Etiquette-Movement and gestures to be avoided-initiating a GD-Resolving conflicts. Preparing Resume/CV-Tips.**(6 Hours)**

COURSE BOOK:

- Dr. K. Alex, *Soft skills,* Chand & company Pvt. Ltd., New Delhi, 2010.

BOOK FOR REFERENCE:

- Kumar, Suresh, Sreehari and Savithri. *Communication Skills and Soft Skills: An Integrated Approach,* Pearson India, 2010.

INTERNAL QUESTION PATTERN

SOFT SKILL - 23PAE1SK1

INTERNAL COMPONENTS

Test 1	40
Test 2	40
Term Paper	5
Seminar	10
Attendance	5
Total	**100**

ORGANIC CHEMISTRY-II

Semester: II **Hours: 5**

Code : 23PCH2C04 **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on the basic concepts of stereoisomerism, conformational Analysis FT-IR, UV-Visible, NMR and mass spectroscopy	PSO-1	K1
CO - 2	Explain the axial chirality, reactivity in acyclic systems, the theory of vibrational, electronic and nuclear magnetic, mass spectroscopy and their techniques	PSO-3	K2
CO - 3	Apply Cahn Ingold Prelog rules for R & S notations, the concept of FT-IR, UV-Visible, NMR and mass spectroscopic techniques in organic compounds	PSO-4	K3
CO - 4	Analyse the conformations of ethane, n-butane, structure organic compounds using FT-IR, UV-Visible, NMR and mass spectroscopy	PSO-2	K4
CO - 5	Formulate topocity of ligands and faces, the spectral data of unknown compounds using FT-IR, UV-Visible, NMR and mass spectra in structural elucidation	PSO-5	K5, K6

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

Semester: II				**ORGANIC CHEMISTRY - II**							**Hours: 5**
Code : 23PCH2C04											**Credit: 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	3	3	5	4	3	3	3	3.64
CO - 2	3	4	4	4	5	4	3	4	5	4	4	4.00
CO - 3	4	3	5	3	3	3	4	3	3	5	3	3.64
CO - 4	3	5	4	3	3	3	3	5	3	4	3	3.64
CO - 5	2	3	3	5	3	5	2	3	3	3	5	3.45
Overall Mean Score												**3.60**

Result: The score for this course is **3.60** (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: STEREOISOMERISM:

Chirality-stereoisomerism - axial chirality - planar chirality and helicity - Newman, Sawhorse and Fischer projections and their conversions- stereochemistry of molecules with axial chirality - atropisomerism - biphenyls, allenes, spiranes, ansa compounds and helicene - Cahn Ingold Prelog rules for R &S notations, proR and proS notation- 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) FT-IR SPECTROSCOPY:

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

b) UV-VISIBLE 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: a) ^{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

b) ^{13}C NMR:

Introduction - chemical classes and chemical shifts: alkanes, functionalized hydrocarbons, hybridization of carbon, the polar effects of substituents on unsaturated carbons- resonance effects, the stereostructure of alkene, carbonyl compounds **(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- 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 - II**
4. Alex V Ramani, Leo A. Stanley, C. Mani, Stereochemistry MJP Publishers, 2012 **Unit I - II**
5. Jag Mohan, Organic Spectroscopy Principles and Applications, Narosa Publishing House 2nd edition, 2012 **Unit III - V.**
6. Robert M. Silverstein, Francis X. Webster, Spectrometric identification of organic compounds - Wiley India, 6th edition, 2007 **Unit IV- V**
7. P. S. Kalsi, Spectroscopy of Organic compounds, New Age International, 6th edition, 2011 **Unit IV.**

PHYSICAL CHEMISTRY II

Semester: II **Hours: 4**

Code : 23PCH2C05 **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the various definitions of electrochemistry and principles of group theory	PSO-1	K1
CO - 2	Explain the terms involved in conductance, electrode potential, electrochemical cells, symmetry operations and representations	PSO-2	K2
CO - 3	Apply the principles of electrochemistry and group theory to solve some related problems	PSO-3	K3
CO - 4	Analyse the application of Debye Huckel equation, transport number, kinetics of electrode process, symmetry operations, hybridization and vibrational modes in terms of group theory	PSO-4	K4
CO - 5	Formulate the theories of electrochemistry, group theory to determine hybridization and selection rule for electronic spectroscopy and vibrational spectra and construct character table	PSO-5	K5, K6

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

Semester: II				**PHYSICAL CHEMISTRY - II**							**Hours: 4**
Code : 23PCH2C05											**Credit: 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	3	4	3	4	3	5	3	4	4	3	3.73
CO - 2	3	5	4	3	3	3	3	5	3	4	3	3.55
CO - 3	3	4	4	4	5	4	3	4	5	4	4	4.00
CO - 4	3	4	5	4	4	4	3	4	4	5	4	4.00
CO - 5	3	3	4	5	4	5	3	3	4	4	5	3.91
Overall Mean Score												**3.84**

Result: The score for this course is **3.84** (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. **(12 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

(12 Hours)

UNIT III: ELECTROCHEMISTRY - III:

Effect of electrolyte concentrations: Nernst equation, standard electrode potentials, emf of galvanic cells and feasible cell reactions - kinetics of electrode process: polarized and non-polarized electrodes - Butler-Volmer equation, dependence of current density on over voltage: The Tafel equation, - fuel cells - electronically conducting polymers. **(12 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}). **(12 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 - symmetries of vibrational modes in non-linear molecules (H_2O, NH_3 and BF_3) - selection rules for vibrational IR and Raman spectra - Mutual exclusion rule for molecules with center of symmetry-use of group theory in determining the selection0 rules for the n-π* and π-π* transitions in formaldehyde - HMO energy calculation for ethylene and butadiene

(12 Hours)

BOOKS FOR REFERENCE:

1. D.R.Crow, Principles and applications of Electrochemistry, Chapman and Hall, London, 2nd edition, 1984 **Unit I-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-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-V**

INORGANIC CHEMISTRY - II

Semester: II **Hours: 4**

Code : 23PCH2C06 **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO Addressed	COGNITIVE LEVEL
CO - 1	Recall the theories, stability, magnetic properties, kinetic mechanisms of co-ordination compounds and supra molecular chemistry	PSO-1	K1
CO - 2	Explain the concepts of metal complexes stability, magnetic properties, kinetic parameters and metal clusters	PSO-2	K2
CO - 3	Apply the generalisations involved in theories, kinetic reaction mechanism of co-ordination compounds and molecular self assembly in supramolecular compounds	PSO-3	K3
CO - 4	Analyse the importance of co-ordination compounds, stability, magnetic properties, kinetic mechanisms of complexes and supra molecular compounds	PSO-4	K4
CO - 5	Formulate the mechanisms, structures of metal complexes, metal clusters and applications of supra molecular chemistry	PSO-5	K5, K6

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

Semester: II				INORGANIC CHEMISTRY-II							Hours: 4
Code : 23PCH2C06											Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	3	3	3	3	3	5	3	3	3	3.36
CO - 3	3	4	3	3	5	3	3	4	5	3	3	3.55
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
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: THEORIES OF CO-ORDINATION COMPOUNDS:

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 - measurement of 10Dq - factors affecting the magnitude of 10Dq - spectrochemical series - crystal field stabilisation energy for high spin and low spin complexes - applications of crystal field theory - Nephelauxetic series - Jahn - Teller effect and consequences of Jahn-Teller distortion - ligand field theory - molecular orbital theory - sigma bonding - Pi bonding in O_h, T_d and Square planar complexes. **(12 Hours)**

UNIT II: STABILITY AND MAGNETIC PROPERTY OF COMPLEXES:

Introduction - thermodynamic stability and kinetic stability - stepwise stability constant and overall stability constant - relationship - inert and labile complexes: Valence bond, crystal field interpretation and geometry of the complex - factors affecting the thermodynamic stability of complexes - methods for the determination of stability constant: spectrophotometric method - Job's method - Bjerrum method. **(12 Hours)**

UNIT III: KINETICS AND MECHANISMS I:

Introduction - rate law and rate constant - elementary and complex reactions - order and molecularity of reaction - pseudo unimolecular reaction - determination of order of reaction: integrated rate equation method - initial rate method - Ostwald's isolation method - graphical method- factors affecting the rate of chemical reactions - kinetic isotope effect: primary and secondary isotope effect - nucleophilicity versus basicity. **(12 Hours)**

UNIT IV: KINETICS AND MECHANISMS II:

Kinetics and mechanism of substitution reactions in octahedral complexes : elementary and complex reaction - significance of energy profile of a reaction - ligand substitution reactions: nature - classification and mechanism -Hydrolysis of reaction: acid hydrolysis - base hydrolysis - anation - aquation reactions - substitution reactions in square planar complexes : general mechanism and features - trans effect - electrostatic polarisation theory - bi bonding theory- mechanism of redox reactions - outer sphere mechanism -inner sphere mechanism. **(12 Hours)**

UNIT V: 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 - chevrel 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 - di nuclear macrocycles - molecular triangles, rectangles and molecular cages (Pd, Pt based). **(12 Hours)**

BOOKS FOR REFERENCE:

1. James E.Huheey Inorganic Chemistry, Dorling Kindersley Pvt.Ltd., 4th edition, 2012. **Unit I - V**
2. E. Douglas, H.Mc Daniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rdedition, 2006 **Unit I - V**
3. J.D. Lee, Concise Inorganic Chemistry, Blackwell publishing, 5thedition, 1996 **Unit II -IV**
4. R.D. Madan, Modern Inorganic Chemistry, S. Chand and Company Ltd, 2ndedition,2002 **Unit I - V**
5. Sathya Prakash,G.D. Tuli, S.K.Basu, and R.D. Madan, Advanced Inorganic Chemistry, vol I, 17th edition,S. Chand & company Ltd,1998. **Unit I - V**
6. Indrajith Kumar, Inorganic reactions mechanism, Vishal publishing Co, 1st edition, 2021**. Unit II - IV**
7. S.P. Banerjee, Advanced inorganic Chemistry, Vol II, Books and allied (P) Ltd. Reprinted, 2017. **Unit I - V**
8. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers and Distributor, Delhi, 31stedition, 2010. **Unit I-V**
9. R.L. Madan,G.D.Tuli,Inorganic Chemistry,S. Chand's puplishing 1999 **Unit I-V**

INORGANIC CHEMISTRY PRACTICAL

Semester: II **Hours: 5**

Code : 23PCH2P02 **Credit: 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 inorganic analysis of mixture of cations, preparation of metal complexes, EDTA and colorimetric estimation	PSO-1	K1
CO - 2	Describe the principles of inorganic analysis of mixture of cations, preparation of metal complexes, EDTA and colorimetric estimation	PSO-4	K2
CO - 3	Apply the procedure to find inorganic common and less common cations, to prepare metal complexes, to perform EDTA and colorimetric estimation	PSO-3	K3
CO - 4	Analyse inorganic mixture of cations, the procedure for preparation of metal complexes, methods of EDTA and colorimetric estimation	PSO-2	K4
CO - 5	Adopt experimental procedures for analysis, preparation and estimation and safety measures in handling chemicals and apparatus	PSO-5	K5, K6

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

Semester: II				**INORGANIC CHEMISTRY PRACTICAL**							**Hours: 5**
Code : 23PCH2P02											**Credit: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	4	3	3	3	5	4	3	4	3	3.72
CO - 2	3	3	5	4	3	4	3	3	3	5	4	3.63
CO - 3	3	4	4	3	5	3	3	4	5	4	3	3.72
CO - 4	4	5	3	4	3	4	4	5	3	3	4	3.81
CO - 5	4	3	4	5	3	5	4	3	3	4	5	3.9
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 = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

INORGANIC ANLYSIS, PREPARATION AND ESTIMATION

a) ANALYSIS OF MIXTURE OF CATIONS:

Analysis of a mixture of four cations containing two common cations and two rare cations. Cations to be tested

Group-I : W, Tl and Pb.

Group-II : Se, Te, Mo, Cu, Bi and Cd.

Group-III : Tl, Ce, Th, Zr, V, Cr, Fe, Ti and U.

Group-IV : Zn, Ni, Co and Mn.

Group-V : Ca, Ba and Sr.

Group-VI : Li, NH_4^+ and Mg.

b) PREPARATION OF METAL COMPLEXES:

a) Preparation of tristhioureacopper (I) sulphate

b) Preparation of tetramminecopper (II) sulphate

c) ESTIMATION:

1. EDTA Titration: Estimation of Magnesium, Zinc and Hardness of water
2. Colorimetry: Estimation of Iron and Copper

BOOKS FOR REFERENCE:

1. Jeya Rajendran, Microanalytical Techniques in Chemistry:Inorganic Qualitative Analysis, United global publishers, 2021. **Unit I - III**
2. V.V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rded.,The National Publishing Company, Chennai, 1974. **Unit I**
3. Vogel's Text book of Inorganic Qualitative Analysis, 4thed., ELBS,London. **Unit I -III**

CHEMISTRY OF CONSUMER PRODUCTS

Semester: II **Hours: 6**

Code : 23PCH2ID1 **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge about the chemistry of household products, energy, polymers, chemotherapeutic drugs and fertilizers	PSO-1	K1
CO - 2	Illustrate the steps involved in preparation of soaps, ceramics, glass, polymers, drugs, fertilizer and household products	PSO-2	K2
CO - 3	Apply the chemical significance of consumer products, polymeric materials and drugs in day- today life	PSO-3	K3
CO - 4	Analyze manufacturing methods of the soaps, ceramics, glass, polymers, fertilizer chemotherapeutic drugs and household products	PSO-4	K4
CO-5	Develop skills in preparation of biofertilizer and consumer products	PSO-5	K5, K6

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

Semester: II				**CHEMISTRY OF CONSUMER PRODUCTS**								**Hours: 6**
Code : 23PCH2ID1												**Credit: 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	3	3	4	4	4	5	3	4	3	4	3.81
CO - 2	3	5	3	3	4	3	3	5	4	3	3	3.54
CO - 3	3	4	3	4	5	4	3	4	5	3	4	3.81
CO - 4	3	4	5	3	3	3	3	4	3	5	3	3.54
CO - 5	3	3	3	5	4	5	3	3	4	3	5	3.72
Overall Mean Score												**3.68**

Result: The score for this course is **3.68** (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) SOAPS AND SOAPLESS DETERGENTS:

Saponification - manufacture of soap: hot process - cold process - modern process - laundry soap - toilet soap - neem soap: preparation - benefits - cleansing action of soap - surfactants: definition-examples - soapless detergents - applications - biodegradable detergents -examples

b) ENERGY AND CHEMISTRY:

Introduction - calorific value - classification - criterion of selection of fuel - fossil fuel - petroleum and oil - coal - natural gas - fuels used in rockets - nuclear energy - solar energy: solar cells - water energy - wind energy - energy from biomass and garbage. **(18 Hours)**

UNIT II: a) GLASS:

Introduction - physical and chemical properties - characteristics - raw materials - manufacturing processes: formation of raw material - melting - shaping - annealing - finishing - colouring materials

b) CERAMICS:

Introduction - subdivision of ceramics - general properties - classification based on reduction in porosity - raw materials - manufacturing process: grinding of raw materials - kneading - jollying - slip casting - pressing - extrusion - turning - drying - firing - glazing - frits - decoration. **(18 Hours)**

UNIT III: POLYMERS:

Introduction-classification-types of polymerization reactions-fibers- natural fibers: cotton, wool and silk - artificial fibers: rayon and nylon - natural biodegradable polymers: cellulose - cellulose acetate - cellophane - preparation, structure and uses: polyethylene - PET - PVC - polypropylene - bakelite - teflon. **(18 Hours)**

UNIT IV: a) CHEMOTHERAPY:

Definition - characteristics of a drug - sulpha drugs: structure and uses of sulphadiazine, sulphanilamide - arsenical drugs: structure and uses of salvarsan, neosalvarsan - antibiotics: definition - examples - antimalarials: structure and uses of chloroquine - antipyretics: definition, preparation and uses of aspirin and paracetamol - anaesthetics - antioxidants - antacids

b) CHEMISTRY OF FERTILIZERS:

Definition - nutrients for plants - role of various elements in plant growth - natural and chemical fertilizers - classification of chemical fertilizers - manufacture of urea-mixed fertilizers - organic farming: biofertilizer - biopesticides - bioinsecticides. **(18 Hours)**

UNIT V: CHEMISTRY OF HOUSEHOLD PRODUCTS:

Introduction - chemistry and household products - molecular formula, chemical name and uses: common salt - baking soda - caustic soda - vinegar - sodawater - moth balls - vanaspathi - mosquito coils - safety matches - preparation and uses: bleaching powder - washing powder - cleaning powder - washing liquids - pain balm - shampoo - talcum powder - alcohol - hand sanitizer - chalk - tooth paste - candles - disinfectants and antiseptics. **(18 Hours)**

BOOKS FOR REFERENCE

1. Kirpal Singh, Chemistry in Daily Life, PHI learning Private Ltd, 3rd edition, 2012 **Unit I - V**
2. P.L. Soni and H.M Chawla, Organic Chemistry, Sultan Chand and Sons, 29th Edition, 2007 **Unit I - V**
3. B.K. Sharma, Industrial Chemistry-I, Krishna Prakashan Media (P) Ltd., 23rd edition, 2020 **Unit I - V**

GRAPHICAL INTERPRETATION USING ORIGIN

Semester: II **Hours: 4**

Code : 23PCH2SE2 **Credit: 2**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on the basic concepts of origin software and its applicability	PSO-1	K1
CO - 2	Illustrate the manipulation of worksheet data and matrix book	PSO-2	K2
CO - 3	Apply the origin tools for data interpretation	PSO-3	K3
CO - 4	Analyze excel data, matrix worksheet and graphical interpretation of the spectral data	PSO-4	K4
CO - 5	Interpret the spectral data, matrix worksheet using origin software	PSO-5	K5, K6

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

Semester: II			**GRAPHICAL INTERPRETATION USING ORIGIN**						**Hours:4**			
Code : 23PCH2SE2									**Credit:2**			
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	3	3	5	4	3	3	3	3.55
CO - 2	3	5	4	3	3	3	3	5	3	4	3	3.55
CO - 3	3	3	4	3	5	3	3	3	5	4	3	3.55
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	3	3	3	5	4	5	3	3	4	3	5	3.73
Overall Mean Score												**3.59**

Result: The score for this course is **3.59** (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: TOOL BAR MANAGEMENT:

Introduction - installing and updating origin - tool bar and tools - origin file types import data - data source file path - data navigator - data connectors and drag-and-drop - connecting to text / CSV - connecting to MATLAB files - connecting to NetCDF and shape files - work with Excel data - importing ASCII files. **(12 Hours)**

UNIT II: WORK SHEET DATA MANIPULATION:

Work books and worksheets - manipulating sheets with object manager - split and freeze - worksheet columns: column designations - formatting column data - date and time formats - colour format - column label rows - naming workbooks, work sheets and columns. **(12 Hours)**

UNIT III: MANIPULATION OF MATRIX WORKSHEET:

Matrix books, matrix sheets and matrix objects: naming matrix books, matrix sheet and matrix objects - different views of matrix - import image to matrix - extracting information from the matrix sheet - image plot - image and video import - image resize - converting matrix to worksheet - converting worksheet to matrixes.

(12 Hours)

UNIT IV: GRAPHICAL MANIPULATION:

Graphing: origin graph types - Creating graph from worksheet data - creating from matrix data - 2D and 3D function plots - pages, layers, plots and active plot - copying and pasting graphs to other applications - export graph: exporting browser graph to video - exporting matrices - exporting work sheet - send graph to power point. **(12 Hours)**

UNIT V: DATA INTERPRETATION:

i) Fitting curves: linear and non linear

ii) Graphing for given data analysis: UV data, FT-IR data

iii) Multi panel plot

iv) Using the origin tools to draw Stern-Volmer plots and calculate the Stern-Volmer constant. **(12 Hours)**

REFERENCE:

1. https://www.originlab.com/index.aspx?go=Products/Origin

Unit I - V

CYBER SECURITY

Semester: II **Hours: 2**

Code : 23PAE2SK2 **Credit: 2**

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	State the need of Cyber Security and history of Internet	PSO-1	K1
CO-2	Understand history and types of Cyber Crime	PSO-2	K2
CO-3	Apply critical thinking in Security Policies and Cyber Laws	PSO-3	K3
CO-4	Discuss and demonstrate the cyber security components and infrastructure security	PSO-4	K4
CO-5	Diagnose the ways and means of fighting Cyber Attacks	PSO-5	K5, K6

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

Semester: II			**CYBER SECURITY**								**Hours: 2**
Code : 23PAE2SK2											**Credit: 2**
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	3	3	3	3	3	5	3	3	3	3	3.36
CO-2	4	3	3	5	3	3	4	5	3	3	3	3.55
CO-3	3	5	3	4	3	3	3	4	5	3	3	3.55
CO-4	3	3	5	4	5	3	3	4	3	5	3	3.73
CO-5	2	3	3	2	3	5	2	2	3	3	5	3.00
Overall Mean Score												**3.44**

Result: The score for this course is **3.44** (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

Introduction: Cyber Security – The need of the Hour - History of Internet – Impact of Internet – Internet in India **(6 Hours)**

UNIT II

Introduction to Cyber Security: Cyber Security – CIA Triad - Reasons for Cyber Crimes – Why we need Cyber Security – Damage to the Organizations – History of Cyber Crimes – Types of Cyber Crimes **(6 Hours)**

UNIT III

Cyber Security Components: OSI Layer – Zero Day Attacks – Types of Network Attacks – Application Security – Endpoint Security – Identify and Access Management (IAM) – Mobile Security – Data Security - Drive-By Download - Infrastructure Security - Disaster Recovery (DR) - End-user Education **(6 Hours)**

UNIT IV

Fighting Cyber Attacks: Defense in Depth – Authentication - Cryptography – Firewall - Data Loss Prevention - Antivirus Software - Virtual Private Network (VPN)- Web browsers - Data Backup – Conclusion **(6 Hours)**

UNIT V

Introduction to Security Policies and Cyber Laws: Need for an Information Security Policy - Information Security Standards – ISO - Introducing Various Security Policies and Their Review Process - Introduction to Indian Cyber Law - Objective and Scope of the IT Act, 2000 - Intellectual Property Issues - Overview of Intellectual-Property- Related Legislation in India - Patent - Copyright - Law Related to Semiconductor Layout and Design - Software License **(6 Hours)**

BOOKS FOR STUDY

1. **"Introduction to Cyber Security: Guide to the World of Cyber Security",** Anand Shinde, Notion Press, 2021

   Unit I : Chapter: 1
   Unit II : Chapter: 2.
   Unit III : Chapter: 3
   Unit IV : Chapter: 4.

2. "Introduction to information security and cyber laws", Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI, Dreamtech Press, 2014

   Unit V : Chapter: 4

BOOKS FOR REFERENCE

1. **"Information and Cyber security: Principles and Practices",** S U, Aswathy; Faizal, Ajesh; V, Antony Asir Daniel, Noor Publishing, 2020
2. "**Security in the Digital Age: Social Media Security Threats and Vulnerabilities**", Henry A. Oliver, Create Space Independent Publishing Platform, 2015
3. "**Cybersecurity for Beginners**", Raef Meeuwisse, Second Edition, 2017
4. "**Auditing IT Infrastructures for Compliance**", Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning, 2017

WEB RESOURCES

1. https://www.coursera.org/professional-certificates/google-cybersecurity
2. https://www.coursera.org/learn/cybersecurity-for-everyone
3. https://www.coursera.org/specializations/intro-cyber-security
4. https://www.udemy.com/course/cybersecurity-from-beginner-to-expert/
5. https://www.udemy.com/course/it-law-cyber-crimes-and-data-protection-laws/

JACEP - EXTENSION

P.G. PROGRAMME OUTCOMES (2023 - 2026)

PO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO
1.	Acquire comprehensive knowledge and evaluate analytically in their specific disciplines.
2.	Apply the acquired knowledge in professional and social life.
3.	Evolve new methodologies in the specific disciplines leading to innovation and employability.
4.	Develop critical thinking required to pursue research.
5.	Apply the computational and life skills to the challenging problems in life.
6.	Design and develop independent projects.

P.G. PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO. NO.	UPON COMPLETION OF THIS PROGRAM THE STUDENTS WILL BE ABLE TO	PO MAPPED
PSO - 1	Understand and identify the needs of the community and articulate viewpoints both practically and theoretically.	PO-1
PSO - 2	Develop among themselves a sense of social and civic responsibility to be more culturally equipped.	PO-2,
PSO - 3	Apply their education in finding practical solutions to individual, community problems to exercise their rights properly.	PO- 3,
PSO - 4	Acquire leadership qualities and a democratic attitude by carrying out their duties as effective citizens of the country.	PO- 4
PSO - 5	Develop the capacity to think clearly and cogently to meet emergencies and national disasters and practise national integration and social harmony.	PO- 5, PO-6

JACEP - EXTENSION

Semester: II **Hours: 30**

Code : 23PSL2EX1 **Credit: 1**

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Impart knowledge of the importance of education	PSO-1	K1
CO - 2	Apply Knowledge to the society	PSO-2	K2
CO - 3	Analyse the reasons for health problems and impart knowledge on a balanced diet.	PSO-3	K3
CO - 4	Develop a concern for the voiceless and faceless	PSO-4	K4
CO - 5	Get awareness of environmental issues	PSO-5	K5, K6

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

Semester: II				**JACEP - EXTENSION**							**Hours: 30**
Code : 23PSL2EX1											**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	3	4	3	3	3	5	4	3	3	3	3.54
CO - 2	3	5	3	3	4	3	4	5	4	3	2	3.54
CO - 3	3	4	5	3	4	4	3	3	5	3	4	3.72
CO - 4	2	4	3	5	3	3	3	3	5	5	3	3.54
CO - 5	3	4	5	3	4	5	3	4	3	3	5	3.81
Overall Mean Score												**3.63**

Result: The score for this course is **3.63** (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: LITERACY GROUP:

Giving orientation to the students about JACEP - focusing on School dropouts and counseling the parents to re-admit the school dropouts - conducting awareness programs through kindling culturals - organizing games based on the disciplines - conducting competitions for school children – educating the school children about the positives and negatives of social media.

UNIT II: HEALTH AND HYGIENE GROUP:

Doing a survey on health problems - organizing medical camps and talks - organizing general check-ups by B. Voc. students of JAC to the adopted villages.

UNIT III: LIAISON GROUP AND PEOPLE ORGANIZATION GROUP:

Motivating NREGA workers to access government savings schemes - celebrating important days - organizing income generation skill training for self-help groups. organizing population education programmes - conducting awareness programmes on emerging social issues - fostering tie-ups with non-governmental organizations and local bodies to ensure the development of the villages - organizing youth, farmers and self-help group to function democratically.

UNIT IV: ENVIRONMENTAL GROUP:

Tree and sapling plantation - promotion of Herbal Gardens - organizing personal hygiene awareness talk – observing environmental-related days –awareness campaign to educate the villagers to protect the environment.

UNIT V: APPLICATION OF KNOWLEDGE:

Conducting Special Skill Training for self-employment based on discipline to the target group with the help of JAC SARWODEEP and government organizations – serving as intermediaries between unorganized sector workers and government welfare schemes.

SCHEME OF EVALUATION

Continuous Internal Assessment		
1.	Attendance (30 hours)	10 Marks
2.	Field Visit & Report	50 marks
3.	Assignment	40 Marks
Total		**100 marks**

ORGANIC CHEMISTRY-III

Semester: III **Hours: 5**
Code : 23PCH3C07 **Credit: 4**
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, pericyclic reactions and alkaloids	PSO-1	K1
CO - 2	Illustrate the types of photochemical reactions, pericyclic reactions and the classification of alkaloids	PSO-2	K2
CO - 3	Apply the knowledge on photochemistry, pericyclic reactions to solve the problems in competitive exams and to elucidate the constitution of alkaloids	PSO-4	K3
CO - 4	Analyse the reactions of photochemistry, pericyclic reactions and the synthesis of alkaloids	PSO-3	K4
CO - 5	Formulate the various photochemical reactions, pericyclic reactions and the structure of alkaloids	PSO-5	K5, K6

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

Semester: III						**ORGANIC CHEMISTRY-III**					**Hours: 5**
Code : 23PCH3C07											**Credit: 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	3	3	3	4	3	5	3	4	3	3	3.55
CO - 2	3	5	2	3	4	3	3	5	4	2	3	3.36
CO - 3	3	4	5	3	3	3	3	4	3	5	3	3.55
CO - 4	4	3	3	3	5	3	4	3	5	3	3	3.55
CO - 5	4	3	2	5	3	5	4	3	3	2	5	3.55
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: PHOTOCHEMISTRY-I:

Introduction - energy of a molecule - thermal and photochemical energy - electronic transitions - types of electronic excitation and molecular orbital view of excitation - Jablonski diagram - photo sensitisers - quenching - photochemistry of carbonyl compounds - α-cleavage - Norrish type 1 process given by acyclic and cyclic saturated ketones, cyclopentanones and cyclobutanones - β-cleavage reaction - intramolecular hydrogen abstraction - intermolecular hydrogen transfer - photocycloaddition reaction (Paterno-Buchi reaction) - addition to electron rich and deficient alkenes - oxetane formation with dienes and alkynes - [2+2] cycloaddition reaction of enones with alkenes **(15 Hours)**

UNIT II: PHOTOCHEMISTRY-II:

Photo rearrangement of cyclopentenone - cyclohexanone rearrangements - Lumi ketone rearrangement - rearrangement of dienones - photo rearrangement of β, γ-unsaturated ketones - 1, 2 and 1, 3 acyl shift - aza-di-π-methane rearrangement - photorearrangement of α,β- unsaturated ketones - di-π-methane rearrangement - photo reduction and photo oxidation - photo reduction of carbonyl compounds - photo reduction of aromatic hydrocarbons - photo oxidation of alkenes and polyenes - photochemistry of alkenes - cis-trans isomerisation of alkenes - dimerisation of alkenes - photoisomerization of benzene and substituted benzene - 1, 2 and 1, 3 alkyl shift - Barton reaction - the Hoffmann-Loeffler-Freytag reaction - chemistry of vision - photography **(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 4nπ (1, 3 -butadiene) and (4n + 2) π {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: ALKALOIDS:

Introduction- occurrence - classification - isolation and functions - general methods of structural elucidation - structure determination of adrenaline, hygrine, piperine, coniine, papaverine, quinine, cocaine and morphine **(15 Hours)**

BOOKS FOR REFERENCE:

1. Jagdamba Singh and Jaya Singh, Photochemistry and Pericyclic reactions, New age International Pvt. Ltd., 5th Edition, 2023. **Unit I-IV**
2. Gurdeep R. Chatwal, Organic Chemistry of Natural Product, Himalaya Publishing House, Volume I, 4th Edition, 2008. **Unit V**
3. I.L. Finar, Organic Chemistry, volume II, Dorling Kindersley, 5th Edition, 2008. **Unit V**
4. O.P. Agarwal, Chemistry of Organic Natural products, Volume I, Prentice Hall, 48th Edition, 2018. **Unit V**

PHYSICAL CHEMISTRY-III

Semester: III **Hours: 5**

Code : 23PCH3C08 **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on concepts of quantum chemistry and Chemical thermodynamics	PSO-1	K1
CO - 2	Explain the quantum mechanical operators and postulates, principles of chemical thermodynamics	PSO-2	K2
CO - 3	Derive Schrodinger equation, solving problems of physical chemistry and partial molal properties	PSO-3	K3
CO - 4	Analyse the approximation methods in quantum chemistry and equations in chemical thermodynamics	PSO-4	K4
CO - 5	Validate and combine relations and equations involved in quantum Chemistry and chemical thermodynamics	PSO-5	K5, K6

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

Semester: III			**PHYSICAL CHEMISTRY-III**						**Hours: 5**
Code : 23PCH3C08									**Credit: 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	3	4	3	4	3	5	3	4	4	3	3.73
CO - 2	3	5	4	3	3	3	3	5	3	4	3	3.55
CO - 3	3	4	4	4	5	4	3	4	5	4	4	4.00
CO - 4	3	3	5	4	4	4	3	3	4	5	4	3.82
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
Overall Mean Score												**3.73**

Result: The score for this course is **3.73** (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: 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 - Fock Self-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 - Clausius-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-Chatelier's 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, 2017. **Unit I-III**
2. R. K. Prasad, Quantum Chemistry, New Age International Pvt. Ltd. Publishers, 4th revised Edition, 2010. **Unit I-III**
3. B.R. Puri, L. R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co, 47th Edition, 2023-2024. **Unit I-V**
4. Kuriacose and Rajaram, Thermodynamics, Jalandar Shoban Lal Co,1993. **Unit IV-V**

FOR FURTHER REFERENCE:

1. N. Levine, Quantum Chemistry, Prentice Hall of India, Pvt. Ltd., 4th Edition, 1994.

INORGANIC CHEMISTRY-III

Semester: III **Hours: 5**

Code : 23PCH3C09 **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on terms of inorganic spectroscopy, inorganic polymers and inorganic heterocyclics	PSO-1	K1
CO - 2	Explain the concepts in inorganic spectroscopy, inorganic polymers and inorganic cyclic and heterocyclics	PSO-2	K2
CO - 3	Apply spectral identification in structural elucidation, reactions of inorganic polymers and inorganic chains, rings and cages	PSO-3	K3
CO - 4	Analyse the spectral data in inorganic compounds, correlate inorganic polymers and inorganic heterocyclics	PSO-4	K4
CO - 5	Interpret and compare the various spectral data, summarize reactions of polymers and inorganic heterocyclics	PSO-5	K5, K6

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

Semester: III				**INORGANIC CHEMISTRY-III**					**Hours: 5**		
Code : 23PCH3C09									**Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	3	3	3	3	3	5	3	3	3	3.36
CO - 3	3	4	3	3	5	3	3	4	5	3	3	3.55
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
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: INORGANIC SPECROSCOPY-I:

Electronic spectroscopy: Electronic configuration - term symbols - effect of distortion and spin orbit coupling on electronic spectra - spin multiplicity - Terms for d electron systems - derivation of term symbols - ground terms for p^n and d^n system and energy level diagrams - calculation of microstates - electronic spectra of transition metal complexes - charge transfer spectra - selection rules for electronic spectra - Orgel correlation diagrams - Tanabe Sugano energy level diagrams - difference between Orgel and Tanabe - Sugano diagram - Racah parameter - calculation of B and 10 Dq **(15 Hours)**

UNIT II: INORGANIC SPECROSCOPY-II:

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: N_2O, ClF_3, NO_3^-, ClO_4^- - vibrational spectra of metal carbonyl complexes - geometry and number of stretching vibrations - uses of group vibrations in the structural elucidation of metal complexes of urea, thiourea, cyanide, thiocyanate, nitrate, sulphate and dimethyl sulfoxide

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 III: INORGANIC SPECROSCOPY-III:

NMR Spectroscopy: Nuclear spin - Larmor frequency - relaxation process in NMR - chemical shift - factors influencing chemical shift - spin-spin coupling - coupling constant - ^1H NMR - ^{13}C NMR - comparison of ^1H and ^{13}C NMR -applications of ^{31}P NMR and ^{19}F NMR spectroscopy in structural identification of inorganic complexes - lanthanide shift reagents - fluxional behavior of molecules - fluxional behavior in tryheptoallyl system, tetramethyl allene iron tetracarbonyl, ferrocenophane, cyclopentadienyl mercury and cyclooctatetraene iron tricarbonyl - quadrupolar nuclei effect in NMR spectroscopy **(15 Hours)**

UNIT IV: INORGANIC POLYMERS:

General properties of inorganic polymers - glass transition temperature - phosphorous based polymers: polydimethoxy and polydiethoxyphosphazines - phosphate based polymers: metaphosphates - polyphosphates - cross linked phosphates - coordination polymers: natural and synthetic polymers - polymers having phthalocyanine and related structure - polymers with bischelating agents - comparison between inorganic and organic polymers - preparation, properties and uses of silicones - types of silicones and their uses **(15 Hours)**

UNIT V: 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 - borazine - preparation, properties and structure - comparison with benzene - silicates - types - beryl, talc, mica, zeolites, feldspar, ultramarine

b) P-N Heterocycles: Synthesis of P-N skeleton - reactions of halo phosphazenes - hydrolysis - aminolysis - metathetical reactions - reactions with organometallic reagents

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

BOOKS FOR REFERENCE:

1. A. Abdul Jameel, Applications of physical methods to inorganic compounds, 2007. **Unit I-III**
2. E. Douglas, H. Mc Daniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edition, 2006. **Unit I-III**
3. Indrajith Kumar, Inorganic reactions mechanism, Vishal publishing Co, 1st Edition, 2021**. Unit I-III**
4. E. Huheey James, Inorganic Chemistry, Principles of structure and reactivity, Dorling Kindersley India Pvt. Ltd., 5th Edition, 2023. **Unit I-V**
5. R.L. Madan, G.D. Tuli, Inorganic Chemistry, S. Chand's Publishing, 1999. **Unit I-V**
6. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers and Distributor, Delhi, 32nd Edition, 2015. **Unit IV-V**
7. S.P. Banerjee, Advanced inorganic Chemistry, Vol II, Books and allied (P) Ltd. Reprinted, 2017. **Unit IV-V**
8. H.R. Allcock, Phosphorous and Nitrogen compounds. **Unit V**

PHYSICAL CHEMISTRY PRACTICAL

Semester: III **Hours: 5**

Code : 23PCH3P03 **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the basic knowledge in the given physical chemistry experiments	PSO-1	K1
CO - 2	Explain the procedures in conductance/ EMF/ rate constant/ heat of solution measurements and adsorption experiment	PSO-2	K2
CO - 3	Apply the experimental procedures in conductance/ EMF/ rate constant/ heat of solution measurements and adsorption experiment	PSO-3	K3
CO - 4	Analyse the results obtained in conductance/ EMF/ rate constant/ heat of solution measurements and adsorption experiment	PSO-4	K4
CO - 5	Interpret and specify the graphical results obtained in the given physical chemistry experiments	PSO-5	K5, K6

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

Semester: III			**PHYSICAL CHEMISTRY PRACTICAL**						**Hours: 5**
Code : 23PCH3P03									**Credit: 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	3	3	5	4	3	3	3	3.55
CO - 2	4	5	3	3	4	3	4	5	4	3	3	3.73
CO - 3	3	4	3	4	5	4	3	4	5	3	4	3.82
CO - 4	4	4	5	3	4	3	4	4	4	5	3	3.91
CO - 5	4	4	4	5	2	5	4	4	2	4	5	3.91
Overall Mean Score												**3.78**

Result: The score for this course is **3.78** (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= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

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, Reprint 2023.
2. B. Viswanathan, P.S. Raghavan, Practical Physical Chemistry, Viva Books Pvt. Ltd., 1st Edition, 2014.

APPLICATIONS OF IT SKILLS IN CHEMISTRY

Semester: III **Hours: 5**

Code : 23PCH3E2A **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire the knowledge on C programming language and cheminformatics	PSO-1	K1
CO - 2	Explain the concept of decision making and branching, arrays, string handling functions in C, HTS and computer representation in chemical structure	PSO-2	K2
CO - 3	Apply the rules of C for solving problems of chemistry, structure elucidation using cheminformatics and HTS data	PSO-3	K3
CO - 4	Construct C program and interpret the results of problems of chemistry, graphical representation of molecular structure and drug likeliness of molecules	PSO-4	K4
CO - 5	Formulate C-programs for chemistry related reactions and structural representation in cheminformatics	PSO-5	K5, K6

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

Semester: III				**APPLICATIONS OF IT SKILLS IN CHEMISTRY**							**Hours: 5**
Code : 23PCH3E2A											**Credit: 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	3	3	5	4	3	3	3	3.55
CO - 2	4	5	3	3	3	3	4	5	3	3	3	3.55
CO - 3	3	4	4	3	5	3	3	4	5	4	3	3.73
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	4	3	3	5	3	5	4	3	3	3	5	3.73
Overall Mean Score												**3.62**

Result: The score for this course is **3.62** (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 **(15 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 while** statement - **for** statement - jumps in loops

b) ARRAYS AND STRINGS:

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 **(15 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 **(15 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 **(15 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 **(15 Hours)**

BOOKS FOR REFERENCE :

Study material prepared by the PG and Research Center of Chemistry

FOR FURTHER REFERENCE:

1. K. V. Raman, Computers in Chemistry, Tata McGraw-Hill Publishing Company Ltd., 4th Edition, 2007.
2. E. Balagurusamy, Programming in ANCI C, Tata McGraw-Hill Publishing Company Ltd., 8th Edition, 2019.
3. Polanski. J, Cheminformatics, Poland: Elsevier Publications, 2009.

BIOMOLECULES AND HETEROCYCLIC COMPOUNDS

Semester: III **Hours: 5**

Code : 23PCH3E2B **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the basic concepts of biological importance of biomolecules and heterocyclic compounds	PSO -1	K1
CO - 2	Explain various functions of carbohydrates, proteins, nucleic acids, steroids, hormones enzymes and heterocyclic compounds	PSO -2	K2
CO - 3	Apply the procedures for the preparation of biomolecules and heterocyclic compounds	PSO -3	K3
CO - 4	Analyze the classification of carbohydrate, amino acids, proteins, enzymes, vitamins and heterocyclic compounds	PSO - 4	K4
CO - 5	Formulate the properties of biomolecules and heterocyclic compounds	PSO - 5	K5, K6

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

Semester: III			**BIOMOLECULES AND HETEROCYCLIC COMPOUNDS**								**Hours: 5**
Code : 23PCH3E2B											**Credit: 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	3	3	5	4	3	3	3	3.55
CO - 2	4	5	3	3	3	3	4	5	3	3	3	3.55
CO - 3	3	4	4	3	5	3	3	4	5	4	3	3.73
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	4	3	3	5	3	5	4	3	3	3	5	3.73
	Overall Mean Score										**3.62**

Result: The score for this course is **3.62** (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: CHEMISTRY AND METABOLISM OF CARBOHYDRATES:

Definition - classification and biological role of carbohydrates - monosaccharides: linear and ring structures (Haworth formula) of ribose, glucose, fructose and mannose (structure determination not required), physical and chemical properties of glucose and fructose - disaccharides: ring structures (Haworth formula) - occurrence, physical and chemical properties of maltose, lactose and sucrose - polysaccharides: starch, glycogen and cellulose - structure and properties, glycolysis of carbohydrates **(15 Hours)**

UNIT II: STEROIDS AND HORMONES:

Steroids: introduction - Diels' hydrocarbon - biological importance, colour reactions of cholesterol - physiological activity - biosynthesis of cholesterol from squalene - hormones - classification - functions of sex hormones - androgens and estrogens, adrenocortical hormones - cortisone and cortisol - structure and functions of non-steroidal hormones: adrenaline and thyroxin **(15 Hours)**

UNIT III: PROTEINS AND NUCLEIC ACIDS:

Separation and purification of proteins: dialysis, gel filtration and electrophoresis - catabolism of amino acids - transamination, oxidative deamination and decarboxylation - biosynthesis of proteins: role of nucleic acids - amino acid metabolism and urea cycle - structure, methods for the synthesis of nucleosides - direct combination - formation of heterocyclic base and nucleoside modification - conversion of nucleoside to nucleotides - primary and secondary structure of RNA and DNA - Watson-Crick model - solid phase synthesis of oligonucleotides

(15 Hours)

UNIT IV: ENZYMES AND VITAMINS:

Nomenclature - classification - characteristics - factors influencing enzyme activity - mechanism of enzyme action - Lock and key hypothesis - Koshland's induced fit model - proenzymes, antienzymes, coenzymes and isoenzymes: allosteric enzyme regulation - vitamins as coenzymes - functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, folic acid, biotin, cyanocobalamin **(15 Hours)**

UNIT V: FUSED RING HETEROCYCLIC COMPOUNDS:

Benzo fused five membered rings: indole, isoindole, benzofuran and benzothiophene - preparation and properties - benzo fused six membered rings: quinoline and isoquinoline: preparation by ring closure reactions, mechanism of electrophilic and nucleophilic substitutions, oxidation and reduction reactions

(15 Hours)

COURSE BOOKS:

1. V. K. Ahluwalia, Steroids and Hormones, Ane Books Publication., New Delhi, 2009. **Unit I**
2. M. K. Jain and S. C. Sharma, Modern Organic Chemistry,Vishal Publishing Co., Jalandhar, Delhi, 2014. **Unit I, III-IV**
3. I. L. Finar, Organic Chemistry Vol-2, 5th Edition, Pearson Education Asia, 1975. **Unit II-III**
4. V. K. Ahluwalia and M. Goyal, Textbook of Heterocyclic compounds, Narosa Publishing, New Delhi, 2000. **Unit V**

SOIL AND AGRICULTURE CHEMISTRY

Semester: III **Hours: 5**

Code : 23PCH3E2C **Credit: 4**

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Gain the basic knowledge of composition and characteristics of soil and types of fertilizers	PSO-1	K1
CO - 2	Describe the properties of soil and fertilizers	PSO-2	K2
CO - 3	Illustrate the major components in soil and fertilizers	PSO-3	K3
CO - 4	Analyze the soil alkalinity, irrigation water resources, biodiversity and vermicompost	PSO-4	K4
CO - 5	Formulate the methods of soil protection for sustainable agriculture and vermicomposting unit as a start-up programme	PSO-5	K5, K6

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

Semester: III				**SOIL AND AGRICULTURE CHEMISTRY**							**Hours: 5**
Code : 23PCH3E2C											**Credit: 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	3	3	5	4	3	3	3	3.55
CO - 2	4	5	3	3	3	3	4	5	3	3	3	3.55
CO - 3	3	4	4	3	5	3	3	4	5	4	3	3.73
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	4	3	3	5	3	5	4	3	3	3	5	3.73
Overall Mean Score												**3.62**

Result: The score for this course is **3.62** (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: COMPONENTS OF SOIL:

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 **(15 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 **(15 Hours)**

UNIT III: FERTILIZERS:

Introduction - methods of applying fertilizers - application of fertilizer in solid form - liquid fertilizer - nitrogenous fertilizer - types - phosphatic fertilizers - classification - potassic fertilizers - potassium sulphate: production, properties **(15 Hours)**

UNIT IV: a) BIOFERTILIZERS:

Soil bio data in sustainable agriculture - biodiversity - management strategies - comparison of chemical fertilizer and bio fertilizer

b) VERMICOMPOSTING:

Economic implications - materials - preliminary treatment - types of vermicomposting - requirements for vermicomposting - eco-friendly farming system: organic farming **(15 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 **(15 Hours)**

BOOKS FOR REFERENCE:

1. Shivanand Tolanur, Soil Chemistry, International Book Distributing Co, 1st Edition, 2006. **Unit I-II**
2. P.K.Gupta, A Handbook of Soil, Fertilizer and Manure, Agrobios (India), 2nd Edition, 2012. **Unit III-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 Publications, New Delhi, 1st Edition, 2009.

INDUSTRIAL CHEMISTRY

Semester: III **Hours: 5**

Code : 23PCH3SE3 **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the importance of chemical industries	PSO-1	K1
CO - 2	Understand the various aspects of dairy products, water analysis and treatment, sugar and paper industry	PSO-2	K2
CO - 3	Apply the procedures for estimation of water parameters, manufacturing, and testing of various industrial products	PSO-3	K3
CO - 4	Analyse the industrial applications for mankind and intellectual property rights	PSO-4	K4
CO - 5	Formulate industrial procedures in various production and receiving copyrights	PSO-5	K5, K6

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

Semester: III				**INDUSTRIAL CHEMISTRY**							**Hours: 5**
Code : 23PCH3SE3											**Credit: 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	3	5	4	4	3	3	3.82
CO - 2	3	5	3	3	4	3	3	5	4	3	3	3.55
CO - 3	3	4	3	3	5	3	3	4	5	3	3	3.55
CO - 4	3	3	5	3	3	3	3	3	3	5	3	3.36
CO - 5	3	.4	3	5	3	5	3	4	3	3	5	3.40
Overall Mean Score												**3.58**

Result: The score for this course is **3.58** (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: DAIRY CHEMISTRY:

Milk and Milk Products: composition of milk - flavour and aroma of milk - physical properties of milk - effect of heat on milk - pasteurization - homogenization - milk products - cream - butter - ice cream - milk powder - nutritive value of milk and milk products - fortified and special milks **(15 Hours)**

UNIT II: ANALYSIS OF WATER:

Measurement of pH, electrical conductivity, turbidity, dissolved solids - estimation of free chlorine, acidity, total acidity, alkalinity, hardness: EDTA method - dissolved oxygen, biochemical oxygen demand, chemical oxygen demand calcium, magnesium, iron-chemical substances affecting health - ammonia - nitrate and nitrite - cyanide - sulphate **(15 Hours)**

UNIT III: WATER TREATMENT:

Sources of water - characteristics imparted by impurities in water - hardness of water-equivalents of calcium carbonate - units of hardness - disadvantages of hard water-scale and sludge formation in boilers - softening methods: lime-soda process, zeolite process, ion exchange process - desalination of brackish water: electrodialysis and reverse osmosis - sewage and its composition - purpose of sewage treatment - methods of sewage treatment: mechanical treatment and biological treatment **(15 Hours)**

UNIT IV: SUGAR INDUSTRY:

Manufacture of cane sugar - extraction of juice-purification of juice - defection - sulphitation and carbonation - concentration or evaporation - crystallisation - separation of crystals - drying-refining - recovery of sugar from molasses - bagasse - preparation of celotex - manufacture of sucrose from beet root - testing or estimation of sugar - double sulphitation process **(15 Hours)**

UNIT V: a) PAPER INDUSTRY:

Raw materials - manufacture of paper - bleaching agents used in paper industry - process of recycling: collection and transportation, sorting and separation, shredding and pulping, screening, rolling, drying, polishing - quantity checking, cutting, products - benefits of paper recycling

b) INTELLECTUAL PROPERTY RIGHTS:

Introduction to intellectual property rights - patents - factors for patentability - novelty, non obviousness, industrial applications - patent offices in india: trademark - types of trademarks - certification marks, logos, brand names, signatures, symbols and service marks **(15 Hours)**

BOOKS FOR REFERENCE

1. Jayashree Ghosh, Fundamental concepts of applied chemistry, S. Chand and Co Edition, Ist Edition 2008. **Unit I**
2. Robert Jenness and Stuart Patton, 2018, Meditech, Principles of dairy chemistry, **Unit I**
3. Jain and Jain, Engineering Chemistry, Dhanpat Rai publishing company, 16th Edition, **Unit II-III**
4. B.K. Sharma, Industrial Chemistry, Goel publishing house, 14th Edition, 2004, **Unit III-IV**
5. B.N. Chakrabarty, Industrial Chemistry, Oxford and IBH publishing Co. Pvt. Ltd., 6th reprint, 1994. **Unit IV-V**
6. D.M. Yusuff, Applied Chemistry, Nisa publications, **Unit V**
7. Neeraj Pandey, Khushdeep Dharni, intellectual property rights, PHI earning, 2014. **Unit V**

INTERNSHIP

Semester: III

Code : 23PCH3IN1 **Credit: 2**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Gain knowledge about industrial management	PSO-1	K1
CO - 2	Describe the different analytical skills and methodology of production	PSO-2	K2
CO - 3	Illustrate the practical and other procedures adopted during internship	PSO-3	K3
CO - 4	Analyse and interpret the results of the project findings	PSO-4	K4
CO - 5	Compile the internship work and exhibit the findings through PPT presentation	PSO-5	K5, K6

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

Semester: III				**INTERNSHIP**							**Credit: 2**
Code : 23PCH3IN1											
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	3	4	3	4	3	5	3	4	4	3	3.72
CO - 2	4	5	4	3	3	3	4	5	3	4	3	3.72
CO - 3	4	3	4	4	5	4	4	3	5	4	4	4.0
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.54
CO - 5	4	3	4	5	3	5	4	3	3	4	5	3.9
Overall Mean Score												**3.78**

Result: The score for this course is **3.78** (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

PG INTERNSHIP - GUIDELINES

I. Selection of industry or analytical course for an internship based on students' interest and conveyance

II. Internship to nearby industries / factories, which enables the students to bridge gap between theory and practice by viewing the different processes of the industry

III. Gains practical skills on applied chemistry products

IV. It promotes creative learning of the subject through experimentation

V. Preparation and submission of an internship report which includes an introduction, the manufacturing process, checking the quality of the products and packaging followed by PPT presentation

ORGANIC CHEMISTRY-IV

Semester: IV **Hours: 5**

Code : 23PCH4C10 **Credit: 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 retro synthesis, disconnection, terpenoids, carotenoids, steroids flavones and dyes approach to solve the problems in competitive exams	PSO-1	K1
CO - 2	Explain the guidelines in retrosynthesis, classification of terpenoids, carotenoids, steroids and the properties of flavones	PSO-2	K2
CO - 3	Predict the synthesis of complex molecules, terpenoids, carotenoids, flavones and dyes, illustrate the colour reactions of steroids	PSO-3	K3
CO - 4	Analyse the structure of complex molecules, terpenoids, carotenoids, harmones, flavones and dyes	PSO-4	K4
CO - 5	Write the structure of complex molecules, terpenoids, carotenoids, harmones, flavones and dyes	PSO-5	K5, K6

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

Semester: IV				**ORGANIC CHEMISTRY-IV**							**Hours: 5**
Code : 23PCH4C10											**Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	3	3	4	3	3	5	4	3	3	3.55
CO - 3	4	3	4	3	5	3	4	3	5	4	3	3.73
CO - 4	3	3	5	3	3	3	3	3	3	5	3	3.36
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
Overall Mean Score												**3.55**

Result: The score for this course is **3.55** (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 reaction - protection and deprotection of groups **(15 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, paracetamol, salbutamol, indomethacin and multistriatin **(15 Hours)**

UNIT III: a) TERPENOIDS:

Introduction - occurrence - classification - isoprene rule - general methods of determining structure - structure determination of camphor, myrcene, squalene, zingiberene

b) CAROTENOIDS:

Introduction - classification - isolation and separation - characteristics of carotenoids - principal methods in elucidating the constitution of carotenoids - functions of carotenoids - constitution of β-carotene and xanthophyll **(15 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: structure and functions of oestrogens, gestrogens, progesterone and testosterone (no structural elucidation) - adrenocortical hormones: relationship to physiological activity - non - steroid hormones: structure and functions of adrenaline, thyroxine (no structural elucidation) **(15 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 of flavones taking flavone as an example - constitution of quercetin - structural relationship between flavonols: queretin - anthocyanidins: cyanidin chloride and catechins - biogenetic relationship between flavonols, anthocyanidins and catechins

a) NATURAL DYES:

Introduction - Witt's theory of colour - dyeing - structural determination and synthesis of indigoitin and alizarin. **(15 Hours)**

BOOKS FOR REFERENCE:

1. Stuart Warren, Organic Synthesis: The Disconnection Approach, Wiley India Pvt. Ltd., Reprint, 2016. **Unit I-II**
2. Francis A. Carey and Richard J. Sundberg Advanced Organic Chemistry Part B: Reactions and Synthesis, Springer Science, 5th Edition, 2007. **Unit I-II**
3. W. Carruthers, Some modern methods of organic synthesis, Cambridge University Press, 3rd Edition, 1986. **Unit I-II**
4. O.P. Agarwal, Chemistry of Organic Natural products-volume I, Prentice Hall, 48th Edition, 2018. **Unit III-V**
5. O.P. Agarwal, Chemistry of Organic Natural products-volume II, Prentice Hall, 33rd Edition, 2008. **Unit III-V**
6. I.L. Finar, Organic Chemistry, volume II, Dorling Kindersley, 5th Edition, 2008. **Unit III-V**
7. Gurdeep R Chatwal, Organic Chemistry of natural products-volume II, Himalaya Publishing house, New Delhi, 4th Edition, 2006. **Unit III-V**
8. Gurdeep R Chatwal, Organic Chemistry of natural products-volume I, Himalaya Publishing house, New Delhi, 4th Edition, 2006. **Unit V**

PHYSICAL CHEMISTRY-IV

Semester: IV **Hours: 6**

Code : 23PCH4C11 **Credit: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge about the fundamentals of chemical kinetics, catalysis, polymerization and statistical thermodynamics	PSO-1	K1
CO - 2	Understand the concepts in theories of reaction rates, homogeneous catalysis, surfactants, different polymerization reactions, thermodynamic and statistical properties	PSO-2	K2
CO - 3	Apply the mathematical skills to derive reaction rates, determination of molecular weight, to derive chemical thermodynamic equations and to apply the skills for doing practicals and research projects	PSO-3	K3
CO - 4	Analyze the mechanism of theories of chemical kinetics, kinetics of polymerization reactions and their structure and statistical equations	PSO-4	K4
CO - 5	Formulate the theories of reaction rates in chemical kinetics, applications of industrially important polymers, statistical thermodynamics and to demonstrate the skills in project work	PSO-5	K5, K6

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

Semester: IV				**PHYSICAL CHEMISTRY-IV**							**Hours: 6**
Code : 23PCH4C11											**Credit: 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	3	4	3	4	3	5	3	4	4	3	3.73
CO - 2	3	5	4	3	3	3	3	5	3	4	3	3.55
CO - 3	3	4	4	4	5	4	3	4	5	4	4	4.00
CO - 4	3	3	5	4	4	4	3	3	4	5	4	3.82
CO - 5	3	3	4	5	3	5	3	3	3	4	5	3.73
Overall Mean Score												**3.77**

Result: The score for this course is **3.77** (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 - 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 **(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 - 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: viscometry - sedimentation velocity method - Industrially important polymers: preparation, properties and uses of LDPE and HDPE, Polystyrene, polyester, acrylo polymer, Teflon, PET, Polyvinyl chloride, 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. B.R. Puri, L.R. Sharma and Madan S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co, 47th Edition, 2016. **Unit I-V**
3. V.R. Gowarikar, N.V. Viswanathan and Jayadev Sreedhar, Polymer Science, New Age International, Reprint 2005. **Unit III**
4. Kuriacose and Rajaram, Thermodyamics, Jalandar Shoban Lal Co,1993. **Unit IV-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 : 23PCH4C12 **Credit: 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 concepts of bioinorganic chemistry, organometallic compounds and inorganic photochemistry	PSO-1	K1
CO - 2	Explain the reactions in bioinorganic chemistry, organometallic compounds and inorganic photochemistry	PSO-2	K2
CO - 3	Apply the generalisations of bioinorganic concepts, organometallic compounds and inorganic photochemistry	PSO-3	K3
CO - 4	Analyse the biological importance of inorganic compounds, organometallic compounds and inorganic photochemistry	PSO-4	K4
CO - 5	Interpret and compare the various aspects in bioinorganic chemistry, organometallic compounds and inorganic photochemistry	PSO-5	K5, K6

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

Semester: IV			**INORGANIC CHEMISTRY-IV**						**Hours: 6**			
Code : 23PCH4C12												**Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	3	3	4	3	3	5	4	3	3	3.55
CO - 3	3	4	3	3	5	3	3	4	5	3	3	3.55
CO - 4	3	3	5	3	3	3	3	3	3	5	3	3.36
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
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: 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 - metallo porphyrins 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:

Introduction - classification - The 18 electron rule - EAN rule - structures of mono and poly nuclear metal carbonyls - distinction between terminal and briding carbonyl groups - chemical reactions of metal carbonyls : reaction with H_2, NO and halogens - olefin complexes - Zeise's salt - structural features of Zeise's salt - bonding in metal alkene complexes - metal allyl complexes - metal acetylene complexes - carbyne, carbene and carbido complexes - metallocenes - structure, bonding and properties of Ferrocene - structure of cyclopenta dienyl complexes - arene complexes - uses of organometallic compounds **(18 Hours)**

UNIT IV: ORGANO METALLIC CHEMISTRY-II:

a) Reactions of organo metallic compounds: Substitution reactions in carbonyl complexes - oxidative addition and reductive elimination - insertion (CO, alkene, SO_2 and CO_2) - elimination (β-hydride, β-fluoride, decarbonylation) - nucleophilic and electrophilic attack of coordinating ligands

b) Catalysis by organometallic compounds: homogenous and heterogenous catalysts - alkene hydrogenation - synthesis of water gas shift - hydroformylation - Wacker process - Zeigler - Natta catalyst - Fischer-Tropsch synthesis **(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., 5th Edition, 2023. **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. J.D. Lee, Concise Inorganic Chemistry, Blackwell publishing, 5th Edition, 1996. **Unit I-IV**
4. Sathya Prakash, G.D. Tuli, S.K. Basu, and R.D. Madan, Advanced Inorganic Chemistry, vol I, 17th Edition, S. Chand and Company Ltd,1998. **Unit I-V**
5. R.L. Madan, G.D. Tuli, Inorganic Chemistry, S. Chand's Publishing 1999. **Unit I-V**
6. Indrajith Kumar, Inorganic Reactions Mechanism, Vishal Publishing Co, 1st Edition, 2021**. Unit III-V**
7. A. Abdul Jameel, Applications of Physical methods to Inorganic compounds, 2007. **Unit V**
8. S. Arunachalam, Inorganic Photochemistry, Kala Publications, 2002. **Unit V**
9. E. Douglas, H. Mc Daniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edition, 2006. **Unit V**

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Semester: IV **Hours: 5**

Code : 23PCH4E3A **Credit: 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	K1
CO - 2	Explain the concepts of analytical techniques, separation techniques and electroanalytical techniques	PSO-2	K2
CO - 3	Apply the methodology of instrumentation and analytical techniques	PSO-3	K3
CO - 4	Analyze the applications of various analytical techniques and interpret the results	PSO-4	K4
CO - 5	Evaluate the advantages of analytical methods in various analytical techniques	PSO-5	K5, K6

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

Semester: IV			**INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**								**Hours: 5**
Code : 23PCH4E3A											**Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	3	3	3	3	3	5	3	3	3	3.36
CO - 3	3	4	3	3	5	3	3	4	5	3	3	3.55
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
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: COLORIMETRY AND SPECTROPHOTOMETRY:

Introduction - theory of spectrophotometry and colorimetry - determinations with UV-visible spectrophotometers - colorimetry - classification - photoelectric colorimeter - spectrophotometric titration - apparatus - determination of copper, iron and nickel **(15 Hours)**

UNIT II: ANALYTICAL TECHNIQUES:

Principle, instrumentation and applications: Flame Emission Spectroscopy (FES) Flame Photometry, Nepheloturbidometry and Inductively Coupled Plasma Spectroscopy (ICPS) **(15 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 - applications **(15 Hours)**

UNIT IV: THERMAL ANALYSIS:

Introduction - thermogravimetry - instrumentation - applications of TGA - Differential Thermal Analysis (DTA) and Differential Scanning Colorimetry (DSC) - instrumentation - experimental and instrumental factors - applications - comparison of TGA and DTA - thermometric titrations: introduction - instrumentation **(15 Hours)**

UNIT V: ELECTRO ANALYTICAL TECHNIQUES:

Voltammetry - polarography: basic principles - direct current polarography - commercial polarographs -determination of lead and copper in steel- cyclic voltammetry- principle and applications - amperometry: amperometric titrations - technique of amperometric titrations with dropping mercury electrode - determination of lead with standard potassium dichromate solution **(15 Hours)**

BOOKS FOR REFERENCE:

1. Vogel's Textbook of Quantitative Inorganic Chemical analysis, 7th Edition ELBS with Longmann Publication, 2008. **Unit I-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.

POLYMER CHEMISTRY

Semester: IV **Hours: 5**

Code : 23PCH4E3B **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recognize the use of polymers in our day-to-day life	PSO-1	K1
CO - 2	Explain microstructure of polymers and importance of biodegradable polymers	PSO-2	K2
CO - 3	Classify the polymers based on different aspects	PSO-3	K3
CO - 4	Analyse polymers, their biodegradability and their applications	PSO-4	K4
CO - 5	Relate specific applications of polymers in day today life	PSO-5	K5, K6

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

Semester: IV				POLYMER CHEMISTRY							Hours: 5
Code : 23PCH4E3B											Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	3	3	3	3	3	5	3	3	3	3.36
CO - 3	3	4	3	3	5	3	3	4	5	3	3	3.55
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
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: STRUCTURE OF POLYMERS:

Introduction - classification of polymers based on origin, mode of formation, structure and application - organic and inorganic polymers - microstructure based on the chemical structure: homochain and heterochain polymers, homopolymer and co-polymers - microstructure based on the geometrical structure: linear, branched and cross-linked polymers, random, alternating, block and graft copolymers and stereo-regular polymers **(15 Hours)**

UNIT II: ADDITION POLYMERS:

Types of polymerization: addition and condensation - addition polymers**:** preparation, structure and uses of polyethylene, polypropylene, polystyrene, polyvinylchloride, polytetrafluoroethylene, polymethylmethacrylate, polyacrylonitrile, polyvinyl acetate, polychloroprene and styrene-butadiene and natural rubber **(15 Hours)**

UNIT III: CONDENSATION POLYMERS:

Preparation, structure and use of polyamides, polyesters, phenol-formaldehyde resin, cellulose acetate, silicones and polyurethanes **(15 Hours)**

UNIT IV: SPECIFIC APPLICATIONS:

Polymers as adhesives and fillers - common plastic polymers used in packaging: polyethylene terephthalate, high-density polyethylene and low-density polyethylene **(15 Hours)**

UNIT V: BIODEGRADABLE PLASTICS:

Composition of biodegradable plastics - starch-based plastics - bacteria-based plastics - soy-based plastics - biodegradable polyesters - biopolymers: definition, example and applications - quality of polymers: the permissible limit of microns in polythene bags - grades of plastic bottles **(15 Hours)**

BOOKS FOR REFERENCE:

1. V.R. Gowariker, N.V. Viswanathan and Jayadev Sreedhar, Polymer Science, New age International Pvt. Ltd., Publishers, Reprint 2014. **Unit I-II**
2. K. Bagavathisundari, Applied Chemistry, MJP Publishers, 2nd Edition, 2008. **Unit III-V**
3. **https://plasgranltd.co.uk/plasgran-guide-plastic-recycling-grades/ Unit V**
4. **https://www.quora.com/Why-is-the-allowed-limit-of-polythene-bags-in-India-40-micron-Are-polythene-bags-lesser-than-40-not-recyclable Unit V**

FORENSIC CHEMISTRY

Semester: IV **Hours: 5**

Code : 23PCH4E3C **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Identify the process of solving crime	PSO-1	K1
CO - 2	Explain the methods to investigate crime	PSO-2	K2
CO - 3	Apply the principles of solving crime	PSO-3	K3
CO - 4	Analyse the process of solving crime	PSO-4	K4
CO - 5	Evaluate the evidence of solving crime	PSO-5	K5, K6

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

Semester: IV				FORENSIC CHEMISTRY								Hours: 5
Code : 23PCH4E3C												Credit: 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	3	4	3	3	3	5	3	3	4	3	3.55
CO - 2	3	5	3	3	3	3	3	5	3	3	3	3.36
CO - 3	3	4	3	3	5	3	3	4	5	3	3	3.55
CO - 4	3	3	5	3	4	3	3	3	4	5	3	3.55
CO - 5	3	3	3	5	3	5	3	3	3	3	5	3.55
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 = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs = Total of Mean Scores / Total No. of COs

UNIT I: POISONS:

Poisons - types and classification - diagnosis of poisons in the living andthe dead - clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysisin detecting arsenic in human hair - treatment in cases of poisoning - use of antidotes for common poisons **(15 Hours)**

UNIT II: CRIME DETECTION:

Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns **(15 Hours)**

UNIT III: FORGERY AND COUNTERFEITING:

Documents - different types of forged signatures - simulated and traced forgeries - inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays -comparison of type written letters - checking silver line water mark in currency notes - alloy analysis using AAS todetect counterfeit coins - detection of gold purity in 22 carat ornaments - detecting gold plated jewels - authenticity of diamond **(15 Hours)**

UNIT IV: TRACKS AND TRACES:

Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints -residue prints, walking pattern or tyre marks - miscellaneous traces and tracks - glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses **(15 Hours)**

UNIT V: MEDICAL ASPECTS:

Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms - laboratory examination of barrel washing and detection of powder residue by chemical tests **(15 Hours)**

BOOKS FOR REFERENCE:

1. SA Iqbal, M Liviu, Textbook of Forensic chemistry, Discoverypublishing house private limited, 2011. **Unit I-V**
2. Sharma B.R., Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi, 2006. **Unit I-V**

FURTHER READING:

1. Richard Saferst in and Criminalistics - An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, 8th Edition, 2003.
2. Suzanne Bell, Forensic Chemistry, Pearson, second international Edition, 2014.
3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first Edition, 2015.
4. Max M. Houck & Jay A. Segal, Fundamentals of Forensic Science, Elsevier Academic press, 2006.
5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, HenryLee's Crime Scene Book Elsevier Academic press, 2006.

PROJECT WITH VIVA VOCE

Semester: IV **Hours: 6**

Code : 23PCH4R01 **Credit: 3**

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 of chemistry research	PSO - 1	K1
CO - 2	Describe the different analytical skills used in characterization of compounds	PSO - 2	K2
CO - 3	Compile the project work of their findings	PSO - 3	K3
CO - 4	Develop the presentation skills and analytical skills	PSO - 4	K4
CO - 5	Interpret the results in suitable methods and equip skills for future research work	PSO - 5	K5, K6

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

Semester: IV				**PROJECT WITH VIVA VOCE**							**Hours: 6**
Code : 23PCH4R01											**Credit: 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	3	4	3	4	3	5	3	4	4	3	3.72
CO - 2	4	5	3	4	3	4	4	5	3	3	4	3.81
CO - 3	4	3	4	4	5	4	4	3	5	4	4	4.0
CO - 4	3	3	5	4	4	4	3	3	4	5	4	3.81
CO - 5	4	3	3	5	4	5	4	3	4	3	5	3.90
Overall Mean Score												**3.85**

Result: The score for this course is **3.85** (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= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

PG PROJECT WITH VIVA VOCE - GUIDELINES

I. Selection of a project based on syllabi, societal usefulness, SDG goals and students' interest. It helps to develop knowledge on lab tests, analytical skills and thrust in research.

II. Carrying out the literature survey by referring standard textbooks, recent research articles.

III. Performing experimental part of the research project

IV. Interpretation of project results using spectral analysis, statistical methods and computational tools

V. Preparation and submission of a project report which includes an introduction, aim, objectives, experimental methods, results and discussion, conclusion and references followed by presentation.

TRAINING FOR COMPETITIVE EXAMINATIONS

Semester: IV **Hours: 2**
Code : 23PCH4SE4 **Credit: 1**
COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	Acquire knowledge on numerical ability and reasoning, concepts of chemistry, environmental sustainability and principles of green chemistry	PSO-1	K1
CO-2	Describe aromatic character and organic reaction mechanism, molecular rearrangements, laws of thermodynamics, chemical kinetics, periodic variation, waste disposal and green solvents	PSO-2	K2
CO-3	Solve problems in numerical ability, thermodynamics, chemical kinetics, organic reaction mechanism, molecular rearrangements and construct MO diagram	PSO-3	K3
CO-4	Analyse mechanisms and rearrangements in organic chemistry, thermodynamic functions, chemical kinetic theories, periodic variation and green methods of synthesis	PSO-4	K4
CO-5	Develop problem solving skills and create confidence to appear for competitive examination	PSO-5	K5, K6

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

Semester: IV				**TRAINING FOR COMPETITIVE EXAMINATIONS**							**Hours: 2**
Code : 23PCH4SE4											**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	3	4	4	3	4	5	3	3	4	4	3.82
CO - 2	3	5	3	3	3	3	3	5	3	3	3	3.36
CO - 3	4	4	3	4	5	4	4	4	5	3	4	4.00
CO - 4	3	3	5	4	4	4	3	3	4	5	4	3.82
CO - 5	3	4	3	5	4	5	3	4	4	3	5	3.91
Overall Mean Score												**3.78**

Result: The score for this course is **3.78** (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) REASONING:

Numbers - highest common factor and least common multiple of numbers - average - problems on numbers - percentages - problems on ages - percentage - profit and loss - ratio and proportion - time and work

b) NUMERICAL ABILITY:

Series completion - analogy - coding and decoding - puzzle test - direction sense test - alphabet test - alpha - numeric sequence puzzle - arithmetic reasoning - inserting missing character - logical sequence of words **(6 Hours)**

UNIT II: ORGANIC CHEMISTRY:

a) Aromaticity: Huckel's rule and concept of aromaticity - aromaticity of benzenoid - non-benzenoid compounds - aromaticity in charged rings and fused ring systems

b) Organic Reaction Mechanism: Aliphatic nucleophilic substitution reactions: S_N1, S_N2 and S_Ni - elimination reactions: E_1, E_2 and E_1cB mechanism

c) Molecular rearrangements: Curtius, Lossen, Schmidt - Baeyer - Villiger, Pinacol - pinacolone - Benzil - Benzilic acid, Benzidine, Favorski and Fries rearrangements **(6 Hours)**

UNIT III: PHYSICAL CHEMISTRY:

a) Thermodynamics: Thermodynamic equations of state - closed and open systems - partial molal quantities - chemical potential with temperature and pressure - third law of thermodynamics - simple related problems

b) Chemical Kinetics: Terms in chemical kinetics: order - molecularity - half-life period - rate constant expression for first and second order reactions - theories of reaction rates: simple collision theory - absolute reaction rate theory (ARRT) - acid base catalysis - enzyme catalysis: Michaelis-Menten law - influence of pH and temperature - simple related problems **(6 Hours)**

UNIT IV: INORGANIC CHEMISTRY:

a) Periodic Properties: Periodic properties - atomic radius - ionic radius, ionization potential, electron affinity and electronegativity - significance in chemical bonding

b) VB theory and MO theory: VB theory - MO theory - VSEPR theory - comparison of VB and MO theories - MO diagram - bond order - bond energy - bond length - bond polarity - partial ionic character of bonds - electron deficient compounds - hydrogen bond

c) Solid state chemistry: Ionic bonding - lattice energy - Born equation - Born Haber cycle - radius ratio rule **(6 Hours)**

UNIT V: a) ENVIRONMENTAL CHEMISTRY:

Importance - greenhouse gases - air, soil and water pollutants - water treatment processes - environmental toxicology of chemicals - waste disposal methods

b) GREEN CHEMISTRY:

Introduction - principles - solvent selection and alternative reaction conditions - atom economy, minimizing waste and maximizing efficiency **(6 Hours)**

COURSE BOOKS:

1. I. Maria Jesili, Aptitude Building, ACCA Printing Press, 1st Edition, 2019. **Unit I**
2. M.K. Jain and S.C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., 4th Edition, 2023. **Unit II**
3. V. K. Ahulvalia, Organic Reaction Mechanisms, Narosa Publishing House Pvt. Ltd., 4th Edition, 2007. **Unit II**
4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 48th Edition, 2023-2024. **Unit III**
5. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Vishal Publishing Co., 33rd Edition, 2022-2023. **Unit IV**
6. Murugeshan, Environmental science and Engineering, Millenium publication, Madurai, 2007. **Unit V**
7. V. K Ahluwalia, Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005. **Unit V**