DEPARTMENT OF CHEMISTRY

PREAMBLE

UG : Programme Profile and the Syllabi of Courses Offered in Semester I and II Along with I and II Evaluation Components (with Effect from 2021 – 2024 Batch onwards).

PG : Syllabi of Programme offered in Semester I and II along with I and II Evaluation Components (with Effect from 2021 – 2023 Batch onwards).

PROGRAMME PROFILE B.Sc., (Chemistry)

Programme Specific Outcomes (PSO)

Upon completion of the programme, the students will be able to

- Development of the Skills in handling various Chemicals, Apparatus and Instruments.
- Application of the Principles of Thermodynamics and Chemical Kinetics in Chemical Reactions.
- Acquiring the Knowledge on Heterocyclic Compounds and Natural Products.
- Ability to apply the basic Principles of various Spectroscopic, Electro and Thermo Analytical Methods to Characterize the Compounds.
- Industrial insights on Polymers, Textile Dyes, Fibre and Medicinal Chemistry.

Semester	Part	Category	Course code	Course Title	Pervious course code	Contact Hour/ Week	Min/Max
I	I	Languages/ AECC-IITamil/ Hindi/French	UTAL107/ UTAL108/ UHIL101/ UFRL101	Basic Tamil-I/ Advanced Tamil-I/ Hindi-I/ French-I	UTAL103/ UTAL104	5	3/4
	II	English/AECC-I	UENL109/ UENL110	English for Communication (Stream – I)/ English for Communication (Stream – II)		5	3/4
	III	Core I/ DSC-I	UCHM108	Inorganic Chemistry-I	-	5	5
		Core II/ DSC-II	UCHM109	Analytical Chemistry	-	4	4
		Core Practical I/ DSC Practical-I	UCHR101	Volumetric Practical	-	3	2
		Allied I/GE	UPHA102	Allied Physics - I	-	3	2
		Allied Practical I/GE Practical-I	UPHR103	Allied Physics Practical-I	-	3	2
		Core III/ DSC-III	UPEM101	Professional English I		6	4
	IV	Value Education				2	1
				Total		**36**	**26/28**
II	I	Languages/ AECC-II Tamil/ Hindi/French	UTAL207/ UTAL208/ UHIL201/ UFRL201	Basic Tamil-II/ Advanced Tamil-II/ Hindi-II/ French-II	UTAL203/ UTAL204	5	3/4
	II	English/AECC-I	UENL209/ UENL210	English for Communication (Stream – I)/ English for Communication (Stream – II)		5	3/4
	III	Core IV/ DSC-IV	UCHM203	Organic Chemistry-I		5	5
		Core V/ DSC-V	UCHM204	Nuclear & Radiation Chemistry	-	3	3
		Core Practical II/DSC Practical II	UCHR206	Organic Practical	-	3	2
		Allied II/GE	UPHA201	Allied Physics II	-	3	2
		Allied Practical II /GE Practical II	UPHR202	Allied Physics Practical-II	-	3	2
		Core VI/ DSC-VI	UPEM201	Professional English II		6	4

II	IV	NME			-	3	2
	V	Extension Programme/ Physical Education/NCC			-	-	1/2
Total						**36**	**27/30**
III	I	Languages/ AECC-II Tamil/Hindi/French	UTAL307/ UTAL308/ UHIL301/ UFRL301	Basic Tamil-III/ Advanced Tamil-III/ Hindi-III/ French-III	UTAL303/ UTAL304	5	3/4
	II	English/AECC-I	UENL309/ UENL310	English for Communication (Stream – I)/ English for Communication (Stream – II)	UENL306	5	3/4
	III	Core VII/ DSC-VII	UCHM307	Physical Chemistry - I	-	4	4
		Core VIII/ DSC-VIII	UCHM308	Electrochemistry	-	3	2
		Core Practical III /DSC Practical III	UCHR404/ UCHR405	Semi Micro Qualitative Inorganic Analysis		3	-
		Allied/GE	UMAA304	Algebra, Differential Calculus and Trigonometry	-	5	4
	IV	Online Course		Online Course (NPTEL/ST)		3	1/2
		Value Education				2	1
Total						**30**	**18/21**
IV	I	Languages/ AECC-II Tamil/Hindi/French	UTAL407/ UTAL408/ UHIL401/ UFRL401	Basic Tamil-IV/Advanced Tamil-IV/ Hindi-IV/ French-IV	UTAL403/ UTAL404	5	3/4
	II	English/AECC-I	UENL409/ UENL410	English for Communication (Stream – I)/ English for Communication (Stream – II)	-/ UENL406	5	3/4
	III	Core IX/ DSC-IX	UCHM407	Molecular Spectroscopy & Photochemistry	-	4	4
		Core X/ DSC-X	UCHM408	Research Methodology	-	3	2
		Core Practical III /DSC Practical III	UCHR404/ UCHR405	Semi micro Qualitative Inorganic Analysis	-	3	4
		Allied/GE	UMAA406	Integral Calculus, Laplace Transform & Ordinary Differential Equation	-	5	4
	IV	NME				3	2
		Soft skill	USKS401			2	1
	V	Extension Programme/ Physical Education/NCC				-	-/2
	Total					**30**	**23/27**
V	III	Core XI/ DSC-XI	UCHM510	Inorganic Chemistry – II	-	5	5
		Core XII/ DSC-XII	UCHM511	Organic Chemistry – II	-	5	5
		Core XIII/ DSC-XIII	UCHM512	Physical Chemistry –II	-	5	5
		Major Elective /DSE-I	UCHO501 UCHO502 UCHO503	Organometallics and Bioinorganic chemistry Heterocyclic Chemistry Organic Spectroscopy	-	5	4
		Core Practical IV /DSC Practical IV	UCHR501	Gravimetric Analysis	-	3	2
		Core XIV/ DSC-XIV	UCHP501	Project	-	5	5
	IV	Value education				2	1
Total						**30**	**27**

VI	III	Core XV/ DSC-XV	UCHM614	Inorganic Chemistry III	-	5	5
		Core XVI/ DSC-XVI	UCHM615	Organic Chemistry III	-	5	5
		Core XVII/ DSC-XVII	UCHM616	Physical Chemistry III	-	5	5
		Core XVIII/ DSC-XVIII	UCHM617	Advanced Material Chemistry		2	2
		Major Elective/ DSE-II	UCHO602 UCHO603 UCHO604	Polymer Chemistry Medicinal Chemistry Forensic Chemistry	-	5	4
		Core Practical V /DSC Practical V	UCHR605	Physical Chemistry Practical	-	3	2
		Core Practical VI /DSC Practical VI	UCHR606	Organic Analysis and Preparation	-	3	2
		Viva –Voce	UCHM605	Comprehensive Viva-Voce	-	-	1
	IV	Soft Skill	USKS601		-	2	1
	V	Extension Programme/ Physical Education			-	-	-/2
Total						**30**	**27/29**
Grand Total						**192**	**148/162**

LIST OF COURSES OFFERED TO OTHER DEPARTMENTS
ALLIED AND ALLIED OPTIONAL COURSES

Semester	Part	Category	Course code	Course title	Pervious course code	Contact Hour per week	Credits
							Min/Max
I	III	Allied- I/GE	UCHA103	Chemistry for Biochemist		3	2
IV	III	Allied- I/GE	UCHA402	Chemistry for Physics		3	2
I	III	Allied Practical-I/ GE Practical-I	UCHR104	Organic Analysis	-	3	2
IV	III	Allied Practical-II/ GE Practical-II	UCHR404	Volumetric Analysis		3	2
V	III	Allied Optional	UCHA502 UCHA504 UCHA505 UCHA506	Industrial Chemistry Dairy Chemistry Agricultural Chemistry Environmental Chemistry	-	5	4

NON- MAJOR ELECTIVE COURSES

Semester	Part	Category	Course code	Course title	Pervious course code	Contact Hour per week	Credits
							Min/Max
II	IV	Non major Elective	UCHE204 UCHE205 UCHE206	Food Chemistry Health and Hygiene Cosmetics and Detergents	-	3 3 3	2 2 2
IV	IV	Non major Elective	UCHE401 UCHE402 UCHE403	Agricultural Chemistry Environmental Chemistry Industrial Chemistry		3 3 3	2 2 2

EXTRA CREDIT EARNING PROVISION

Semester	Category	Course Code	Course Title	Pervious Course Code	Hour per Week	Credits
						Min/Max
II	Core	UCHI201	Internship	-	-	1
IV	Core	UCHI401	Internship	-	-	1
VI	Core	UCHS601/ UCHP601	Green Chemistry (Self Study Paper) / Project	-	-	1/2

EXPERIENTIAL LEARNING (MANDATORY/ONLY FOR INTERESTED STUDENTS)

Related Paper	Work experience		Proposed period (Sem.Break/May / Any Other)	Collaborating Agency	Mode of Evaluation
	Nature of the Course/Institution	Proposed Duration (No.of.Days/Weeks/Months)			
UCHM509	Organic Farming	2 days	August	MSME	To get Certificate

SKILL ORIENTATION PROGRAMME (MANDATORY/ONLY FOR INTERESTED STUDENTS)

Semester	Category	Course code	Course title	Collaborating Agency	Hour/Days/Month	Mode of Evaluation
V	Core	UCHT501	Industrial Lab safety	TCIL	4 days	To get Certificate

INORGANIC CHEMISTRY-I

UCHM108

Semester : I **Credit :05**
Category : Core I/DSC-I **Hour/Week : 05**
Class & Major : I B.Sc., Chemistry **Total Hour : 65**

Objectives:

To enable the students

- Learn Scientific Theory of Atoms and its Concept.
- Understand the Elements in the Periodic Table.
- Predict the Structure of Atoms and their Chemical Bonding.

Learning Outcomes:

On completion of the course, the students will be able to

- Understand the Structure of Atoms and Rules Involved in it.
- Gain Knowledge about the Basic Concepts Block Elements and their Properties.
- Acquire about the various types of Chemical Bonding and their Characteristics.

UNIT-I ATOMIC STRUCTURE **15 Hour**

Bohr's Theory-Limitations-Atomic Spectrum of Hydrogen Atom-Wave Mechanics-de Broglie Equation-Heisenberg's Uncertainty Principle and its Significance-Schrödinger's Wave Equation-Significance of ψ and ψ^2-Quantum Numbers and their Significance-Normalized and Orthogonal Wave Functions-Sign of Wave Functions-Radial and Angular Wave Functions for Hydrogen Atom-Radial and Angular Distribution Curves-Shapes of *s*, *p*,

d and *f* Orbitals-Contour Boundary and Probability Diagrams-Pauli's Exclusion Principle-Hund's Rule of Maximum Multiplicity-Aufbau's Principle and its Limitations-Variation of Orbital Energy with Atomic Number.

UNIT-II PERIODICITY OF ELEMENTS **15 Hour**

s, *p*, *d*, *f* Block Elements-Long Form of Periodic Table- *s* and *p*-Block and their Properties -Effective Nuclear Charge-Shielding or Screening Effect-Slater Rules-Variation of Effective Nuclear Charge in Periodic Table-Atomic radii (Vander Waals)-Ionic and Crystal radii-Covalent radii (Octahedral and Tetrahedral)- Ionization Enthalpy-Successive Ionization Enthalpies-Factors affecting ionization energy-Applications of Ionization Enthalpy-Electron Gain Enthalpy-Trends of Electron Gain Enthalpy-Electro Negativity-Pauling-Mullikan-Allred Rochow Scales-Electro Negativity and Bond Order-Partial Charge-Hybridization-Group Electro Negativity-Sanderson electron density ratio.

UNIT-III CHEMICAL BONDING I **10 Hour**

Ionic Bond-General Characteristics-Types of Ions-Size Effects-Radius Ratio Rule and its Limitations-Packing of Ions in Crystals-Born-Landé Equation with Derivation-Expression for Lattice Energy-Madelung Constant-Born-Haber Cycle and its Application-Solvation Energy. Covalent bond-Lewis structure-Valence Shell Electron Pair Repulsion Theory (VSEPR)- Shapes of Simple Molecules-Ions Containing Lone and Bond Pairs of Electrons-Multiple Bonding-Sigma and Pi-Bond Approach.

UNIT-IV CHEMICAL BONDING II **13 Hour**

Valence Bond Theory (Heitler-London Approach)- Hybridization Containing s, p, d Atomic Orbital-Shapes of Hybrid Orbital-Bents Rule-Resonance and Resonance Energy-Molecular Orbital Theory-Molecular Orbital Diagrams- Simple Homonuclear and Heteronuclear Diatomic Molecules-MO Diagrams of Simple Tri and Tetra-Atomic Molecules (N_2, O_2, C_2, B_2, F_2, CO, NO)-Ions; HCl, BeF_2, CO_2, HCHO (Idea of s-p Mixing and Orbital Interaction to be Given)-Covalent Character in Ionic Compounds- Polarizing Power-Polarizability-Fajan Rules-Polarization-Ionic Character in Covalent Compounds-Bond Moment and Dipole Moment-Ionic Character from Dipole Moment- Electro Negativities.

UNIT-V METALLIC AND WEAK BONDS **12 Hour**

Metallic Bond-Qualitative Idea of Free Electron Model-Semiconductors-Insulators-Weak Chemical Forces-Vander Waals-Ion Dipole-Dipole Dipole- Dipole Induced Dipole Interactions-Lenard Jones 6 to 12 Formula-Hydrogen Bond-Effects of Hydrogen Bonding on Melting and Boiling Points-Solubility-Dissolution.

Reference Books

- Puri, B.R. Sharma, L.R. and Khalia, K. C. (2020). *Principles of Inorganic Chemistry*. Vishal Publishing Co. (33rd Ed.). India.
- Tuli, G.D. Satyaprakash. Basu, S.K. and Madan, R.D. (2006). *Advanced Inorganic Chemistry* (Vol. I & II). S. Chand. New Delhi.

Text Books

- Madan, R.D. (2019). *Modern Inorganic Chemistry*. S. Chand and Company Ltd. (3rd Ed.). New Delhi.
- Lee, J.D. (2014). *Concise Inorganic Chemistry.* (5thEd.). ELBS. London.

ANALYTICAL CHEMISTRY
UCHM109

Semester : I **Credit: 04**
Category : Core II/DSC-II **Hour/Week: 04**
Class & Major : I B.Sc., Chemistry **Total Hour : 52**

Objectives:
To enable the Students

- Understand the Basic Concepts of Analytical Process.
- Different Method of Instrumentation Available for the Studies.
- Various Techniques that are Involved in the Analytical Chemistry.

Learning Outcomes:
On completion of this course, the Students will be able to

- Familiar with Sampling, Statistical Testing of Data.
- Know the Basics of Thermal, Electroanalytical Techniques.
- Learn the Concept of Separation Techniques, Mechanism and its Applications.
- Gain Knowledge in Qualitative and Quantitative Aspects of Chromatographic Methods.

UNIT-I QUALITATIVE AND QUANTITATIVE ASPECTS OF ANALYSIS 9 Hour

Tools in Analytical Chemistry and their Applications, Sampling, Evaluation of Analytical Data, Errors, Accuracy and Precision, Statistical Test of Data; F, Q and t-test, Rejection of Data and Confidence Intervals.

UNIT-II THERMAL AND ELECTROANALYTICAL METHODS 10 Hour

Thermal analysis: Theory of Thermogravimetry (TG and DTG), Instrumentation, Estimation of Ca and Mg from their Mixture. Electroanalytical Methods: Classification of Electroanalytical Methods, Basic Principle of pH Metric, Potentiometric and Conductometric Titrations. Techniques Used for the Determination of Equivalence Points. Determination of pKa Values.

UNIT-III SEPARATION TECHNIQUES 15 Hour

Solvent Extraction: Classification, Principle and Efficiency of the Technique. Mechanism of Extraction: Extraction by Solvation and Chelation. Technique of Extraction: Batch, Continuous and Counter Current Extractions. Qualitative and Quantitative Aspects of Solvent Extraction: Extraction of Metal Ions from Aqueous Solution, Extraction of Organic Species from the Aqueous and Non-Aqueous Media.

UNIT-IV PURIFICATION TECHNIQUES 8 Hour

Desiccants, Distillation - Principle and Types-Fractional, Steam Azeotropic, Re-Crystallization and Sublimation. Test of Purity - Melting and Boiling Point.

UNIT-V CHROMATOGRAPHY TECHNIQUES 10 Hour

Classification, Principle and Efficiency of the Technique. Mechanism of Separation: Adsorption, Partition & Ion Exchange. Development of Chromatograms: Frontal, Elution and Displacement Methods. Qualitative and Quantitative Aspects of Chromatographic Methods of Analysis Using LC, GLC, TLC and HPLC.

Reference Books

- Khopkar, S.M. (1998). *Basic Concepts of Analytical Chemistry*. New Age International Publisher. (2nd Ed.). India.
- Skoog, D.A. Holler, F.J. Nieman, T.A. (1997). *Principles of Instrumental Analysis*. Brooks & Cole. (5th Ed.). United States.

Text Books

- Mendham, J. A. I. (2009). *Vogel's Quantitative Chemical Analysis*. Pearson. (6th Ed.). London.
- Christian, G.D. (2004). *Analytical Chemistry*. John Wiley & Sons. (6th Ed.). New York.
- Skoog, D.A. Holler F.J. & Nieman, T.A. (1998). *Principles of Instrumental Analysis.* Saunder College Publications. United States.

VOLUMETRIC PRACTICAL

UCHR101

Semester	**: I**	**Credit**	**: 02**
Category	**: Core Practical-I/DSC Practical -I**	**Hour/Week**	**: 03**
Class & Major	**: I B.Sc., Chemistry**	**Total Hour**	**: 39**

Objectives:

To enable the students

- Gain Practical Knowledge of Using Apparatus.
- Analysis the Concentration and Mass of the Given Compound.

Learning Outcomes:

On completion of this course, the students will be able to

- Understand the Practical Knowledge of Titrimetric Analysis.
- Gain the Knowledge of Acid-Base Titrations.
- Understand the Oxidation-Reduction Reactions.

(A) Titrimetric Analysis

(i) Calibration and Use of Apparatus.
(ii) Preparation of Solutions of Different Molarity/Normality of Titrants.
(iii) Use of Primary and Secondary Standard Solutions.

(B) Acid-Base Titrations

(i) Estimation of Carbonate and Hydroxide Present Together in Mixture.
(ii) Estimation of Carbonate and Bicarbonate Present Together in a Mixture.
(iii) Estimation of Free Alkali Present in Different Soaps/Detergents.

(C) Oxidation-Reduction Titrimetry

(i) Estimation of Fe (II) and Oxalic Acid Using Standardized $KMnO_4$ Solution.
(ii) Estimation of Oxalic Acid and Sodium Oxalate in a Given Mixture.
(iii) Estimation of Fe (II) with $K_2Cr_2O_7$ Using Internal (Diphenylamine, Anthranilic acid) and External Indicator.

(D) Complexometric Titrations

(i) Estimation of Hardness of Water.
(ii) Estimation of Calcium EDTA Method.
(ii) Estimation of Zinc EDTA Method.

References Books

1. Mendham, J.A.I. (2009). *Vogel's Quantitative Chemical Analysis*. Pearson. (6th Ed.). London.
2. Svehala, G. and Sivasankar, I. B. (2012). *Vogel's Qualitative Inorganic Analysis*. Pearson. London.

ORGANIC CHEMISTRY-I

UCHM203

Semester	**: II**	**Credit**	**: 05**
Category	**: Core IV/DSC-IV**	**Hour/Week**	**: 05**
Class & Major	**: I B.Sc., Chemistry**	**Total Hour**	**: 65**

Objectives:

To Enable the Students

- Understand about the Concept of Organic Chemistry and Stereo chemistry.
- Know the Concepts of Saturated and Unsaturated Hydrocarbons
- Study the Aromaticity and its Mechanism**.**

Learning Outcomes:

On completion of this course, the students will be able to

- Know the Basics of Organic Molecules, Structure, Bonding, Reactivity and Reaction Mechanisms.
- Understand the Stereochemistry of Organic Molecules – Conformation and Configuration, Asymmetric Molecules and Nomenclature.
- Gain Knowledge in Alkanes and Cycloalkanes Compounds.
- Acquire about Elimination Reaction and its Mechanism.
- Familiar about Aromaticity of the Compounds.

UNIT-I BASICS OF ORGANIC CHEMISTRY **5 Hour**

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of Hybridization on Bond Properties. Electronic Displacements: Inductive, Electromeric, Resonance and Mesomeric Effects, Hyperconjugation and their Applications; Dipole Moment; Organic Acids and Bases; their Relative Strength. Homolytic and Heterolytic Fission with Suitable Examples. Curly Arrow Rules, Formal Charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, Shape and Relative Stabilities of Reaction Intermediates (Carbocations, Carbanions, Free radicals and Carbenes). Organic Reactions and their Mechanism: Addition, Elimination and Substitution Reactions.

UNIT-II STEREOCHEMISTRY **15 Hour**

Concept of asymmetry, Fischer Projection, Newman and Sawhorse projection formulae and their inter-conversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Diastereoisomers, meso structures, Racemic mixtures, Relative and absolute configuration: D/L and R/S designations.

UNIT-III CHEMISTRY OF SATURATED HYDROCARBONS **10 Hour**

Carbon-Carbon Sigma Bonds -Chemistry of Alkanes: Formation of Alkanes, Wurtz Reaction, Wurtz- Fittig Reactions, Free radical substitutions: Halogenation - Relative Reactivity and Selectivity. Cycloalkanes and Conformational Analysis Cycloalkanes and Stability, Baeyer Strain Theory, Conformation Analysis, Energy Diagrams of Cyclohexane: Chair, Boat and Twist Boat Forms.

UNIT-IV CHEMISTRY OF UNSATURATED HYDROCARBONS **13 Hour**

Formation of Alkenes and Alkynes by Elimination Reactions, Mechanism of E1, E2, E1cB Reactions. Saytzeff and Hofmann Eliminations. Reactions of Alkenes: Electrophilic Additions their Mechanisms (Markownikoff/ Anti-Markownikoff addition), Mechanism of Oxymercuration Demercuration, Hydroboration- Oxidation, Ozonolysis, Reduction (Catalytic and Chemical), Syn and Anti-Hydroxylation (Oxidation). 1, 2- and 1, 4- Addition Reactions

in Conjugated Dienes and, Diels- Alder reaction; Allylic and Benzylic Bromination and Mechanism, e.g. Propene, 1-Butene, Toluene, Ethyl Benzene. Reactions of Alkynes: Acidity, Electrophilic and Nucleophilic Additions.

UNIT-V AROMATIC HYDROCARBONS **12 Hour**

Aromaticity: Huckel's Rule, Aromatic Character of Arenes, Cyclic Carbocations/Carbanions and Heterocyclic Compounds with Suitable Examples. Electrophilic Aromatic Substitution: Halogenation, Nitration, Sulphonation and Friedel-Craft's Alkylation/Acylation with their Mechanism. Directing Effects of Substituent Groups.

Reference Books

- Morrison, R.N. & Boyd, R.N. (2002). *Organic Chemistry*. (6th Ed.). Prentice- Hall of India. India.
- Pine, S.H. (2007). *Organic Chemistry*. (5th Ed.). Mc Graw Hill. United States.
- Carey, F.A. (2008). *Organic Chemistry*. (7th Ed.). Tata McGraw Hill. United States.

Text Books

- Clayden, J. Greeves, N. Warren, S. (2012). *Organic Chemistry*. (2nd Ed.) Oxford University Press. United Kingdom.
- Carey, F. A. Sundberg, R. J. (2000). *Advanced Organic Chemistry. Part A: Structure and Mechanism.* Kluwer Academic Publisher. Amsterdam.

NUCLEAR & RADIATION CHEMISTRY

UCHM204

Semester	**: II**	**Credit**	**: 03**
Category	**: Core V/DSC-V**	**Hour/Week**	**: 03**
Class & Major	**: I B.Sc., Chemistry**	**Total Hour**	**: 39**

Objectives:

To enable the students

- Familiar about Nucleus and its Reactions.
- Understand the Radio Chemistry.
- Aware about the Pollution of Nuclear Reactions.

Learning Outcomes:

On completion of this course, the students will be able to

1. Understand the Nuclear Reactions Basic Concepts and its Classification.
2. Gain Knowledge about the Reactions Involved in Nucleus.
3. Know about the Radiations and its Process.
4. Acquires about the Nuclear Pollution.

UNIT-I NUCLEUS AND ITS CLASSIFICATION **8 Hour**

Nuclear Forces-Nuclear Stability-Binding Energy-Nuclear Models-Radioactive Decay-Radioactive Elements-General Characteristics of Radioactive Decay-Decay Kinetics-Decay Constant-Half Life-Mean Life Period-Units of Radioactivity-Transient and Secular Equilibria- Carbon Dating and its Usefulness.

UNIT-II NUCLEUS REACTIONS **8 Hour**

Bethe Notation-Types of Nuclear Reactions (n, p, α, d and γ)-Conservation of Quantities (Mass-Energy and Linear Momentum) in Nuclear Reactions-Reaction Cross-Section-Compound Nucleus Theory and Nuclear Reactions-Nuclear Fission-Process-Fragments-Mass Distribution and Fission Energy.

UNIT-III MEASUREMENT OF RADIOACTIVITY **9 Hour**

Idea about Accelerator and Detectors-Van de Graaff-Linear Accelerators-Synchrotrons-Geiger-Muller Detector-Scintillation Detectors-Type of Nuclear Reactions-Nuclear Fission-Nuclear Fusion-Nuclear Reactor-Classification of Reactors-Natural Uranium Reactor-Breeder Reactor- Nuclear Fusion-Stellar Energy.

UNIT-IV RADIATION CHEMISTRY **8 Hour**

Elementary Ideas of Radiation Chemistry-Radiolysis of Water and Aqueous Solutions-Unit of Radiation-Chemical Yield (G-Value)-Radiation Dosimetry (Fricke's Dosimeter)-Units of Radiation Energy (Rad, Gray, Roentgen, RBE, Rcm, Sievert). Interaction of Radiation with Matter-Radio Pharmaceutical Drugs.

UNIT-V NUCLEAR POLLUTION AND RADIOLOGY **6 Hour**

Radioactive Isotopes and their Applications-Isotopic Dilution Analysis-Neutron Activation Analysis-Disposal of Nuclear Waste- Nuclear Disaster and its Management-Nuclear Accidents and Holocaust.

Reference Books

- Choppin, G. R. (1994). *Radiochemistry and Nuclear Chemistry*. Elsevier. Amsterdam.
- Friedlander, G. Kennedy, J. W. Macias, E. S. Miller, J. M. (1981). *Nuclear and Radiochemistry.* John Wiley & Sons, Technology & Engineering. (3rd Ed.). United States.

Text Books

- Vértes**,** A. Nagy**,** S. Klencsár**,** Z. Lovas**,** R.G. Rösch**,** F. **(**2011). *Handbook of Nuclear Chemistry*. (1st Ed.). Springer. Germany.
- Grenier, J.J. (2020). *Handbook of Nuclear Chemistry*. Springer. (2nd Ed.). Germany.

ORGANIC PRACTICAL-I

UCHR206

Semester	**: II**	**Credit**	**: 02**
Category	**: Core Practical-II/ DSC Practical -II**	**Hour/Week**	**: 03**
Class & Major	**: I -B.Sc., Chemistry**	**Total Hour**	**: 39**

Objectives:

To enable the students

- Acquire Skills to Handle the Instruments.
- Analyse the Techniques involved in the Chromatography.

Learning Outcomes:

On completion of this course, the students will be able to

- **C**hecking the Calibration of the Thermometer.
- Know the Purification of Organic Compounds by Crystallization Using Solvents.
- Determine the Melting Points of Given Organic Compounds and Unknown Organic Compounds.
- Acquire the Knowledge of Chromatography Techniques to Separate the Mixture of Amino acids, Sugars and Other Organic Compounds.

1. Checking the Calibration of the Thermometer.
2. Purification of Organic Compounds by Crystallization Using the Following Solvents:
   a. Water b. Alcohol c. Alcohol-Water.

3. Determination of the Melting Points of Given Organic Compounds and Unknown Organic Compounds (Using Kjeldahl Method and Electrically Heated Melting Point Apparatus).
4. Effect of Impurities on the Melting Point – Mixed Melting Point of Two Unknown Organic Compounds.
5. Determination of Boiling Point of Liquid Compounds. (Boiling Point Lower Than and More Than 100 °C by Distillation and Capillary Method).
6. **Chromatography**
   a. Separation of a Mixture of Two Amino Acids by Ascending and Horizontal Paper Chromatography.
   b. Separation of a Mixture of Two Sugars by Ascending Paper Chromatography.
   c. Separation of a Mixture of o-and p-nitrophenol or o-and p-aminophenol by Thin Layer Chromatography (TLC).

Reference Books

1. Mann, F.G. & Saunders, B.C. (2009). *Practical Organic Chemistry*, Pearson Education. London.
2. Furniss, B.S. Hannaford, A.J. Smith, P.W.G. Tatchell, A.R. (2012). *Practical Organic Chemistry*. (5th Ed.). Pearson. London.

CHEMISTRY FOR BIOCHEMIST

UCHA103

Semester : I **Credit : 02**
Category : Allied **Hour/ Week : 03**
Class & Major: I B.Sc., Biochemistry **Total Hour : 39**

Objectives:

To enable the students

- Acquire the Basic Concepts in Structure and Bonding in the Molecular Structure.
- Interpolate the Concepts in Co-ordination Chemistry and Stereochemistry.
- Validate the Thermodynamic Derivations and Biomolecular Properties.

Learning Outcomes:

On completion of this course, the students will be able to

- Understand the Concept of Chemical Bonding.
- Chemistry involved in Co-ordination Compounds.
- Gain Knowledge Regarding Reaction Involved in Electrochemistry and Solutions.
- Acquire the Role of Biomolecules.

UNIT-I CHEMICAL BONDING **6 Hour**

Types of Bonds-Ionic, Covalent, Co-ordinate Bond and Metallic Bond. Hydrogen Bond, Vander Walls Interaction. VSEPR Theory- Shapes of H_2O, NH_3.

UNIT-II CO-ORDINATION CHEMISTRY **6 Hour**

Nomenclature of Co-ordination Compounds-Werner Theory –Chelation –Functions and Structure of Haemoglobin and Chlorophyll. Stereo Isomerism- Elements of Symmetry, Optical Activity- Isomerism of Lactic Acid and Tartaric Acid. Racemisation, Resolution, Geometrical Isomerism of Maleic Acid and Fumaric Acid.

UNIT-III KINETICS AND ELECTRO CHEMISTRY **9 Hour**

Chemical Kinetics- Order and Molecularity. First Order Rate Equation–Determination of Rate Constant of Hydrolysis of Ester. Catalysis- Catalyst- Auto Catalyst- Enzyme Catalyst – Promoters- Catalytic Poisoning- Active Center-Distinction Between Homogeneous and

Heterogeneous Catalysis-Industrial Application of Catalysts. Electro Chemistry-Specific and Equivalent Conductivity- their Determination Effect of Dilution of Conductance.

UNIT-IV SOLUTIONS **10 Hour**

Solutions: Solute-Solvent-Types of Solutions with One Example Each. - Strengths of Solutions- Calculation of Equivalent Weights- Normality, Molality, Molarity, Mole Fraction, Percentage by Weight & ppm. Preparation of Standard Solutions. First law of Thermodynamics- Concept of Internal Energy, Enthalpy. Thermochemistry- as Applied to Biochemical Reactions-Second law of Thermodynamics- Concept of Entropy, Free Energy, Criteria for Spontaneity**.** Water and its Effect on Biomolecules– Introduction-Water as Solvent- Proton Mobility-Ionic Product of Water-$_p$H scale-Buffering Against $_p$H Changes in Biological System- Henderson Equation – Biological Buffers.

UNIT –V BIOMOLECULES **8 Hour**

Polymer- Types of Polymerization- Addition and Condensation- Thermosetting and Thermoplastics- Rubber-Natural and Synthetic Fibers-Nylon-6 and 66, Polyesters, PE, PVC, Polyvinyl Acetate. Amino Acids- Classification and Sources of Amino Acids, Preparation and Properties of Glycine, Zwitter Ion Structure, Isoelectric Point.

Reference Books

- Malik, W.U. Tuli, G.D. and Madan, R.D. (2012). *Selected Topics in Inorganic Chemistry.* S.Chand Publications. (7th Ed.). India.
- Soni, P.L. (2011). *Text Book of Physical Chemistry.* Sultan Chand. (25th Revised Ed.). New Delhi.

Text Books

- Madan, R.D. (2012). *Modern Inorganic Chemistry.* S.Chand & Company Ltd. (5th Ed.). New Delhi.
- Puri, B.R. Sharma, L.R & Pathania, M.S. (2011). *Principles of Physical Chemistry.* Millennium Edition. Vishal Publishing & Co. Jalandhar. India.

ORGANIC ANALYSIS

UCHR104

Semester : I **Credit : 02**
Category : Allied Practical **Hour/ Week : 03**
Class &Major: I B.Sc., Biochemistry **Total Hour : 39**

Objectives:

To enable the students

- Identify the Analyzing Skills of Organic Functional Groups.
- Gain knowledge about confirmation test.

Organic Analysis

Reaction of the following functional group

Systematic Analysis of Organic Compound Containing One Functional Group & Characterization by Confirmatory Tests or Derivative.

1. Aldehyde (Aromatic).
2. Ketone (Aliphatic & Aromatic).
3. Carboxylic Acid (Mono & Di).
4. Carbohydrate (Reducing).
5. Phenol.
6. Aromatic Primary Amine.
7. Amide.
8. Diamide.

Reference Books

- Thomas, A.O. (2006). *Practical Chemistry.* Scientific Book Center. (2nd Ed.). Cannanore. Kerala.
- Venkateswaran, V. Veerasawamy, R. and Kulandaivelu, A.R. (2005). *Basic Principles of Practical Chemistry.* Chand S & Sons Publications. (2nd Ed.). New Delhi.

III & IV EVALUATION COMPONENTS OF CIA

Semester	Course Code	Course Title	Component III	Component IV
I	UCHM109	Inorganic Chemistry-I	Assignment	Seminar
	UCHM111	Analytical Chemistry	Assignment	Seminar
II	UCHM203	Organic Chemistry-I	Assignment	Seminar
	UCHM205	Nuclear & Radiation Chemistry	Assignment	Seminar

PROGRAMME PROFILE M.Sc., (Chemistry)

Programme Specific Outcomes (PSO)

Upon completion of the programme, the students will be able to

- Development of the Skills in Handling Various Chemicals, Apparatus and Instruments.
- Application of the Principles of Thermodynamics and Chemical Kinetics in Chemical Reactions
- Acquiring the Knowledge on Heterocyclic Compounds and Natural Products
- Ability to Apply the Basic Principles of Various Spectroscopic, Electro and Thermo Analytical Methods to Characterize the Compounds
- Industrial Insights on Polymers, Textile Dyes, Fiber and Medicinal Chemistry.

Semester	Category	Course Code	Course Title	Contact Hour/Week	Credits	
					Min	Max
I	Core-I/DSC-I	PCHM113	Organic Chemistry-I	5	4	4
	Core-II/DSC-II	PCHM114	Inorganic Chemistry-I	5	4	4
	Core-III/ DSC-III	PCHM115	Physical Chemistry-I	5	4	4
	Core-IV/DSC-IV	PCHM116	Analytical Chemistry	5	4	4
	Core Practical-I/ DSC Practical-I	PCHR203	Organic Practical	5	-	-
	Core Practical-1I/ DSC Practical-II	PCHR204	Inorganic Practical	5	-	-
			Total	**30**	**16**	**16**
II	Core-V/DSC-V	PCHM207	Organic Chemistry-II	5	4	4
	Core-VI/DSC-VI	PCHM208	Inorganic Chemistry-II	5	4	4
	Core-VII/DSC-VII	PCHM209	Physical Chemistry-II	5	4	4
	Core Practical-I/ DSC Practical-I	PCHR203	Organic Practical	5	5	5
	Core Practical-II/ DSC Practical-II	PCHR204	Inorganic Practical	5	5	5
	NME			5	4	4
	Service Learning	PCHX201	Vermicomposting	-	1	1
			Total	**30**	**27**	**27**
III	Core-VIII/DSC-VIII	PCHM301	Organic Chemistry-III	5	4	4
	Core-IX/DSC-IX	PCHM302	Inorganic Chemistry-III	4	4	4
	Core –X/DSC-X	PCHM303	Physical Chemistry-III	4	4	4
	AECC		Research Methodology	5	4	4
	Core-XI/GE	PCHI301	Sustainable Materials and Technologies	5	4	4
	Core Practical –III/ DSC Practical-III	PCHR401	Physical Chemistry Practical	5	-	-
	Core XVII/ DSC-XVII	PCHP401	Project	2	-	-
			Total	**30**	**20**	**20**
IV	Core-XIII/DSC-XIII	PCHM404	Organic Chemistry-IV	6	4	4
	Core-XIV/DSC-XIV	PCHM408	Inorganic Chemistry-IV	5	4	4
	Core-XV/DSC-XV	PCHM409	Physical Chemistry-IV	5	4	4
	Core-XVI/DSC-VI	PCHM411	Natural Products	5	4	4
	Core Practical –III/ DSC Practical	PCHR401	Physical Chemistry Practical	5	5	5
	Core XVII/ DSC-XVII	PCHP401	Project	4	6	6
			Total	**30**	**27**	**27**
			Grand Total	**120**	**90**	**90**

EXTRA CREDIT EARNING PROVISION

Semester	Category	Course Code	Course Title	Pervious Course Code	Hour per Week	Credits
						Min/Max
II	-	-	Online Course	-	-	-/2

ORGANIC CHEMISTRY-I

PCHM113

Semester : I **Credit : 04**
Category : Core I/DSC-I **Hour/Week : 05**
Class & Major : I M.Sc., Chemistry **Total Hour : 65**

Objectives:

To Enable the Students

- Learn Acidity and Basicity of Organic Acids and Bases.
- Understand the Aromaticity and its Importance in Organic Chemistry.
- Acquire the Knowledge of Elimination Reactions, its Synthetic Applications in Organic Chemistry and the Factors Affecting them.

Learning Outcomes:

On completion of the course, the students will be able to

- Understand Basics of Stereochemistry, Stereoisomers and Related Topics.
- Gain Knowledge about the Various Methods of Determining the Reaction Mechanisms.
- Acquire about the Various Types of Chemical Bonding and their Characteristics.

UNIT–I REACTION MECHANISM **12 Hour**

Factors Affecting the Strength of Acids and Bases – Bronsted and Lewis Concepts of Acids and Bases - Guidelines to Propose a Reasonable Reaction Mechanism – Energy Profile, Intermediate, Transition State – Kinetic and Thermodynamic Control – Hammond Postulate – Methods of Determining Reaction Mechanism – Kinetic Methods – Primary and Secondary Kinetic Isotopic Effect – Non Kinetic Methods – Isotope Labeling, Crossover Experiment, Trapping of Intermediates, Stereochemical Studies.

UNIT–II STEREOCHEMISTRY I **15 Hour**

Concepts of Chirality – Recognition of Symmetry Elements – Necessary and Sufficient Condition for Optical Activity – Chirality About a Center – Specification of Configuration by Cahn Ingold and Prelog Rule – Compounds with more than One Chiral Centre – Calculation of Number of Stereoisomers – Erthyro and Threo Nomenclature – Inter-Conversion of Sawhorse, Fisher and Newman Projections - The Concept of Prochirality – Topocity – Prostereoisomerism – Equivalent, Enantiotopic, Diastereotopic Ligands – Atropisomerism – Concept of Axial Chirality – R and S Nomenclature for Axially Chiral Molecules. Geometrical Isomerism – E and Z Nomenclature – Determination of Configuration of Geometrical Isomers by Physical and Chemical Methods.

UNIT–III ALIPHATIC SUBSTITUTION REACTIONS **12 Hour**

Distinction between Nucleophile and a Base –SN1 and SN2 Mechanisms – Kinetic and Stereochemical Features – Ion Pair Mechanism – Effects of Substrate Structure, Nature of Nucleophile, Solvent Polarity, Leaving Group Ability on the Course of the Reactions – SNi Reaction – Neighbouring Group Participation – Allylic and Vinylic Substitution. Mechanism of Aliphatic Electrophilic Substitution Reactions – SE1, SE2 and SEi Mechanisms.

UNIT–IV AROMATIC SUBSTITUTION REACTIONS 15 Hour

The concept of Aromaticity – Huckel's Rule and Identifying Aromaticity in Various Carbocyclic and Charged Species – Nonaromatic and Antiaromatic Systems – Effects of Aromaticity on Bond Length and Resonance Energies – Ring Current Effects – Chemistry of Fullerenes, Annulenes and Heteroannulenes. Mechanism of Aromatic Electrophilic Substitution Reactions – Pi and Sigma Complexes – Nitration, Halogenation, Sulfonation, Friedel Crafts Alkylation and Acylation Reactions, Reimer Tiemann Reaction – Orientation and Reactivity - Partial Rate Factors.-Aromatic Nucleophilic Substitution Reactions – SNAr, SN1 and Benzyne Mechanisms – Chichibabin Reaction - Linear Free Energy Relationship – Hammett Equation – Significance of sigma and Rho – Taft Equation.

UNIT–V ELIMINATION AND ADDITION REACTIONS 11 Hour

E1, E2 and E1CB Mechanisms - Structure and Solvent Effects - Orientation of Double Bonds – Regio and Stereoselectivities – Cis-Elimination Reactions – Competition Between Elimination and Substitution. Regio and Stereochemistry of Addition of Halogens and Halogeno Acids to Carbon Carbon Multiple Bonds – Hydroboration – Addition to Carbonyl Bond – Aldol, Perkin, Stobbe, Dieckmann Condensations, Reformatsky, Grignard, Mannich Reactions – Michael Addition – Formation and Applications of Enamines – Stork Enamine Reaction – Mechanisms of Ester Hydrolysis.

Reference Books

- March, J. (2007). *Advanced Organic Chemistry.* John Wiley. (6th Ed.). New York.
- Sykes, P.A. (2003). Guide book to *Mechanisms in Organic Chemistry.* Longmans Scientific and Technical. (6th Ed.). Essex.

Text Books

- Morrison and Boyd, R.T. (2010). *Organic Chemistry.* Prentice Hall of India. (6th Ed.). New Delhi.
- Eliel, E.L. (2001). *Stereochemistry of Carbon Compounds*. McGraw Hill. United States.
- Nasipuri, D. (2020). *Stereochemistry of Organic Compounds.* New Age International. (4th Ed.). New Delhi.

INORGANIC CHEMISTRY-I

PCHM114

Semester	**: I**	**Credit**	**: 04**
Category	**: Core II/DSC-II**	**Hour/Week**	**: 05**
Class & Major	**: I M.Sc., Chemistry**	**Total Hour**	**: 65**

Objectives:

To Enable the Students

- Learn the Solid State Chemistry.
- Understand Crystal Structure.
- Acquire the Basic Concept of Covalent Bond.

Learning Outcomes:

On Completion of the Course, the Student will be Able to

- Understand the Principles and Theories of Solid State Chemistry, Diffraction Methods, Bonding Nature and Inorganic Ring Systems.
- Understand the Different Approaches to Types of Chemical Bonding.
- Knowledge of Electronic Concepts of Structure of the Molecules.
- Understand the Nature and Effects of Metallic Bonding.
- Acquires Crystal Structures and Principles of Diffraction Methods.

UNIT–I SOLID STATE STRUCTURE **12 Hour**

Close Packing of Atoms and Ions – HCP and BCC Types of Packing – Voids, Radius Ratio Derivation and its Influence on Structures. Representative Structures of AB and AB2 Types of Compounds: Rock Salt, Calcium Chloride, Wurtzite, Zinc Blende, Rutile, Fluorite, Antifluorite, Cadmium Iodide and Nickel Arsenide. Structure of Graphite, Diamond and Spinels - Normal and Inverse Types -Perovskite Structures.

UNIT – II: CRYSTAL STRUCTURE **11 Hour**

Crystallographic Point Groups – Space Groups – Screw Axis and Glide Plane – Seven Crystal Systems and Bravais Lattice –Miller Indices- Interplanar Distances in Orthogonal Crystal Systems – X-ray Diffraction Studies – Powder and Rotating Crystal Methods – Systematic Absences and Lattice Types – Data Analysis for Cubic System – Electron Diffraction by Gases – Principles and Measurements – Determination of Structures – Comparison Between Electron, Neutron and X-Ray Diffractions.

UNIT–III COVALENT BONDING **15 Hour**

VB Approach to Bonding -Concept of Hybridisation and Structure of Molecules. VSEPR Theory - Shapes of Molecules. MO Approach to Covalent Bonding – Symmetry and Overlap of Atomic Orbitals – Symmetry of Molecular Orbitals – Sigma, Pi and Delta Bondings – Energy Levels in Homo and Hetero Nuclear Diatomic Systems – Bond Length, Bond Order and Bond Energy – Ionic Character in a Covalent Bond. The Concept of Multicentre Bonding. Structure and Bonding in Fluorine and Oxygen Compounds of Xenon, Di- and Tri-Nuclear Clusters of Rhenium Halides, Diborane and Tetraborane.

UNIT–IV METALLIC BONDING **15 Hour**

Drude Lorentz Model Merits and Demerits – Sommerfeld Model – Band Theory – Formation of Brillouin Zones – Conductors and Insulators – Semiconductors - Hall Effect – Photoconductivity - Superconductors, Point-, Line- and Plane Defects in Solids – Stoichiometric and Non-Stoichiometic Defects – Frenkel and Schottky Defects.Effect of Imperfections on Physical Properties Like Electrical Conductivity, Thermal, Optical and Magnetic Phenomena.

UNIT–V POLYMERIC INORGANIC COMPOUNDS **12 Hour**

Isopoly and Heteropoly Acids – Structure and Bonding of 6- and 12 – Isopoly and Heteropoly Anions. Structure of Silicates - Applications of Pauling's Rule of Electrovalence –One-, Two- and Three- Dimensional Silicates Synthesis and Structure of Ring and Cage Compounds–Borazine, Phosphazine, Carboranes and Sulfur-Nitrogen Compounds.

Reference Books

- Cotton, F.A. and Wilkinson, G. (2007). *A Text Book of Advanced Inorganic Chemistry*. Wiley. (6th Ed.). United States.
- Figgis, B.N. and Hitchman, M.A. (2010). *Ligand Field Theory and its Applications.* Wiley. United States.
- Wells, A.F. (1984). *Structural Inorganic Chemistry*. Oxford University Press. (5th Ed.). Oxford.
- Huheey, J. Keiter, E.A. Keiter, R.L. (1997). *Inorganic Chemistry: Principles of Structure and Reactivity*. (4th Ed.). Harper Collins, New York.

Text Books

- Jordan, R.B. (2007). *Reaction Mechanism of inorganic and Organometallic Systems*, (3rd Ed.). Oxford University Press.
- Douglas, B. Me Daniel, D.H. and Alexander, J.J. (2001). *Concepts and Models of Inorganic Chemistry*. John Wiley and Sons. New Delhi.
- Manku, G.S. (1994). *Theoretical Principles of Inorganic Chemistry*. Tata McGraw Hill Publishing Company Ltd. New Delhi.
- Chakrabarthy, D.K. (2005). *Solid State Chemistry*. New Age International Publishers. New Delhi.

PHYSICAL CHEMISTRY-I

PCHM115

Semester	**: I**	**Credit**	**: 04**
Category	**: Core III/DSC-III**	**Hour/Week**	**: 05**
Class & Major	**: I M.Sc., Chemistry**	**Total Hour**	**: 65**

Objectives:

To Enable the Students

- Acquire the Knowledge About the Essential Concepts of Physical Chemistry.
- Analyze the Quantum Mechanics.
- Knowledge of Principle of Group Theory and Application.

Learning Outcomes:

On Completion of the Course, the Student will be Able to

- Recall Basic Mathematical Concepts and Learn to Apply to Quantum Mechanics and Group Theory.
- Classify the Pre-Quantum Limitations and Need for the Quantum Mechanical Approaches.
- Illustrate Principles of Quantum Mechanics of Simple Systems.
- Apply Quantum Mechanical Treatment of Multi-Electron Systems.
- Apply Principles Governing Group Theory Through Construction of Character Tables.
- Analyze Symmetry and Chemical Bonding of Chemical Systems Through Group Theory.

UNIT–I BASIC MATHEMATICS AND FUNDAMENTALS OF QUANTUM CHEMISTRY **15 Hour**

Basic Mathematics-Exponential Functions, Vectors, Matrices, Determinants, Differentiation, Integration and Differential Equations. Operators, Algebra of Operators, Linear Operators, Setting up Operators of Linear Momentum, Angular Momentum, Kinetic

Energy and Total Energy of Systems-Writing the Hamiltonian for H and He Atoms-Eigen Functions and Eigen Values, Proving that Linear Momentum and Angular Momentum Operators are Linear, Hermitian Operator and its Properties, Commutator Theorem and its Converse, Expansion Theorem.

UNIT–II QUANTUM MECHANICS OF SIMPLE SYSTEMS 15 Hour

Introduction to Quantum Mechanics - Postulates of Quantum Mechanics-Black Body Radiation, Photoelectric Effect, De Broglie Equation and its Verification, Interpretation of Bohr's First Postulate in Terms of Wave Nature of Electron, Heisenberg Uncertainty Principle; Setting up the Schrödinger Equation,- Particles in 1D and 3D Boxes, Harmonic Oscillator, Rigid Rotator, Hydrogen Atom-Approximation Methods - Perturbation Theory (First Order and Non-Degenerate), the Variation Method, Linear Variation Principle, Helium - Hartree-Fock Self-Consistent Field Method .

UNIT–III APPLICATIONS OF QUANTUM CHEMISTRY 12 Hour

Chemical Bonding- VB & MO Theory as Applied to H^{2+}, Conjugated Hydrocarbons and Aromatic Hydrocarbons, Huckel MO Theory - Molecular Spectroscopy and Quantum Mechanics- Born Oppenheimer Approximation, Schrodinger Equation for Rotational, Vibrational and Electronic Components and their Selection Rules.

UNIT–IV PRINCIPLES OF GROUP THEORY 12 Hour

Introduction - Groups, Subgroups, Classes, Group Multiplication Table; Molecular Symmetry, Symmetry Elements and Operations–Products of Symmetry Operations; Classes Of Symmetry Operations and Point Group Classification of Molecules. Representations of Groups: Matrix Representation of Symmetry Operations, Reducible and Irreducible Representations; Statement of Great Orthogonality Theorem; Character Tables and their Construction.

UNIT–V: APPLICATIONS OF GROUP THEORY 11 Hour

Symmetry and Chemical Bonding: Formulating SALC's with Projection Operators, Formation of Hybrid Orbitals in Molecules Like BF_3, $[PtCl_4]^{2-}$ and CH_4, Molecular Orbital Theory for C2v (H_2O or NO^{2-}) and Td Compounds - Selection Rules for Electronic Transitions in Carbonyl Chromophore.

Reference Books

- McQuarrie, Donald A. (2003). *Quantum Chemistry.* Viva Books Private Limited. Chennai.
- Prasad, R.K. (1997). *Quantum Chemistry through Problems and Solutions.* New Age International Publishers. India.

Text Books

- Prasad, R.K. (2020). *Quantum Chemistry*. New Age. United States.
- Cotton, F.A. (2020). *Chemical Applications of Group Theory*. Wiley Eastern Ltd. United States.
- Ramakrishnan, V. and Gopinathan, M.S. (2013). *Group Theory in Chemistry*. Vishal Publications. India.
- Raman, K.V. (2004). *Group Theory and its Applications to Chemistry*. Tata McGraw-Hill. United States.

ANALYTICAL CHEMISTRY
PCHM116

Semester	**: I**	**Credit**	**: 04**
Category	**: Core IV/DSC-IV**	**Hour/Week**	**: 05**
Class & Major	**: I M.Sc., Chemistry**	**Total Hour**	**: 65**

Objectives:

To enable the students

- Understand the Basic Concepts of Analytical Process.
- Know About Instrument Analysis
- Various Techniques that are Involved in the Analytical Chemistry.

Learning Outcomes:

On completion of this course, the students will be able to

- Understand the Error Analysis of the Experimental and Instrumentals Studies
- Acquire the Skill to Determine the Functional Groups Present in Unknown Molecules Using IR and UV-Visible Spectra.
- Introduce Basic Analytical Techniques and Practical Aspects of Classical Chemical Separation by Chromatography and Mass Spectroscopy Analysis.
- Get Knowledge About Various Electrochemical Phenomena.
- Understand the Morphological Observations of the Materials and their Applications

UNIT–I ERRORS IN CHEMICAL ANALYSIS **12 Hour**

Systematic and Random Errors- Distribution of Experimental Results. Statistical Treatment- Standard Deviation, Variance, Confidence Limits, Application of Statistics to Data Treatment and Evaluation, Student-T and F Tests, Detection of Gross Errors, Rejection of A Result-Q Test, Estimation of Detection Limits. Least Square Method, Correlation Coefficient and its Determination.

UNIT–II SPECTRAL AND THERMAL TECHNIQUES **15 Hour**

Instrumentation of UV-Vis, AAS, AES and Spectrofluorimetry. Types of Optical Instruments, Components of Optical Instruments-Sources, Monochromators, Detectors-Sample Preparations- Applications in Quantitative Analyses. IR Spectrometry: Instrumentation Designs-Various Types of Sources, Monochromators, Sample Cell Considerations, Different Methods of Sample Preparations, FTIR Instruments Principles, Instrumentation and applications of Thermogravimetry Analtsis (TGA), Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC).

UNIT–III CHROMATOGRAPHIC TECHNIQUES AND MASS SPECTROMETRY **12 Hour**

Principles of Chromatography: TLC, Column. Principles and Instrumentation of HPLC, GC, GC-MS Mass Spectrometry: Basic Principles – Molecular Ion Peak – Parent Peak – Fragments –Meta Stable Ion – Isotope Peaks – Determination of Molecular Weight and Molecular Formula – Fragmentation Pattern of Simple Organic Molecules – Mclafferty Rearrangement – Retro Diels Alder Reaction.

UNIT–IV ELECTROANALYTICAL TECHNIQUES **15 Hour**

Instrumentation - Different Types of Electrodes - Two Electrode and Three Electrode Cell Setup, Importance of Supporting Electrolyte, Mass Transport Processes - General Classification of Electro Analytical Techniques. Potentiometry - Ion Selective Electrodes and Measurement of Open Circuit Potential. Coulometry- Controlled Potential Coulometry, Constant Current Coulometry, Determination of Number of Transferred Electrons and Methods for Determination of the Thickness of Electrodeposits. Voltammetry Techniques – Polarography - Cyclic Voltammetry – Pulse Techniques (Normal Pulse,

Differential Pulse and Square Wave)-Stripping Voltammetry: Anodic, Cathodic and Adsorptive. Chronopotentiometry and Chronoamperometry.

UNIT–V INSTRUMENTATION ANALYSIS **11 Hour**

Principle, Instrumentation and Applications of PES (UPS and XPS), Aüger Electron Spectroscopy, Electron Microscopy (SEM and TEM), EDAX and SPM (STM and AFM).

Reference Books

- Ewing, G.W. (2019). *Instrumental Methods of Chemical Analysis*. McGraw Hill Pub. United States.
- Fritz, J.S. Gjerde, D.T. and Phlandt, C. (2009). *Ion Chromatography*. Huthing. Heidelberg.
- Paterson, R. (1970). *An Introduction to Ion Exchange*. Heydon – Sadtler. London.
- Knox, J.H. (1982). *High Performance Liquid Chromatography*. Edinburgh University Press. Edinburgh.

Text Books

- Williams, D.H. and Fleming, I. (2011). *Spectroscopic Methods in Organic Chemistry*. McGraw Hill. (6th Ed.). New York.
- Pavia, D.L. Lampman, G.M. and Kriz, G.S. (2001). *Introduction to Spectroscopy*. Brooks/Cole Publication. (3rd Ed.). Singapore.
- Fletcher, D. (1990). *Industrial Electrochemistry*. Chapman and Hall. London.
- Bockris, J. and Reddy, A.K.M. (2002). *Modern Electrochemistry*. Volume II. Mac Donold. London.
- Willard, Merit Dean and Settle. (2004). *Instrumental Methods of Analysis*. CBS Publishers and Distributors. (7th Ed.).

ORGANIC PRACTICAL

PCHR203

Semester : I & II **Credit : 05**
Category : Core Practical-I/DSC Practical-I **Hour/Week : 05**
Class & Major : I M.Sc., Chemistry **Total Hour : 65**

Objectives:

To enable the students

- Acquire the Skills in the Estimation & Preparation of Organic Compounds.
- Analyze the Various Isolation Techniques.

Learning Outcomes:

On completion of this course, the students will be able to

- Understand the Extraction Process.
- Acquire Skill about Estimation of Organic Compounds.
- Analyse the Qualitative Process of Mixture of Compounds.

I. Extraction

1. Isolation of Lactose from Milk(Demo)
2. Isolation of Caffeine from Tea Dust (Demo)
3. Isolation of Citric Acid from Lemon.

II. Qualitative Analysis

Identification of Components in a Two Component Mixture and Preparation of the Derivative.

III. Functional group inter conversion

a) Single stage

1. Hydrolysis.
2. Oxidation.
3. Reduction.
4. Nitration.
5. Acetylation

b) Double stage

1. Hydrolysis
2. Nitration

IV. Estimation

1. Estimation of Phenol.
2. Estimation of Aniline.
3. Estimation of Glucose.
4. Estimation of Ketone.
5. Estimation of Iodine, Saponification & Acetyl Value of Oil. (Demo)

V. Chromatographic Separations (demo)

1. Column Chromatography- Separation of Anthracene and Picric acid from Anthracenepicrate.
2. TLC Separation of Green Leaf Pigments

VI. Determination of Physical Constants (Melting Point)

Note: Two Sets of Questions can be Given for End Semester Examination as the following Lot System

1. Qualitative Analysis and Preparation.
2. Estimation and Preparation.

Text Books

- Gnanapragasam, N.S and Ramamoorthi, G. (2008). *Organic Chemistry Lab Manual*.Viswanathan Printers & Publishers Pvt. Ltd., India.
- Glasstone, S. (2010). *Statistical Thermodynamics.* Affiliated East West Press. NewDelhi.

Reference Books

- Thomas, A.O. (2005). P*ractical Chemistry,* Scientific Book Center, Cannanore, Kerala.
- Vogel's . (2009). *Text Book of Practical Organic Chemistry.* Longman. London.

INORGANIC PRACTICAL

PCHR204

Semester : I & II **Credit : 05**
Category : Core Practical-I/DSC Practical-I **Hour/Week : 05**
Class & Major : I M.Sc., Chemistry **Total Hour : 65**

Objectives

To enable the students

- Formulate the Preparation of Inorganic Complexes.
- Develop the Skills to Separate and Analyze the Inorganic Compounds.
- Analyze the Metal or Ions Present in the Compound or Substance by Volumetrically or Gravimetrically.

Learning Outcomes:

On completion of this course, the students will be able to

- Qualitative Analysis of Mixture Containing two Common and two Rare Cations.
- Understand the Concept of Preparation of Inorganic Complex.
- Learn the Estimation of Metal Ions by Volumetric and Gravimetrical Analysis.
- Acquire the Knowledge of Spectrophotometer.

I. Semi Micro Qualitative Analysis of Mixture Containing Two Common and Two Rare Cations.

The following are the Rare Cations to be Included. W, Ti, Mo, Te, Se, U,Th, Ce, Zr, V,Li, & Be.

II. Preparation of the following Complexes:

1. Potassium Tris (Oxalato) Chromate (III)
2. Bis (Acetyl Acetanato) Copper (II)
3. SodiumBis (Thiosulphato) Cuprate (II)
4. Tris (thiourea) Copper(I) Chloride

III. Estimation of metal ions by Volumetric and Gravimetrical analysis.

1. Estimation of Copper and Sulphate ion.
2. Estimation of Manganese and Nickel
3. Estimation of Copper and Zinc.
4. Estimation of Calcium and Magnesium.

IV. Spectro photometry (only for demonstration)

1. Estimation of Iron.
2. Estimation of Nickel.
3. Estimation of Copper.
4. Estimation of Manganese.

Note: Two sets of Questions can be Given for End Semester Examination as the FollowingLot System

1. Semi Micro Qualitative Analysis and Preparation.
2. Estimation of Metals by Volumetry & Gravimetry and Preparation.

Text Book

- Ramanujam, V. (2009). *Inorganic Semi Micro Qualitative Analysis.* The National Publishing Company. New Delhi.

Reference Books

- Thomas, A.O. (2005). *Practical Chemistry*. Scientific Book Center. Cannanore. (2nd Ed.). Kerala.
- Venkateswaran, V. Veerasawamy & Kulandaivelu, A. R. (2010). *Basic Principles of Practical Chemistry*. S. Chand & Sons publications. New Delhi.

ORGANIC CHEMISTRY-II

PCHM207

Semester	**: II**	**Credit**	**: 04**
Category	**: Core V/DSC-V**	**Hour/Week**	**: 05**
Class & Major	**: I M.Sc., Chemistry**	**Total Hour**	**: 65**

Objectives:

To enable the students

- Understand the Basic Concepts of Stereochemistry
- Know about Types of Reaction
- Various Type of Rearrangement.

Learning Outcomes:

On completion of this course, the students will be able to

- Inculcate the Basic Knowledge of Conformational Isomers and Various Inter/Intra Molecular Interactions and their Relative Stabilities.
- Teach the Role of the Conformation, Inter/Intramolecular Interactions in Directing the Various Mechanisms of Reactions in Acylic and Cyclic Systems.
- Introduce and Explain in Detail the Types of Reactions and the Reagents Employed in the Reactions.
- Teach Situations Wherein the Rearrangements are Taking Place. Also the Types of Various Rearrangements are to be Discussed in Detail with Mechanism.
- Inculcate the Basic Knowledge of Synthons and Other Terminology Used in Organic Synthesis.

UNIT–I CONFORMATIONAL ANALYSIS 15 Hour

Restricted Rotation in C-C Bonds – Conformation of N-Butane – Conformational Isomers –Conformational Free Energy – Population of Conformers – Influence of Dipole Dipole Repulsion, Van Der Walls Forces – Intramolecular Hydrogen Bonding on the Stability of Conformers. Cyclohexanes – Stability and Isomerism in Mono and Di Substituted Cyclohexanes – Flexible Forms – A1,2 Strain and A1,3 Strain – Conformation of Cyclohexanone and 2-Halocyclohexanones – Alkyl Ketone Effects – Anomeric Effect. Conformation of Decalin, Perhydrophenanthrene and Perhydroanthracene.

UNIT–II STEREOCHEMISTRY II 11 Hour

Conformation and Reactivity in Acylic Systems – Steric and Steroelectronic Effects – Cis-Elimination, Streospecific and Streoselective Reaction-E2 Elimination, Intramolecular Rearrangements – Neighbouring Group Participation. Cyclohexyl Systems - Esterification – Oxidation - Substitution Reaction - E2 Elimination - Intramolecular Rearrangements – Neighbouring Group Participation – Formation and Cleavage of Epoxide. Reactivity in Decalyl Systems- Reactions of Enols and Enolates.

UNIT–III REAGENTS IN ORGANIC SYNTHESIS 15 Hour

Use of the Following Reagents in Organic Synthesis and Functional Group Transformations: Complex Metal Hydrides, Gilmans Reagent, Lithium Diisopropylamide, Dicyclohexylcarbodiimide, Trimethylsilyl Iodide, Tri-N-Butyltin Hydride, Osmium Tetroxide, DDQ, Wilkinsons Catalyst and Bakers Yeast. Woodward Prevost Hydroxylation, Peterson Synthesis, Collins Reagent, Samarium Iodide, Raney Ni, Sharp Less Asymmetric Epoxidation – 1,3-Dithiane.

UNIT–IV MOLECULAR REARRANGEMENTS 11 Hour

Migratory Aptitudes – Nucleophilic, Electrophilic and Free Radical Rearrangements, Intermolecular and Intramolecular Rearrangements – Wagner Meerwein,

Pinacol-Pinacolone, Benzil-Benzilic Acid, Schimidt, Hoffmann, Lossen, Curtius, Fries, Beckmann, Faavorski, Stevens, Neber Rearrangements

UNIT–V RETRO SYNTHESIS **13 Hour**

Importance of Synthesis – Carbon-Carbon Bond Making Reactions – Functional Group Modifications – Reterosynthetic Analysis – Synthons and Synthetic Equivalents – Nucleophilic, Electrophilic, Electroneutral and Free Radical Synthons – Retron, Partial Retron and Super Retron - Chiron – Umpolung – Protection and Deprotection – Product, Chemo, Regio and Stereoselectivities. One and Two Group Disconnections – Diels Alder Reactions – Robinson Annulation Method – 1,2- 1,3- 1,4- 1,5- and 1,6-Difunctional Compounds.

Reference Books

- Eliel, E.L. Wilen, S. H. Mander, L.N. (2008). *Stereochemistry of Organic Compounds*. John Wiley and Sons. Inc. New Delhi.
- Ireland, R.E. (1969). *Organic Synthesis*. Prentice Hall. United States.

Text Books

- Turner, S. (1976). *Design of Organic Synthesis*. Elsevier. Amsterdam.
- Warren, S. (1978). *Designing Organic Synthesis – A Programmed Introduction to Synthon Approach.* Wiley. New York.

INORGANIC CHEMISTRY-II

PCHM208

Semester	**: II**	**Credit**	**: 04**
Category	**: Core VI/DSC-VI**	**Hour/Week**	**: 05**
Class & Major	**: I M.Sc., Chemistry**	**Total Hour**	**: 65**

Objectives:

To enable the students

- Understand the Basic Concepts of Coordination Compound.
- Acquire the Knowledge of Inorganic Reaction Mechanism.
- Various Metal that are Involved in the Bioinorganic Chemistry.

Learning Outcomes:

On completion of this course, the students will be able to

- Learn Crystal Field Theory and MO Theory of Coordination Compounds.
- Be Able to Recognize the Types of Isomers in Coordination Compounds.
- Learn the Structure and Bonding in Transition Metal Compounds with Ligands Commonly Encountered in Organometallic Chemistry.
- Understand the Structure, Reactivity and Applications of Acceptor Complexes.
- Understand the Role of Metal Ions in Hb, Mb, Enzymes, Vitamins and Other Biological Systems.

UNIT–I CHEMISTRY OF COORDINATION COMPOUNDS **11 Hour**

Werner's Coordination Theory-Isomerism in Coordination Compounds – Types of Ligands and Chelate Effect – Stability Constant Determination. VB Theory and CFT - Splitting of D-Orbitals Under Different Geometries – CFSE – Evidence for CFSE – Structure of Spinels – Factors Affecting CFSE – Spectrochemical Series – Jahn-Teller Distortion – M.O. Theory of Bonding – Sigma and Pi-Bonding in Coordination Compounds.

UNIT–II INORGANIC REACTION MECHANISMS **15 Hour**

Electron Transfer Reactions: Outer-Sphere and Inner Sphere Electron Transfer Reactions – the Marcus Theory – Non-Complementary Reactions – Synthesis of

Coordination Compounds by Electron Transfer Reactions. Substitution Reactions : Substitution Reactions of Square Planar Complexes of Pt(II) and Other D8 Metal Complexes – Significance of Trans-Effect – Substitution Reactions of Octahedral Complexes – Acid and Base Hydrolysis Reactions – Anation Reactions – Synthesis of Coordination Compounds by Substitution Reactions. Molecular Rearrangements and Reactions of Coordinated Ligands – The Template Effect and Macrocyclic Ligands.

UNIT–III ORGANOMETALLICS **14 Hour**

Metal Alkyl and Aryls – 18 Electron Rule – Olefin and Acetylene Complexes – Zeise's Salt – Dewar-Chatt Approach to Bonding in Ethylene and Acetylene Complexes – Cyclopentadiene, Benzene and Cyclobutadiene Complexes of Transition Metals – their Preparations, Bonding and Reactions. Homogeneous Catalysis Involving Organometallics: Oxidative Addition and Reductive Elimination Reactions – Hydrogenation, Isomerization and Hydroformylation of Olefins – Carbonylation of Methanol, Oxidation of Olefins (Wacker's Process) - Heterogeneous Catalysis – Ziegler-Natta Catalysis.

UNIT–IV π-ACCEPTOR COMPLEXES **10 Hour**

Synthesis, Structure and Bonding of Mono Nuclear and Poly-Nuclear Carbonyls – Nitrosyl Complexes – Dinitrogen Complexes – Metal Carbonylato Complexes, Carbonyl Hidrides and Complex Metal Cyanides.

UNIT–V BIOINORGANIC CHEMISTRY **15 Hour**

Metalloporphyrins – Chlorophyll, Hemoglobin and Myoglobin – Structure and Function of Hemoglobin Cytochromes. Metalloenzymes, Enzyme Action Inhibition and Restoration – Carboxypeptidase-A and Carbonic Anhydrase – Vitamin B12 and B12 Coenzymes. Metalloproteins – Non-Heme Iron Proteins – Rubredoxin and Ferredoxin – Copper Proteins and their Classification – Nitrogenases, their Structure and Function. Metal Ions in Biology -–Sodium Ion Pump – Metal Poisons and Chelating Agents in Medicine.

Reference Books

- Cotton, F.A. and Wilkinson, G. (2007). *A Text Book of Advanced Inorganic Chemistry.* Wiley. (6th Ed.). United States.
- Cotton, F.A. (2008). *Chemical Applications of Group Theory*. Wiley. United States.
- Drago, R.S. (2012). *Physical Methods in Inorganic Chemistry*. Van Nostrand Reinhold. (2nd Ed.).
- Figgis, B.N. and Lewis, J. (1996). *The Magneto Chemistry of Complex Compounds in Modern Coordination Chemistry.* Lewis & Wilkins, Interscience, New York.
- Drago, Russell. S. (2016). *Physical Methods for Chemists.* East West Press Pvt. Ltd. (2nd Ed.).

Text Books

- Douglas, B. McDaniel, D.H. and Alexander, J.J. (2001). *Concepts and Models of Inorganic Chemistry*. John Wiley and Sons. New Delhi.
- Mabbs, F.E. and Machin, D.J. (2008). *Magnetism and Transition Metal Complexes.* Dover Publications. New York.
- Roberts, A.P. (2016). *Polyoxometalates: Properties, Structure and Synthesis*. Nova Science Publishers. New York.

PHYSICAL CHEMISTRY-II

PCHM209

Semester	**: II**	**Credit**	**: 04**
Category	**: Core VII/DSC-VII**	**Hour/Week**	**: 05**
Class & Major	**: I M.Sc., Chemistry**	**Total Hour**	**: 65**

Objectives:

To enable the students

- Basic Concept of Spectroscopy in Physical Chemistry.
- Know About Application of Spectroscopy
- Get Knowledge of Nuclear Magnetic Spectroscopy.

Learning Outcomes:

On completion of this course, the students will be able to

- Learn Origin and Principles of Microwave Spectroscopy and Infrared Spectroscopy and Apply to Simple Chemical Molecules.
- Understand Origin and Principles of Raman Spectroscopy, Electronic Spectroscopy and Fluorescence Spectroscopy.
- Gain Knowledge on the Origin and Principles of FT-NMR Spectroscopy.
- Critically Analyze the Origin of Various NMR Parameters and Principles of 2D-NMR Spectroscopy.
- Demonstrate the Origin and Principles of EPR/ESR Spectroscopy and their Applications to Organic Radicals and Paramagnetic Complexes.

UNIT–I ROTATIONAL AND VIBRATIONAL SPECTROSCOPY 14 Hour

Electromagnetic Radiation - Interaction of Electromagnetic Radiation with Molecules - Types of Molecular Spectroscopy - Factors Affecting Line width and Intensity - Signal to Noise Ratio and Resolving Power - Absorption and Emission Spectroscopy. Microwave Spectroscopy - Rotation of Molecules - Rotational Spectra of Rigid Rotator, Intensities of Rotational Lines, Effect of Isotopic Substitution - Rotational Spectrum of Non-Rigid Rotator - Linear & Symmetric Top Molecules - Stark Effect. Applications of Microwave Spectroscopy - Determination of Bond Length, Bond Angle Dipole Moment and Atomic Mass from Microwave Spectra. Infrared Spectroscopy: Vibrating Diatomic Molecule - Harmonic and Anharmonic Oscillators - Diatomic Vibrating Rotator - Vibrations of Polyatomic Molecules - Molecular Vibrations, Types Of Molecular Vibrations, Rotational Vibrational Spectra of Linear and Symmetric Top Molecules. Raman Spectroscopy- Classical and Quantum Theory of Raman Effect- Rotational Raman Spectra- Linear, Symmetric Top Molecules-Vibrational Raman Spectra- Raman Activity of Vibrations, Rule of Mutual Exclusion, Polarizability Ellipsoids- Rotational Fine Structures- Resonance Raman and Laser Raman Spectroscopy.

UNIT–II ELECTRONIC AND FLUORESCENCE SPECTROSCOPY 14 Hour

Electronic Spectra of Diatomic Molecules-the Born-Oppenheimer Approximation, Vibrational Coarse Structure: Progressions, Intensity of Vibrational-Electronic Spectra: Franck-Condon Principle, Dissociation Energy and Dissociation Products, Rotational Fine Structure of Electronic-Vibration Transitions, Fortrat Diagram-Pre-Dissociation. Fluorescence and Phosphorescence – Jablonski Diagram – Fluorescence Spectroscopy – FRET.

UNIT–III NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY-I 13 Hour

Nuclear Spin States and NMR Active Nuclei, Nuclear Magnetic Moments- Mechanism of Resonance Absorption- Population of Nuclear Spin States, Proton NMR- Interaction of Spin Magnetic Moment of a Proton with External Magnetic Moment,

Chemical Shift and Shielding. Nuclear Spins in a Magnetic Field - Zeeman Effect -Larmor Precession -Resonance Phenomenon -Bloch Equations -Spin - Lattice and Spin-Spin Relaxation Times -Nuclear Shielding and Chemical Shift -Spin-Spin Coupling – Basic Principles of FT NMR -inversion recovery and CPMG Sequenced for T1 and T2 Measurements.

UNIT–IV NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY-II 12 Hour

Analysis of Complex NMR Spectra -Chemical Equivalence, Chemical Environment, Spin-Spin Splitting, Coupling Constant, Geminal, Vicinal, Long-Range, Trans, Aromatic, Allylic Coupling, Factors Influencing Coupling Constant, Splitting of NMR signals- AB, AX and AMX Types -Overhauser Effect - NMR of Paramagnetic Compounds -Relaxation by Paramagnetic Ions in Solution - INDOR, CIDNP - 2 Dimensional NMR - Pulse Sequences - NMR in Solids -Magic Angle Spinning -Chemical Shift Anisotropy - NMR Imaging - MRI.

UNIT–V ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY 12 Hour

Electron Spin - Electronic Zeeman Effect – Presentation of the Spectrum-EPR Spectrum of Hydrogen Atom (First Order Treatment) - G Factors - Hyperfine Splitting: Nuclear Spin (I = 1/2, 1, 3/2, 5/2) Interaction with electron Spin - Hyperfine Coupling Constants - EPR Spectra of Organic Radicals (AA and AB type) - EPR Spectra of Heteronuclear Compounds - Mcconnell's Relation – Introduction to Multi-Electron Systems: Zero Field Splitting – Multi-Electron Systems-Kramer's Degeneracy - Applications of EPR Spectra for Inorganic Compounds - Anisotropy in the Hyperfine Coupling Constant - EPR Instrumentation.

Reference Books

- Kemp, W. (2019). *Organic Spectroscopy*. Macmillan Press Ltd. London.
- Russel, S.Drago. (2016). *Physical Methods for Chemists*. Affiliated East-West Press Pvt. Ltd. New Delhi.
- Robert, M.Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce. (2015). *Spectrometric Identification of Organic Compounds*. Wiley. (7th Ed.). USA.

Text Books

- Jag, Mohan. (2004). *Organic Spectroscopy, Principles and Applications*. Narosa Publishing House, Chennai.
- Aruldhas, G. (2001). *Molecular Structure and Spectroscopy*. Prentice-Hall of India Pvt. Ltd. New Delhi.
- Banwell, C.N. and McCash, E.M. (2013). *Fundamentals of Molecular Spectroscopy*. Tat McGraw-Hill Publishing Co. Ltd. (5th Ed.). New Delhi.

VERMICOMPOSTING

PCHX201

Semester : II **Credit :1**

Category : Service Learning **Total Hour :40**

Class &Major : I M.Sc., Chemistry

Target Group : Villagers in the Age Group of 20-50 years

Objectives:

To enable the students

- Create Awareness About Utilization of Natural Fertilisers to the Society.
- Implement Vermicomposting at a small scale.

Learning Outcomes:

On completion of this course, the students will be able to

- Understanding the role of Worm Farming in Modern Farming.
- Understanding the Potential of Vermicompost as an Alternative to Chemical Fertilizers.
- Role of Vermicultre in Maintaining the Health of Soil and Humans.
- Economic Importance of Vermiculture.
- Role of Vermicuture on Protecting the Environment and Managing the Waste.

UNIT – I INTRODUCTION **8 Hour**

Definition – Usage – Advantage of Over Artificial Fertilisers, Ingredients **Activity:** Spreading Awareness on Vermicomposting.

UNIT–II BIO-DEGRADABLE & NON BIODEGRADABLE **8 Hour**

Introduction, Organic Waste, Difference in Biodegradable & Non-Biodegradable Common Items Suitable for Biocomposting: Clean Paper, Dried Net, Egg Shell, Leaves Garden Trimming, Fruits & Vegetables Wastes, Coffee & Tea Extract. **Activity:** Separation & Collection of Biodegradable & Non-Biodegradable.

UNIT–III VERMI GROWTH **8 Hour**

Earthworm – Introduction-Nature of Soil Required – Easily Usable Waste – Factors Affecting Growth of the Vermi. **Activity:** Vermi Growth in Soil-Earthworm.

UNIT-IV VERMICOMPOSTING METHOD **8 Hour**

Grub Composting – Compost Tea – Humanure – Vermicompost – Bokashi Composting Common. **Activity:** Carrying out the Methods & Identifying the most Effective Method to beused.

UNIT–V FEEDBACK & RESULT FROM SOCIETY **8 Hour**

Evaluation of Results & Difference in Plant Growth with Vermicompost Oral & Written Feedback from Villagers. **Activity:** Measurement of Plant Growth Assessment of Utilization of Household Waste.

Reference Books

- Thompson, P.M. Das, S.A. K.C. (2005). *Bioresource Technology*. United Kingdom.
- Nancarrow, Loren and Janet Hogan Taylor. (2007). *The Worm Book.* Ten Speed Press. California.
- Logsdon, Gene. (2009). *Worldwide Progress in Vermicomposting* Biocycle. USA.

APPLIED CHEMISTRY
PCHE104

Semester : I **Credit : 4**
Category : Non-Major Elective **Hours/Week : 5**
Class & Major : I PG **Total Hours : 65**

Objectives:

To enable the students

- Provide Basic Knowledge in Chemistry involved in Daily Life.
- Recognizes the Uses of Food and Nutrition.
- Implications of Chemistry in Pharma Drugs and Fertilizers.

UNIT-I GENERAL SURVEY OF CHEMICALS USED IN EVERYDAY LIFE 13 Hour

General Survey of Chemicals used in Everyday Life. Cosmetics –Talcum Powder, Tooth Paste, Shampoo, Nail Polish, Perfumes, Soaps and Detergents, - General Formation and Preparation – Hazards of Cosmetic Use.

UNIT – II FOOD AND NUTRITION 13 Hour

Food and Nutrition – Carbohydrates, Proteins, Fats, Minerals and Vitamins – Definition, Sources and their Physiological Importance – Balanced Diet. Adulterants – in Milk, Ghee, Oil, Coffee Powder, Tea, Asafoetida, Chilli Powder, Pulses and Turmeric Powder – Identifications.

UNIT – III CHEMICALS IN FOOD PRODUCTION 13 Hour

Chemicals in Food Production – Fertilizers in Used in Natural Sources – Fertilizers – urea, NPK and Super Phosphates – Needs, Uses and Hazards.

UNIT- IV POLYMERS 13 Hour

Plastics, Polyethene, PVC, Bakelite, Poly Esters, Resins – Properties and Applications. Natural Rubber, Synthetic Rubber- Vulcanization – Definition and its Applications – Color Chemicals used in Food – Soft Drinks- and its Health Hazards.

UNIT – V DRUGS 13 Hour

Pharmaceutical Drugs – Analgesics and Antipyretics – Antibiotics – Definition, Examples and its Applications. Antiseptics – Disinfectants, Definition, Examples and Applications. Explosives – Classification and its Examples.

Text Books

- Sharma, B.K. (2006). *Industrial Chemistry*. Goel Publication. (1st Ed.). Meerut.
- Charabarthy, B.N. (2007). *Industrial Chemistry.* Oxford and IBH Publishing. (1st Ed.). New Delhi.

Reference Books

- Gowariker, V.P. Viswanathan, N.V. (2005). *Polymer Science*. Wiley Easter Pvt. Ltd. (1st Ed.). New Delhi.
- Ghosh, Jayashree. *Text Book of Pharmaceutical Chemistry.* S. Chand & Co. Ltd. (3rd Ed.). New Delhi.
- Krishnamoorthy, P. Vallinayagan. Jaya Subramanian, K. (2007). *Applied Chemistry*. Tata MaGraw-Hill Publishing Co. Ltd. (2nd Ed.). New Delhi.

III & IV EVALUATION COMPONENTS OF CIA

Semester	Course Code	Course Title	Component III	Component IV
I	PCHM113	Organic Chemistry-I	Mechanism writing	Seminar
	PCHM114	Inorganic Chemistry-I	Paper Presentation	Seminar
	PCHM115	Physical Chemistry-I	Problem solving	Seminar
	PCHM116	Analytical Chemistry	Assignment	Seminar
II	PCHM207	Organic Chemistry-II	Rearrangement writing	Seminar
	PCHM208	Inorganic Chemistry-II	Poster Presentation	Seminar
	PCHM209	Physical Chemistry-II	Assignment	Seminar