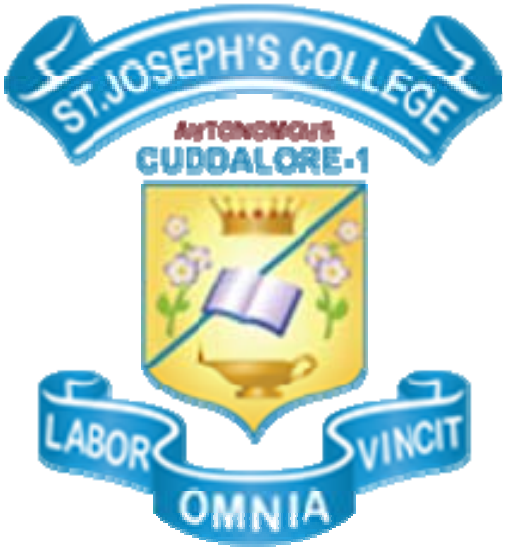
ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

CUDDALORE-1



PG & RESEARCH DEPARTMENT OF CHEMISTRY

PG - SYLLABUS 2019-2020

M.Sc. CHEMISTRY

CURRICULUM DESIGN TEMPLATE FROM 2019-2020

Semester	Code	Part	Course Title	Hours	Credit
I	19PCH11	III	Organic Chemistry-I	4	5
	19PCH12	III	Inorganic Chemistry-I	4	5
	19PCH13	III	Quantum Mechanics and Molecular Structure	4	5
	Elective-I			4	4
	EPCH704T	III	1. Bio-Inorganic And Supramolecular Chemistry		
	EPCH704A		2. Heterocyclics And Natural Products		
Total for Semester I				**16**	**19**
II	19PCH21	III	Organic Chemistry-II	4	5
	19PCH22	III	Inorganic Chemistry-II	4	5
	PCH807T	III	Group Theory and its Applications in Spectroscopy	4	5
	Elective-II			4	5
	19EPCH24	III	1. Reagents and Naming Reactions		
	EPCH808A		2. Nuclear and Radiochemistry		
	PCHP201	III	Practical – I: Organic Chemistry Practical-I	4	2
	PCHP202S	III	Practical – II: Inorganic Chemistry Practical-I	4	2
	19PCHP23	III	Practical – III: Physical Chemistry Practical-I	4	2
Total for Semester II				**28**	**26**

Semester	Code	Part	Course Title	Hours	Credit
III	19PCH31	III	Organic Chemistry-III	4	4
	19PCH32	III	Inorganic Chemistry –III	4	4
	PCH911S	III	Statistical Thermodynamics and its Applications	4	4
	ECHR901S	III	Human Rights	2	1
	Elective-III			4	4
	19EPCH34	III	1. Physical Methods In Organic Chemistry		
	EPCH912A		2. Bioorganic Chemistry		
	PCHP304T	III	Practical – IV: Organic Chemistry Practical -II	4	2
	19PCHP32	III	Practical – V: Inorganic Chemistry Practical –II	4	2
	PCHP306	III	Practical – VI: Physical Chemistry Practical –II	4	2

Total for Semester III				**30**	**23**
IV	19PCH41	III	Organic Chemistry –IV	4	4
	19PCH42	III	Inorganic Chemistry –IV	4	4
	21PCH43	III	Reaction kinetics, Electrode Kinetics, and Photochemistry	4	4
	JPCH1016	III	Project		9
	JPCH1017	III	Seminar & Paper Presentation		1
Total for Semester IV				**12**	**22**
Grand Total				**86**	**90**

I M.Sc (CH)	ORGANIC CHEMISTRY – I For the students admitted in the year 2019	19PCH11
SEMESTER – I		HRS/WK – 4
CORE – 1		CREDIT-5

Objective:

To appreciate the applications of stereochemistry. To learn various reactions and rearrangements involving reactive intermediates like carbocations, carbanions, free radicals, carbenes and nitrenes. To learn the applications of oxidation and reduction reactions in organic synthesis.

COURSE OUTCOMES (COs)

CO1: Understanding of the concepts involved in stereochemistry and the ability to solve the problems based on stereochemistry**.**

CO2: Understanding of the principles of reaction mechanism and the ability to arrive at reasonable mechanisms for organic reactions**.**

CO3: Knowledge of the reactive intermediates such as Benzynes, Free radicals, Carbenes and Nitrenes and the reactions involving these intermediates.

CO4: Knowledge of reactions involving Carbocations, Carbanions and the ability to apply it in organic synthesis.

CO5: A sound knowledge of Oxidising and reducing agents and the ability to apply them in Organic synthesis.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: 19PCH11					TITLE OF THE COURSE: ORGANIC CHEMISTRY – I								HOURS: 4	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	4	4	4	4	4	3	3	3	4	4	4	4	3.79	
CO2	4	4	4	4	4	4	3	3	3	4	4	4	4	3.79	
CO3	4	3	3	4	3	4	3	3	3	4	4	4	4	3.54	
CO4	3	3	4	4	3	4	3	3	3	4	4	4	4	3.54	
CO5	3	3	4	4	3	4	3	3	3	4	4	4	4	3.54	
Mean Overall Score														3.64	

Result: The Score of this Course is 3.64 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: STEREOCHEMISTRY -I [12 Hrs]

Basic principles of stereochemistry – Interconversion of Sawhorse, Newman,and Fischer projections. R, S notation of biphenyls, allenes,molecules with one and two asymmetric centers. Erythro and threo notations. Asymmetric synthesis. Geometrical isomerism, E, Z - nomenclature of olefins, Geometrical and optical isomerism of disubstituted cyclopropane, cyclobutane, and cyclopentane. Cram's rule and Felkin- Ahn Modification.Stereospecific andstereoselective reactions.

UNIT – II: PHYSICAL ORGANIC CHEMISTRY [12 Hrs]

Introductory physical organic chemistry: Acids and Bases, HSAB, the equilibrium constant, thermodynamic effect, kinetic effects – thermodynamic and kinetic control of organic reactions. Hammond postulate, Curtin – Hammett principle. Hammett equation – Application to organic reactions. Methods of determining reaction mechanism –Non-kinetic methods- Product analysis; Determination of the presence of intermediates-isolation, detection, trapping; cross-over experiments, isotopic labeling and isotope effects, stereochemical evidences. Kinetic methods - the relation of the rate with the mechanism of the reaction.

UNIT – III: REACTIVE INTERMEDIATES [12 Hrs]

Structure, reactivity, formation, stability,and reactions involving free radicals, benzynes, carbenes and nitrenes. Long and short-lived free radicals. Addition of free radicals to olefinic double bonds. Aromatic radical substitutions: Decomposition of diazocompounds, phenol – coupling, sandmeyer reaction, Gomberg reaction, Pschorr reaction, Ullmann reaction, Hunsdiecker reaction.

UNIT – IV: MOLECULAR REARRANGEMENTS [12 Hrs]

Structure, reactivity, formation, stability and the following rearrangements involving carbocations and carbanions: Wagner – Meerwein, Pinacol – Pinacolone, Tiffeneau-Demjanov, Beckmann, Dienone – phenol, Favorski, Wittig, Neber, Stevens and Sommelet-Houser rearrangements. Hofmann, Curtius, Lossen, Schmidt and Wolff Rearrangements.

UNIT – V: OXIDATION AND REDUCTION [12 Hrs]

Mechanism – study of the following oxidation reactions–oxidation of alcohols with Cr(VI)and Mn reagents – oxidation of methylene to carbonyl, oxidation of aryl methanes – Etard reaction – Formation of C = C bonds- Wittig reaction, Formation of C – C bonds by dehydrogenation, dehydrogenation by Quinones, $Hg(OAc)_2$ and $Pb(OAc)_4$. Formation of C – C bond by phenol coupling and acetylene coupling – allylic oxidation-SeO_2, oxidation of alcohols, glycols, halides and amines to aldehydes and ketones, oxidation of Olefinic double bonds and unsaturated carbonyl compounds – oxidative cleavage of C – C bond. Synthetic importance of Clemmensen and wolf-Kishner reductions – modification of Wolf-Kishner reduction – Birch reduction, MPV reduction. Catalytic hydrogenation and Sommelet reaction. Reduction with $LiAlH_4$, $NaBH_4$, tritertiarybutoxyaluminium hydride, Sodium cyanoborohydride,and trialkyl tin hydride.

Text Books:

1. J. March and M. Smith, Advanced Organic Chemistry, 5th ed., John-Wiley and Sons. 2001.
2. P. S. Kalsi, Stereochemistry of carbon compounds, 8thedn, New Age International Publishers, 2015.
3. E. L. Eliel "Stereochemistry of carbon compounds", John Wiley, 1997.

4. P. Y.Bruce, Organic Chemistry, 7thedn. Prentice-Hall, 2013.
5. F. A. Carey and R. J. Sundberg, Advanced organic chemistry, Plenum Publishers Ltd. 2000.
6. Clayden, Greeves, Warren, Wothers, Organic chemistry, Oxford University Press.

Reference Books:

1. R.O.C. Norman, J.M. Coxon, Principles of organic synthesis, ELBS publications, 1994.
2. Seyhan Ege, Organic Chemistry, AITBS, 2001.
3. Michael Smith, Organic Synthesis, McGraw Hill, 1996.
4. W. Carruthers, J.Coldham, Modern methods of Organic synthesism IV edition, Academic Press, 1989.

I M.Sc (CH)	INORGANIC CHEMISTRY – I For the students admitted in the year 2019	19PCH12
SEMESTER – I		HRS/WK – 4
CORE – II		CREDIT – 5

Objectives:

To know about the various types of isomerism existing in complexes. To learn the concepts of CFT and the applications of macrocyclic ligands**.** To learn about poly acids and inorganic polymers

COURSE OUTCOMES (COs)

CO1: To know about the various types of isomerism existing in complexes.
CO2: To learn the concepts of CFT and the applications of macrocyclic ligands.
CO3: To interpret the stability of various complexes.
CO4: To acquire the knowledge about the molecular polyhedral and clusters.
CO5: To learn about poly acids and inorganic polymers.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: 19PCH12					TITLE OF THE COURSE: INORGANIC CHEMISTRY – I								HOURS: 4	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	2	3	2	3	3	2	4	3	4	3	3	4	2	2.92	
CO2	2	3	3	3	3	4	3	3	4	4	3	4	3	3.23	
CO3	2	3	3	3	2	3	3	3	4	3	4	4	4	3.15	
CO4	3	2	3	3	2	3	3	4	3	3	3	4	2	2.92	
CO5	3	3	3	2	3	2	3	3	3	4	3	3	3	2.92	
Mean Overall Score														3.09	

Result: The Score of this Course is 3.09 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: ISOMERISM IN COORDINATION COMPLEXES [12 Hrs]

1.1 Isomerism in complexes-ionization isomerism, hydrate isomerism, linkage isomerism, ligand isomerism, Coordination isomerism and polymerization isomerism

1.2 Numerical problems on isomerism of the complexes – Geometrical and optical isomerism in 4 and 6 coordinated complexes. Chirality and nomenclature of chiral complexes.

UNIT – II: MACROCYCLIC LIGANDS AND CFT [12 Hrs]

2.1 Crystal field theory- Splitting of d-orbitals in octahedral, tetrahedral and square planar complexes- crystal field stabilization energy-calculation of CFSE in octahedral complexes-

2.2 Consequences of CFSE – factors affecting CFSE - low spin and high spin complexes-explanation of magnetic properties and color of complexes using CFT – Jahn-Teller distortion and its consequences

UNIT – III: THERMODYNAMIC AND KINETIC STABILITY OF COMPLEXES [12 Hrs]

3.1 Metal-Ligand Equilibria in Solution: Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin.

3.2 Determination of stability constants by Potentiometric, Polarography and Spectrophotometric techniques – Jobs method

UNIT – IV: MOLECULAR POLYHEDRA: BORON HYDRIDES AND METAL CLUSTERS [12 Hrs]

4.1 Classification of boranes, carboranes, hydroborate ions, carboranes, metallacarboranes and ionic clusters of main group elements as closo, Nido, arachno, hypo,klado – STYX numbers

4.2 Metal Clusters: Structure and bonding of binuclear compounds – $Re_2Cl_8^{2-}$ and $Mo_2Cl_8^{2-}$ - structures of three-atom clusters – $Re_3Cl_{12}^{3-}$ and $Fe_3(CO)_{12}$ – Four atom tetrahedral clusters – $Co_4(CO)_{12}$ and $Ir_4(CO)_{12}$ - Six atom clusters $Rh_6(CO)_{16}$ – determination of number of metal-metal bonds in polynuclear carbonyls

UNIT – V: POLYACIDS AND INORGANIC POLYMERS [12 Hrs]

5.1 Polyacids: Isopolyacids and hetereopolyacids of vanadium, chromium, molybdenum,and Tungsten.

5.2 Inorganic Polymers: Silicates – structure, properties and applications – polysulphur – nitrogen compounds and poly-organophosphazenes.

Text Books:

1. J.E. Huheey, Inorganic Chemistry, 5th Edn. Harper International.1993.
2. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5th Edn. John Wiley.1985.
3. M.F.Purcell, J.C.Kotz, Inorganic Chemistry, Saunder, 1977.
4. R. Gopalan, V.Ramaligam, Concise Coordination Chemistry, 2 nd Ed, Vikas publishing house, 2008.

Reference Books

1. B.Douglas, D.McDaniel, J.Alexander, Concepts, and Models of Inorganic Chemistry, 3rd Edn. John Wiley,2001.
2. J.D.Lee, A New Concise Inorganic Chemistry, 3rd Edn. ELBS, 1987.

3. W.L.Jolly, Modern Inorganic Chemistry, 2nd Edn. McGraw-Hill, 1991.
4. N.N.Greenwood, A.Earnshaw, Chemistry of the Elements, 2nd Edn. BH,1997.
5. D.F.Shriver, P.W.Atkins, C.H.Langford, 3rd Edn. Inorganic Chemistry, ELBS.1999

I M.Sc (CH)	QUANTUM MECHANICS AND MOLECULAR STRUCTURE	19PCH13
SEMESTER - I		HRS/WK – 4
CORE – III	For the students admitted in the year 2019	CREDIT- 5

Objective:

To study the fundamental principles of Quantum chemistry, Schrodinger wave equation and its applications.

COURSE OUTCOMES (COs)

CO1: Students learn the elements of classical mechanics, quantum mechanical postulates and Schrodinger equations.

CO2: Students acquire the knowledge about the solution of Schrodinger equation, quantum numbers and their physical significance.

CO3: Students learn the knowledge of approximation methods and the concept of hybridization.

CO4: Students learn the knowledge of Empirical MO theory.

CO5: Students understand the Basics of Popular quantum chemical calculations and Semi-empirical methods.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: 19PCH13					TITLE OF THE COURSE: QUANTUM MECHANICS AND MOLECULAR STRUCTURE								HOURS: 4	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	3	3	3	2	4	3	5	3	2	4	4	4	3.30	
CO2	3	5	4	4	3	4	4	4	3	3	3	4	3	3.61	
CO3	4	4	4	4	3	4	4	3	3	3	3	3	4	3.54	
CO4	4	4	3	4	3	3	4	2	4	3	3	3	4	3.38	
CO5	4	4	4	3	3	4	4	3	4	3	3	3	4	3.54	
Mean Overall Score														3.47	

Result: The Score of this Course is 3.47 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: QUANTUM CHEMISTRY I [12 Hrs]

1.1 Elements of Classical mechanics- Newton's equation of motion- Lagrange's equation of motion –Rayleigh-Jeans- Max Planck radiation law – Bohr's quantum theory and subsequent developments – the Compton effect – wave-particle duality – uncertainty principle.

1.2 Wave equation for electrons – quantum mechanical postulates – the operators – Hermitian property.

1.3 Schrodinger equation – elementary application of Schrodinger's equation – the particle in a box (one, two and three-dimensional cases)

UNIT – II: QUANTUM CHEMISTRY II [12 Hrs]

2.1 The harmonic Oscillator - Solution of the Schrodinger equation –Ladder Operator method – the rigid rotor – particle in a ring Schrodinger equation for the hydrogen atom (no derivation is required) and the solution.

2.2 The origin of quantum numbers (angular momentum and spin) – their physical significance.

UNIT – III: QUANTUM CHEMISTRY [12 Hrs]

3.1 Approximation methods – perturbation and variation methods – application to hydrogen (Zeeman and Stark's effect was included), helium atoms – R.S. Coupling and term symbols for atoms in the ground state.

3.2 Born Oppenheimer approximation – valence bond theory for Hydrogen molecule – LCAO – MO theory for diatomic and polyatomic molecules.

3.3 The concept of hybridization – Huckel theory for conjugated molecules (ethylene, butadiene,and benzene)

UNIT – IV: EMPIRICAL MO THEORY [12 Hrs]

4.1 The simple Huckel method – Assumptions – Determinant, Energies and wave functions – Extended Huckel method – overlap – population analysis.

4.2 FMO theory – Interaction and Walsh diagrams- examples-benzene,naphthalene, butadiene,and cyclobutadiene.

UNIT – V [12 Hrs]

5.1 Basics of Popular quantum chemical calculations: Hamiltonian and wave functions – Roothan's equations.

5.2 Semi-empirical methods – Slater orbital and HF- SCF methods.

Text Book:

1. A.B. Sannigrahi, Quantum Chemistry, Books and Allied (P) Ltd, 2nd edition, 2010.

Reference Books:

1. R. K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi, 2nd edition,1992.
2. P.W. Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford 3rd edition, 1983

I M.Sc (CH)	BIOINORGANIC AND SUPRAMOLECULAR CHEMISTRY	EPCH704T
SEMESTER - I		HRS/WK – 4
ELECTIVE – 1	For the students admitted in the year 2011	CREDIT- 4

Objectives:

To learn about the various concepts and applications of Bioinorganic and Supramolecular Chemistry. To learn about the functions of metal ions in biology and function of enzymes.

COURSE OUTCOMES (COs)

CO1: Students learn about metal storage, transport and biomineralisation.
CO2: Students understand various enzymes and their importance in the biological process.
CO3: Students become familiar with metal-genetic molecular interactions.
CO4: Students learn interaction, recognitions in supramolecular chemistry.
CO5: Students understand supramolecular devices.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: EPCH704T					TITLE OF THE COURSE: BIOINORGANIC AND SUPRAMOLECULAR CHEMISTRY								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	4	3	4	3	4	4	4	4	4	4	4	3	3.69	
CO2	3	3	3	3	3	3	3	3	4	3	3	4	4	3.23	
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53	
CO4	3	3	3	3	3	3	3	4	4	3	4	4	4	3.38	
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38	
Mean Overall Score														3.44	

Result: The Score of this Course is 3.44 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I **[12 Hrs]**

Metal Storage Transport and Biomineralization. Ferritin, Transferrin, and siderophores
Calcium in biology - Calcium in living cells, transport and regulation, molecular aspects of intramolecular processes, extracellular binding proteins

UNIT – II **[12 Hrs]**

Metalloenzymes – zinc enzymes – carboxypeptidase and carbonic anhydras. Iron enzymes – catalase, peroxidase and cytochrome P – 450. Copper enzymes – superoxide dismutase. Molybdenum oxatransferase enzymes – xanthine oxidase. Coenzyme vitamin B_{12}

UNIT – III **[12 Hrs]**

Metal-Nucleic Acid Interactions: Metal ions and metal complex interactions. Metal complexes – nucleic acids – binding of cisplatin with DNA
Metals in Medicine: Metal deficiency and disease, toxic effects of metals, metals used for diagnosis and Chemotherapy with particular reference to an anticancer drug.

UNIT – IV: SUPRAMOLECULAR CHEMISTRY – I **[12 Hrs]**

Concepts, Nature of Supramolecular interactions, preorganization and complementarity-design principles.
Molecular recognition: - Spherical and tetrahedral recognition–Recognition of ammonium ions, neutral molecules.
Molecular receptors – Cation binding hosts-Crown ethers, Cryptands, Calixarenes - design principles - Anion receptors – the shape of anions - Recognition of anionic substrate.
Co-receptor molecules - dinuclear and polynuclear metal ion cryptates - ditopic, heterotopic co-receptors - multiple recognition in metalloreceptors.

UNIT – V: SUPRAMOLECULAR CHEMISTRY – II **[12 Hrs]**

Supramolecular devices: Light Conversion and Energy Transfer Devices, Photoinduced Electron Transfer Devices
Molecular wires, switchable molecular wires, photoswitching devices.
Supramolecular racks, ladders, grids.
Supramolecular chemistry in biology.

Text Books:

1. Asim K. Das, Bioinorganic Chemistry, Books and Allied (P) Ltd, 2007
2. J.E.Huheey, Inorganic Chemistry, 5th edition, Harper International, 1993.
3. Ivano Bertini, Harry. B.Gray, J. Lippard, Valentine, Bioinorganic chemistry, 1998.
4. P.S. Kalsi, Bioinorganic and Supramolecular Chemistry, 2007.

Reference Books:

1. J.L. Atwood, J.E.D. Davies, D.D. Mac Nicol, F. Vogtle, J.M. Lehn, Comprehensive Supramolecular Chemistry, Pergamon, 1996.
2. Albert L. Lehninger, David Lee Nelson, Michael M. Cox, Principles of Biochemistry, 4th Ed, 2005
3. R.W. Hay, Bioinorganic chemistry, Ellis Harwood, 1987.
4. J. M. Lehn, Supramolecular Chemistry, Concepts and perspectives, VCH, 1995.
5. J. W. Steed, J.L. Atwood, Supramolecular Chemistry, AConcise Introduction, John Wiley, 2000.

I M.Sc (CH)	HETEROCYCLICS AND NATURAL PRODUCTS	EPCH704A
SEMESTER - I		HRS/WK – 4
ELECTIVE – 1	For the students admitted in the year 2017	CREDIT- 4

Objectives:

To enable the student to understand and appreciate the importance of steroid chemistry and heterocyclic compounds. To understand the techniques involved in the extract ion and methods of determinat ion of structure of alkaloids and terpenes.

.COURSE OUTCOMES (COs)

CO1: Students understand the Nomenclature, synthesis of few heterocyclic chemicals.
CO2: Students acquire the knowledge about the Occurrence, isolation, classification, functions and general properties of alkaloids.
CO3: Students learn the structural elucidation and general properties of terpenes.
CO4: Students understand the Nomenclature and classification of steroids and steroidal alkaloids.
CO5: Students get the in depth knowledge on Anthocyanins.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: EPCH704A					TITLE OF THE COURSE: HETEROCYCLICS AND NATURAL PRODUCTS								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	4	4	4	4	4	4	4	4	4	4	4	4	3.92	
CO2	4	4	4	3	4	4	4	3	3	3	4	3	4	3.62	
CO3	3	3	3	3	3	4	3	3	3	3	4	3	4	3.23	
CO4	4	4	3	3	3	4	3	2	3	4	3	3	3	3.23	
CO5	3	3	3	3	3	4	3	3	3	3	4	2	2	3.0	
Mean Overall Score														3.4	

Result: The Score of this Course is 3.4 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: HETEROCYCLIC CHEMISTRY [15 Hrs]

1.1 Nomenclature – reactivity – aromaticity – spectral properties.

1.2 Elementary study of the following systems only – indole, isoindole – oxazole, imidazole, thiazole, pyridines, pyrimidine, pyridazine, pyrazine, chromans, chromones, coumarins, carbazoles, uracil, uric acid, xanthones, and flavonoids. Synthesis and reactions of 5 membered (pyrrole, thiophene, furan) and 6 membered heterocyclic compounds (pyridine), fused rings (quinoline and isoquinoline)

UNIT – II: ALKALOIDS [10 Hrs]

2.1 General methods of structural elucidation of alkaloids -a general survey.

2.2 The structural elucidation of Belladine, Papaverine, Cocaine, Atropine, Heptaphylline, Peepuloidin, Morphine.

2.3 Occurrence, isolation, classification, functions and general properties of alkaloids.

UNIT – III: TERPENES [6 Hrs]

3.1 General methods of determination of structure.

3.2 Structural elucidation of Camphor, Cadinene, Vitamin A, Abietic acid, Gibberellic acid, Zinziberine and Squalene

3.3 Occurrence, isolation, classification, functions and general properties of terpenes.

UNIT – IV: STEROIDS [6 Hrs]

4.1 Conformations of steroids - molecular rearrangements (acid and base-catalyzed, photochemical).

4.2 Synthesis of steroids – ring-forming reaction and control of ring junction stereochemistry.

4.3 Synthesis of cholesterol, androgens, oestrone, progesterone, and cortisone. (questions on complete synthesis is not included for examination)

4.4 Nomenclature and classification of steroids, steroidal alkaloids

UNIT – V: ANTHOCYANINS [8 Hrs]

5.1 General nature of anthocyanins – the structure of the anthocyanidins

5.2 General methods of synthesizing anthocyanidins.

5.3 Structural elucidation of cyanidin chloride, pelargolidin chloride.

5.4 Flavones – flavonols – isoflavones.

5.5 Biosynthesis of flavonoids – depsides – tannins.

Synthesis of delphinidin chloride, peonidin chloride, malvidin chloride, and quercetin.

Text Books:

1. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 1, Goel Publishing House, Meerut, 1997.
2. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 2, Goel Publishing House, Meerut, 1997.
3. I. L. Finar, Organic Chemistry Vol-2, 5th edn, Pearson Education Asia, 1975.

Reference Books:

1. T.L. Gilchrist, Heterocyclic Chemistry, Longman Scientific and Tech, 1985
2. I. L. Finar, Organic Chemistry Vol-1, 6th edn, Pearson Education Asia, 2004.
3. Pelletier, Chemistry of alkaloids, Van Nostrand Reinhold Co, 2000.
4. Shoppe, Chemistry of the steroids, Butterworthes, 1994.

I M.Sc (CH)	ORGANIC CHEMISTRY - II For the students admitted in the year 2019	19PCH21
SEMESTER – II		HRS/WK – 4
CORE– IV		CREDIT- 5

Objectives:

To learn the aspects of substitution reactions and its applications. To appreciate the principles of addition and elimination reactions.

COURSE OUTCOMES (COs)

CO1: Knowledge pertaining to stereochemistry.
CO2: Aliphatic electrophilic and nucleophilic substitution reaction mechanisms.
CO3: Addition and elimination reactions.
CO4: Aromatic electrophilic substitution reactions.
CO5: Aromatic nucleophilic substitution reactions.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: 19PCH21					TITLE OF THE COURSE: ORGANIC CHEMISTRY - II								HOURS: 4	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	4	3	4	3	4	4	4	4	4	4	4	3	3.76	
CO2	4	3	3	3	3	3	3	3	4	3	3	4	4	3.30	
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53	
CO4	4	3	3	3	3	3	3	4	4	3	4	4	4	3.46	
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38	
Mean Overall Score														3.48	

Result: The Score of this Course is 3.48 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: STEREOCHEMISTRY–II [12 Hrs]

Conformations of some simple 1,2 – disubstituted ethane derivatives.

Conformational analysis of disubstituted cyclohexanes and their stereochemical features. Conformation and reactivity of substituted cyclohexanol(oxidation and acylation), cyclohexanone.(reduction) and cyclohexane carboxylic derivatives (esterification and hydrolysis). Conformations and Stability of - cis and trans Decalins -9 – methyl decalin.

UNIT – II: ALIPHATIC NUCLEOPHILIC AND ELECTROPHILIC SUBSTITUTION [12 Hrs]

Substitution at saturated reaction center (carbon). SN1, SN2,SNi mechanisms –

Reactivity, structural and solvent effects. Neighbouring group participation – substitution in Norbornyl and bridgehead systems – Substitution at carbon doubly bonded to oxygen. Alkylation and acylation of active methylene carbon compounds, hydrolysis of esters. SE1, SE2, SEi mechanisms – reactivity. Hell-Volhard-Zelinsky reaction, Stork – enamine reaction. Decarboxylation of aliphatic acids.

UNIT – III: ADDITION AND ELIMINATION REACTIONS [12 Hrs]

Electrophilic, nucleophilic and free radical mechanisms of addition to carbon-carbon multiple bonds – isolated and conjugated multiple bonds. Hydration, hydroxylation, hydroboration. Stereochemical aspects to be studied wherever applicable.Nucleophilic addition reactions of carbonyl compounds: Aldol, Perkin, Stobbe, Claisen, Dieckmann,Benzoin condensation. Mannich, Reformatsky, Grignard, Robinson Annulation and Shapiro reactions.

Elimination reactions: E1, E2,and E1CB mechanism. Hofmann and Saytzeff rules. Dehydration, dehydrohalogenation,and dehalogenation. Stereochemistry of E2 elimination in cyclohexane systems. Mechanism of pyrolytic eliminations. Chugaev and Cope eliminations

UNIT – IV: AROMATIC ELECTROPHILIC SUBSTITUTION [12 Hrs]

The arenium ion mechanism – Orientation and reactivity – typical reactions – nitration, halogenation, alkylation, acylation,and diazonium coupling. Reimer- Tiemann, Vilsmeyer-Hack, Gattermann, Kolbe reactions. Synthesis of di- and trisubstituted benzenes. Electrophilic substitution of furan, pyrrole, thiophene,and pyridine- N- oxide.

UNIT – V: AROMATIC NUCLEOPHILIC SUBSTITUTION [10 Hrs]

Methods for the generation of benzyne intermediate and reactions of aryne intermediate. Nucleophilic substitution involving diazonium ions. Aromatic nucleophilic substitution of activated halided. Zeigler alkylation. Chichibabin reaction. Problems.

Text Books:

1. J. March and M Smith, Advanced Organic Chemistry, 5th ed., John-Wiley and sons, 2001.
2. I. L. Finar, Organic Chemistry Vol-1, 6thedn., Pearson Education Asia, 2004.
3. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry, Part A and B, 5thed., Kluwer Academic/Plenum Publishers, 2008.
4. S.M.Mukherji and S.P.Singh, Reaction Mechanism in Organic chemistry, 3rd ed., Macmillan India Ltd. 1984.
5. Clayden, Greeves, Warren, Wothers, Organic Chemistry, Oxford Univ Press.
6. P.S. Kalsi Stereochemistry, conformation, and mechanism, 6th edition, New Age International (P) Ltd. 2005.

Reference Books:

1. S. H. Pine, Organic Chemistry, 5thedn, McGraw HillInternational Edition,1987.

2. L. F. Fieser and M. Fieser, Organic Chemistry, Asia Publishing House, Bombay, 2000.
3. E.S. Gould, Mechanism and Structure in OrganicChemistry, Holt, Rinehart and Winston Inc., 1959.
4. T. H. Lowry K. S. Richardson, Harper, and Row, Mechanism, and theory in organic chemistry, 2nd, NewYork, 1981.
5. R.O.C. Norman, J.M. Coxon, Principle of Organic Synthesis, ELBS Publications,1994.

I M.Sc (CH)	INORGANIC CHEMISTRY – II For the students admitted in the year 2019	19PCH22
SEMESTER - II		HRS/WK – 4
CORE – V		CREDIT- 5

Objectives:

To learn about MO theory of complexes. To learn the fundamental concepts of nano technology, Lanthanides, actinides and about the applications of metal ions in biological systems. To interpret the electronic spectra of various complexes

COURSE OUTCOMES (COs)

CO1: To learn about the MO theory of complexes.
CO2: To interpret the electronic spectra of various complexes.
CO3: To learn the fundamental concepts of nanotechnology and about the Lanthanides and actinides.
CO4: To appreciate the applications of metal ions in biological systems.
CO5: To understand the theory behind the nuclear reactions and their applications.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: 19PCH22					TITLE OF THE COURSE: INORGANIC CHEMISTRY - II								HOURS: 4	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	2	3	2	3	3	2	4	3	4	3	3	4	2	2.92	
CO2	2	3	3	3	3	4	3	3	3	3	3	3	3	3.00	
CO3	2	3	3	3	2	3	4	4	4	3	4	4	4	3.30	
CO4	3	2	3	3	2	3	4	4	3	3	4	4	2	3.07	
CO5	3	3	3	2	3	3	3	3	3	3	3	3	3	2.92	
Mean Overall Score														3.04	

Result: The Score of this Course is 3.04 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: MO THEORY OF COMPLEXES AND CHEMISTRY OF LANTHANIDES AND ACTINIDES [12 Hrs]

1.1 Metal-Ligand Bonding: Limitation of crystal field theory, Molecular Orbital Theory, Evidence of metal-ligand covalency, TASO-MO concepts of Oh and Td complexes, MO energy level diagrams of sigma- and pi-bonding in Oh complexes, nature of metal-ligand pi-bonds, evidence for pi-back bonding, spectrochemical series, and pi-acceptor series. Jahn-Teller Effect and its consequences.

1.2 The Chemistry of Lanthanides and Actinides: oxidation state, spectral & magnetic characteristics, coordination numbers, stereochemistry, lanthanide contraction-causes, consequences - comparison between 3d and 4f block elements - comparative account of lanthanides and actinides - nuclear and non-nuclear applications.

UNIT – II: ELECTRONIC SPECTRA OF TRANSITION METAL COMPLEXES [12 Hrs]

2.1 Electronic Spectra of Transition Metal Complexes: Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), Nephelauxetic effect - calculations of Dq, B,and β parameters.

2.2 Charge Transfer spectra – Comparison of CT and d-d spectra.

UNIT – III: NANOTECHNOLOGY [12 Hrs]

3.1 Nanotechnology – Introduction – preparatory methods – chemicals methods, thermolysis, and pulsed laser method – Microwave Synthesis -Basic concepts of Nanoscience and technology – Quantum wire – Quantum well – Quantum dot – Properties and technological advantages of Nanomaterials – Carbon Nanotubes and applications – Principles of SEM, TEM and AFM.

3.2 Biomedical applications of nanotechnology.

UNIT – IV: BIOINORGANIC CHEMISTRY [12 Hrs]

4.1 Bioinorganic Chemistry: Metal Ions in Biological Systems: Essential and trace metals.Na^+/K^+ Pump, Role of metals ions in biological processes, Transport and Storage of Dioxygen: Heme proteins and oxygen uptake, structure and function of hemoglobin, myoglobin, hemocyanins,and hemerythrin,

4.2 Electron Transfer in Biology: Structure and function of metalloproteins in electron transport processes – cytochromes and iron-sulphur proteins – Nitrogenase: Biological nitrogen fixation, molybdenum nitrogenase.

UNIT – V: NUCLEAR CHEMISTRY [12 Hrs]

5.1 Nuclear Chemistry: Modes of Radioactive Decay: Orbital electron capture: nuclear isomerism, internal conversion, detection and determination of activity by cloud chamber, nuclear emulsion, bubble chamber, G.M., Scintillation,and Cherenkov counters. Nuclear Reaction: Types, reactions, cross section, Q-value, threshold energy, compound nucleus theory: high energy nuclear reaction, nuclear fission and fusion reactions as energy sources; direct reactions; photonuclear and thermonuclear reaction.

5.2 Stellar Energy: Synthesis of elements - hydrogen burning, carbon burning, the e, x, r, p and x processes. Nuclear Reactors: fast breeder reactors, particle accelerators, linear accelerators, cyclotron,and synchrotron. Radio Analytical Methods: Isotope dilution analysis, Radiometric Titrations, Radioimmunoassay, Neutron activation analysis.

Text Books:

1. J.E. Huheey, Inorganic Chemistry, 5th Edn., Harper International.1993.

2. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5thEdn., John Wiley.1985.
3. M.F.Purcell, J.C.Kotz, Inorganic Chemistry, Saunder, 1977.
4. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, "Nano Technology – Basic Science and Emerging Technologies", 1st edition, Overseas Press, New Delhi,2005.
5. Arnikar, Essentials of Nuclear Chemistry, 2nd Edn., Sulthan & Chand Publishers, 1991.
6. R.W.Hay, Bioinorganic chemistry, Ellis Harwood, 1987.
7. A.K.Das, Inorganic Chemistry

Reference Books:

1. Mich Wilson, Kamali Kanengara, Geoff Smith, Michelle Simmons, and Burkhard Raguk, Nanotechnology Basic Science and Energy Technologies, Overseas press (I), N.D.2005.
2. R.W.Hay, Bio-Inorganic Chemistry, Ellis Horwood, 1987.
3. Lehninger, Principles of Biochemistry, Van Eikeren, 1982.
4. T.M.Loehr, Iron carriers, and Iron proteins, VCH, 1989.
5. Gladstone, Sourcebook of Atomic Energy, 3rd Edn. ELBS, 1986.
6. N.N.Greenwood, A.Earnshaw, Chemistry of the Elements, 2nd Edn.BH,1997.

I M.Sc (CH)	GROUP THEORY AND ITS APPLICATIONS IN SPECTROSCOPY	PCH807T
SEMESTER - II		HRS/WK – 4
CORE – VI	For the students admitted in the year 2014	CREDIT-5

Objective:

To study the elements of group theory and the application of group theory. To study the different types of molecular spectroscopy

COURSE OUTCOMES (COs)

CO1: To study the elements of group theory and the application of group theory.
CO2: To study the different types of molecular spectroscopy
CO3: To study about the various spectroscopy in molecular level.
CO4: To understand about the normal modes and vibrational analysis.
CO5: To study about the various types of NMR spectroscopy and its importance.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: PCH807T					TITLE OF THE COURSE: GROUP THEORY AND ITS APPLICATIONS IN SPECTROSCOPY								HOURS: 4	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	3	4	4	4	4	4	5	4	5	3	4	5	4.00	
CO2	4	4	5	4	4	3	3	4	4	4	4	3	4	3.84	
CO3	3	4	4	5	5	3	4	4	4	3	5	4	4	4.00	
CO4	3	4	3	4	4	4	4	4	4	4	4	3	4	3.76	
CO5	4	3	3	3	4	4	4	4	4	5	3	3	4	3.69	
Mean Overall Score														3.85	

Result: The Score of this Course is 3.85 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: GROUP THEORY [12 Hrs]

Symmetry elements and symmetry operations – group multiplication table – subgroups, similarity transformation, and classes – identifications of symmetry operations and determination of point groups.

Reducible and irreducible representations – direct product representation.

UNIT – II: APPLICATIONS OF GROUP THEORY [12 Hrs]

Orthogonality theorem and its consequences – construction of character table for C_2V and C_3V – hybrid orbital in nonlinear molecules (CH_1, XeF_4, BF_3, SF_6, and NH_3).

Determination of representations of vibrational modes in nonlinear molecules (H_2O, CH_4, BF_3, and NH_3).

Symmetry selection rules of infrared and Raman spectra – application of group theory for the electronic spectra of ethylene and formaldehyde.

UNIT – III: PROPERTIES OF MOLECULES [12 Hrs]

Normal modes – Vibrational Analysis and Characterization of Stationary points – Electrical Properties - dipole moments, optical activity, polarizability.

Magnetic properties NMR chemical shifts, shielding, spin-spin coupling, and hyperfine interactions.

UNIT – IV: SPECTROSCOPY – I [12 Hrs]

Interaction of matter with radiation – Einstein theory of transition Probability – Rotational spectroscopy of a rigid rotator – diatomic and polyatomic molecules.

Vibrational spectroscopy – harmonic oscillator – anharmonicity – vibrational spectra of polyatomic molecules – vibrational frequencies – group frequencies – vibrational coupling overtones – Fermi resonance- Raman Spectra.

Electronic spectra of polyatomic molecules – group symmetry of molecules and selection rules – types of transition – solvent effects.

UNIT – V: SPECTROSCOPY – II [12 Hrs]

Resonance spectroscopy – Zeeman effect – the equation of motion of spin in magnetic fields – chemical shift – spin-spin coupling.

Calculation of coupling constants - ^{13}C, ^{19}F, ^{31}P NMR spectra – applications – a brief discussion of Fourier transformation in resonance spectroscopy. Splitting of spin energy level in the magnetic field – quantum mechanical treatment.

Text Books:

1. C. N. Banwell. 1966, Fundamentals of Molecular Spectroscopy, McGraw Hill.
2. K. V. Raman, Group Theory and its Applications to Chemistry, Tata Mcgraw Hill publishing.Co. 5th edition, 1990.

Reference Book:

1. Bhattacharya. Group Theory and its Applications, PK edition, Himalaya Publishing House, 1996.

I M.Sc (CH)	REAGENTS AND NAMING REACTIONS	19EPCH24
SEMESTER - II		HRS/WK – 4
ELECTIVE – 2	For the students admitted in the year 2019	CREDIT- 5

Objective:

To inculcate the problem solving nature. To learn about green chemistry

COURSE OUTCOMES (COs)

CO1: Students understand the importance of stereochemical aspects of structure and properties.
CO2: Students learn the overview of the organic reaction mechanisms.
CO3: Students learn the chemistry of organometallic compounds and its organic reactions.
CO4: Students understand the concept of photochemical reaction and its applications.
CO5: Students are motivated to know the concept of green chemistry

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: 19EPCH24					TITLE OF THE COURSE: REAGENTS AND NAMING REACTIONS								HOURS: 4	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	4	4	3	4	3	3	4	3	3	3	4	4	3.46	
CO2	4	3	4	3	3	4	3	3	4	3	3	4	4	3.46	
CO3	3	4	4	4	3	3	3	4	4	4	4	4	4	3.69	
CO4	4	4	3	3	4	3	3	4	4	3	4	4	4	3.62	
CO5	3	4	3	4	4	4	3	3	3	4	4	4	4	3.62	
Mean Overall Score														3.57	

Result: The Score of this Course is 3.57 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS [12 Hrs]

Recognition of chiral structures – R & S, E & Z nomenclature,(including allene,biphenyl& spiranes), diastereoisomerism in acyclic systems. Conformational analysis of simple cyclic and acyclic systems & their effect on the reaction. Interconversion of Fischer, Newman,and Sawhorse projections. Asymmetric synthesis - newer methods. Enantiotopic and diastereotopic ligands and faces.

UNIT- II: COMMON ORGANIC REACTION MECHANISMS [12 Hrs]

Methods of determining reaction mechanism – reactive intermediates – carbocations, carbanions, carbenes, nitrenes, arynes,and free radicals. Nucleophilic and electrophilic substitutions and additions to multiple bonds. Elimination Reactions. Kinetic isotope effects. Hammett equation – Neighbouring group participation.

UNIT – III: PALLADIUM-CATALYSED COUPLING REACTIONS AND SELECTIVE NAME REACTIONS [12 Hrs]

Palladium-catalyzed Coupling Reactions: Heck, Suzuki, Stille, Sonogashira, Kumuda, Buchwald- Hartwig, Negishi,and Himaya.

Favorskii, Stork – enamine, Mannich, Michael, Baeyer – Villiger, Shapiro, Hoffmann – Loffler – Freytag reactions. Routine functional group transformations. Oppenaur Oxidation, Meerwein - Ponndorf – Verley, Simmons – Smith reaction.

UNIT – IV: REAGENTS IN ORGANIC SYNTHESIS & PHOTOCHEMISTRY [12 Hrs]

Uses of complex metal hydrides, Gilman's reagent, LDA, DCC, 1,3-dithiane, trimethylsilyl iodide, tri-n-butyl tin hydride, osmium tetroxide, SeO2, DDQ, Peterson's synthesis, Wilkinson's catalyst, Baker's yeast, Merrifield resin.

Alpha cleavage given by cyclobutanones - beta cleavage reactions, the formation of photoenols and photoenolization, intermolecular hydrogen transfer &intermolecular photo reduction - Photo rearrangements:photo rearrangements of beta-gamma unsaturated ketones, 1,2 acyl shift - 1,3 acyl shift, aza di-pi methane rearrangement

UNIT – V: GREEN CHEMISTRY [12 Hrs]

Green Chemistry – Genesis and concept of Green Chemistry, Principles, Strategies

Alternative Techniques in Organic Synthesis

Use of microwave, ultrasound, ionic liquids, super-critical solvents in organic synthesis; Multi-component reactions

Text Books:

1. P. S. Kalsi. Organic Reaction stereochemistry & Mechanism. 4thedition. New Age International publishers. 2006.
2. Clayden, Greeves, Warren, Wothers. Organic chemistry. Oxford University Press. 2001.
3. Jerry March. Advanced organic chemistry. 4th edition. Wiley Interscience publications. 1999.
4. Paula Yurkanis Bruice. Organic chemistry. 3rd edition Pearson Education Inc. 2001.
5. Peter Sykes. A guide book to the mechanism in organic chemistry. Orient Long mann. 2002
6. Paul T. Anastas, John C. Warner, Green Chemistry: Theory and Practice, Oxford University Press, 2000

7. V. K. Ahluwalia and M.Kidwai, New Trends in Green Chemistry, Kluwer Academic Publishers,1st edition, 2004

Reference Books:

1. Seyhan Ege. Organic Chemistry. 3rd edition. D. C. Health & company.
2. Raj. K. Bansal. Organic Reaction Mechanism. 3rd edition Tata Mc. Graw Hill.
3. V. K. Ahluwalia, R. K. Parashar. Organic Reaction Mechanism. 3rd edition. Narosa Publishing House.
4. Coxon, Halton; organic photochemistry, Cambridge university press, 1987

I M.Sc (CH)	NUCLEAR AND RADIOCHEMISTRY For the students admitted in the year 2017	EPCH808A
SEMESTER - II		HRS/WK – 4
ELECTIVE – 2		CREDIT- 5

Objectives:

To make the students knowledgeable in nuclear chemistry. To familiarize the students with nuclear and radioisotopes techniques. To equip the students for their future career in nuclear industry.

COURSE OUTCOMES (COs)

CO1: Students understand subatomic particles and nuclear models.
CO2: Students learn different decays and detectors in nuclear chemistry.
CO3: Students acquire disintegration processes, nuclear reactions and fission.
CO4: Students learn about the radiation safety.
CO5: Students understand the fundamentals and the applications of radioactivity in medicine for diagnosis and therapy (nuclear medicine).

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: EPCH808A					TITLE OF THE COURSE: NUCLEAR AND RADIOCHEMISTRY								HOURS: 4	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	4	3	4	3	4	4	4	4	4	4	4	3	3.69	
CO2	3	3	3	3	3	3	3	3	4	3	3	4	4	3.23	
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53	
CO4	3	3	3	3	3	3	3	4	4	3	4	4	4	3.38	
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38	
Mean Overall Score														3.44	

Result: The Score of this Course is 3.44 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: THE NUCLEUS [12 Hrs]

1.1 Radius of atomic nuclei: binding energy of nuclei, the force between nucleons.

1.2 Nuclear moment: nuclear angular momentum, nuclear magnetic dipole moment, electric quadrupole moment - NQR

1.3 Nuclear models: liquid drop model, nuclear shell model, fermi gas model.

1.4 The subatomic particles: electron, proton, neutron, antiproton, positron, meson, quacks. Mass of nuclei: isotopes, isobars, mass spectrometry- identification of isotopes.

UNIT – II: RADIOCHEMISTRY [12 Hrs]

2.1 Alpha decay: theory of emission, alpha-ray energy spectra.

2.2 Beta-decay: decay theory, electron capture, double beta decay.

2.3 Gamma-ray: theory of emission, internal conversion, the Auger effect, nuclear resonance absorption. Principles of Mossbauer spectroscopy.

2.4 Geiger counters, scintillation counters, proportional counters, semiconductor detectors.

2.5 Radioactive series decay: radioactive series growth and decay, determination of half-lives.

UNIT – III: NUCLEAR REACTION [12 Hrs]

3.1 Types of nuclear reactions: reaction cross-section-compound nucleus theory, high energy nuclear, direct nuclear, photonuclear and thermonuclear reactions.

3.2 Source of nuclear bombarding particles: Charged particle accelerators, gamma-ray, X-ray and neutron sources.

3.3 Fission: Fission products and the Fission yield curve, Fission energy, the theory of nuclear fission, nuclear reactor, breeder reactor - nuclear reactors in India. Fusion reactions hydrogen bomb and energy of the sun.

3.4 Transuranium elements: Synthesis, separation, and properties of transuranium elements.

3.5 Reprocessing of spent fuels. Solvent Extraction - Specific sequestering agents for transuranium elements. Nuclear reactions – one example for each category.

UNIT – IV: RADIATION CHEMISTRY [12 Hrs]

4.1 Interaction of radiation with matter: the range of alpha, beta, and gamma radiations, radiation dosimetry.

4.2 Radiolysis of water: Mechanism-hydrated electron.

4.3 Radiation safety precaution: Safety standards and safe working methods.

UNIT – V: ANALYTICAL METHOD IN NUCLEAR CHEMISTRY [12 Hrs]

5.1 Radioisotopes: Co-precipitation, ion-exchange, solvent extraction – as a tracer, Synthesis of labelled compounds (any two), isotopic dilution and radiopharmaceuticals.

5.2 Neutron activation analysis, positron annihilation and autoradiography. Dating of objects and mechanistic study.

Text Books:

1. H. J. Arnikar, “Essentials of Nuclear Chemistry”, Wiley Eastern Ltd., New Delhi (1982)
2. A.K. Srivastava and P. Jain, “Essential of nuclear Chemistry”, S.Chand, N.Delhi, 1989

Reference Books:

1. G.R. Choppin, “Radiochemistry and Nuclear chemistry”, 2002.

I M.Sc (CH)	ORGANIC CHEMISTRY PRACTICAL – I For the students admitted in the the year 2008	PCHP201
SEMESTER – II I &II		HRS/WK – 4
CORE PRACTICAL –I		CREDIT – 2

COURSE OUTCOMES (COs)

CO1: Students learn the Identification of Compounds in a two-component mixture.
CO2: Students learn the preparation of some organic compounds.

I. Identification of Compounds in a two-component mixture and Preparation of their derivatives and Determination of Boiling Points and Melting Points for Compounds and Melting Point for their derivatives.

II. Organic Preparations (Any Six from the followings)

1. Anthraquinone from Anthracene
2. Benzhydrol from Benzophenone
3. Methyl Orange from Sulphanilic Acid
4. p-Nitrobenzoic acid from p-Nitrotoluene
5. m-Nitroaniline from m-Dinitrobenzene
6. Diphenylmethane from Benzyl chloride
7. p-Chlorotoluene from p-Toluidine
8. 1,2,3,4-Trtrahydrocarbazole from Cyclohexanone
9. Preparation of o-Benzyl Benzoic Acid

Quantum of marks in respect of Practical Examinations:

Qualitative Organic Analysis	:	30 Marks
Preparation	:	15 Marks
Record	:	5 Marks
Practical Viva	:	10 Marks
Total	**:**	**60 Marks**

Text Books:

1. Vogel, ATextbook of Practical Organic Analysis, ELBS.
2. Raj K. Bansal, Laboratory Manual of Organic Chemistry, Wiley Eastern Ltd.

Reference Book:

1. Mann and Saunders, Laboratory Manual of Organic Chemistry.

I M.Sc (CH)	INORGANIC CHEMISTRY PRACTICAL-I For the students admitted in the the year 2014	PCHP202S
SEMESTER – II I & II		HRS/WK – 4
CORE PRACTICAL –II		CREDIT – 2

COURSE OUTCOMES (COs)

CO1: To improve the skill in quantitative estimation of metal ions by complexometric titration.
CO2: To identify the metal ions qualitatively in a mixture of metal ions.
CO3: To improve the skill in the synthesis of inorganic complexes.

1. Semi micro qualitative analysis of mixture containing two common and two rare cations. The following are the cations to be included- W, Se, Te, Mo, Ce, Th, Ti, Zr, V, U, Li.
2. Complexometric titrations (EDTA method) – Estimation of Ca, Mg and Zn.
3. Preparation of the following

2.1 Potassium tris(oxalato)aluminate(III)hydrate
2.2 Sodium bis(thiosulphato)cuprate(II)
2.3 Tris(thiourea)copper(I) sulphate
2.4 Diisothiocyanatodipyridine manganese(II)
2.5 Tetramminecopper(II) sulphate

Continuous internal assessment (CIA) (40 marks)

Based on the periodical evaluation of record and experiments assessed by the staff in charge.

External examination (60 marks)

6 Hrs. Exam **Total Marks: 60**

1. a) Qualitative analysis (semi micro)(:Mix of 4 radicals anions) (2 rare +2 common cations)	20 Marks
2. (a) Preparation	10 Marks
(b) EDTA (complexometric tiration)	20 Marks
3. (a) Practical Record Note Book	5 Marks
(b) Pratical Viva-Voce	5 Marks

I M.Sc (CH)	PHYSICAL CHEMISTRY PRACTICAL -I For the students admitted in the year 2019	19PCHP23
SEMESTER – II I & II		HRS/WK – 4
CORE PRACTICAL - III		CREDIT-2

COURSE OUTCOMES (COs)

CO1: Students learn the Experiments in Thermodynamics, colligative properties, phase rule, Surface Phenomenon, chemical equilibrium, and chemical kinetics.

CO2: Typical examples are given and a list of experiments is also provided from which suitable experiments can be selected as convenient.

1. Verification of Arrhenius equation
2. Determination of activity and activity coefficient from freezing point depression method.
3. Construction of vapour pressure curves for different types of solutions.
4. Molecular modelling
5. Simulations to find out the symmetry of the molecule
6. Simulations to find vibrational modes and verification by using group theory.
7. Effect of the ionic strength of solvents and solutions.
8. Phase diagram construction involving two-component systems.
9. Adsorption isotherm
10. Reaction rate and evaluation of other kinetic parameters using polarimetry, analytical techniques, and conductometry.

DETAILS OF LIST OF EXPERIMENTS FOR PHYSICAL CHEMISTRY PRACTICAL–I

1. Determine the temperature coefficient and energy of activation of hydrolysis of ethyl acetate.
2. Study the inversion of cane sugar in the presence of acid using polarimeter.
3. Study the effect of ionic strength on the rate of saponification of an ester.
4. Study the salt effect, solvent effect on the rate law of alkaline hydrolysis of crystal violet.
5. Determine the molecular weight of benzoic acid in benzene and find the degree of association.
6. Determine the activity coefficient of an electrolyte by freezing point depression method.
7. Study the phase diagram from toluidine and glycerine system.
8. Construct the boiling point composition diagram for a mixture having a maximum boiling point and minimum boiling point.
9. Determine the partial molal volume of glycine/methanol/formic acid/sulphuric acid by the graphical method and by determining the densities of the solutions of different compositions.
10. Determine the strength of hydrogen bond in solutions.
11. Kinetics of decomposition of sodium thiosulphate using Hydrochloric acid,
12. Construction of phase diagram for the three-component system (KCl-Glucose-Water), (Chloroform-Acetic acid-Water).

Scheme of Evaluation: (Total = 60 marks)

Aim & short procedure	– 10
Record	– 5
Spectral interpretation	– 10
Experiment & manipulation	– 25
Viva voce	– 10
Total	– **60**

II M.Sc (CH)	ORGANIC CHEMISTRY – III For the students admitted in the year 2019	19PCH31
SEMESTER – III		HRS/WK – 4
CORE – VII		CREDIT-4

Objectives:

To learn the applications of various reaction in organic synthesis.

COURSE OUTCOMES (COs)

CO1: Students understand stereo chemical implications of pericyclic reaction in organic synthesis.

CO2: Students understand the structural and stereochemical implications on photochemical reactions.

CO3: Students get learnt the concept of aromatic character in some molecules.

CO4: Students learn the applications of various reaction in organic synthesis.

CO5: Students understand stereo chemical implications of pericyclic reaction in organic synthesis.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III	COURSE CODE: 19PCH31					TITLE OF THE COURSE: ORGANIC CHEMISTRY – III								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	3	4	3	4	3	3	4	3	3	3	4	4	3.38	
CO2	3	3	4	3	3	2	4	3	4	3	3	4	4	3.31	
CO3	3	3	4	3	3	3	4	4	4	4	4	4	4	3.62	
CO4	3	3	3	3	2	3	3	4	4	3	4	4	4	3.31	
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38	
Mean Overall Score														3.40	

Result: The Score of this Course is 3.40 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: PERICYCLIC REACTIONS [12 Hrs]

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3 – butadiene, 1,3,5 – hexatriene and allyl system. Classification. Electrocyclic reactions – cycloadditions and cheletropic reactions. Sigmatropic rearrangements – Woodward – Hoffmann rules and correlation diagrams.Claisen and Cope rearrangements. Fluxional tautomerism, Ene reaction, Applications of concerted reactions in organic synthesis.

UNIT – II: ORGANIC PHOTOCHEMISTRY [12 Hrs]

Introduction to organic photochemistry, Photochemical excitations, Fate of the excited molecules, Jablonski diagram, Study of photochemical reactions of alkenes, dienes, aromatic, carbonyl and conjugated systems, Norrish Type-I and IIreactions, Paterno- Buchi reaction, Di-pi-methane rearrangement, Applications of photochemical reactions in Organic Synthesis.

UNIT – III: AROMATICITY [12 Hrs]

Aromaticity of benzenoid, heterocyclic and non-benzenoid compounds, Huckel's rule – Aromatic systems with pi-electron numbers other than six – non-aromatic (cyclooctatetraene etc,) and antiaromatic system (cyclobutadiene etc.) – system with more than 10 pi electrons – Annulenes up to C18 (synthesis of all these compounds is not expected)

UNIT – IV: REAGENTS IN ORGANIC SYNTHESIS [12 Hrs]

Applications of the following reagents in organic synthesis: AIBN, 9-BBN, DCC, CAN, PCC, Crown ethers, LDA, Lindlar's catalyst, Gilman's reagent, 1,3-Dithiane-Umpolung, Trimethylsilyl iodide, Phase transfer catalysts, Wilkinson's catalyst, Baker yeast, Organo transition metal reagents. Applications of reagents containing silicon, Phosphorus, Sulphur, selenium, palladium, rhodium, and titanium reagents in organic synthesis.

UNIT – V: SELECTIVE NAME REACTIONS AND THEIR APPLICATIONS IN ORGANIC SYNTHESIS [12 Hrs]

Michael addition, Mannich reaction, Sharpless asymmetric epoxidation, Hofmann – Loffler – Freytag reaction, Knoevenagel reaction, Peterson Olefination reaction, Skraup reaction, Barton reaction, Reformatsky reaction, Von Richter reaction, Prevost reaction and Woodward modification of the Prevost reaction.

Text Books:

1. Jagdamba Singh, Jaya Singh, Photochemistry and Pericyclic Reactions, New Age International Publishers, 1st edi, 2017
2. S. M. Mukherji, "Pericyclic reactions", Mac Millan, India
3. F. A. Carey and R. J. Sundberg, Advanced organic chemistry, Plenum Publishers Ltd. 2000.
4. Clayden, Greeves, Warren, Wothers, Organic Chemistry, Oxford Univ Press.

Reference Books:

1. R.O.C. Norman, J.M. Coxon, Principles of organic synthesis, ELBS publications, 1994.
2. C. K. Ingold, Structure and Mechanism in Organic chemistry, Cornell Univ. Press.
3. Michael Smith, Organic Synthesis, McGraw Hill, 1996.
4. W. Carruthers, J.Coldham, Modern methods of Organic synthesism IV edition, Academic Press, 1989.

II M.Sc (CH)	INORGANIC CHEMISTRY – III For the students admitted in the year 2019	19PCH32
SEMESTER – III		HRS/WK – 4
CORE – VIII		CREDIT-4

Objectives:

To understand the concepts of spectral techniques and to apply these techniques for the quantitative and structural analysis of inorganic compounds. To learn the various concepts of organometallic chemistry.

COURSE OUTCOMES (COs)

CO1: To understand the bonding nature of the metal complexes and the reaction mechanisms of the metal complexes.
CO2: To learn the catalytic behavior of the metal complexes.
CO3: To gain knowledge in isolable analogy of the metal carbonyls.
CO4: To understand the EPR and photo electron spectra and the theories behind them.
CO5: To describe ^{31}P, ^{19}F NMR, and the principles, applications of NQR Mossbauer Spectroscopy.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III	COURSE CODE: 19PCH32					TITLE OF THE COURSE: INORGANIC CHEMISTRY – III								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	4	3	3	3	4	4	4	3	3	3	4	3	3.46	
CO2	4	4	4	3	3	3	3	3	4	4	4	3	4	3.54	
CO3	4	3	3	3	3	4	4	4	4	3	3	4	4	3.54	
CO4	4	4	3	3	3	3	3	3	4	3	4	4	4	3.46	
CO5	4	4	4	3	3	3	4	4	4	4	4	4	3	3.69	
Mean Overall Score														3.54	

Result: The Score of this Course is 3.54 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT- I: ORGANOMETALLIC CHEMISTRY – I [12 Hrs]

1.1 Organometallic Chemistry: Carbon σ donors: Alkyls and aryls - metalation reactions - Bonding in carbonyls and nitrosyls – Metal carbene (Fisher & Schrock) and carbyne complexes - Carbon π donors: olefins, acetylene and π-allyl systems - cyclic π donors - synthesis structure and bonding in ferrocene

1.2 Organometallic Reaction: Association, substitution, addition and elimination, ligand protonation, electrophilic and nucleophilic attack on ligands. carbonylation and decarbonylation, oxidative addition, reductive elimination,and fluxionality.

UNIT – II: ORGANOMETALLIC CHEMISTRY – II [12 Hrs]

2.1 Organometallic Chemistry - Catalysis: Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt catalyst (oxo process), oxidation of olefins to aldehydes (Wacker process).

2.2 Polymerization of Olefins: Polymerization (Zeigler – Natta Catalyst); cyclo oligomerization of acetylene using nickel catalyst (Repee's Catalyst); polymer- bound catalysts

UNIT – III: ORGANOMETALLIC CHEMISTRY – III [12 Hrs]

3.1 Monsanto acetic acid synthesis, water gas shift reaction, Fischer Tropsch synthesis – Olefin metathesis ROM & RCM

3.2 Parallels between main group and binary carbonyl complexes – the isolable analogy – isolable analogyCH_4, CH_3, CH_2, CH, C, CH_4^+ CH_3^+, CH_2^+, CH^+, CH_3^-, CH_2^-, CH^- fragments with metallic carbonyls – an extension of the isolobal analogy

UNIT – IV: INORGANIC SPECTROSCOPY - I [12 Hrs]

4.1 EPR Spectra: Hyperfine splitting: hyperfine splitting in isotropic systems involving one nucleus and more than one nucleus, hyperfine splitting caused by quadrupole nuclei. g value and the factors affecting g values, anisotropy in g-value, factors causing anisotropy.

4.2 EPR spectra of systems with more than one unpaired electrons: zero-field splitting, causes of ZFS, McConnel's equation, Krammer's theorem. ESR of transition metal complexes of copper, manganese and Vanadyl ions. ESR spectrum of simple organic free radicals.

4.3 Photoelectron spectroscopy (UV and X-ray) – photoelectron spectra of O_2 and N_2 molecules – Koopman's theorem, chemical shift,and correlation with electronic charges.

UNIT – V: INORGANIC SPECTROSCOPY -II [12 Hrs]

5.1 Inorganic Spectroscopy: ^{31}P ,^{19}F NMR spectrum of HPF_2, P_4S_3, TiF_4, BrF_5, SIF_6^{2-}, NF_3, ClO_4^-, $P_4N_4Cl_4F_2$, ClF_3 Phosphorous and Hypophosphorous acid systems - shift reagents.

5.2 NQR - Principles and applications of NQR - Mossbauer spectra – Principle, chemicals shift, Doppler shift - Mossbauer spectra of Fe and Sn systems.

5.3 Inorganic Spectroscopy: Applications to inorganic systems of the following: ultraviolet, visible, infra-red and Raman spectra of metal complexes, organometallic and simple inorganic compounds.

Text Books:

1. J.E. Huheey, Inorganic Chemistry, 5thEdn. Harper International.1993.
2. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5thEdn. John Wiley.1985.
3. M.F.Purcell, J.C.Kotz, Inorganic Chemistry, Saunder, 1977.
4. R.S.Drago, Physical Methods in Inorganic Chemistry, 2nd Edn, ELBS, 1985.
5. Gary L. Meisler, Donald A. Torr, Inorganic chemistry, 3rd Edition, Pearson, 2017

Reference Books:

1. P.Powell, Principles of Organometallic Chemistry, 2nd Edn. ELBS,1991.
2. R.S.Drago, Physical methods in Spectroscopic Techniques, 2nd Edn, ELBS, 1985.

II M.Sc (CH)	STATISTICAL THERMODYNAMICS AND ITS APPLICATIONS	PCH911S
SEMESTER – III		HRS/WK – 4
CORE – IX	For the students admitted in the year 2014	CREDIT-4

Objective:

To study the chemical potential and its significance. To get acquainted with statistical thermodynamics

COURSE OUTCOMES (COs)

CO1: To understand the average behavior of large group of individual particles and to know the probabilities about microstates of the system.

CO2: To develop a vast knowledge in the interpretation of partition function and to relate partition function and thermodynamic function.

CO3: To get acquainted with the concept of statistical mechanics of ensemble.

CO4: To study Partial molar properties and thermodynamics of real gases.

CO5: To give the concept of thermodynamics of ideal and non-ideal binary solutions with problem solving skill.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III	COURSE CODE: PCH911S					TITLE OF THE COURSE: STATISTICAL THERMODYNAMICS AND ITS APPLICATIONS						HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)							MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	2	3	3	4	3	4	3	2	3	3	3	4	3	3.07
CO2	3	4	3	3	3	4	4	3	3	3	3	3	3	3.23
CO3	2	4	3	3	3	3	3	2	3	3	3	3	3	2.92
CO4	4	4	4	3	3	4	4	4	4	3	3	4	3	3.61
CO5	4	4	3	3	2	4	4	3	3	3	3	4	3	3.30
Mean Overall Score														3.22

Result: The Score of this Course is 3.22 (High

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: STATISTICAL THERMODYNAMICS I [12 Hrs]

Objectives of statistical thermodynamics – the concept of thermodynamics and mathematical probabilities – distribution of distinguishable and nondistinguishable particles.

Maxwell Boltzmann, Fermi – Dirac, and Bose-Einstein statistics – comparison and applications – modes of contribution to energy – Ortho and Parahydrogen – radiation law – an electron in metals.

UNIT – II: STATISTICAL THERMODYNAMICS II [12 Hrs]

The partition function –Boltzmann distribution –the interpretation of the partition function – examples of the partition function.

Partition function evaluation of translational, vibrational and rotational partition functions for mono, diatomic and polyatomic ideal gases.

Thermodynamic functions in terms of partition functions, isotope exchange and dissociation of diatomic molecules – application of partition functions to heat capacities of ideal gases – nuclear partition function – Einstein and Debye models.

UNIT – III: STATISTICAL THERMODYNAMICS III & IRREVERSIBLE THERMODYNAMICS [12 Hrs]

Statistical mechanics of ensemble – thermodynamic functions of the ensemble- canonical ensemble- properties of the canonical ensemble- grand canonical ensemble- microcanonical ensemble.

UNIT – IV: THERMODYNAMICS I [12 Hrs]

Partial molar properties – Partial molar free energy (Chemical Potential) – Partial molar volume and Partial molar heat content – Their significance and determination of these quantities - Variation of chemical potential with temperature and pressure.

Thermodynamics of real gases – gas mixture – definition of fugacity – determination of fugacity – a variation of fugacity with temperature and pressure.

UNIT – V: THERMODYNAMICS II [12 Hrs]

Thermodynamics of ideal and nonideal binary solutions – dilute solutions.

Excess function for non ideal solutions and their determination – the concept of activity and activity coefficients – determination of standard free energies – choice of standard states – determination of activity and activity coefficients for electrolytes by EMF vapour pressure measurements.

Gibbs Duhem equation and solubility product method – Thermodynamic equilibrium – Three component system.

Text Books:

1. M.C. Gupta. Statistical thermodynamics. Revised 2nd edition. New age international publishers.
2. Rajaram and J.C. Kuriacose, Thermodynamics for Students of Chemistry, New Delhi: Lal Nagin Chand, 3rd editon1986.

Reference Book:

1. P.W. Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford 3rd edition, 1983.

II M.Sc (CH)	PHYSICAL METHODS IN ORGANIC CHEMISTRY	19EPCH34
SEMESTER - III		HRS/WK – 4
ELECTIVE - 3	For the students admitted in the year 2019	CREDIT-4

Objective:

To understand the concepts of spectral techniques and to apply these techniques for the quantitative and structural analysis of organic compounds.

COURSE OUTCOMES (COs)

CO1: Students learn concepts and applications of UV-Vis spectroscopy.

CO2: Students get learnt the concept IR spectroscopy and are able to find out the IR stretching frequency of organic functional groups.

CO3: Students get to know the instrumentation, ionization techniques and fragmentation patterns, of chemical compounds using mass spectrometry.

CO4: Students learn and understand the concepts of ^{1}H NMR spectroscopy and its applications.

CO5: Students learn the principles, techniques and applications of ^{13}C NMR spectroscopy for the structural elucidation.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III	COURSE CODE: 19EPCH34					TITLE OF THE COURSE: PHYSICAL METHODS IN ORGANIC CHEMISTRY								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	3	4	3	4	3	4	4	3	3	4	4	4	3.54	
CO2	3	3	4	3	3	4	4	3	4	3	4	4	4	3.54	
CO3	3	3	4	3	3	3	4	4	4	4	4	4	4	3.62	
CO4	3	4	3	3	4	3	4	4	4	3	4	5	4	3.69	
CO5	3	3	3	4	3	3	4	3	3	4	4	4	4	3.46	
Mean Overall Score														3.51	

Result: The Score of this Course is 3.51 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: UV – VISIBLE SPECTROSCOPY [12 Hrs]

Electronic transitions – Beer-Lambert's law,the effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Woodward-Fieser rulesfor conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic and heterocyclic compounds. Octant rule, Applications of ORD and CD to stereochemicalassignments.

UNIT – II: INFRARED SPECTROSCOPY [12 Hrs]

Instrumentation and sample handling. Vibrational frequencies of different functional groups. Effect of hydrogen bonding and solvent on vibrational frequencies, overtones,combination bands,and Fermi resonance. FT – IR. IR of gases,solids and polymeric materials.

UNIT – III: MASS SPECTROMETRY [12 Hrs]

Introduction, ion production – EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, of common functional groups, molecular ion peak, base peak, and isotope peaks, metastable peak, McLafferty rearrangement. Nitrogen rule. High-resolution mass spectrometry. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

UNIT – IV: ^{1}H -NMR SPECTROSCOPY [12 Hrs]

Basic principles. Macroscopic magnetization. General introduction to NMR techniques – CW and FT NMR techniques, magnetic anisotropy,^{1} H NMR spectral parameters – chemical shift, coupling constant, factors affecting chemical shift. Karplus equation. Proton NMR spectra of simple organic molecules. Simplification of complex spectra. Nuclear Overhauser effect (NOE). Identification of Homotopic, diastereotopic and enantiotopic protons.

UNIT – V: ^{13} C NMR SPECTROSCOPY [12 Hrs]

^{13}C NMR – proton decoupled and off-resonance spectra. Factors affecting ^{13}C chemical shift – electronegativity. ^{13}C NMR spectra of simple organic molecules. DEPT spectra. 2D NMR techniques^{1}H COSY, ^{13} C COSY spectra.

Text Books:

1. R.M. Silverstein, G.C. Bassler, and T.C. Morrill, Spectrometric Identification of Organic compounds, John Wiley.,1997
2. D.H. Williams, I. Fleming, Spectroscopic Methods in Organic Chemistry, Tata McGraw – Hill, 1998.
3. W. Kemp, Spectroscopy, Macmillan Ltd., 1994.

Reference Books:

1. J. R. Dyer, Application of spectroscopy of Organic Compounds, Prentice-Hall.
2. Jagmohan, Spectroscopy of Organic compounds, Narosa Publications.
3. Pavia, Lampman and Kriz, Introduction to Spectroscopy, 3rd edition, Brooks/Cole Pubs. Co.

II M.Sc (CH)	BIOORGANIC CHEMISTRY For the students admitted in the year 2017	EPCH912A
SEMESTER – III		HRS/WK – 4
ELECTIVE – 3		CREDIT-4

Objectives:

This course aims to explain the basic concepts in Chemistry and Metabolism of Carbohydrates, amino acids, Proteins and Lipids. In addition to this, the student can gain the full understanding of various types of Nucleic acids and classification of Vitamins and Enzyme.

COURSE OUTCOMES (COs)

CO1: To study about the classification and biological role of carbohydrates.
CO2: To study about the types of amino acids and its metabolism, proteins types
CO3: To study about various types of lipids and its metabolism.
CO4: To understand about structure and function of DNA, RNA
CO5: To know about the vitamins types and its biological role.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III	COURSE CODE: EPCH912A					TITLE OF THE COURSE: BIOORGANIC CHEMISTRY								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	3	3	4	4	4	4	4	4	3	3	3	4	3.53	
CO2	4	4	4	3	3	4	3	4	4	3	4	4	5	3.76	
CO3	4	4	3	3	4	4	4	3	3	4	5	4	3	3.69	
CO4	4	3	3	3	4	5	4	3	3	3	4	4	5	3.69	
CO5	4	3	3	3	3	4	4	4	4	4	5	3	4	3.69	
Mean Overall Score														3.67	

Result: The Score of this Course is 3.67 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: CHEMISTRY AND METABOLISM CARBOHYDRATES [12 Hrs]

Definition, classification and biological role of carbohydrates.Monosaccharides Linear and ring structures (Haworth formula) of ribose, glucose, fructose, and mannose (structural 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.

UNIT – II: CHEMISTRY AND METABOLISM OF AMINO ACIDS AND PROTEINS [12 Hrs]

Amino acids: Various classifications, essential amino acids, physical properties (amphoteric nature and isoelectric point) and reactions.

Proteins: Classifications (based on shape, composition, and solubility), physical properties.

Primary structure - End group analysis (N- terminal analysis- Edman's method, dansyl chloride method; C - terminal analysis- hydrazinolysis and biochemical methods)

Biological functions of proteins, Deamination, transamination reactions, Urea cycle.

UNIT – III: CHEMISTRY AND METABOLISM OF LIPIDS [12 Hrs]

Definition, classification- simple lipids (fatty acids), compound lipids and derived lipids. Properties: saponification number, Acetyl number.

Sterols: Cholesterol (structure not needed), biological importance and chemical properties. Bile acids- functions. Biological functions of lipids.

UNIT – IV: NUCLEIC ACIDS [12 Hrs]

Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, DNA structure - various types, RNAstructure - various types.

Biological functions of DNA and RNA, Genetic code.

UNIT – V: VITAMINS [12 Hrs]

Vitamins: Definition, classification- water-soluble vitamins (B_v B_2, B_3, B_6, B_{12} and vitamin-C) and fat-soluble vitamins (A, D, E and K) - occurrence, structure, deficiency diseases, biochemical rules,and daily requirements

Text Books:

1. C.B. Powar and G.R. Chatwal. Biochemistry
2. Ragunatha Rao, Elements of Biochemistry

Reference Books:

1. U. Sathyanarayanan, Essential Biochemistry
2. J.L. JAIN, Essential Biochemistry

II M.Sc (CH)	ORGANIC CHEMISTRY PRACTICALS –II For students admitted in the year 2016	PCHP304T
SEMESTER – III		HRS/WK – 4
PRACTICAL-IV		CREDIT-2

COURSE OUTCOMES (COs)

CO1: Students learn the Quantitative Organic analysis.

CO2: Students learn the double stage organic compound preparation.

(External Marks: 60 & Internal Marks: 40)

Course outcome:

1. Students learn Quantitative Organic analysis.
2. Students learn the double stage of organic compound preparation.

1.a)Preparation of organic compounds involving two stages.
b) Spectral interpretation of organic molecules.

2. Quantitative Organic analysis
   i) Estimation of Phenol
   ii) Estimation of Aniline
   iii) Estimation of Glucose

Quantum of marks in respect of the Practical Examinations:

1. Preparation and spectral interpretation (15 +10)	25 marks
2. Estimation	25 marks
3. Viva-voce	5 marks
4. Record	5 marks
Total	**60 marks**

Text Books:

1. Mann and Saunders, Laboratory Manual of Organic Chemistry.
2. Vogel's Quantitative Organic Analysis.

Reference Books:

1. R.M. Silverstein, G.C. Bassler, and T.C. Morrill, Spectrometric Identification of Organic compounds, John Wiley.,1997
2. D.H. Williams, I. Fleming, Spectroscopic Methods in Organic Chemistry, Tata McGraw – Hill, 1998.

II M.Sc (CH)	INORGANIC CHEMISTRY PRACTICALS –II For the students admitted in the year 2019	19PCHP32
SEMESTER – III		HRS/WK – 4
PRACTICAL - V		CREDIT-2

COURSE OUTCOMES (COs)

CO1: To improve the skill in quantitativeestimation of metal ions by colorimetry.
CO2: To identify the methodology to estimate a metal ion in the presence of another metal ion.
CO3: To improve the skill in the synthesis of inorganic compounds

1. Spectral interpretation of some inorganic compounds
2. Colourimetric estimation of metal ions (Fe, Cu, Ni)
3. Estimation of metal ions by Gravimetric and Volumetric analysis(Cu, Ni, Zn, Fe)

EVALUATION PATTERN

Continuous internal assessment (CIA) (40 marks)

Based on the periodical evaluation of record and experiments assessed by the staff in charge

External Examination (60 marks)

Duration: 6 Hrs **Total Marks: 60**

1. Estimation of metal ions by Volumetric & Gravimetric method - 20 marks
2. Estimation of metal ions by photo colorimetric method - 15 marks
3. Preparation of complex - 10 marks
4. Spectral interpretation - 10 marks
5. Viva voce - 5 marks
6. Record - 10 marks

II M.Sc (CH)	PHYSICAL CHEMISTRY PRACTICALS – II For the students admitted in the year 2014	PCHP306
SEMESTER – III		HRS/WK – 4
PRACTICAL - VI		CREDIT-2

COURSE OUTCOMES (COs)

CO1: Students learn various experiments in Conductometry, Potentiometry and Pulse polarography.

I. **Pulse Polarography.**
1. Determination of Half wave potential of Cd ion in KCl.
2. Determination of Half wave potential of Zn & Mn.
3. Determination of Pb and Cu in Steel.
4. Determination of Ni, Zn, and Fe.
5. Analysis of Cu based Alloys.
6. Stability constants for complexes (Pb Oxalate complexes).

II. **UV- Visible Spectrophotometer**
1. Determination of concentration of Potassium Nitrate.
2. Determination of molar extinction coefficient of Potassium dichromate and Potassium permanganate.
3. Determination of concentration of para paracetamol in the antipyretic drug.

III. **Nephelometer**
1. Nephelometric determination of Sulphate.
2. Nephelometric determination of Phosphate.

IV. Conductometric Titrations.
1. Determination of strength of weak acid (CH_3COOH Vs NaOH)
2. Determination of strength of strong acid (HCl Vs NaOH).
3. Determination of strength of a mixture of acids (HCl+CH_3COOH Vs NaOH)
4. Determination of Endpoint in the Precipitation titration (KCl Vs $AgNO_3$)
5. Verification of Ostwald's dilution law.
6. Verification of Onsager's equation.

V. Potentiometric Titrations.
1. Determination of pH of the buffer using Quinhydrone electrode.
2. Determination of pKa of a weak acid using Std. NaOH solution.
3. Determination of strength of FAS using Redox titration (FAS Vs $KMnO_4$).
4. Determination of Single Electrode potential.
5. Determination of strength of strong acid (HCl Vs NaOH).
6. Determination of strength of weak acid (CH_3COOH Vs NaOH)
7. Determination of Endpoint in the Precipitation titration (KCl + KI Vs $AgNo_3$)

VI. **Computational Chemistry.**
1. Computing atomic charges for H_2O molecule by AIM method.
2. Computing molecular orbital coefficients of 1,3-cyclobutadiene by HF method.
3. Geometry optimization of H_2O by HFSCF method.

Scheme of Evaluation: (Total = 60 marks)

Aim & short procedure	– 10
Record	– 5
Experiment & manipulation	- 35
Viva voce	– 10
Total	**- 60**

II M.Sc (CH)	ORGANIC CHEMISTRY - IV For the students admitted in the year 2019	19PCH41
SEMESTER - IV		HRS/WK – 4
CORE – X		CREDIT-4

Objectives:

To learn the chemistry of functional groups of organic compounds. To learn the modern synthetic methods and synthetic strategies. This helps in planning the synthesis of any type of organic compound and natural products.

COURSE OUTCOMES (COs)

CO1: Knowledge pertaining Alkaloids and Bioorganic chemistry
CO2: proteins peptides and their structures
CO3: Modern synthetic methods, reactions, and reagents
CO4: Knowledge pertaining to Reterosynthesis
CO5: Advanced programming techniques using pointers, files and graphics concepts.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: 19PCH41					TITLE OF THE COURSE: ORGANIC CHEMISTRY - IV								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	5	5	4	5	3	4	4	4	4	4	4	4	4	4.1	
CO2	4	4	4	4	5	4	4	4	4	4	4	4	4	4.0	
CO3	5	5	4	4	5	4	5	5	5	4	5	4	4	4.5	
CO4	5	5	4	5	4	5	5	5	5	4	5	4	4	4.6	
CO5	4	4	4	4	4	5	5	5	5	4	5	4	4	4.3	
Mean Overall Score														4.3	

Result: The Score of this Course is 4.3 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **Very High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: ALKALOIDS AND BIOORGANIC CHEMISTRY [12 Hrs]

Total synthesis of quinine, morphine, reserpine, cocaine, hygrine,and reticulene

Nucleic acids: Types of nucleic acids – DNA & RNA polynucleotide chain. Components – Structure and role of (genetic code) DNA and RNA (Nucleotides only).

UNIT – II: PROTEINS [12 Hrs]

Peptides and their synthesis – synthesis of tripeptide. Merrifield synthesis, End group analysis of peptides, Primary,Secondary and tertiary structure of proteins, Determination ofthe tertiarystructure of proteins.

UNIT – III: MODERN SYNTHETIC METHODS, REACTIONS, AND REAGENTS [12 Hrs]

Principles and synthetic processes involving phase transfer catalysis, (Nitriles from Alkyl halides, Alcohol from Alkyl halides) Polymer-supported reagents(Synthesis of oligosaccharides), (Microwave-assisted Organic synthesis – Esterification, deacetification,and hydrolysis)Synthesis of simple organic molecules using standard reaction like acetylation,alkylation of enamines and active methylene compounds, Grignard reactions, Phosphorus and sulphur ylides,Protection and deprotection of functional groups(R-OH, R-CHO, RCO-R , R-NH_2 and R-COOH).

UNIT – IV: PLANNING ORGANIC SYNTHESIS AND RETROSYNTHETIC ANALYSIS [12 Hrs]

An introduction to retrosynthesis – Synthon, Synthetic equivalent, Target molecule, Functional group interconversion – Disconnection approach – One group disconnection – Disconnection of simple alcohols, olefins and ketones – Logical and illogical disconnections, Two group disconnection –1,2 – 1,3 – 1,4 – 1,5 and 1,6 – dioxygenated skeletons and dicarbonyls. Retro Diels – Alder reactions.(Synthesis of the following target molecules: cyclohex-3-ene carbaldehyde, 1-phenylpentan-3-one,1-bromo-3-methylbut-2-ene,(E)-3-(4-nitrophenyl)acrylaldehyde,Pentane-2,4- dione,ethyl-2-oxocyclopentane carboxylate,nonane-3,7-dione, 2-amino-3-methyl butanoic acid,2,3-dimethylbutane-2,3-diol)

UNIT – V: HETEROCYCLES, VITAMINS, AND STEROIDS [12 Hrs]

Imidazole, Oxazole, Thiazole, Flavones, isoflavones, anthocyanins, pyrimidines (cytosine and L uracil only) and purines(adenine, Guanine only). Synthesis of parent and simple alkyl or aryl substituted derivatives are expected. Synthesis of vitamin A1 (Reformatsky and Wittig reaction methods only). Conversion of cholesterol to progesterone, estrone,and testosterone.

Text Books:

1. T. K Lindhorst, Essentials of Carbohydrate Chemistry and Biochemistry, Wiley VCH, North America, 2007.
2. G. K. Chatwal, Organic Chemistry on Natural Products, Vol. 1, Himalaya Publishing House, Mumbai, 2009.
3. G. K. Chatwal, Organic Chemistry on Natural Products, Vol. 2, Himalaya Publishing House, Mumbai, 2009.
4. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 1, Goel Publishing House, Meerut, 1997.
5. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 2, Goel Publishing House, Meerut, 1997.
6. I. L. Finar, Organic Chemistry Vol-2, 5th ed., Pearson Education Asia, 1975.

7. Workbook for organic synthesis, The disconnection approach by Stuart Warren, John Wiley & Sons (Asia) Pvt. Ltd.,

References Books:

1. Pelletier, Chemistry of alkaloids, Van Nostrand Reinhold Co, 2000.
2. Shoppe, Chemistry of the steroids, Butterworthes, 1994.
3. I. A. Khan, and A. Khanum. Role of Biotechnology in medicinal&aromatic plants, Vol 1 and Vol 10, Ukkaz Publications, Hyderabad, 2004.
4. M. P. Singh, and H. Panda, Medicinal Herbs with their formulations, Daya Publishing House, Delhi, 2005.
5. Guidebook to organic synthesis by Ramond K. Mackie and David M. Smith, ELBS Publication.

II M.Sc (CH)	INORGANIC CHEMISTRY – IV For the students admitted in the year 2019	19PCH42
SEMESTER – IV		HRS/WK – 4
CORE – XI		CREDIT-4

Objectives:

To learn about the reaction mechanisms of transition metal complexes. To acquire the knowledge of solid state chemistry.

COURSE OUTCOMES (COs)

CO1: To learn about the reaction mechanisms of transition metal complexes.
CO2: To acquire the knowledge of photochemistry.
CO3: To describe about the electron transfer reactions.
CO4: To gain knowledge on solid state chemistry.
CO5: To describe electronic and magnetic properties of molecules.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: 19PCH42					TITLE OF THE COURSE: INORGANIC CHEMISTRY – IV								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	4	4	3	3	4	4	4	4	3	4	3	3	3.61	
CO2	3	3	3	3	3	3	3	4	3	4	4	3	3	3.23	
CO3	4	4	4	3	3	4	4	4	3	3	3	3	3	3.46	
CO4	3	3	4	3	3	4	3	3	3	3	3	3	3	3.15	
CO5	4	4	4	4	3	4	3	3	4	4	4	4	4	3.78	
Mean Overall Score														3.45	

Result: The Score of this Course is 3.45 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT – I: REACTION MECHANISM OF TRANSITION METAL COMPLEXES-I [12 Hrs]

1.1 Energy profile of a reaction, inert and labile complexes, substitution reactions of octahedral complexes-, acid hydrolysis, base hydrolysis, conjugate base mechanism, anation reactions.

1.2 Synthesis of Platinum & Cobalt complexes by substitution reactions.

UNIT – II: REACTION MECHANISM OF TRANSITION METAL COMPLEXES-II [12 Hrs]

2.1 Substitution reactions in square planar complexes, mechanism of Substitution reactions-Trans effect – theories of Trans effect. Reactivity of platinum complexes, influences of entering, leaving and other groups and a central metal ion.

2.2 Inorganic Photochemistry: photo-substitution, photo redox &isomerization process, application of metal complexes in solar energy conversion.

UNIT – III: ELECTRON TRANSFER REACTIONS [12 Hrs]

3.1Electron transfer reactions: Outer and Inner sphere processes, atom transfer reaction. Formation and rearrangement of precursor complexes, the nature of the binding ligand, successor complexes, Marcus theory.

3.2 Complementary, Non-complementary and two-electron transfer reactions.

UNIT – IV: SOLID STATE CHEMISTRY - I [12 Hrs]

4.1 Solid state reactions: General principles, coprecipitation as a precursor to solid-state reactions, the kinetics of solid-state reactions – types of the void – types of crystal structures – NaCl, Rutile, Wurtzite, Zincblende and CaF_2

4.2 Crystal defects and nonstoichiometry: perfect and imperfect crystals, intrinsic and extrinsic defects – point defects, line and plane defects, – Schottky defects and Frenkel defects. Thermodynamics of Schottky defects and Frenkel defect formation, colour centres, nonstoichiometry defect.

UNIT – V: SOLID STATE CHEMISTRY – II [12 Hrs]

5.1Electronic Properties and Band Theory, the band structure of metals, insulators, and semiconductors. , intrinsic and extrinsic semiconductors, doping semiconductors, superconductors – theories and applications

5.2Optical properties- Optical reflectance, photoconduction-photoelectric effects Magnetic properties- Classification of materials: para, dia, Ferro, Ferri, antiferromagnetism - Magnetic Susceptibility and measurements – Guoy method, Faraday method, VSM, and their applications – magnetic domains, hysteresis.

Text Books:

1. J.E. Huheey, Inorganic Chemistry, 5thEdn. Harper International.1993.
2. M.F.Purcell, J.C.Kotz, Inorganic Chemistry, Saunder, 1977.
3. W.R.West, Solid State Chemistry and its Applications, John Wiley and Sons, New York, 1984.

Reference Books:

1. G.J.Ferraudi, Inorganic Photochemistry, 1973.
2. A.W.Adamson, E.D.Fleishcer, Concepts in Inorganic Photochemistry, 1963.
3. L. E. Smart, E. A. Moore, Solid State Chemistry – An introduction 3rded, Taylor and Francis group 2005.

4. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5thEdn. John Wiley.1985.
5. H.V.Keer, Principles of Solid State, Wiley Eastern Limited, 1993.

II M.Sc (CH)	REACTION KINETICS, ELECTRODE KINETICS AND PHOTOCHEMISTRY	19PCH43
SEMESTER - IV		HRS/WK – 4
CORE – XII	For the students admitted in the year 2019	CREDIT-4

Objective:

To study the chemical potential and its significance. To study the effect of temperature on reaction rate. To study the different types Enzyme catalysis and Kinetics of complex reactions.

COURSE OUTCOMES (COs)

CO1: To study the chemical potential and its significance.
CO2: To study the effect of temperature on the reaction rate.
CO3: To study the different types of Enzyme catalysis and Kinetics of complex reactions.
CO4: To understand about the kinetics of unimolecular and bimolecular photo physical processes.
CO5: To study about types of photochemical reactions and radiation chemistry.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: 19PCH43					TITLE OF THE COURSE: REACTION KINETICS, ELECTRODE KINETICS AND PHOTOCHEMISTRY								HOURS: 4	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	4	4	3	3	5	4	3	4	3	3	3	4	3.61	
CO2	3	3	4	4	4	4	5	4	4	3	4	5	4	3.46	
CO3	3	4	4	4	4	5	5	4	4	3	3	4	5	4.00	
CO4	4	4	3	4	4	4	4	3	3	5	3	4	3	3.69	
CO5	3	4	4	4	4	3	3	3	4	4	4	4	4	3.69	
Mean Overall Score														3.69	

Result: The Score of this Course is 3.69 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome.

UNIT - I: CHEMICAL KINETICS I [12 Hrs]

1.1 Effect of temperature on reaction rates – collision theory of reaction rate – molecular beams – collision cross sections – effectiveness of collisions – probability factor.

1.2 Potential energy surfaces – partition function and activated complex – erying equation – estimation of free energy, enthalpy, and entropy of activation and their significance.

1.3 Reactions in solutions – the effect of pressure, dielectric constant and ionic strength on reactions in solutions – kinetic isotope effects.

1.4 Acid-base catalysis – mechanism of acid-base catalyzed reactions – Bronsted catalysis law.

UNIT – II: CHEMICAL KINETICS II [12 Hrs]

2.1 Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions – general treatment of chain reactions – chain length – rice Herzfeld mechanism – explosion limits.

2.2 Catalysis by enzymes – the rate of enzyme reactions – the effect of substrate concentration, pH and temperature on enzyme-catalyzed reactions – Inhibition of enzyme-catalyzed reactions.

2.3 Study of surfaces – Langmuir and BET adsorption isotherms – the study of the kinetics of surface reactions – catalytic by metals, semiconductor oxides – mechanism of heterogeneous catalytic reactions – the absorption coefficient and its significance.

2.4 Study of fast reactions – relaxation methods – temperature and pressure jump methods – stopped flow and flash photolysis methods.

UNIT – III: ELECTRODE KINETICS [12 Hrs]

3.1 Mean ionic activity and mean ionic activity coefficient – concept of ionic strength, Debye- Huckel theory of strong electrolytes – activity coefficient of strong electrolytes – determination of activity coefficient by electrical method – Debye – Huckel limiting law-qualitative and quantitative verification – limitation of Debye Huckel limiting law at appreciable concentrations of electrolytes – Huckel equation – Debye – Huckel – Bronsted equation.

3.2 Electrode-electrolyte interface – adsorption at the electrified interface – electrified double layer – an electrocapillary phenomenon – Lipmann equation – the structure of double layers – Helmholtz – Perrin, Guoy – Chapman and Stern model of electrical double layers. Butler-Volmer and Tafel equation- applications in electrode reactions, overvoltage,and corrosion.

3.3 Irreversible thermodynamics – forces and fluxes – linear force – flux relation – phenomenological equations – Onsager's theorem diffusion – electrokinetic phenomena – membrane potential.

UNIT – IV: PHOTOCHEMISTRY – I [12 Hrs]

4.1 Absorption and emission of radiation – Franck – Condon Principle – decay of electronically excited states – Jablonski diagram – radiative and nonradiative processes – fluorescence and phosphorescence – spin forbidden radiative transition – internal conversion and intersystem crossing – energy transfer process.

4.2 Kinetics of unimolecular and bimolecular photophysical processes – excimers and exciplexes – static and dynamic quenching – Stern Volmer analysis.

UNIT – V: PHOTOCHEMISTRY II [12 Hrs]

5.1 Experimental methods – quantum yield and lifetime measurements – steady state principle – quantum yield and chemical actinometry.

5.2 Kinetics of photochemical reactions: hydrogen and halogen reactions, photoredox, photo substitution, photoisomerization,and photosensitized reactions – photovoltaic and photogalvanic cells, photo-assisted electrolysis of water, and aspects of solar energy conversion.

5.3 Radiation chemistry – Interaction of high energy radiation with matter – primary and secondary processes – G value – radiolysis of water – hydrated electron.

Text Books:

1. J.Rajaram and J.C.Kuriacose, kinetics and mechanism of chemical transformation. India: Macmillan India Ltd. 1993.
2. K.K. Rohatgi Mukherjee, Fundamentals of Photochemistry, Wiley Eastern Ltd, 1978.

Reference Book::

1. K.J. Laidler, Chemical Kinetics. New York: Harpet and Row, 2nd Indian edition.., 1987.

Question paper pattern for Post graduate

THEORY EXAMINATION

Continuous internal assessment (CIA) (25 marks)

1.	Two internal Examinations	15 marks
2.	Assignment / Seminar	10 marks
	Total	**25 marks**

External Examination (75 marks)

Question Pattern

Time: 3 Hours **Max. Marks: 75**

SECTION – A (20 x 1 = 20)

Answer **ALL** the Questions

I. Choose the correct answer (10 x 1 = 10)

II. Fill in the blanks (5 x 1 = 5)

III. Match up the following (5 x 1 = 5)

SECTION -B (10 x 2 = 20)

Answer any **Ten** out of **Twelve**

SECTION –C (5x 7 = 35)

Answer **Five out of Seven**

(Each question should contain a maximum of two subdivisions)

NOTE:

1. Equal weightage will be given for all units.

2. For Physical Chemistry Papers = 20 % of the questions are problems.