



M.Sc. ORGANIC CHEMISTRY
(For students admitted from the academic year 2014-2015)
CURRICULUM AND SYLLABUS

FACULTY OF SCIENCE AND HUMANITIES
SRM UNIVERSITY
SRM NAGAR, KATTANKULATHUR – 603 203

M.Sc. ORGANIC CHEMISTRY
(For students admitted from the academic year 2014-2015)
CURRICULUM AND SYLLABUS

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	Total of L+T+P	C
SEMESTER I						
PCY14101	Inorganic Chemistry-I	3	3	-	6	4
PCY14102	Organic Chemistry-I	3	3	-	6	4
PCY14103	Physical Chemistry-I	3	3	-	6	4
PCY14104	Nanochemistry	3	3	-	6	3
PCY14105	Inorganic Chemistry Practical	-	-	6	6	3
Total		12	12	6	30	18
SEMESTER II						
PCY14201	Inorganic Chemistry-II	4	1	-	5	4
PCY14202	Organic Chemistry-II	4	1	-	5	4
PCY14203	Physical Chemistry-II	4	1	-	5	4
PCY14204	Analytical Chemistry	4	1	-	5	4
PCY14205	Organic Chemistry Practical	-	-	5	5	3
PCY14206	Physical Chemistry Practical	-	-	5	5	3
Total		16	4	10	30	22

SEMESTER III						
PCY14321	Natural Products	4	1	-	5	4
PCY14322	Spectroscopy of Organic Compounds	4	1	-	5	4
xxxxxxx	Elective - 1 (List IC)	4	1	-	5	4
xxxxxxx	Elective - 2 (List II)	3	1	-	4	3
PCY14323	Multistep Synthesis of Organic Compounds and Estimations	-	-	6	6	3
PCY14305	Applications of Computer in Chemistry	2	1	-	3	2
PCY14306	Mini Project*	-	-	2	2	2
Total		17	5	8	30	22
SEMESTER IV						
xxxxxxx	Elective- 3 (List IC)	4	1	-	5	4
PCY14402	Career Comprehensive Course*	2	-	-	2	2
PCY14403	Project Work	-	-	12	12	12
Total		6	1	12	19	18
Total number of credits to be earned for the award of degree				80		

Mode for opting specialization: The number of seats in each specialization course would be upto a maximum of 30% of the total eligible candidates

LIST - I (C) (MAJOR ELECTIVES)

SEMESTER	SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	Total of L+T+P	C
III	PCY14E05	Heterocyclic Chemistry	4	1	-	5	4
	PCY14E06	Organic Synthesis	4	1	-	5	4
IV	PCY14E55	Bio-organic Chemistry	4	1	-	5	4
	PCY14E56	Pharmaceutical Chemistry	4	1	-	5	4
	PCY14E57	Advanced Experimental Techniques and Organic Synthesis	4	1	-	5	4

LIST - II (INTERDISCIPLINARY ELECTIVES)

SEMESTER	SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	Total of L+T+P	C
III	PCY14E07	Scientific research methodology	3	1	-	4	3
	PCY14E08	Chemistry of nano science and Technology	3	1	-	4	3
	PCY14E09	Industrial Chemical Analysis and Quality Control	3	1	-	4	3
	PCY14E10	Environmental Chemistry	3	1	-	4	3
	PCY14E11	Industrial Chemistry	3	1	-	4	3

Note:

* - Continuous Assessment (Full Internals)

L – Lecture Hours, T – Tutorial Hours, P – Practical Hours & C – Credits

SEMESTER I

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14101	Inorganic Chemistry-I	3	3	-	6	4
INSTRUCTIONAL OBJECTIVES						
(i)	To study in depth about atomic structure , periodic table , bonding and structure					
(ii)	To gain knowledge about the main group chemistry					
(iii)	To acquire knowledge about coordination chemistry					
(iv)	To study in detail about the reaction mechanism of complexes					

UNIT I Atomic Structure and Periodic Table

Atom as nucleus with orbital electrons, concept of wave-functions, quantum numbers and spin, shape of s, p and d orbitals and their radial distribution functions, electronic configuration of atoms, Aufbau principle, Pauli Exclusion Principle and Hund's rule. Slater's rules for the determination of screening constants; arrangement of elements in Groups in the Periodic Table- s-block, p-block, d-block and f- block elements; periodic properties, ionic radii, ionization potential, electron affinity, electronegativity (Pauling, Mulliken and Alfred-Rochnow scales) atomic states and term symbols.

UNIT II Bonding and Structure

Types of bonds, ionic, covalent, coordinate, double and triple bonds, orbital symmetry and overlaps. Concept of MO and VB theory, concept of hybridization, the extent of d orbital participation in molecular bonding, bond energy and covalent radii. Concept of resonance, bond moment and molecular dipole moment; polarizing power and polarizability and Fajan's rules.

UNIT III Main Group Chemistry

Main Group Chemistry: Chemistry of boron – borane, higher boranes, carboranes, borazines and boron nitrides. Chemistry of silicon – silanes, higher silanes, multiple bonded systems, disilanes, silicon nitrides, siloxanes and silicates. P-N compounds, cyclophosphazenes and cyclophosphazanes. S-N compounds – S_4N_4 , (SN)_x.

Ionic Model-Lattice energy–Born-Landé equation – Kapustinski equation - High T_c superconductors–Solid state reactions–Types and examples.

UNIT IV Coordination Chemistry

Theories of Metal-Ligand bond: VB theory and its limitations – Crystal field theory - splitting of d-orbitals under various geometries – Factors affecting splitting–CFSE and evidences for CFSE (Structural and thermodynamic effects) – Spectrochemical series – Jahn Teller distortion – Spectral and magnetic properties of complexes – Site preferences - Limitations of CFT – Ligand field theory – MO theory – sigma – and pi-bonding in complexes–Nephelauxetic effect–The angular overlap model.

UNIT V Reaction Mechanism of complexes

Coordination Chemistry–Reaction Mechanism: Kinetics and mechanism of reactions in solution–labile and inert complexes – Ligand displacement reactions in octahedral and square planar complexes – acid hydrolysis, base hydrolysis and anation reactions – trans effect – theory and applications. Electron transfer reactions – electron exchange reactions – complementary and non-complementary types –inner sphere and outer sphere processes – Application of Electron transfer reactions in inorganic complexes - isomerization and racemization reactions of complexes – Molecular rearrangement – reactions of four and six- coordinate complexes – Interconversion between stereoisomers. Reactions of coordinated ligands–Template effect and its application for the synthesis of Macrocyclic ligands – Unique properties.

Text Books

1. Day, M.C and Selbin, J (1985): Theoretical Inorganic Chemistry, 2nd Edition, Affiliated East West Press Pvt.Ltd.
2. Cotton, F. A and Wilkinson, G (2009): Advanced Inorganic Chemistry, 4th Edition, A Wiley- Interscience Publication, John–Wiley & Sons, USA.
3. Huheey, J.E (1983): Inorganic Chemistry, 3rd Edition, Harper & Row publisher, Singapore.

References

1. Kettle, S.F.A. (1996): Physical Inorganic Chemistry – A Coordination Chemistry Approach, Spectrum, Academic Publishers, Oxford University Press.
2. Adamson, A.W (1975): Inorganic Photochemistry, John Wiley & Sons, New York.
3. Basolo, F. and Pearson, R.G (1967): Mechanism of Inorganic Reactions, John Wiley, New York.

SEMESTER I

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14102	Organic Chemistry-I	3	3	-	6	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge on the importance of basic organic chemistry					
(ii)	To acquire knowledge about aromaticity					
(iii)	To understand the substitution reaction mechanisms					
(iv)	To acquire knowledge in stereochemical aspects of organic molecules					
(v)	To gain knowledge about the reagents and their application to organic chemistry					

UNIT I Structure, Bonding and Reactive Intermediates

Structure and Bonding Localized Chemical Bonding: Electronic Structure of molecules; VB and MO - Inductive and Field Effects, Bond distances, Bond angles and Bond energies. Delocalized Chemical Bonding: Bond energies and Bond distances in compounds containing delocalized bonds - Cross conjugation- Resonance - Hyperconjugation and Keto – Enol tautomerism.

Reactive Intermediates: Generation, Structure, Stability and Reactivity of Carbocations and Carbanions, Free radicals, Carbenes, Nitrenes and Benzynes.

UNIT II Aromaticity

Huckel's theory of aromaticity, Concept of homoaromaticity and antiaromaticity. Electron occupancy in MO's. Systems with 2, 4, 8 and 10 electrons, systems of more than 10 electrons, alternant and non-alternant hydrocarbons (azulene type). Bonding properties of systems with $(4n + 2)\pi$ electrons and $4n\pi$ electrons, Aromaticity of benzenoid, heterocyclic and non-benzenoid compounds. Annulenes, Sydnone and Fullerenes. NMR concept of Aromaticity

UNIT III Substitution Reactions

Aliphatic Nucleophilic substitutions: The S_N2 , S_N1 , mixed S_N1 and S_N2 and SET mechanisms. The neighbouring group mechanism, neighbouring group participation by σ and π - bonds, anchimeric assistance. Classical and nonclassical carbocations, phenonium ions and norbornyl system. The S_N1 mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate, attacking nucleophile, leaving group and reaction medium.

Aromatic Nucleophilic Substitution: The S_NAr , S_N1 , benzyne and $S_{RN}1$ mechanisms. Reactivity - effect of substrate, structure, leaving group and attacking nucleophile.

UNIT IV Stereochemistry

Fundamentals of Organic Stereochemistry: Principles of symmetry-Stereoisomerism-Optical isomerism-Definitions-Conventions used in Stereochemistry: Newmann, Sawhorse and Fischer notations and interconversions and representations. Nomenclature, correlation of configuration, Cahn-Ingold-Prelog rules for simple molecules, Optical activity and chirality-Types of molecules exhibiting optical activity-Fischer projection-absolute configuration. Molecules with more than one chiral center-molecular chirality-Atropisomerism-Biphenyl, allenes and spiranes. Methods of determining configuration.Prochiral centers-Asymmetric synthesis-racemisation and resolution.

Geometrical Isomerism: E&Z Nomenclature, Determination of configuration of geometrical isomers. Stereochemistry of addition and elimination reactions. Stereoselective and stereospecific synthesis (Elementary examples)Conformational Analysis. Basic concepts of conformation analysis-conformation of ethane, substituted ethane, n-butane and cyclohexane

UNIT V Reagents

Use of the following reagents in organic synthesis:, Diazomethane, Dicyclohexylcarbodiimide, DIBAL, Grignard, Lead tetraacetate, Lithium aluminium hydride, Lindlar's catalyst, N-Bromosuccinimide, Osmium tetroxide, PCC, Raney Nickel, Selenium dioxide, Wittig reagent.

Text Books

1. March, J (2000): Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 5th edition, Wiley.
2. Morrison, R.Tand Boyd, R.N (1992): Organic Chemistry, 6th edition, Pearson.

References

1. Nasipuri, D (2002): Stereochemistry of organic compounds-Principles and applications,, 2nd edition, New Age International.
2. Bansal, R.K (1975): Organic Reaction Mechanisms, Tata McGraw Hill.

SEMESTER I

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14103	Physical Chemistry-I	3	3	-	6	4
INSTRUCTIONAL OBJECTIVES						
(i)	To understand the theories and concepts of electrochemistry.					
(ii)	To suggest the applications of electrochemistry.					
(iii)	To understand the thermodynamic properties and its determination.					
(iv)	To make the students understand and appreciate the concepts of chemical kinetics.					

UNIT I Ions in Solutions

Conductivity of solutions and their measurement - the Arrhenius ionisation theory - transport numbers and mobilities of ions - measurement of transport numbers - Hittorff method and moving boundary method - ionic activities and activity coefficients and their determination by various methods - Debye-Huckel-Onsager theory - ionic atmosphere - Debye-Huckel limiting law - dissociation constant of acids and bases.

UNIT II Electrochemical Cells

Electromotive force - measurement of EMF - the cell EMF and the cell reaction - reversible cells - types of half cells - classification of cells - the standard EMF of a cell - electrochemical potential - standard electrode potentials - calculation of the EMF of a cell - Nernst equation and its limitations - calculation of solubility products - standard free energies and entropies of aqueous ions - electrode concentration cells - electrolyte concentration cells - cells with liquid junctions - oxidation - reduction reactions, measurement of PH, concentration cells - decomposition voltages - concentration polarisation and over voltage - polarography.

UNIT III Chemical Kinetics - I

Simple collision theory, absolute reaction rate theory (ARRT), thermodynamic treatment, potential energy surfaces, application of ARRT to simple bimolecular process; chain reactions - general characteristics, study of kinetics of chain reaction like H_2-Br_2 reaction, decomposition of acetaldehyde and N_2O_5 , study of H_2-O_2 explosive reactions. Theory of unimolecular reactions-Lindemann, Hinshelwood, RRKM and Slater treatment- steady state approximation, principle of microscopic reversibility and detailed balancing - kinetic isotope effect.

UNIT IV Chemical Thermodynamics

Second law of thermodynamics-concept of entropy-Gibbs function- Gibbs –Helmholtz equation- Maxwell relations- Thermodynamic equation of state- thermodynamics of systems of variable composition- partial molar quantities, partial molar volume-chemical potential, Gibbs-Duhem equation – Experimental determinations of fugacity of real gases. Third law of thermodynamics – absolute entropies-determination-exception to third law – Unattainability of absolute zero

UNIT V Surface Phenomenon and Catalysis

Introduction-adsorption of gases on solids- physisorption and chemisorptions, adsorption isotherms- Freundlich – Langmuir-BET-Temkin adsorption isotherm- Adsorption on liquid surface-surface tension-Gibbs's adsorption isotherm-surface area determination.

Specific and general acid-base catalysis. Bronsted catalysis law. Acidity functions. Enzyme catalysis (single substrate reactions only).Michaelis-Menton kinetics. Influence of pH and temperature on enzyme catalysis. Kinetics of heterogeneous catalysis (Langmuir Hinshelwood mechanism and Eley-Rideal mechanism)

Text Books

1. Gurudeep Raj (2006): Advanced Physical chemistry, 32nd edition, Goel Publishing House, Krishna Prakashan Media (P) Ltd.
2. Bockris J.O.M and Reddy, A.K.N (2008): Electrochemistry, volumes 1 and 2, Springer.
3. Laidler, J (1987): Chemical Kinetics, 3rd edition, Harper & Row.

References

1. Glasstone, S (2004) : An Introduction to Electrochemistry, Affiliated East West press, New Delhi.
2. Arthur W. Adamson, Alice P. Gast (1997): Physical chemistry of surfaces, 6th Edition, Wiley Eastern Ltd.
3. Glasstone, S (2012): Thermodynamics for chemists, East West press.

SEMESTER I

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14104	Nanochemistry	3	3	-	6	3
INSTRUCTIONAL OBJECTIVES						
(i)	To educate students on the basics of nanochemistry					
(ii)	To make students understand the various techniques involved in the characterisation of nanomaterials					
(iii)	To acquire knowledge on the synthesis of nanomaterials					
(iv)	To envision the importance of nanomaterials					

UNIT I Nanochemistry – An Introduction

Definition of nanodimensional materials - Some historical milestones in the saga of nano forms - Size effects - Importance of nanomaterials - Classification of nanomaterials - Simple examples of unique properties of nanosized materials - Elementary aspects of bionanotechnology - Some important recent discoveries in nanoscience and technology.

UNIT II Techniques in Nanochemistry

Techniques for characterisation of nanoscale materials (Basic aspects): Atomic force microscopy (AFM)-Transmission electron microscopy (TEM)-Resolution and scanning transmission electron microscopy (STEM) Scanning Tunneling Microscopy (STM) Scanning nearfield optical microscopy (SNOM) and surface plasmon spectroscopy.

UNIT III Synthesis of Nanomaterials

Chemical methods in preparation of nanomaterials: Sol – gel technique – co-precipitation hydrolysis –sonochemical method – combustion technique – colloidal precipitation – template process.

Inorganic Nanoparticles and Nanoporous Materials: Oxide nano particles – Oxomolybdates – Nano catalysis – Porous silicon –Transition and Non transition metal phosphates.

UNIT IV Carbon Clusters and Nanostructures

Nature of carbon bond – New carbon structures – Carbon clusters: Discovery of C₆₀ – Alkali doped C₆₀ – Superconductivity in C₆₀ – Larger and smaller fullerenes. Carbon nanotubes: Synthesis – Single walled carbon nanotubes – Structure and characterization – Mechanism of formation – Chemically modified carbon nanotubes – Doping – Functionalizing nanotubes – Application of carbon nanotubes. Nanowires – Synthetic strategies – Gas phase and solution phase growth – Growth control – Properties.

UNIT V Organic Films and Supramolecular Assembly

Organic films - insulating and passivating layers – electron transfer – Organic nanostructures – Optical properties – Organic semiconductors – Active organic devices. Polymerization – Sizes of polymers – Nanocrystals – Conductive polymers – Block co-polymers. Supramolecular structures – Transition-metal mediated types - Dendritic molecules – Supramolecular dendrimers – Micelles – Biological nanostructures – Examples of proteins

Applications of nanomaterials: Applications of Nanoparticle in various fundamental research, industries, medical field and environmental issue; toxicity, biosafety and ethical issue in application of Nanoparticles.

Text Books

1. Rao, C. N. R, Muller, A and Cheetam, A.K. (Eds) (2004): The Chemistry of Nanomaterials, Vol.1, and 2, Wiley – VCH, Weinheim.
2. Poole, C. P and Owens, Jr. F. J (2003): Introduction to Nanotechnology Wiley Interscience, New Jersey.
3. Kenneth J. Klabunde (Ed) (2001), Nanoscale materials in Chemistry, Wiley-Interscience, New York.

References

1. Pradeep, T (2007): Nano: The Essentials in understanding nanoscience and nanotechnology, Tata McGraw Hill, New Delhi.
2. Gleiter, H (2000): Nanostructured Materials: Basic Concepts, Microstructure and Properties.
3. Tang, T and Sheng, P. (2004): Nano Science and Technology – Novel Structures and Phenomena, Taylor & Francis, New York, 2004.

SEMESTER I

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14105	Inorganic Chemistry Practical	-	-	6	6	3
INSTRUCTIONAL OBJECTIVES						
(i)	To enable the students, to apply the principle in the semi-micro analysis of an inorganic salt mixture.					

Semi – micro qualitative analysis:

Analysis of mixtures containing two familiar and two less familiar cations from the following W, Pb, Se, Te, Mo, Cu, Cd, As, Sb, Ce, Be, Th, Zr, Ti, V, Cr, Mn, U, Ni, Co, Zn, Ca, Ba, Sr, Li, Mr (insoluble and interfering anion may be avoided).

Any eight combinations of different salts.

General scheme for distribution of marks in practical examination

Time: 6 h (One day Examination) Marks: 50 (External) + 50 (Internal)

Identification of ions: 20 Marks

Procedure : 10 Marks

Record : 10 Marks

Viva-Voce : 10 Marks

Internal : 50 Marks

Total : 100

Text Books

1. Vogel's (1987): Qualitative Inorganic Analysis, Revised by G Svehla, 6th Edition, Longman.
2. Ramanujam, V.V (1974): "Inorganic Semi-micro Qualitative Analysis", The National Publishing Co, Chennai.

SEMESTER II

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14201	Inorganic Chemistry-II	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To understand the various concepts of acids and bases					
(ii)	To understand the basic principles of ionic bond					
(iii)	To gain knowledge in nuclear chemistry					
(iv)	To educate students on the various spectroscopic techniques and its applications to some selected molecules					

UNIT I Acids and Bases

Acids and Bases: Bronsted and Lewis acids and bases, pH, pKa, acid–base concept in non-aqueous media, buffer solution, Protonic acids – Proton Affinities –Differentiation and Leveling solvents – Hammett scale – Acidic behavior of the binary hydrides – Cosolvating agents – Oxy acids – Organic acids – Acetic acid and the Inductive Effect, Aromatic Acids and Resonance Effects – Hydrolysis and Aquo acids – Basic precipitations – Amphoteric oxides – Nonprotonic concepts of Acid – Base reactions – Lux Concept – Solvent Ion theory of Acids and Bases – Liquid Ammonia, Acetic acid as a solvent, Bromine trifluoride, Dinitrogen tetroxide, Liquid hydrogen chloride – Hard and Soft Acids and Bases – Classification – Acid – Base strength and Hardness and Softness – Symbiosis – Theoretical basis of Hardness and Softness –Electronegativity and Hardness and Softness.

UNIT II Ionic Bond and Crystal Structure

Radius Ratio rules – Calculation of some limiting radius ratio values for C.N. 3 (planar triangle), C.N. 4 (tetrahedral), C.N. 6 (octahedral). Classification of ionic structures – AX (ZnS, NaCl, CsCl), AX₂ (fluorite, rutile, beta-cristobalite) and AX₃ types (Structures only), Layer structure – CdI₂, Nickel arsenide structures –Lattice energy–Born–Lande equation derivation–Important points arising from Born –Lande equation – Schottky defect and Frenkel defect – explanation and calculation of number of defects formed per cm³– Metal excess defect – F centers and interstitial ions –Metal deficiency defect – positive ions absent – extra interstitial negative ions – Semiconductors and transistors – Rectifiers – Photovoltaic cell –Transistors–steps in the manufacture of memory chips for computers.

UNIT III Nuclear Chemistry

Radioactive decay – Theories of decay processes – Laws of radioactivity – Detection and measurement of radiations – Nuclear structure – Composition of nuclei – properties of nuclei – nuclear radii, nuclear spin etc – nuclear forces – its characteristics – Meson field theory – nuclear stability – characteristics – nuclear models – liquid drop, shell and collective models. Artificial radioactivity – Nuclear reactions transmutations, stripping and pickup, fission, fusion, spallation and fragmentation reactions – scattering reactions – nuclear cross section. Nuclear reactors – charged particle accelerators – neutron sources – gamma ray and X-ray sources. Applications of nuclear science in agriculture and biology – neutron activation and isotopic dilution analysis.

UNIT IV Spectroscopic Techniques

Infrared and Raman Spectroscopy: Structural elucidation of coordination compounds containing the following molecules/ions as ligands- NH_3 , H_2O , CO , NO , OH^- , SO_4^{2-} , CN^- , SCN^- , NO_2^- and X^- (X =halogen).

Electron Paramagnetic Resonance Spectroscopy:

EPR of d^1 and d^9 transition metal ions in cubic and tetragonal ligand fields, evaluation of g values and metal hyperfine coupling constants.

UNIT V Studies and Applications of Lanthanides and Actinides

Spectral and magnetic properties, use of lanthanide compounds as shift reagents, Modern methods of separation of lanthanides and actinides, Organometallic chemistry applications of lanthanide and actinide compounds in Industries

Text books

1. Bodie, E. Douglas and Darl H. McDaniel (1970): Concepts and Models in Inorganic Chemistry, Indian Edition, Oxford & IBH Publishing Co, New Delhi.
2. Friedlander, J.W, Kennady and Miller, J.M (1981) : Nuclear and Radiochemistry, 3rd Edition.
3. Cotton and Wilkinson (1988): Advanced Inorganic Chemistry, 5th ed., John Wiley & Sons, New York.

References

1. Kaim, W and Schwederski, B (1994): Bioinorganic Chemistry, Inorganic elements in the Chemistry of Life, John Wiley & Sons, New York.
2. James E. Huheey, Ellen A Keiter and Richard L. Keiter (2006): Inorganic Chemistry – Principles of Structures and Reactivity, 4th ed, Addison-Wesley, New York.

SEMESTER II

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14202	Organic Chemistry– II	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge in the addition reactions and its applications					
(ii)	To acquire knowledge about Elimination reactions					
(iii)	To understand the rearrangements and its mechanisms					
(iv)	To acquire knowledge in photochemistry of organic molecules					
(v)	To gain knowledge in pericyclic concerted reactions					

UNIT I Addition Reactions

Addition to Carbon - Carbon Multiple Bonds: Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals - regio and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds - Hydrogenation of aromatic rings and Hydroboration. Sharpless asymmetric epoxidation.

Addition to Carbon - Hetero Multiple Bonds: Steric course of addition reactions to C=O and C=N, Cram's rule, Aldol condensation, Cannizzaro, Perkin, Knoevenagel condensations, Claisen - Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Wittig, Grignard, Mannich, Michael reaction. Hydrolysis of Carbon-Nitrogen bond, Isocyanates and isothiocyanates.

UNIT II Elimination Reactions, Esterification and Hydrolysis

Elimination Reactions: Types of elimination reactions, Mechanisms, Stereochemistry and Orientation. Hofmann and Saytzeff rules. Syn elimination versus anti- elimination, competition between elimination and substitution, factors influencing elimination and substitution reaction, dehydration, dehydrogenation, dehalogenations, decarboxylative eliminations, pyrolytic eliminations, molecular rearrangement during elimination and Fragmentation reactions.

Esterification and hydrolysis: Mechanism of hydrolysis of Esters, amides and acyl halides, Esterification of acids and trans esterification.

UNIT III Rearrangements

Rearrangement involving migration to electron-deficient carbon

Wagner-Meerwein, Pinacol-Pinacolone, Benzil-Benzilic, Wolf rearrangements.

Rearrangement involving migration to electron-deficient nitrogen

Beckmann, Hofmann, Curtius, Lossen, Schmidt rearrangements

Rearrangement involving migration to electron-deficient oxygen

Baeyer-Villiger oxidation, Hydroperoxide rearrangement.

Rearrangement involving migration to electron-rich carbon

Favorskii, Stevens, Neber rearrangements

UNIT IV Photochemistry

Organic Photochemistry – Fundamental concepts – Jablonski diagram – Energy transfer, characteristics of photoreactions, photoreduction and photooxidation, photoreactions of ketones and enones, Norrish Type I and II reactions. Photochemistry of alkenes, dienes and aromatic compounds, reactions of unactivated centres – Photolytic cycloadditions and photolytic rearrangements –Photosensitisation – Photoadditions – Barton reaction – PaternoBuchi reaction.

UNIT V Pericyclic Reactions

Concerted reactions – stereochemistry-orbital symmetry and concerted symmetry and correlation diagram –Frontier molecular orbital approach – Woodward and Hoffmann rules – Electrocyclic reactions – cycloaddition reactions – sigmatropic rearrangements – selection rules and examples with simple molecules – 1,3 and 1,5 hydrogen shifts – Cope and Claisen rearrangements.

Text Books

1. March, J (2000): Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 5th edition, Wiley.
2. Morrison, R.T. and Boyd, R.N (1992): Organic Chemistry, 6th edition, Pearson.

References

1. Finar, I.L (1975): Organic Chemistry, Vol.II, 5th edition, ELBS.
2. Bansal,R.K (1975): Organic Reaction Mechanisms, Tata McGraw Hill.
3. CareyF.A and Sundberg,R.J (2002): Advanced Organic Chemistry, Parts A & B, Plenum, 2002

SEMESTER II

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14203	Physical Chemistry - II	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To have a good foundation in understanding the physical and mathematical aspects of quantum mechanics.					
(ii)	To become familiar with the aspects of group theory.					
(iii)	To understand and appreciate the concepts of statistical thermodynamics.					
(iv)	To know about electrochemical phenomena.					

UNIT I Electrochemical Phenomena

Evidences for electrical double layer. Electrocapillary phenomena-Electro capillary curves, Electro-osmosis, electrophoreses. Streaming and Sedimentation potentials. Zeta potentials and its determination by electrophoresis, influence of ions on Zeta potential. Helmholtz-Perrin, Guoy-Chapmann and Stern models of electrical double layer-Applications and limitations. Kinetics of electrode process. Energy barrier at electrode surface- electrolyte interface, overpotential, Butler – Volmer equation, Tafel equation

UNIT II Chemical Kinetics II

Comparison between gas phase and solution reactions, Cage effect. The influence of the solvent on the reactions between ions and reaction between ions and neutral molecules. Influence of ionic strength on rates of reactions in solution. Arrhenius equation for reaction in solution, Significance of volume and entropy of activation. Primary and secondary salt effect.

UNIT III Statistical Thermodynamics

Aims of statistical thermodynamics, definition of state of a system, ensembles (microcanonical and canonical) Boltzmann distribution law and its derivation. Boltzmann-Planck equation: partition functions, thermodynamic properties from partition functions, partition function and equilibrium constant; Quantum statistics-Fermi Dirac and Bose-Einstein statistics, photon gas, electron gas according to such statistics: population inversion, negative Kelvin temperature, Einstein's and Debye's theories of heat capacities of solids. Nuclear spin statistics-statistical basis of entropy

of H₂ gas- ortho and para nuclear states- Calculation of entropy in terms of ortho- para ratio – residual entropy of H₂ at 0 K.

UNIT IV Basics of Group Theory

Symmetry elements and symmetry operations, group and its properties, Multiplication table, point symmetry groups. Schoenflies symbol, representations of groups by matrices, Irreducible representation of groups, the Great Orthogonality theorem, construction of character table (C_{2v}, C_{3v} only). Applications of group theory to normal modes analysis, Selection rules for fundamental vibrational transition – IR and Raman activity of fundamentals in H₂O, BF₃, – The rule of mutual exclusion.

UNIT V Basics of Quantum Mechanics

de-Broglie's concept, experimental verification- Compton effect - Heisenberg's uncertainty principle – derivation of Schrodinger wave equation - requirements of the acceptable wave function. Operators, linear operators, method of getting the following quantum mechanical operators: Position, Momentum, kinetic energy, potential energy, total energy, angular momentum. Hermiticity and proving the quantum mechanical operators are Hermitian operation- commutator algebra-evaluation of commutators - eigen functions and eigen values - postulates of quantum mechanics.

Text Books

1. Prasad, R. K (2010): Quantum chemistry, 4th edition, New Age International.
2. Cotton F. A (2004): Chemical applications of group theory, 3rd edition, John Wiley & Sons.
3. Rajaram J (2013): Chemical Thermodynamics: Classical, Statistical and Irreversible, Dorling Kindersley (India)Pvt Ltd.

References

1. Bockris J.O.M and Reddy, A.K.N (2008): Electrochemistry, volumes 1 and 2, Springer.
2. Banwell, C.N (2013): Fundamentals of molecular Spectroscopy, 5th edition., TMH, New Delhi.
3. Gilbert W. Castellan (2004): Physical Chemistry, 4th edition, Narosa Publishing House.

SEMESTER II

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14204	Analytical Chemistry	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To learn the fundamental principles of analytical chemistry.					
(ii)	To understand the difference between accuracy and precision, significance of figures, and be able to apply statistical analysis to rely on or reject results.					
(iii)	To understand the different types of titrations and their applications.					
(iv)	To understand the different chromatographic methods and their applications.					

UNIT I Errors and Evaluations

Systematic and random errors, Effects of errors on analytical results, Accuracy, precision, Absolute and Relative errors, Significant figures, mean, mean deviation and median, standard deviation, variance, confidence limits, application of statistics, Reliability and rejection of results, Q test, Analysis of variance.

UNIT II Types of Titrations

Redox titration: Redox potentials, theory and feasibility of redox titration, calculation of potentials at different stages of titrations, redox indicators, their choice and applications.

Precipitation titrations: Theory and types, Mohr, Volhard and Fajan's methods.

Adsorption indicators: theory, choice and applications.

Complexometric titrations: Theory, Stepwise and overall formation constants, Titrations involving chelates (EDTA). Metallochromic indicators: Theory and Choice, Masking and demasking methods and applications.

UNIT III Chromatography

Solvent extraction, principles, types and applications of paper, column, thin layer, gas and ion exchange Chromatographic techniques. Adsorbents, columns, detection methods, estimations, preparative column, GC, MS techniques: methods, principles and uses.

UNIT IV Thermal Methods of Analysis

Thermogravimetric analysis: Principle, Thermal analysis of silver nitrate, methods of obtaining thermograms, TGA, factors influencing the thermogram, Instrumentation, precautions in the use of thermo balance and applications.

Differential Thermo Analysis: Theory, principle, instrumentation and applications, DTA of calcium oxalate monohydrate, thermal analysis of calcium monohydrate.

Thermometric titrations: Theory, instrumentation, technique of thermometric titrations applications of thermometric titrations in complexometric and redox titrations.

UNIT V Electro analytical Techniques

Polarography: Introduction, Instrumentation, Ilkovic equation and its verification. Derivation of wave equation, Determination of half wave potential, qualitative and quantitative applications.

Amperometry: Basic principles, instrumentation, nature of titration curves and analytical applications.

Theory of Electrogravimetric analysis, electrode reactions, overpotential, completeness of deposition, electrolytic separation of metals with controlled cathode potential.

Textbooks

1. Skoog, D.A, West,D.M and Holler,F.J and Crouch,S.R (2007): Fundamentals of Analytical Chemistry, 8thEdn., Saunders College Pub.
2. Miller, J.C and Miller, J.N (1988): Statistics for Analytical Chemistry – Ellis Horwood. Chichester..
- 3.Skoog, Willard and Dean (1988): Instrumental methods of analysis. 8th Edition, East West Press, New Delhi. 1988.

References

1. Christian, G.D and J.E. O'Reilly (1986): Instrumental Analysis, Allyn& Bacon.
2. Sivasankar, B (2012): Instrumental methods of analysis, Oxford University Press
3. Kaur,H (2001): Instrumental methods of Chemical analysis, Pragati Prakashan, 1st Edition, Meerut.

SEMESTER II

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14205	Organic Chemistry Practical	-	-	5	5	3
INSTRUCTIONAL OBJECTIVES						
(i)	To understand the separation methods of organic mixtures.					
(ii)	To impart knowledge in the synthesis of organic compounds.					

Qualitative Analysis of an organic mixture containing two components.

Pilot separation, bulk separation, analysis, derivatization.

- Detection of elements (N, Cl, S) by Lassaigne's test
- Detection of the following functional groups by systematic chemical analysis: Aromatic amino ($-\text{NH}_2$), aromatic nitro ($-\text{NO}_2$), Amido ($-\text{CONH}_2$, including imide), Phenolic $-\text{OH}$, Carboxylic acid ($-\text{COOH}$), Carbonyl ($>\text{C}=\text{O}$); only one test for each functional group is to be reported.

Preparation of Organic compounds (Single stage).

- (a) 2,4,6-trinitrophenol(picric acid)from phenol (nitration)
- (b) Benzophenoneoxime from Benzophenone (addition reaction)
- (c) Benzophenoneoxime to Benzanilide(rearrangement)
- (d) 4-nitrobenzoic acid to 4-nitrobenzanilide (Substitution)
- (e) o-chlorobenzoic acid from anthranillic acid (Sandmeyer reaction)
- (f) p-benzoquinone from hydroquinone (oxidation)
- (g) 2,4,6-tribromophenol from phenol (bromination)

General scheme for distribution of marks in practical examination

Time: 6 h (One day Examination) Marks: 50 (External) + 50 (Internal)

Qualitative analysis: 10 Marks

Preparation : 10 Marks

Procedure : 10 Marks

Record : 10 Marks

Viva-Voce : 10 Marks

Internal : 50 Marks

Total : 100

Text Books

1. Vogel (1996): A Textbook of Practical Organic Chemistry, 5th edition, Prentice Hall,
2. Fieser and Fieser (2006): Reagents in Organic Synthesis, Wiley, 2006

References

1. Mann & Saunders (1960): Practical Organic Chemistry, 4th edition, Longmans.
2. Clarke.H. T (1975): A Handbook of Quantitative & Qualitative Analysis, Arnold Heinemann.
3. March,J (2000): Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 5th edition, Wiley.

SEMESTER II

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14206	Physical Chemistry Practical	-	-	5	5	3
INSTRUCTIONAL OBJECTIVES						
(i)	To motivate the students to understand the principles of chemical kinetics, potentiometric and conductometric titrations.					
(ii)	To impart knowledge with respect to the phase transformation of different systems.					

LIST OF EXPERIMENTS

1. Determination of rate constant of Acid hydrolysis of an ester.
2. Determination of molecular weight of substances by Rast method.
3. Determination of Critical Solution Temperature (CST) of phenol- water system and effect of impurity on CST.
4. Study of phase diagram of two components forming a simple eutectic.
5. Distribution of benzoic acid between water and benzene.
6. Adsorption of oxalic acid/acetic acid on charcoal.
7. Determination of E_a of saponification of Ester by conductometry method.
8. Determination of equivalent conductance, degree of dissociation and dissociation constant of weak acid by conductometry.
9. Determination of relative strength of two acids by conductance measurements.
10. Titration of AgNO_3 vs Halide mixture by potentiometry.
11. Redox titrations (MnO_4^- vs I^- / $\text{Cr}_2\text{O}_7^{2-}$ vs Fe^{2+}) by potentiometry.
12. Determination of dissociation constant of weak acids by potentiometry.

General scheme for distribution of marks in practical examination

Time: 6 h (One day Examination) Marks: 50 (External) + 50 (Internal)

Observations including tables and figures: 20 Marks

Procedure : 10 Marks

Record : 10 Marks

Viva-Voce : 10 Marks

Internal : 50 Marks

Total : 100

Text Books

1. Yadav, J. B (2005): Advanced Practical Physical Chemistry, 22nd edition, Goel publishing House, Krishna Prakashan Media Ltd.
2. Venkatesan, V, Veeraswamy, R and Kulandaivelu, A.R (1997): Basic Principles of Practical Chemistry”, 2nd edition, Sultan Chand and Sons Publication, New Delhi.

References

1. Findlay's (1985): Practical Physical Chemistry, Revised and edited by B.P. Levitt 9th edition, Longman, London.
2. Chatwal, G.R. and Anand, S.K (2000): Instrumental Methods of Chemical Analysis, Himalaya Publishing House, Delhi.

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14321	Natural Products	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge in the area of terpenoids and carotenoids and their structure elucidation					
(ii)	To acquire knowledge in the area of alkaloids and their structural elucidation					
(iii)	To understand about the structural aspects of steroids					
(iv)	To acquire knowledge in the fields of flavonoids and isoflavonoids					
(v)	To gain knowledge in peptides, proteins and their structures					

UNIT I Terpenoids and Carotenoids

Classification, nomenclature, occurrence, isolation, isoprene rule and special isoprene rule general methods of structure determination. Structure determination, stereochemistry and synthesis of the following representative molecules: Citral, Geraniol, Terpeneol, Farnesol and Zingiberene.

UNIT II Alkaloids

Definition, nomenclature and physiological action, occurrence, classification, isolation, general methods of structure elucidation, degradation. Structure determination, stereochemistry and synthesis of the following: Ephedrine, Nicotine, Atropine and Morphine

UNIT III Steroids

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol (total synthesis not expected, but partial synthesis is expected) Bile acids, Androsterone, Testosterone, Progesterone.

UNIT IV Flavonoids and Isoflavonoids

Occurrence, nomenclature, Isolation, structure determination and synthesis of Apigenine, Luteoline, Quercetin, Butein.

UNIT V Peptides and Proteins

Peptides and proteins, methods of peptide synthesis, sequence determination, structure of Oxytocin, proteins-classification, structure, conformation and properties, peptide synthesis (using Merrifield resin)

Text Books

1. Finar, I.L. (2002): Organic chemistry, Vol-I&II, 6th Edition, Pearson
2. Clayden, J, Greeves, N, Warren, S. and Wothers, P (2001): Organic Chemistry, Oxford University Press.

References

1. Tsuji, J. (2003): Palladium Reagents and Catalysts, New Perspectives for the 21st Century, John Wiley & Sons.
2. Ojima, I. (2000): Catalytic Asymmetric Synthesis, 2nd edition, Wiley—VCH New York.
3. Carruthers, W. (1996): Modern Methods of Organic Synthesis, Cambridge University Press,
4. Noyori, R. (1994): Asymmetric Catalysis in Organic Synthesis, John Wiley & Sons.

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14322	Spectroscopy of Organic Compounds	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge in UV-Visible spectroscopy and its application to conjugated systems					
(ii)	To acquire knowledge in identifying the organic functional groups and their stretching frequencies					
(iii)	To understand about the proton environment and its chemical shift values					
(iv)	To acquire knowledge about carbon chemical shift values					
(v)	To gain knowledge in fragmentation of organic molecules					

UNIT I UV-Visible Spectroscopy

Beer-Lamberts law- various electronic transitions-instrumentation and sampling - Effect of solvent on electronic transitions - Fieser-Woodward rules - Ultraviolet spectrum of carbonyl and unsaturated carbonyl compounds - Ultraviolet spectra of aromatic and heterocyclic compounds

UNIT II IR Spectroscopy

Principle-vibrational frequencies –instrumentation-sampling-fingerprint region-FTIR spectra of organic functional groups- Effect of hydrogen bonding and solvent effect on vibrational frequencies.

UNIT III H¹NMR Spectroscopy -I

Principle-instrumentation-sampling- nuclear spin-nuclear resonance-saturation-shielding and deshielding magnetic nuclei-shielding mechanism-chemical shift and its measurements-factors influencing chemical shifts-chemical shift values. Interpretation of standard representative organic molecules.

UNIT IV H¹ NMR Spectroscopy -II and ¹³C NMR Spectroscopy

Spin-Spin interaction-coupling constant(J)-complex-classification-spin-spin interaction between two, three, four and five nuclei(ABC, ABX, AMX, A₂B₂etc)-Hindered rotation-Karplus curve variation of coupling constant with dihedral angle-contact shift reagents- double irradiation-nuclear overhauser effect (NOE).

¹³C-NMR Spectroscopy: General considerations - Chemical shift (aliphatic, olefinic, alkyne, carbonyl carbon, aromatic).

UNIT V Mass Spectrometry

Principle-Instrumentation-ion production -Types of ionization; EI, CI, FD, and FAB - Nitrogen rule- Molecular-ion peak - Metastable peak Factors affecting fragmentation-- Mass spectral fragmentation of organic compounds - Mc. Lafferty rearrangement- Isotope labeling/identification.

Text Books

1. Kemp, W (1994): Organic Spectroscopy, 3rd Ed., MacMillan
2. Kalsi, P.S (2007): Spectroscopy of Organic Compounds, 6th Edition, New age international publishers.

References

1. Silverstein, P.M and Wester, F. X(1988): Spectroscopic Identification of Organic Compounds, 6th ed., Wiley .
2. Sharma Y.R (1992): Elementary Organic Spectroscopy – Principles and Chemical applications, S.Chand.
3. Glusker, J.P and Trueblood, K.N. (1972): Crystal structure analysis: A primer., Oxford university press, New York,

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14323	Multistep Synthesis of Organic Compounds and Estimations	-	-	6	6	3
INSTRUCTIONAL OBJECTIVES						
(i)	To gain skill in the estimation of organic compounds					
(ii)	To gain experimental skill in multi step organic synthesis					

Quantitative analysis of organic compounds

Estimation of phenol, aniline, ketone, glucose.

Preparation of organic compounds (Double stage)

- p-bromo acetanilide from aniline (acetylation and bromination).
- acetyl salicylic acid from methyl salicylate (hydrolysis and acetylation).
- 1,3,5-tribromobenzene from aniline (bromination, diazotization and hydrolysis).
- p-nitroaniline from acetanilide (nitration and hydrolysis).
- benzilic acid from benzoin (rearrangement).
- p-amino benzoic acid from p-nitro toluene (oxidation and reduction).
- benzanilide from benzophenone (rearrangement).
- p-bromoaniline from acetanilide (bromination and hydrolysis).
- m-nitroaniline from nitrobenzene (nitration and reduction).
- 1,2,4-triacetoxy benzene from hydroquinone (oxidation and acylation).

Text Books

- Vogel (1996): A Textbook of Practical Organic Chemistry, 5th edition, Prentice Hall,
- Fieser and Fieser (2006): Reagents in Organic Synthesis, Wiley, 2006

References

- Mann & Saunders, (1960): Practical Organic Chemistry, 4th ed, Longmans,
- Clarke, H. T (1975): A Handbook of Quantitative & Qualitative Analysis- Arnold Heinemann
- Blat. (2004): Organic Synthesis Collective Volumes, Wiley,
- March, J. (2000): Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 5th edition, Wiley
- Vogel, A. I (1996): A Textbook of Practical Organic Chemistry, 5th ed., Prentice Hall
- Fieser and Fieser. (2006): Reagents in Organic Synthesis, Wiley, 2006

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14305	Applications of Computer in Chemistry	2	1	-	3	2
INSTRUCTIONAL OBJECTIVES						
(i)	To introduce the basics of computers.					
(ii)	To learn C language and its applications in solving problems in Chemistry					

UNIT I Recapitulation of Computer Basics

PC hardware, operating systems, data storage and backup, networks, information technology. Basic operations using windows.

UNIT II Computer Programming

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages.

UNIT III Word Processing- I

Handling numeric data: spreadsheet software (Excel), simple calculations, statistical analysis, plotting graphs using a spreadsheet (radial distribution curves for hydrogenic orbitals, gas kinetic theory, spectral data, pressure-volume curves of van der Waals gas, data from phase equilibria studies), graphical solution of equations, solving equations numerically (e.g. pH of a weak acid ignoring/ not ignoring the ionization of water, volume of a van der Waals gas, equilibrium constant expressions).

Word Processing- II

Numeric modelling, numerical curve fitting, linear regression (rate constants from concentration- time data, molar extinction coefficients from absorbance data), numerical differentiation (e.g. handling data from potentiometric titrations), integration (e.g. entropy/enthalpy change from heat capacity data). Numerical solution of differential equations (e.g. kinetics).

UNIT IV Molecular Modelling

Visualization of 3D structures, calculation of molecular structures and properties (e.g., conformational energies of butane, rotation of 1,3-butadiene, distribution of isomers, energies of orbitals and total energy as a function of bond angle for H₂O, simulation of Diels-Alder reaction, SN₂ reactions).

UNIT V Chemical Information on the Web

Chemical abstracts. Structures and properties.

Software: Microsoft Office, Chem Office, Microcal Origin, Scifinder, scopus, literature search (ACS, RSC, Wiley interscience (Free alternatives: Open Office (www.openoffice.org), ISIS Draw (<http://www.mdli.com>; registration required), ArgusLab (www.planaria-software.com)).

Text Books

1. Noggle, J. H (1985):Physical chemistry on a Microcomputer. Little Brown & Co.
2. Venit, S.M (1996):Programming in Basic: Problem solving with structure and style.Jaico Publishing House, Delhi.

References

1. Engel, T. & Reid, P (2010): Physical Chemistry, 2nd Ed. Pearson.

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14306	Mini Project*	2	-	-	2	2

PURPOSE

To undertake project in the relevant field of study

The student is free to pick up any topic for the mini project under the supervision of faculty member the project internally will be evaluated by the supervisor and the end semester assessment by duly appointed examiner (s)

Assessment Tool Weightage

Review I – 25 Marks

Review II – 25 Marks

Review I & II Mark Distribution

Novelty -5 Marks

Submission of hard copy -20 Marks

Presentation -20 Marks

Interactive session -5 Marks

Total - 50 Marks

Total 100 Marks

LIST-II (INTERDISCIPLINARY ELECTIVES)

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E07	Scientific Research Methodology	3	1	-	4	3
INSTRUCTIONAL OBJECTIVES						
(i)	To know the purpose and importance of research for future development in science.					
(ii)	To familiarize the methodology behind the laboratory techniques					
(iii)	To learn the ways of carrying out literature review					
(iv)	To know the methodology of writing thesis and journal articles.					

UNIT I Introduction

Nature and importance of research - aims, objective, principles and problems - selection of research problem - survey of scientific literature - primary and secondary sources - citation index for scientific papers and journals - patents.

UNIT II Conduct of Research Work

Physical properties useful in analysis and methods of separation prior to analysis - Isolation techniques - extraction - Soxhlet extraction, crystallization, sublimation - methods for vacuum sublimation and distillation under reduced pressure.

Chemistry of working with hazardous materials - acid / water sensitive, corrosive, toxic, explosive and radioactive materials.

UNIT III Data Collection and Analysis

Execution of research - observation and collection of data - Methods of data collection: Experimental data, field data, data from other sources - Sampling method - Data processing and analyzing: Precision and accuracy - Reliability - determinate and random errors - distribution of random errors - normal distribution curve. Statistical treatment of finite samples - the student's t test and F test - Criteria for rejection of an observation - the Q test, significant figures and computation rules - data plotting - least square analysis.

UNIT IV Scientific Writing

Scientific writings: research reports, theses, journal articles, and books.

Steps to publishing a scientific article in a journal: types of publications communications, articles, reviews; when to publish, where to publish, specific format required for submission, organization of the material.

Documenting: abstracts-indicative or descriptive abstract, informative abstract, footnotes, end notes, referencing styles, bibliography-journal abbreviations (CASSI), abbreviations used in scientific writing. Patent writing and filing

UNIT V Computer Usage in Research

Searches of Literature: ASAP Alerts, CA Alerts, SciFinder, ChemPort, ScienceDirectSTN International. Journal home pages. Preparing research papers: Using word processing software – MS office/Latex/others, Drawing graphs and diagrams – Origin/Excel/others. Seminar presentations – Power point for oral and poster presentations. Different file formats particularly useful in research communication (pdf, jpg, jpeg, djvuetc)

Text Books

1. Kothari, C.R (1990): Research Methodology: Methods and Techniques, New Age International.
2. Sinha, S.C. and Dhiman, A.K (2002): Research Methodology, 2 volumes, Ess Publications.
3. Coley, S.M. and Scheinberg, C. A. (1990): Proposal Writing, Sage Publications.

Reference

1. Fink, A (2009): Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
2. Douglas A. Skoog, Donald, M. West, F. James Holler & Stanley R. Crouch (2013): Fundamental of analytical chemistry, 9th Edition, Mary Finch.
3. H. F. Ebel, C. Bliefert and W. E. Russey (1988): The Art of Scientific Writing, VCH, Weinham.

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E08	Chemistry of Nanoscience and Technology	3	1	-	4	3
INSTRUCTIONAL OBJECTIVES						
(i)	To understand the basic concept of nano science and technology.					
(ii)	To acquire knowledge about synthesis, preparation and characterization of nanomaterials					
(iii)	To gain knowledge on application of nanomaterials.					

UNIT I Basic Aspects of Nanotechnology

Introduction and classification - What is nanotechnology - Classification of nanostructures - Nanoscale architecture - How nanoscale dimensions affect properties - Carbon and inorganic nanostructure - self assembled materials - Making thin organic films -nanopatterning surfaces by self-assembly - Templated nanostructures.

UNIT II Characterization Methods

X-ray diffraction - XPS Working Principle, Instrumentation and Applications. Impedance Analysis - Micro hardness - nanoindentation- Nuclear Magnetic Resonance (NMR). Differential scanning calorimeter (DSC)- Thermogravimetric/Differential Thermal Analyzer (TG/DTA)-UV-Visible Spectrophotometer - FTIR - Principle and Applications - Photoluminescence (PL) Spectroscopy.

UNIT III Lithographic Methods

Introduction - Lithography - Photolithography - Phase-shifting photolithography - Electron beam lithography - X-ray lithography - Focused ion beam (FIB) lithography - Neutral atomic beam lithography - Nanomanipulation and Nanolithography - Soft Lithography - Assembly of Nanoparticles and Nanowires Other Methods for Microfabrication.

UNIT IV Sensors

Static and Dynamic Characteristics - Inorganic Nanotechnology Enabled Sensors - Gas Sensing with Nanostructured Thin Films - Nanotechnology Enabled Mechanical Sensors - Nanotechnology Enabled Optical Sensors - Magnetically Engineered Spintronic Sensors - Organic Nanotechnology Enabled Sensors - Surface Materials and Surface Modification.

UNIT V Energy Devices

Nanoscale Electronic and Ionic Transport – Energy Conversion and Storage in Electrochemistry - Overview of the Principles of Operation of Energy Conversion and Storage Devices - Solar Cells -Nanomaterials and Nanostructured Films as Electro active Electrodes - Nanomaterials as Electrolytes - Lithium Ion Batteries - Fuel Cells. Quantum Dot Sensitizers.

Text Books

1. Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan (2005): Nanoscale Science and Technology John Wiley & Sons, Ltd., UK.
2. Pradeep,T (2008): Nano: The Essentials: Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi.

References

1. Rao,C. N. R, Thomas,P. J. andKulkarni,G. U (2007): Nanocrystals: Synthesis, Properties and Applications, Springer .
2. Kourosh Kalantar-zadeh and Benjamin Fry (2008): Nanotechnology - Enabled Sensors,Springer.
3. Guozhong Gao (2004): Nanostructures & Nanomaterials: Synthesis, Properties & Applications, ImperialCollegePress .

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E09	Industrial Chemical Analysis and Quality Control	3	1	-	4	3
INSTRUCTIONAL OBJECTIVES						
(i)	To study in detail about toxic and hazardous chemicals					
(ii)	To gain knowledge about green chemistry					
(iii)	To understand the basics of clinical health and first aid safety					

UNIT I Environmental Management of Toxic and Hazardous Chemicals

Introduction to toxic and hazardous chemicals, Procedure for working with substances that pose flammable or explosive hazards, Incineration of hazardous chemicals. Identification, classification and segregation of industrial toxic/hazardous chemicals, Recovery, recycling and reuse of industrially important chemicals.

UNIT II Small Scale Industry and R & D Technology Transfer

Need and scope of small scale, Industry, SSI rules and regulations, Registration, Licensing, Incentives, Factory act, Labor laws, FDA, export-import regulations, and tax benefits, Role of R and D, Functional structure of R&D Unit, Research strategies and manufacturing interface

UNIT III Green Chemistry

Introduction, Twelve principles of Green Chemistry with their explanations and examples; designing a Green Synthesis using these principles; Prevention of Waste/byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy); prevention/minimization of hazardous/toxic products. Green Synthesis of the following compounds: adipic acid, catechol, BHT, methyl methacrylate, urethane, and aromatic amines(4-aminodiphenylamine), benzyl bromide, disodium iminodiacetate (alternative to strecker synthesis), citral, ibuprofen, paracetamol.

UNIT IV Clinical Health and First aid Safety

Definition of Health, WHO standard, Sterilization of surgical instruments. Biochemical analysis of urine and serum. Blood - Composition, grouping and Rh factor. Treatment of shock, haemorrhage, cuts and wounds. Burns – classification and first aid. Asbestos,

silica, lead paints, cement, welding fumes and gases - Hazard alert and precautions for safety.

UNIT V Indian Industrial Scenario and Quality Control in Industries

Survey of Indian chemical industries, Indian mineral resources, ferrous metallurgy, heavy chemical industries, nonferrous metals Fine chemicals and pharmaceuticals, natural products and agro-based chemicals, contribution of fertilizers and pesticide, Quality Control Role, Government standards like ISI, MINAS, Agmark, I. P., D. P., U.S.P concepts of quality and quality control.

Text Books

1. Mukharjee, R. R (1984): Elements of Quality Control (Vani Ed Books).
2. Tulsi, S. K (1980): Incentives for Small Scale Industries (ESRS).

References

1. Gerstenfield , A (1980): Effective Management of R & D.
2. Ahluwalia, V.K. & Kidwai M.R (2005): New Trends in Green Chemistry, Anamalaya Publishers.
3. Matlack, A.S. (2001): Introduction to Green Chemistry, Marcel Deckkar

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E10	Environmental Chemistry	3	1	-	4	3
INSTRUCTIONAL OBJECTIVES						
(i)	To study in detail about ecosystem and biodiversity					
(ii)	To gain knowledge about the energy resources					
(iii)	To discuss in detail the various social issues					

UNIT I Energy and Environment

Energy resources and their exploitation, Sun as source of energy- nature of its radiation, Conventional energy sources: coal, oil, biomass and nature gas, non-conventional energy sources: hydroelectric power, tidal, wind, geothermal energy, solar collectors, photovoltaic, solar ponds, nuclear-fission and fusion, magneto-hydrodynamic power (MHD), Energy use pattern in different parts of the world and its impact on the environment. CO₂ emission in atmosphere.

Mechanism of radiation action on living systems- Stochastic and Non-stochastic effects; delayed effects, radioactivity from nuclear reactors, fuel processing and radioactive waste, hazards related to power plants, terrestrial and non terrestrial radiation, dose from environment and nuclear radiations, ultraviolet radiations, pathways analysis and dose assessment, radiologic age dating, radioactivity risk assessment, criterion for safe exposure.

UNIT II Ecosystem, Biodiversity and its Conservation

Biodiversity concepts and patterns, Microbial diversity, Plant diversity, Agrobiodiversity, Soil biodiversity, Economic value of biodiversity, biodiversity losses. Biodiversity hotspots and their characteristic flora and fauna, threatened plants and animals of India, ecosystem people and traditional conservation mechanisms, Biodiversity Convention and Biodiversity Act, IPRs, national and international programmes for biodiversity conservation.

Wildlife values and eco-tourism, wildlife distribution in India, problem in wildlife protection, role of WWF, WCU, CITES, TRAFFIC, Wildlife Protection Act 1972. In-situ conservation: sanctuaries, biospheres reserves, national parks, nature reserves, preservation plots. Ex-situ conservation: botanical gardens, zoos, aquaria, homestead garden; herbarium; In-vitro Conservation: germplasm and gene Bank; tissue culture: pollen and spore back, DNA bank.

UNIT III Energy Resources and Maintenance

Renewable and non-renewable energy resources, growing energy need, sun as source of energy, solar radiation and its spectral characteristics, fossil fuels classification, composition. Physico-chemical characteristics and energy content of coal, petroleum and natural gas. Principle of generation and conservation of conventional and non-conventional energy. Energy from biomass and biogas, an aerobic digestion, energy use pattern and future need projection in different parts of the world, energy conservation policies.

UNIT IV Solid and Hazardous Waste Management

Solid wastes: Definition, types, sources, characteristics, and impact on environmental health. Waste generation rates. Concepts of waste reduction, recycling and reuse. Collection, segregation and transport of solid wastes Handling and segregation of wastes at source. Collection and storage of municipal solid wastes. Solid waste processing technologies. Mechanical and thermal volume reduction. Biological and chemical techniques for energy and other resource recovery.

Composting, Vermicomposting, Incineration of solid wastes. Disposal in landfills: site selection, design, and operation of sanitary landfills; secure landfills and landfill bioreactors; leachate and landfill gas management; landfill closure and post-closure environmental monitoring; landfill remediation. Hazardous wastes: Definition, sources and characteristics: Hazardous waste categorization, generation, collection, transport, treatment and disposal. Legislation on management and handling of municipal solid wastes and hazardous wastes.

UNIT V Social Issues

Urban issues - Energy - water conservation - environmental ethics - global warming - resettlement and rehabilitation issues - environmental legislations - environmental protection Act. 1986 - Air, Water, Wildlife and forest conservation Act - Population growth and Explosion - Human rights and Value education - environmental health - HIV/AIDS - Role of IT in environment and human health - Women and child welfare - Public awareness.

Text Books

1. Sharma, B.K. and Kaur, H (1996): Environmental Chemistry, Goel Publishing House, Meerut, India.
2. Jadhav, H.V (1992): Elements of Environmental Chemistry, Himalaya.
3. Samir, K. Banerji (1999): Environmental Chemistry, PHI Learning Pvt. Ltd.

References

1. Moore, J. W. and Moore, E. A (1976): Environmental Chemistry, Academic Press, New York.
2. Lunn, G. and Sansone, E.B (1990): Destruction of hazardous chemicals in the laboratory, Wiley, New York.
3. Dara, S.S (2005): A Text book of Environmental Chemistry and Pollution Control 8th Edn, Publisher, S. Chand & Company.

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E11	Industrial Chemistry	3	1	-	4	3
INSTRUCTIONAL OBJECTIVES						
(i)	To study in detail about the raw materials and energy required for the chemical industry					
(ii)	To gain knowledge about the surfactants, pesticides and explosives					
(iii)	To gain in depth knowledge about the various spectroscopic techniques used in industrial analysis of samples.					

UNIT I Raw Materials and Energy for Chemical Industry

Raw materials – Characteristics of raw materials and their resources – methods of raw material concentrations–integral utilization of raw materials.

Energy for chemical industry–Fuels–classification of fuels–coal–fuel gases and liquid fuels–petroleum–cracking–Octane number–cetane number–composition and uses of coal gas, water gas, producer gas, oil gas and gobar gas.

UNIT II Surfactants, Explosives, Pesticides

Surfactants: Classification with examples, Adsorption and micelle formation, Manufacture of anionic, cationic, zwitterionic and nonionic detergents, Applications in industries Applications as Foaming agent, Wetting agent, Dispersant, Solubilizers, Emulsifiers and Rheology modifiers, Detergent formulations, Detergent biodegradation, Biosurfactants.

Explosives: Classification, characteristics, preparation of nitrocellulose-T.N.T, Picric acid, Dynamite-cordite and Gunpowder, Dynamite, HMX, PETN, Cyclonite, plastic explosives, gelatin, RDX, cordite and seismic explosives, propellants–manufacture of liquid and solid propellants–hydrazine, incendiaries and smoke screens. Industrial applications.

Pesticides: Introduction, classification, synthesis of few common pesticides of chlorinated (DDT, BHC, Chlordane, Aldrin), organophosphorus and carbamate (parathion, malathion, carbaryl) compounds family, Plant pesticides, Pesticide formulations.

UNIT III Cement, Ceramics, Polymeric Materials, Glass, Paints and fertilizers

Cement: Manufacture – Wet Process and Dry process. Types, Analysis of major constituents, setting of cement, reinforced concrete. Cement industries in India.

Ceramics: Important clays and feldspar, glazing and verification.

Polymeric Materials: Industrial polymers (Thermoplastics polymers and thermosetting Polymers) and composite materials—their constitutions, chemical and physical properties, Industrial applications.

Glass: Types, Composition, manufacture of Optical glass, colored glasses, lead glass and neutron absorbing glass.

Fertilizers: Fertilizer industries in India, Manufacture of ammonia, ammonium salts, urea, superphosphate, triple superphosphate and nitrate salts.

Paints: Components of paints, pigments, thinner, binder, types of paints, water based paints, drying of paints

UNIT IV Industrial Chemical Analysis

Sampling procedures, sampling of bulk materials, techniques of sampling—solids, Liquids and gases. Collection and processing of data.

Chromatography: Principles, working and applications of paper chromatography, TLC, GLC, HPLC.

Particle size determination, rheological properties of liquids, plastics and their analysis. Modern Instrumental Methods of analysis—UV-visible spectroscopy-IR spectroscopy and non-dispersive IR- Raman spectroscopy-NMR Spectroscopy-Electron spin resonance spectroscopy-Atomic absorption spectroscopy-Flame photometry-Neutron diffraction-X-ray fluorescence-Ion chromatography

UNIT V Industrial Hygiene and Chemical Safety

(a) Industrial hygiene: Concept, air and biological monitoring, occupational disease, operational control measures, personal protective equipments; (b) Industrial hazards and Safety: Process hazards checklists, hazard surveys, safety program, Hazop safety reviews. c) Industrial pollution: Classification of hazards chemicals, storage, transportation, handling, risk assessments, challenges/solutions (d) Eco-friendly effluents disposal: Water pollutants, health hazards, sampling and analysis of water, water treatment, different industrial and domestic effluents and their treatment and disposal, advanced waste water treatment, effluent quality standards and laws, chemical industries, tannery, dairy, textile effluents, common treatment.

Text Books

1. Mukhlyonov (ed.) (1979): Chemical Technology, Vol.1, 3rd Edition, Mir publication, Moscow.
2. De.,A.K. (1989): Environmental Chemistry,WileyEasternLtd.,11thedn., Meerut.
3. Sharma, B.K (1997): Industrial Chemistry, Goel publishing house.

References

1. Norris Shreve, R. and J.A.Brink (1977): Jr. Chemical Process Industries. 4thedn.McGrawHill, Tokyo.
2. Chakrabarty, B.N (1981): Industrial Chemistry, Oxford & IBH Publishing Co., New Delhi.

LIST (1C) ELECTIVES

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E05	Heterocyclic Chemistry	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge on nomenclature of heterocyclic systems					
(ii)	To acquire knowledge about synthesis, reactivity and applications					
(iii)	To gain knowledge on the synthesis and applications of heterocycles with two heteroatoms					

UNIT I Heterocyclic Compounds

Replacement and systematic nomenclature (Hantzsch-Widman system) of monocyclic, fused and bridged heterocycles

UNIT II Three and Four membered Heterocycles with one Heteroatom

Synthesis and reactions of aziridines, oxiranes, thiiranes, aziridines, oxetanesthietanes, and applications

UNIT III Five membered Heterocycles with one/multiple Heteroatom

Synthesis and reactions of Pyrrole, furan, thophene, pyrazole and imidazole, oxazole and isoxazole, thiazole, isothiazoles, and applications.

UNIT IV Fused Heterocycles

Synthesis and reactions including medicinal applications of indole, quinoline, isoquinoline, benzopyroles, benzofurans, benzothiophenes, benzimidazoles, purins and pyrimidines application

UNIT V Heterocycles with multiple Heteroatoms

Synthesis and reactions of pyridazine, pyrimidine, pyrazine, pyrane, thiopyrane, diazines, thiazines, dioxane, oxazine, quinazoline application

Text Books

1. Bansal R K(1999):Heterocyclic Chemistry, New Age International
2. Acheson R H, (1976): An introduction to the chemistry of Heterocyclic compounds, Wiley

References

1. Trivedi J J, Gwynn P., (2001) Chemistry of Heterocyclic Compounds, Ellis –
2. Gupta R R, Kumar M and Gupta V., Heterocyclic Chemistry, Springer
3. Eicher T and Hauptmann S.,(2003): The Chemistry of Heterocycles, Siegfried,
4. Joule J A, Mills K and Smith G F., (1998) :Heterocyclic Chemistry, , Chapman and Hall, London,

SEMESTER III

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E06	Organic Synthesis	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge in modern organic reactions					
(ii)	To acquire knowledge in metal mediated coupling reactions					
(iii)	To understand the applications of phosphorus and sulfur reagents					
(iv)	To acquire knowledge in asymmetric synthesis					
(v)	To gain knowledge in retro-synthetic analysis					

UNIT I Modern Organic Named Reactions

Baylis-Hillman reaction, Henry reaction, Nef reaction, Kulinkovich reaction, Ritter reaction, sakurai reaction, Tischenko reaction, Ugi reaction, Tebbeolefination.

UNIT II Metal Mediated Coupling Reactions

Heck coupling, Stille coupling, Suzuki coupling, Negishi coupling, Sonogashira coupling, Nozaki-Hiyama coupling, Buchwald – Hartwig coupling, Ullmann coupling

UNIT III Chemistry of Organophosphorus and Sulfur Reagents

Electronic structure and bonding in phosphorus and sulfur compounds, their reactivity and application in organic synthesis.

Phosphorus reagents: formation of double bond- Wittig reaction functional group transformation, reactivity as electrophiles and nucleophiles.

Sulfur reagents: Sulfur ylides, stabilized and non-stabilized ylides, preparation and reactivity, sulfonyl carbanions

UNIT IV Asymmetric Synthesis

Definition-need for asymmetric synthesis-nomenclature-Topocity, Prochirality, substrate selectivity, diastereoselectivity and enantioselectivity. Asymmetric synthesis based on asymmetric substrate, asymmetric catalyst- examples. Substrate controlled methods, most common chiral auxiliaries, asymmetric Diels – Alder reaction

UNIT V Retrosynthetic Analysis

General concepts -Disconnection, Synthons, synthetic equivalent, retrosynthetic analysis, key intermediates and starting materials, reconnection, linear and convergent synthesis, one group and two group C-X disconnections, reversal of polarity, amine synthesis, One group C-C disconnection-alcohols, carbonyl compounds, alkene synthesis

Protecting groups for alcohol, amine, carbonyl and carboxylic groups, deprotection.

Text Books

1. Cary, F. A. and Sundberg, R. I (2009): Advanced Organic Chemistry, Part A and B, 5th Edition, Springer.
2. Smith, M. B (2005): Organic Synthesis, 2nd Edition.

References

1. Warren S. (2004): Organic Synthesis, The disconnection Approach, John Wiley & Sons
2. Tsuji, J. (2003): Palladium Reagents and Catalysts, New Perspectives for the 21st Century, JohnWiley & Sons
3. Ojima, I. (2000): Catalytic Asymmetric Synthesis, 2nd edition, Wiley—VCH, New York.
4. Carruthers, W. (1996):Modern Methods of Organic Synthesis, Cambridge University Press
5. Noyori, R. (1994):Asymmetric Catalysis in Organic Synthesis, John Wiley & Sons

SEMESTER IV

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E55	Bio-Organic Chemistry	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge on the structure and applications					
(ii)	To acquire knowledge about the structure, synthetic route and applications					

UNIT I Lipids and Fatty Acids

Definition and classification of lipids. Fatty acids - classification, nomenclature, structure and properties. Classification, structure and function of prostaglandins, triacylglycerols. Chemical properties of fats - iodine value, S_op value, acid number, Rancidity, R_m value

UNIT II Phospholipids

Structures - functions - Chemical properties of phospholipids. Lecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, plasmalogens, glycolipids (cerebrosides and gangliosides), isoprenoids and sterols (cholesterol and zymosterol),

UNIT III DNA and RNA-I

Nature of genetic material. Isolation of RNA and DNA. Composition of RNA and DNA. Structure of purine and pyrimidines, nucleosides and nucleotides-genetic code-sequencing.

UNIT IV DNA and RNA-II

Size and structure of different types of DNA-A, B, Z. Structure and role of different types of RNA. Properties of nucleic acids - denaturing and annealing of DNA

UNIT V Enzyme Action

Mechanism of enzyme catalysis, factors influencing enzyme action, examples of typical enzyme mechanisms, chymotrypsin, ribonuclease. Enzyme catalysed addition, elimination, condensation, carboxylation. Structure and functions of coenzyme A, thiamine pyrophosphate, NAD, NADP and vitamin B₁₂

Text Books

1. Adam, R.L. (1992): The Biochemistry of nucleic acids Springer Netherlands.
2. Jain, J.L. (2004): Text book of biochemistry, S.Chand.

References

1. West and Todd, (1974) : Text book of biochemistry, Macmillan Publishing Co. Inc, Agarwal, O. P. (2007):Text book of biochemistry, Krishna Prakasan Media(P), Ltd,
2. Lehninger, (2013): Principles of biochemistry.
3. SathyaNarayana,(2006):Text book of biochemistry, New Central Book Agency (p) Ltd

SEMESTER IV

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E56	Pharmaceutical Chemistry	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge on the structure and applications					
(ii)	To acquire knowledge about the structure, synthetic route and applications					

UNIT I Anti-Bacterial Agents

Classification, mechanism of action and SAR of Sulphonamides. Structure, chemical name, synthesis and clinical uses of Sulfamethiazole, sulfamethoxazole, Nalidixic acid, Ciprofloxacin, Nitrofurazone and Furozolidone.

UNIT II Antibiotics

Introduction, chemical classification, structure of Natural and semi synthetic penicillin, chemistry and uses of Streptomycin, Tetracyclines, Chloramphenicol, Cephalosporin.

UNIT III Anti-Fungal Agents

Classification and mechanism of action of antifungal agents. SAR of azole antifungals, Structure, chemical name, synthesis and clinical uses of Clotrimazole, Ketoconazole, Flucytosin.

UNIT IV Antimalarials

Classification, mechanism of action, synthesis and clinical uses of Chloroquine, Amodiaquine, Primaquine, Pyrimethamine, Proguanil

UNIT V Anti Inflammatory Agents

Classification, mechanism of action and SAR of NSAIDs, synthesis and clinical uses of Indomethacin, Ibuprofen, Ketoprofen, Diclofenac sodium, Acetaminophen,

Text Books

1. Kadam, Mahadik, Bothara, (1997) :Principles of Medicinal chemistry, Vol I&II, 5th edition, Niralprakashan, Pune.
2. Ashutoshkar(2005): Medicinal chemistry, , 3rd edition, , Ashutoshkar, New age International publishers, New Delhi.

References

1. Burger's (2007) Medicinal chemistry & Drug Discovery. Vol I to IV edited by Donald J. Abraham, 6thedn, Wiley interscience publication, New Jersey.
2. David. A. Williams, Thomas. L. Lenke (2005) : Foye's principle of Medicinal chemistry, , 5th edition, , Lippincott Williams and Wilkins, Philadelphia.
3. Wilson and Gisvold's(2004) :Text book of Organic Medicinal and Pharmaceutical Chemistry, 11th ed, , Lippincott Williams & Wilkins, Philadelphia.
4. Pandeya S.N(2006), Text book of Medicinal chemistry,, 3rd edition, , SG publisher, Varanasi.

SEMESTER IV

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14E57	Advanced Experimental Techniques in Organic Synthesis	4	1	-	5	4
INSTRUCTIONAL OBJECTIVES						
(i)	To gain knowledge on newer methods in organic synthesis					
(ii)	To acquire knowledge on the applications of organometallic compounds					
(iii)	To gain knowledge about the oxidation and reduction reaction strategies					

UNIT I Techniques in Organic Synthesis-I

Phase –Transfer Catalysis- Solid-Solid, Solid-Liquid Systems- mechanism of catalytic action, types of catalysis, application in few important reactions

UNIT II Techniques in Organic Synthesis-II

Bio-transformations – Enzyme catalysed reactions

Microwave induced reactions-Principle, conditions, advantages over conventional heating methods- Applications, sonication.

UNIT III Organometallic Reagents

Synthesis and applications of Grignard reagents-organolithium, Zinc, Copper, Palladium, Nickel compounds in organic synthesis- Homogeneous catalytic reactions- hydrogenation, hydroformylation

UNIT IV Methods of Organic Synthesis-I

Alcohols to Carbonyls – Chromium (IV) oxidants- Dimethyl sulfide oxidation, peroxide oxidation, Oppenauer oxidation, oxidation with manganese dioxide

Alkenes to epoxides- peroxide induce epoxidations

Alkenes to diols-oxidation with potassium permanganate, osmium tetroxide, Prevost reaction

Oxidative bond cleavages- cleavages of alkenes by transition metals

UNIT V Methods of Organic Synthesis-II

Reduction with lithium aluminium hydride, sodium borohydride, alkoxides, bis-methoxyethoxyaluminium hydride, boron aluminium hydride and derivatives-catalytic

metal hydrogenation-dissolving metal reductions, Non-metallic reducing agents including enzymatic and microbial reductions

Text Books

1. Cary, F. A and Sundberg, R. I. (2009) :Advanced Organic Chemistry, Part A and B, 5th Edition, Springer.
2. Smith, M. B. (2005):Organic Synthesis, 2nd Edition, McGraw-Hill: New York

References

1. Warren, S. (2004) :Organic Synthesis, The disconnection Approach, John Wiley & Sons
2. Tsuji, J.(2003): Palladium Reagents and Catalysts, New Perspectives for the 21st Century, John Wiley & Sons
3. Carruthers, W.(1996): Modern Methods of Organic Synthesis, Cambridge University Press
4. Clayden, J. Greeves, N, Warren, S. and Wothers, P (2001):Organic Chemistry, Oxford University Press

SEMESTER IV

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14402	Career Comprehensive Course*	2	-	-	2	2
INSTRUCTIONAL OBJECTIVE						
(i)	To evaluate the subject knowledge and presentation skill of the candidate and to train them for their employability					

Courses covered under the syllabus from First Semester to Fourth Semester (including electives) will form the basis for Career Comprehensive Course.

SEMESTER IV

Subject Code	Title of the Subject	L	T	P	Total of L+T+P	C
PCY14403	Project Work	-	-	12	12	12

PURPOSE

To undertake research in an area related to the program of study.

INSTRUCTIONAL OBJECTIVE

M.Sc. projects should be socially relevant and research oriented ones.

Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester.

The project internally will be evaluated by the concerned guide.

The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.

Phase II of the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project.

The method of assessment for both Phase I and Phase II is shown in the following table:

Assessment Tool Weightage

Review I : 40 Marks

Review II : 40 Marks

Review I & II Mark Distribution

Attendance : 5 Marks

Novelty : 5 Marks

Submission of hard copy : 15 Marks

Presentation : 10 Marks

Question session : 5 Marks

Total 40Marks

Seminar- 20 Marks from III semester

Report evaluation : 70 Marks

Viva : 30 Marks

Total 200 Marks

Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for

presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.