ITEM NO. FS 13.04(4)

M. Phil. CHEMISTRY

Curriculum for Full Time Programme (2 Semesters) effective from 2009

Semester I

Course Code	Course Title	L	T	P	C
Theory					
CY 911	Research methodology	4	0	0	4
CY 912	Concepts in chemistry	4	0	0	4
	Elective I	4	0	0	4
	Elective II	4	0	0	4
	Total	**12**	**0**	**0**	**16**

Semester II

Course Code	Course Title	L	T	P	C
Theory					
CY 921	Seminar	0	0	3	1
CY 922	Research Project	0	0	30	15
	Total	**0**	**0**	**33**	**16**

Total number of credits to be earned for the award of degree 32

ELECTIVES

Course Code	Course Title	L	T	P	C
Theory					
CY 951	Physical Organic Chemistry	4	0	0	4
CY 952	Polymer Chemistry and Technology	4	0	0	4
CY 953	Concepts and Techniques in Catalysis	4	0	0	4
CY 954	Environmental Chemistry	4	0	0	4
CY 955	Bio-inorganic Chemistry	4	0	0	4
CY 956	Solid State Chemistry	4	0	0	4
CY 957	Electrical Properties of Polymeric Materials	4	0	0	4
CY 958	Principles of Biochemistry	4	0	0	4
CY 959	Bioseparations	4	0	0	4
CY 960	Enzyme Technology	4	0	0	4
CY 961	Advanced Organic Chemistry	4	0	0	4
CY 962	Advanced Physical Chemistry	4	0	0	4

CY 911 RESEARCH METHODOLOGY AND ANALYTICAL TECHNIQUES

L T P C
4 0 0 4

UNIT I **10**

Survey of literature – primary and secondary sources – reviews, treatises, monographs, patents – current literature methods – abstraction of research papers – writing scientific papers – identification and selection of research problems – experimental design – analysis and interpretation of data – writing of thesis.

UNIT II **14**

Spectral methods of analysis – principles, instrumentation and techniques of UV–Vis, IR and Raman Spectroscopy – Emission Spectroscopy, Fluorometry and Atomic Absorbtion Spectroscopy.

UNIT III **14**

Magnetic Resonance Spectroscopy – ^{1}H-NMR – Chemical shift – anisotropic effects – coupling – simplification of complex spectra – principles, instrumentation and applications ^{13}C-NMR and ESR

UNIT IV **11**

Mass Spectrometry – determination of molecular weights – nitrogen rule – metastable peaks – Instrumentation and applications – Thermal methods – TGA, DTA and DSC techniques – principles, instrumentation and applications.

UNIT V **12**

Chromatographic techniques – adsorption chromatorgraphy – TLC, GC, LC – HPLC, GPC – hyphenated techniques.

Total periods 60

REFERENCES

1. Robert D. Braun, “Introduction to Instrumental analysis”, Pharma Book Syndicate, Indian reprint (2006).
2. H.H.Willard, L.L.Merritt Jr., J.A.Dean and F.A.Setle Jr., “Instrumental method of analysis” 7th Edn.,CBS Publishers and Distributors, New Delhi (2004).
3. D.J.Pasto, C.R.Johnson and M.J.Miller, “Experiments and Techniques in Organic Chemistry”, Printice Hall, Inc.(1992).
4. Skoog, D.A., West, D.M., Holler, F.J. and Crouch, S.R., “Analytical Chemistry – An Introduction”, 8th Edn., Saunders College Pub.(2005).

CY 912 CONCEPTS IN CHEMISTRY

L T P C
4 0 0 4

UNIT I **12**

Chemical Kinetics: Kinetics of homogeneous reactions – Theory of absolute reaction rates, comparison of results with Eyring and Arrhenius equations – study of fast reactions - study of kinetics by stopped flow technique and flash photolysis. Catalysis – homogeneous and heterogeneous – acid-base and metal ions – Application of X-ray and Auger Electron Spectroscopy to study the surfaces

UNIT II **12**

Electrochemistry: Thermodynamic properties of ions in solution – enthalpy – Gibbs energy – entropies of ion in solution. Electrode kinetics – process at electrodes – Butler Volmer equation. Electroanalytical techniques – Polarography, amperometry, cyclic voltametry and coulometry.

UNIT III **12**

Organometallic compounds: Synthesis of organolithium, tin and silicon compounds – Application to carbon – carbon bond forming reactions – transition metal organometalitics – homogeneous catalytic reaction – hydrogenation, hydroformylation, isometrisation and polymerization – pi – metal complexes, activation of small molecules by coordination.

UNIT IV **12**

Reactive Intermediates: Generation, structure and reactivity of carbenes and free radicals – addition and rearrangement reactions – substitution reactions by free radicals. Name reactions – Favorskil rearrangement, Stork enamine reaction – Mannich reaction and Baeyer – Villiger oxidation – Chichibabin reaction.

UNIT V **12**

Reagents in Organic Synthesis: Uses of NBS, lithium diisopropylamide, aluminium isopropoxide, lithium aluminium hydride, potassium tertiary butoxide and trimethylsilyl iodide. Protecting groups – hydroxyl, amino, carbonyl and carboxylic acid. Synthetic analysis and planning – control of stereochemistry – illustrative synthesis – Longifolene.

Total periods 60

REFERENCES

1. D.F. Shriver and P.W.Atkins – Inorganic Chemistry, 3rd Edn. Oxford University Press (2004).
2. P. W. Atkins, and J.D. Paula, Physical Chemistry, 7th Edn. Oxford University Press, London (2002).
3. Francis A. Carey and Richard J. Sundberg, “Advanced Organic Chemistry”, (Part A and B), 5th Edn., Plenum Press (2006).
4. Jerry March, “Advanced Organic Chemistry Reactions, mechanisms and structures ”, 4th Edn.,John Wiley & Sons (2003).
5. J.Rajaram and J.C.Kurlacose, “Kinetics and Mechanism of Chemical Transformations”, Macmillan India Ltd. (1993).

CY 951 PHYSICAL ORGANIC CHEMISTRY

L T P C
4 0 0 4

UNIT I CHEMICAL KINETICS 12

Kinetics of homogeneous reactions in solution – Transition state model – activation parameters – rate determining step – Isokinetic relationship – location of transition state – Hammond Postulate – reactivity and selectivity – Kinetic and thermodynamic control of products – Principles of least motion and microscopic reversibility – Effect of substituents, solvent and ionic strength – Study of fast reactions.

UNIT II KINETIC ISOTOPE EFFECTS 12

Primary and secondary salt effects – acid base catalysis – acidity functions – resonance and steric effects on acidity and basicity – Bronsted catalysis – solvent isotope effect – deduction of reaction mechanisms – Kinetic and non-kinetic methods – mechanistic interpretation of rate law.

UNIT III STRUCTURE AND REACTIVITY RELATIONSHIP 12

LFER – Hammett equation – substituent and reaction constants – theories of substituent effects – Deviations from the Hammett equation – Dual parameter correlation –Taft Model.

UNIT IV ORGANIC REACTION MECHANISMS 12

Substitution reactions – mechanisms of S_N1, S_N2 and S_Ni reactions – effects of solvent, substrate, nucleophile and leaving group – stereochemistry of substitution reactions – Elimination reactions – mechanism of E1, E2 and E1CB mechanisms – effects of substrate, base, leaving group and medium – Pyrolytic elimination – Mechanism of oxidation and reduction of organic substrate – catalytic hydrogenation.

UNIT V PHOTOCHEMICAL REACTIONS 12

Excitations – spin multiplicity sensitization and quenching – techniques of photochemistry – Photochemistry of C=C – Diπ-methane rearrangement – Photoaddition to alkenes – Photoreaction of carbonyl compounds – photosubstitution at aromatic ring – Photo Fries rearrangement – Photocyclic additions and photooxidation – Pericyclic reactions – Suprafacial and antrafacial geometrics – Diels Alder reactions – Sterio and regio specificity – Retro Diels Alder reactions – Cyclo additions of Cumulenes – (2 + 2) Cyclo reversions – Electrocyclic, Chelotropic and Sigmotropic reactions.

Total periods 60

REFERENCES

1. J.March, Advances in Organic Chemistry, 5th Ed., John Wiley & Sons, New York (2003).
2. N.S. Issac, Physical Organic Chemistry ELBS, Longman Pub.(1978).
3. F.A.Carey and R.J.Sundberg, “Advanced Organic Chemistry”, (Part A and B) 5th edition, Plenum Press, New York (2005).
4. Ed.Chapman and J.Shorter, “Advances in Linear Free Energy Relationships” Plenum Press, London and New York (1972).

CY 952 POLYMER CHEMISTRY AND TECHNOLOGY

L T P C
4 0 0 4

UNIT I BASIC CONCEPTS OF POLYMER SCIENCE 12

Classification of polymers – chain polymerization – mechanism of free radical, cationic, anionic and co-ordination polymerization – Living polymers- atom transfer radical polymerization (ATRP)– chain transfer reaction and constant – Alfin catalysts – Iniferter – Step-growth polymerization-kinetics of esterification in presence and absence of external catalyst.

UNIT II COPOLYMERIZATION 12

Copolymer equation – determination of reactivity ratios & its significance– sequence length – copolymer composition by 1H-NMR, UV, IR, and elemental analysis. Preparation of block and graft copolymers. Thermal, group transfer, metathetical, electrochemical and ring opening polymerization. Techniques of polymerization – bulk, solution, emulsion, suspension, interfacial, solid state and melt polycondensation.

UNIT III CRYSTALLINE AND AMORPHOUS POLYMERS 12

Crystalline and amorphous polymers-factors affecting crystallinity and crystallisability -effect on polymer properties. Glass transition temperature- thermal transitions-Determination of Tg and Tm – factors affecting Tg Polymer characterization by IR, NMR , TGA, DTA and DSC – Molecular weight of polymers and its distribution – molecular weight determination by GPC and Viscosity measurement- Mark – Houwink equation.

UNIT IV PROCESSING OF POLYMERS 12

Compounding of polymers, moulding techniques – compression, injection, extrusion, blow moulding, thermoforming, vacuum forming, calendering, casting, reaction injection moulding and lamination.

UNIT V SPECIALTY POLYMERS 12

Interpenetrating polymer net works (IPN) - Heat resistant polymers – Ladder polymers- conducting polymers – photocrosslinking polymers - liquid crystalline polymers - Bio-compatible polymers – polymer composites- polymers for optical storage devices.

Total periods 60

REFERENCES

1. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, “Polymer Science” New Age International (p) Ltd., New Delhi (2006).
2. F.W.Bill Mayor, “Text Book of polymer science” 3rd Edition – John Wiley & sons, Inc., New York (2002).
3. George Odian “Principles of polymerization”, 3rd Edition – John Wiley & sons, Inc., New York (2003).
4. J.A.Brydson, “Plastic materials”, Newnes – Butterworths, London (2002).
5. Krzysztof Matyjaszenski, “Hand Book of Radical Polymerisation”,-Wiley, John & Sons. (2003).
6. M.S.Bhatnagar, “ A Text Book of Polymers9 chemistry and Technology of polymers), Vol I, II & III, 1st Edn., S.Chand and Company, New Delhi, (2007)

CY 953 CONCEPTS AND TECHNIQUES IN CATALYSIS

L T P C
4 0 0 4

UNIT I CATALYSIS FUNDAMENTALS 12

Acid-base catalysis – catalysis by transition metal ions and their complexes – supported transition metal complexes as catalysts – catalysis by enzymes – phase transfer catalysis - photocatalysis – adsorption – chemisorption on metals, metal oxides and semiconductors - kinetics of unimolecular and bimolecular surface reactions - Contact time - WHSV - Time on stream. Catalyst deactivation and regeneration.

UNIT II CATALYSTS SYNTHESIS 12

Impregnation method, ion-exchange, sol-gel process - supported metals - metal oxides - Superacids - hydrotalcites - zeolites - zeotypes - mesoporous aluminosilicates and aluminophosphates. Unit operations in catalyst manufacture-drying, calcination, spray drying.

UNIT III CATALYSTS CHARACTERIZATION 12

Temperature programmed techniques – TPD, TPR, TPS, TPO - XRD, Auger - EPS - TEM - EPMA - BET - pore size distribution - ^{29}Si, ^{31}P, ^{27}Al-MAS NMR - DRS - EXAFS - ESR. Metal dispersion by chemisorption and XRD.

UNIT IV CATALYTIC REACTORS 12

Integral and fixed bed reactors - differential reactors - stirred flow reactors – microcatalytic reactors of pulse type - static reactors - Reaction monitoring by GC.

UNIT V CATALYTIC REACTIONS 12

Catalytic asymmetric synthesis – C-C, C-H bond formation, oxidation – acid catalysed isomerisation - Heterogeneous hydrogenation, dehydrogenation, cyclodehydrogenation, oxidation - Homogeneous catalysis by transition metal organometalic complexes - Metathesis of olefins - Synthetic fuels.

Total periods 60

REFERENCES

1. Kinetics and mechanism of chemical transformation, J.Rajaram and J.C. Kuriacose, Macmillan India Ltd. (1998).
2. Introduction to principles of heterogeneous catalysis, Thomas T.M and Thomas. T.J, Academic Press, London (1995).
3. The Chemistry of catalytic conversions, Herman Pine, Academic Press, New Delhi (1981).
4. Spectroscopy in catalysis: An introduction, J.W.Niemantsverdrict, VCH, New York (1976).
5. Experimental methods in catalysis research, Volume II and III, Robert B Anderson, Peter T Dawson, Academic Press, New Delhi (1976).

CY 954 ENVIRONMENTAL CHEMISTRY

L T P C
4 0 0 4

UNIT I CHEMICALS AND ENVIRONMENT 12

Environmental segments – ecosystem and natural cycles of the environment – chemical and photochemical reactions in the atmosphere – ozone chemistry – oxides of sulphur and nitrogen – organic compounds – green house effect and global warming – acid rain – environmental fate of pollutants – biological activity – biodegradation of carbohydrates, fats and oil, proteins, detergents, pesticides.

UNIT II CHEMICAL TOXICOLOGY 12

Toxic chemicals in the environment – toxic effects – biochemical effects of arsenic, cadmium, lead, mercury, copper, chromium – biochemical effects of some gaseous pollutants, cyanide, pesticides, asbestos – air pollutants – air quality standards – sampling and analysis – air pollution control – noise pollution – injurious effects of noise.

UNIT III WATER POLLUTION 12

Water quality parameters and standards – turbidity, colour, pH, acidity, solids, hardness, chlorides, residual chlorine, sulphates, fluorides, phosphates, iron and manganese, nitrogen, DO, BOD, COD, grease, volatile acids – analytical techniques in water analysis – soil pollution.

UNIT IV WASTEWATER TREATMENT 12

Primary treatment - equalisation, neutralisation, proportioning, sedimentation, oil separation, floatation, coagulation- aeration – air stripping of volatile organics; biological treatment process – lagoons, activated sludge process, trickling filtration, anaerobic decomposition – adsorption – theory of adsorption - properties of activated carbon – ion-exchange, chemical oxidation - ozone, hydrogen peroxide, chlorine – wet oxidation; photochemical oxidation.

UNIT V SLUDGE HANDLING AND DISPOSAL 12

Characteristics of sludge – disposal methods – aerobic digestion, gravity thickening, floatation, thickening, centrifugation, specific resistance, vacuum filtration, pressure filtration, sand bed drying, land disposal, incineration – energy and environment – non-renewable and renewable energy – energy sources and resources – energy conservation – nuclear energy and the environment – disposal of nuclear waste; wastewater reclamation and reuse – effluent disposal.

Total periods 60

REFERENCES

1. A.K De, “Environmental Chemistry”, 5th Edn., New Age International Pub., New Delhi (2004).
2. M.S.Sethi,“Environmental Chemistry”, Shri Sai Printographers, New Delhi (1994).
3. C N.Sawyer, “Chemistry for Environmental Engineering”, 4th Ed., McGraw – Hill Inc.(1994).
4. APHA – AWWA – WPCF, “Standard methods for the examination of water and wastewater”, 17th ed., Washington DC (1989).
5. Metcalf & Eddy, “Wastewater Engineering”, 3rd ed., McGraw Hill, Inc. (1991).
6. W.Wesley, Eckenfelder, Jr., “Industrial Water Pollution Control”, McGraw – Hill Book Company, 1989.

CY 955 BIO-INORGANIC CHEMISTRY

L T P C
4 0 0 4

UNIT I METAL IONS IN BIOLOGICAL SYSTEMS 12

Survey of metal ions, metal ion transport – passive and active transport –sodium and potassium ion pumps; transport proteins – ionophores; storage proteins – iron, copper and calcium.

UNIT II METALLOENZYMES 12

Structure, active site and general mechanism of catalytic activity – kinetic aspects – ATP hydrolysis, acid catalysis – carboxypeptidases, oxaloacetate decarboxylase.

UNIT III OXYGEN TRANSPORT 12

Hemoglobin, myoglobin, - iron coordination chemistry – Perutz mechanism; hemocyanin, hemeerythrin

UNIT IV PROTEINS IN ELECTRON TRANSPORT 12

Iron–sulphur proteins, cytochromes – cytochrome – P450-Nitrogen fixation – photosynthesis.

UNIT V CHEMOTHERAPY 12

Toxicity and carcinogenicity of metal ions – deficiency, defects and therapy – role of metal ions in diagnosis and treatment – metal complexes and chelating agents in medicine.

Total periods 60

REFERENCES

1. M.N.Hughes, “Inorganic chemistry of biological processes” 2nd Edn. John Wiley and sons (1985).
2. D.E.Fenton, “Biocoordination chemistry” Oxford Sci.Pub. (1995).
3. J.J.R.Frausto das Silva and R.J.P.Williams, “The Biological chemistry of the elements – The Inorganic Chemistry of Life”, Oxford Univ. Press (1993).
4. H.Sigel, (Ed) “Metal ions in biological systems” Vol. 1 – 30, Marcel Dekker, (1998).

CY 956 SOLID STATE CHEMISTRY

L T P C
4 0 0 4

UNIT I CRYSTAL CHEMISTRY 12

Structures of complex oxides and related compounds – defects in solids – origin and types of defects, non-stoichiometry – defects and physical properties – ionic conductivity and optical properties.

UNIT II PREPARATIVE METHODS 12

Polycrystalline materials by solid state, precipitation, precursor, ion exchange, sol-gel, intercalation methods – high pressure synthesis, preparation of single crystals – different methods – preparation of thin films, amorphous and nano crystalline materials.

UNIT III CHARACTERISATION OF SOLIDS 12

X-ray diffraction, electron and neutron diffraction – thermal methods – TGA, DTA, DSC and TMA – electron microprobe, EDAX – SEM, TEM spectroscopic methods – XPS, Auger, ISS, SIMS – principles and techniques.

UNIT IV ELECTRICAL PROPERTIES 12

Band theory of solids – metals, non metals, semiconductors – thermopower – Hall effect – insulators – measurement by 2 probe and 4 probe methods – dielectric, ferroelectric, pyroelectric and piezoelectric materials – superconductivity – theory – high TC materials.

UNIT V MAGNETIC, OPTICAL AND THERMAL PROPERTIES 12

Dia, para, ferro and antiferromagnetic properties – measurement of magnetic susceptibilities – Guoy and Faraday methods – magnetic ordered solids – soft and hard materials. Optical and thermal properties of solids

Total periods 60

REFERENCES

1. A.R.West, Solid State Chemistry and its applications" John Wiley (1984).
2. Lesley Smart and Elaine Moore – "Solid State Chemistry – an introduction" Chapman and Hall (1992).
3. D.K.Chakrabarty – "Solid State Chemistry" New Age Pub.(1996).
4. L.V.Azaroff "Introduction to Solids" Tata McGraw Hill (1990).

CY 957 ELECTRICAL PROPERTIES OF POLYMERIC MATERIALS

L T P C
4 0 0 4

UNIT I POLYMER BLENDS 12

Introduction – equilibrium phase – polymer behaviour – Effect of molecular structure, polymer – polymer interactions - Spatial structural effects – Blend morphology – Chemical reactions – properties – miscible blends – Immiscible blends – Toughened polymers. Commercial blends – applications.

UNIT II RESISTIVITY 12

General features – Polymer as wide band gap insulators – theories – trapping – carrier injection – effects of structural features – effects of additives.

UNIT III DIELECTRIC BEHAVIOUR 12

Mechanism of loss – relaxation – non-polar polymers – Amorphous dipolar polymers – crystalline dipolar polymers – effects of structure- effects of additives – effects of impurities – testing of degradation in polymers.

UNIT IV THERMAL PROPERTIES 12

Specification of thermal evaluation and classification of electrical insulation – Determination of resistivity – Relative resistance of solid insulating materials – Relative resistance of insulating materials to breakdown by surface discharges – Artificial pollution tests of H.V. insulator – AC, DC

UNIT V BREAKDOWN TESTING AND ANALYSIS 12

Breakdown test methods – Statistical Analysis – Graphical Techniques – Numerical Techniques.

Total periods 60

REFERENCES

1. J. Kreschurity, " Concise encyclopedia of polymer science and engineering" John Wiley & Sons, New York (1990).
2. Balrd M.E. "Electrical properties of polymeric materials" The Plastic Institute London (2002).
3. Tiller Shugg W. " A hand book of Electrical and Electronic materials" van nostrand reinhold New York (1986).
4. Dissado L.A. Fothergil J.C. " Electrical Degradation and Breakdown in Polymers" Peter Peregrinus Ltd., London (1992).
5. Bradwell A. Ed. "Elkectrical Insulation" Peter Peregrinus Ltd (1983).

CY 958 PRINCIPLES OF BIOCHEMISTRY

L T P C
4 0 0 4

UNIT I CARBOHYDRATES AND LIPIDS 12

Basic concepts of biochemistry – Biomolecules and their interactions with water and other biological substances, carbohydrates – Mono, di,oligo and poly saccharides, complex carbohydrates, Lipids – properties and structure of glycerolipids, phospholipids, sphingolipids, glycolipiods, steroids and prostaglandin.

UNIT II PROTEINS 12

Properties and structure of amino acid, peptides, proteins and conjugated proteins. Protein conformation: Native conformation of protein molecules, the secondary structure of fibrous protein, the alpha helix, beta pleated sheet, collagen helix, tertiary structure of globular proteins. The quaternary structure of oligomeric proteins

UNIT III ENZYMES 12

Enzyme synthesis, isolation and purification, effect of charge and hydrophobicity, activity and turnover number. Enzyme kinetics:Michaelis – Mention equation, Km, mechanisms, enzyme denaturation, enzyme regulation and activities; occurrence, structure, properties and functions of coenzymes and cofactors.

UNIT IV NUCLEIC ACIDS 12

Properties and structure of purines, pyrimidines, nucleosides, nucleotides, poly nucleotides; ribo nucleic acids, and deoxy ribo nucleic acids and nucleo protein complexes and structure of chromosomes. Replication, transcription and translation of genetic information. Ribosome and protein synthesis, genetic code and regulation of protein synthesis.

UNIT V METABOLISM AND ENERGETICS 12

Carbohydrate, lipid, protein and nucleic acid metabolism interconversion of biological substance, glyolysis, TCA cycle, oxidation of fatty acids in animal tissues, urea cycle, respiratory chain, ATP cycle and other energy rich compounds.

Total periods 60

REFERENCES

1. A.L.Leninger, D.L.Nelson, M.M.Cox. " Principles of Biochemistry:" Second Edition, C.B.S. Publications (1993).
2. D.Voet, G.Voet, " Biochemistry" Second Edition, John wiley & Sons (1995).
3. Lubert Stryer, "Biochemistry", Fifth Edition, W.H. Freeman and Company (1995).

CY 959 BIOSEPARATIONS

L T P C
4 0 0 4

UNIT I OVERVIEW OF BIOSEPARATIONS 12

Bioprocess industries – fermentation broths: release of intracellular products – cell disruption – mechanbical and chemical methods; solid – liquid separation – filtration – theory for incompressible and compressible cakes, batch and continuous filtration, centrifugation – Principles, equipment.

UNIT II ENZYME ISOLATION 12

Isolation of products – membrane process – dialysis, ultra filteration, reverse osmosis and electro dialysis; adsorption – adsorption isotherms, batch and fixed bed adsorption, extraction and aqueous two phase extractions, precipitation – salting out, organic solvent mediated precipitation, selective denaturation and large scale precipitations.

UNIT III ENZYME PURIFICATION 12

Product purification – Chromatography – principles of chromatographic separation – gel filtration, reversed phase, hydrophobic interaction, ion exchange IMAC and bio affinity chromatographic techniques.

UNIT IV ELECTROKINETIC METHODS 12

Electrophoretic separation – gel electrophoresis – analytical and preparative scale, capillary electrophoresis, isoelectroic focusing.

UNIT V FINISHING OPERATIONS 12

Final product purification and formulation – crystallization; drying and lyophilisation; formulation strategies.

Total periods 60

REFERENCES

1. P A Belter, E.L.Cussler and Wei Shou Hu, “Bioseparations – Downstream Processing for Bio Technology”, Wiley Inter Science Pub. (1988).
2. Product recovery in Bioprocess Technology Biotechnology Series, Butterworth Heinemann (1992).
3. J.Asenjo (ed), “ Separation Process in Biotechnology” Marcel –Dekker (1993).
4. M.S. Verrall and M.J.Hudson. “Separations for Biotechnology” Ellis Harwood Ltd. (1990).
5. R.K.Scopes, “ Protein Purification, Principles and Practice”. Third Editon, Narosa Publishing House (1994).

CY 960 ENZYME TECHNOLOGY

L T P C
4 0 0 4

UNIT I ENZYME ISOLATION 12

Sources of enzymes; enzyme extraction; principles of enzyme assays and kinetics studies; effects of enzyme concentration; expression of enzyme activity; effect of substrate concentration

UNIT II ENZYME IMMOBILIZATION 12

Immobilization techniques; Adsorption; entrapment; covalent cross – linking with bi or multifunctional reagents; covalent coupling to polymeric supports.

UNIT III ENZYME CATALYSIS 12

Immobilized enzyme catalytic reactor design, enzyme catalysis in aqueous and non-aqueous solvents, polymerization esterification, ester hydrolysis; peptide synthesis.

UNIT IV INDUSTRIAL ENZYMES 12

Production, applications in various industries, food processing; bakery products, dairy products, brewing: leather industry detergents, enzyme in medicine diagonostics, enzyme sensors, Biosensors; Use of enzymes in analysis – types of sensing – gadgetry and method, Use of unnatural substrates – artificial enzymes – enzyme mimicking.

UNIT V ENZYME REACTORS 12

Design and operation of ideal reactors – CSTR and PER; design and packed bed and fluidized –bed immobilized enzyme reactors: membrane reactors for immobilized enzyme systems.

Total periods 60

REFERENCES

1. P. Cacessa & J. Hubble, " Enzyme Technology" 1st Edn., Open University Press (1987).
2. R. Eisenthal & M. J. Danson, " Enzyme Assays – A Practical approach". I.R.L. Press (1992).

CY 961 ADVANCED ORGANIC CHEMISTRY

L T P C
4 0 0 4

UNIT I STEREOCHEMISTRY 13

Introduction to molecular symmetry and point groups. Topicity and prostereoisomerism, nomenclature of stereotopic ligands and faces, stereoheterotopic ligands – centre of chirality, assignment of absolute stereochemistry, axial chirality, planar chirality and helicity. Conformational analysis – acylic systems, cyclic systems, cyclohexane and decalins. Conformation and reactivity with examples. Stereoselectivity – classification, terminology, principle of stereoselectivity, examples of diastereoselectivity and enantioselectivity including few examples from pericyclic reactions.

UNIT II REACTIVE INTERMEDIATES 13

Formation, stability and reactions involving carbonium ions, carbanions, carbenes, nitrenes and radicals – Generation of enolates, enolate selectivities, alkylation of enolates and stereochemistry of enolate alkylation. Mechanism of ester hydrolysis (only B_{AC}^2, A_{AC}^2 and A_{AL}^1). Alkylation of active methylene compounds. Assymmetric alkylation (Evans, Enders and Meyers procedures). Preparation and synthetic utility of enamines - Finkelstein reaction.

UNIT III OXIDATION AND REDUCTION REACTIONS 12

Oxidation with Cr and Mn reagents – oxidation with LTA, DDQ and SeO_2 – oxidation using DMSO either with DCC or Ac_2O or oxalyl chloride, oxidaion using Dess – Martin reagent – vicinal hydroxylation of olefinic double bonds – Woodward and Prevost procedures – epoxidation using peracids including Sharpless procedure, ozonolysis. Reduction using various reagents – hydrogenation, hydration of carbon – carbon double and triple bonds – asymmetric reduction of carbonyl functions

UNIT IV ORGANOMETALLIC CHEMISTRY FOR ORGANIC SYNTHESIS 12

Fundamental concepts in transition metal chemistry for organic synthetic transformations – metal carbenes, synthesis, reactivity, cycloaddition reactions of metal carbenes, synthesis of fused ring systems, Dotz reaction, mechanism of ring formation, application of cobalt carbonyls in organic synthesis, Pauson Khand reacion, Volhardt reaction, Pearson reaction, use of organoiron complexes for stereospecific synthesis of substituted cyclic compounds

UNIT V APPLICATIONS OF SPECTRAL TECHNIQUES 10

Principles and applications of UV – Visible, IR, NMR, EPR, XRD and Mass spectrometry in the determination of structure of organic molecules-Optical rotatory dispersion and its applications.

Total periods 60

REFERENCES

1. Jerry March, Advanced Organic Chemistry 5th Edn. Wiley Interscience, New York, (2003).
2. Francis A Carey and Richard J. Sundberg, " Advanced Organic Chemistry- Part A and Part B", 5rd Edn. Plenum Press, New York (2005).
3. E.L. Eliel and S.H.Wilen, Stereochemistry of Organic Compounds, John Wiley and Sons, New York (2005).
4. S.G.Davies, Organotransition Metal Chemistry, Applications to Organic Synthesis, Pergamon Press (1982).

CY 962 ADVANCED PHYSICAL CHEMISTRY

L T P C
4 0 0 4

UNIT I CATALYSIS 12

Phase transfer catalysis – concepts – classifications – mechanism – applications (organic and polymer synthesis) - catalysis by ion exchange resins – super acid catalysis – sulphate, metal oxides – applications intermolecular catalysis - enzyme like catalysis by synthetic linear polymers

UNIT II PHOTOPHYSICS 12

Interaction of light with molecules, radiative and non-radiative processes-excited states-their properties. Fluorescence, phosphorescence, exciplexes, excimers, delayed fluorescence. Photophysical processes, internal conversion, intersystem crossing, energy transfer, quenching-Stern-Volmer analysis-photosensitization

UNIT III INDUSTRIAL APPLICATIONS OF PHOTOCHEMISTRY 12

Solar energy conversions, semiconductor applications, photovoltaics, photo electrochemistry, photochromism, photopolymerization and photocopying.

UNIT IV BIO-PHYSICAL CHEMISTRY 12

Thermodynamics of biochemical reactions-binding of oxygen by hemoglobin. Electrophoresis-types-paper electrophoresis-cellulose acetate electrophoresis-gel electrophoresis-applications-analytical use-uses in molecular biology

UNIT V MACROMOLECULAR DYNAMICS 12

Molar masses – determination – viscometry – osmometry – Donnan membrane equilibrium – ultracentrifugation – light scattering – diffusion – Stokes – Einstein equation – Einstein – Smoluchowski equation – thermodynamics of polymers solution –Flory – Huggin theory.

Total periods 60

REFERENCES

1. P.W.Atkins and J.D.Paula, Physical chemistry, 7th Edn., Oxford University Press, London (2002).
2. G.W.Castellan, Physical chemistry, 3rd Edn., Narosa Pub. House, Delhi (2004).
3. A.Singh and R. Singh, Biophysical Chemistry,1st edition, Campus Books International, New Delhi (2004).
4. C.M.Starks, Phase transfer catalysis – Principles and Techniques Academic Press, New York (1978).
5. Rohatgi Mukherjee, Fundamentals of Photochemistry, 2nd edition, New Age International (2004).
6. K.J. Laidler, Physical chemistry with biological applications, Pergamon Press, Oxford (2001).