Semester I

M.SC. CHEMISTRY SCHEME EFFECTIVE FROM 2018-19		
SEMESTER I		
Course Code	University Course Type	Course Name
CHY 166	Core Theory	Advanced Inorganic Chemistry-I
CHY 167	Core Theory	Advanced Organic Chemistry -I
CHY 168	Core Theory	Advanced Physical Chemistry -I
CHY 169	Core Theory	Spectroscopy
CHY 205	Core Practical	Computer for Chemist
CHY 170	Core Practical	Chemistry Practical-I
ENG 109	Skill Enhancement Course	Communicative English

CHY166

ADVANCED INORGANIC CHEMISTRY-I

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module –I

Metal Ligand bonding: Limitation of crystal field theory, molecular orbital theory, introduction to ligand field theory, octahedral, tetrahedral and square planar complexes π-bonding and molecular orbital theory.

Module – II

Metal Ligand Equilibria in solution: Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH metry and spectrophotometry.

Module –III

Stereochemistry and Bonding in main group compound: Limitation of VSEPR Theory, Walsh diagram triatomic (AH_2 molecule) and tetra atomic (AH_3 molecules), dπ-pπ bond, Bent rule and energitics of hybridization, some simple reaction of covalently bonded molecules.

Module –IV

Chemistry of Lanthanides: Chemistry of lanthanides and stable oxidation states, lanthanides and actinides contraction, absorption spectra of lanthanides and actinides and their magnetic properties, separation of lanthanides ,use of lanthanides and their compounds.

Module –V

Chemistry of Actinides and super heavy elements: Chemistry of actinides, stable oxidation states, separation of actinides, use of actinides and their compounds, chemistry of super heavy metals.

Books Suggested:

1. Advanced inorganic chemistry, F.A. Cotton and Wilkinson, John Wiley, 1980.
2. Inorganic chemistry, J.E. Huhey, Harpes & Row, 1983.
3. Chemistry of the elements, N.N. Greenwood and A. Earnshow, Pergamon, 1997.
4. Theoretical inorganic chemistry by Dey and Selben, 1962.
5. Inorganic Chemistry; Third Edition; D.F. Shriver and P.W. Atkins; Oxford University Press, New York, 1999.
6. A New Concise Inorganic Chemistry; Fifth Edition, J.D. Lee; Blackwell Science, London, 2000.

CHY167
ADVANCED ORGANIC CHEMISTRY-I

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module-I

Nature of Bonding in Organic Molecules: Aromaticity in benzenoid and non-benzoid compounds, alternate and non-alternante hydrocarbons. Huckel's rule, energy, level of pi molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach, bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compounds, catenanes and rotaxanes.

Module-II

Stereochemistry: Conformational analysis of cycloalkanes, decalines, effect conformation on reactivity, conformation of sugars, strain due to unavoidable crowding, elements of symmetry, chirality, molecules with more than one chiral center, threo and ertyhro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, asymmetric synthesis, optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirallity due to helical shape, stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

Module-III

Reaction Mechanism: Structure and reactivity: Type of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle, isotopes effects, effect of structure on reactivity, resonance and field effects, steric effect, quantitative treatment of the effect of structure on reactivity, the Hammett equation and linear free energy relationship, substituent and reaction constants, Taft equation.

Module –IV

Aliphatic Nucleophilic Substitution: Aliphatic Nucleophilic Subsitution: The SN_1, SN_2, mixed SN_1 and SN_2 and SET mechanism, the neighboring group participation by pi and sigma bonds, anchimeric assistance, classical and nonclassical carbocations, phenonium ions, norborynl systems, application of NMR spectroscopy in the detection of carbocations, nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon, reactivity ,effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

Module-V

Aromatic Nucleophilic Substitution:. **Aromatic Nucleophilc Substitution**

The S_NAr S_N1, benzyne and $S_{RN}1$ mechanism, reactivity effect of substrate structure, leaving group and attacking nucleophile, the Von Richte, Sommelet-Hauser and Smiles rearrangements.

Books Suggested:

1. Structure and Mechanism in Organic chemist, C. K. Ingold, Cornell University Press,
2. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March,John Wiley, 1992.
3. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum, 1977.
4. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman, 6th edition, 1985.
5. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan, 3rd edition, 1984.
6. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International, 3rd edition, 2011.
7. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age Internationa, 2008.

CHY168

ADVANCED PHYSICAL CHEMISTRY-I

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module –I

Quantum Chemistry: Schrodinger equation, postulates of quantum mechanics, operators and commutation relations, discussions of solutions of the Schrodinger equation to some model systems – particle in a box, harmonic oscillator, rigid rotor, hydrogen atom.

Module –II

Angular Momentum: Ordinary and generalized angular momentum, eigen functions and eigen values for angular momentum, operator using ladder operators, addition of angular momenta, spin, antisymmetry and Pauli's exclusion principle.

Molecular orbital theory: Huckel theory of conjugate systems, bond and charge density calculation, applications to ethylene, butadiene, cyclopropenyl radical, cyclobutadiene, introduction to extended Huckel theory.

Module –III

Adsorption: Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsoption isotherm, estimation of surface area (BET equation), surface films on liquids(Electro-Kinetic phenomenon).

Module –IV

Micelles: Surface active agents, classification, micellization, hydrophobic, interaction, critical micellar concentration(CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solubilization, micro emulsion, reverse micelles

Module –V

Electrochemistry: Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extansion, ion solvent interactions. Debye-Huckel-Jerummode, thermodynamics of electrified interface equation, derivation of electro-capillarity, Lippmann equations(surface excess), methods of determination.

Books Suggested:

1 Physical- Chemistry, P.W. Atkins, ELBS, 1990.
2 Introductory Quantum Chemistry; Fourth Edition; A.K. Chandra; Tata McGraw Hill Publishing Company, New Delhi, 1998.
3 Quantum Chemistry; Fourth Edition; Ira N. Levine; Prentice-Hall of India Pvt. Ltd, New Delhi, 2002
4 Quantum Chemistry; Second Edition; R.K. Prasad; New Age International (P) Ltd, New Delhi, 2003.

.

CHY169

SPECTROSCOPY

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module –I

Infrared spectroscopy: Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths, anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy, P,Q,R branches. Breakdown of Oppenheimer approximation, vibrations of polyatomic molecules, selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal-ligand vibrations.

Module –II

Raman Spectroscopy: Classical and quantum theories of Raman effect, pure rotational, vibrational and vibrational- rotational Raman spectra. Selection rule, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti stokes Raman spectroscopy (CARS).

Module –III

Electronic Spectroscopy:

Atomic Spectroscopy: Energies of atomic orbitals, vector representation of momenta and vector coupling, spectra of hydrogen atom and alkali metal atoms**.**

Molecular Spectroscopy: Energy levels, molecular orbitals, vibronic transition, vibrational progressions and geometry of the excited states, Franck-condon principle, electronic spectra of polyatomic molecules. Emission spectra, radioactive decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra.

Module –IV

Nuclear Magnetic Resonance Spectroscopy: Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant 'J', classification (ABX, AMX, ABC, A_2B_2, etc.), spin decoupling, basic ideas about instrument, NMR studies of nuclei other than proton- ^{13}C, ^{19}F and ^{31}P. FT NMR, use of NMR in medical diagnostics.

Module –V

X-ray Diffraction: X-ray Bragg condition, Miller indices, X-ray structural analysis of crystals by Laue method, Bragg method, Debye-Scherrer methods, index reflections, identification of unit cells from systematic absences in diffractions, pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem, absolute configuration of molecules, Ramchandran diagram.

Books Suggested:

1. Basic principles of spectroscopy, R.Chang, McGraw Hill, 1970.
2. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L. Ho, Wiley Interscience, 1982.
3. Fundamentals of Molecular Spectroscopy, Third Edition; Colin N, Banwell and Elaine M,

McCash; Tata McGraw Hill, New Delhi, 1983.
4. Modern Spectroscopy, Third Edition; J.M. Hollas; John Wiley and Sons, India, 1996.
5. Introduction to Molecular Spectroscopy; G.M. Barrow; International Edition; Tata McGraw Hill, Singapore, 1962.
6. Physical Methods in Inorganic Chemistry; R. S. Drago, First Edition; Affiliated East-West Press Pvt. Ltd., New Delhi, 1968.
7. Analytical Chemistry – Theory and Practice, First Edition; U. N Dash; S. Chand and Co., New Delhi, 1995.

CHY 205

COMPUTER FOR CHEMIST

L-T-P-C Structure 0-0-6-3 **Course Type: Core Practical**

- Functional components of a digital computer, Concepts of hardware and software, Memories: RAM, ROM, Cache Memory, Virtual memory; Batch processing systems
- input/output and storage devices,
- Window operating system.
- MS Office: Word, Excel, Power Point, Math type.
- Principles of programming, algorithms and flow-charts.
- Operating System Windows.
- Overview of: Information Technology (IT), Data Communication, Data processing, Computer Networks (LAN, WAN and MAN).
- MATLAB,WORDSTAR and its applications
- A brief introduction of C language.
- Graph plotting and data analysis of XRD, FT-IR, NMR, and UV-Vis using Oracle
- Chem Office and Chemdraw and their application

Books Suggested :

1. "The C Programming Language" Brian W. Kernighan, Dennis M. Ritchie, 2nd edition, 1988.
2. " Let us C" BPB Publications, Yashwant Kanetkar, 2006.
3. Computational Chemistry, A.C. Norris.
4. Microcomputer Quantum Mechanics, Second Edition; J.P. Killingback and Adam Hilger Ltd., Bristol and Boston, 1985
5. Quick basic Programming for Scientists and Engineers; Joseph H. Noggle; CRC Press, 1992.
6. Meth Norton's; Introduction to Computers; Fourth Edition; McGraw Hill, New York.
7. Computers for Chemists; K.V. Rajoraman; Tata Megraw Hill Co. Ltd.; New Delhi; 1993.

CHY170

CHEMISTRY PRACTICAL-I

L-T-P-C Structure 0-0-6-3 **Course Type: Core Practical**

A- Inorganic Chemistry

Qualitative analysis (any two)

Analysis of mixture consisting of eight radicals (four cationic/ four anionic) including

i. Less common metal ions- Mo, W, Ti, Zr, Th, V , U
ii. Insolubles- oxides, sulphates and halides
iii. Interfering- Oxalate, phosphates, borate , fluoride

Quantitative analysis- volumetric analysis (any three)

i. Determination of chloride ion in water by Mohr's method or by use of adsorption indicator
ii. Determination of Nickel using Erichrome Black T as an indicator(Back titration).
iii. Determination of percentage purity of boric acid
iv. Comparison of an antacid capacity of commercial tablet samples.
v. Determination of Nitrite in a given sample.

B- Organic Chemistry

Basic techniques involved in synthetic organic chemistry

i. Different types of glass wares
ii. Filtration
iii. Distillation (distillation at atmospheric pressure, steam distillation, fractional distillation and distillation at reduced pressure).
iv. Recrystallization and melting point correction.
v. Use of decolourising carbon.

Synthesis

a. One step synthesis (any three)

i.Halogen Addition to C=C bond (Bromination of Trans stilbene)
ii. Aldol condensation (Synthesis of dibenzal propanone)
iii. Acetylation (synthesis of acetanilide from aniline)
iv. [4+2 cycloaddition reaction (Diel's Alder reaction between furan and maleic acid)
v. Pechmann Condensation for Coumarin synthesis (Clay catalysed solid state synthesis of 7-hydroxy -4-methyl coumarin)

b. Two step synthesis (any two)

i.Benzoin → benzil → benzilic acid
ii.Benzophenone → benzopinacol → benzapinacolone
iii.Acetanilide → p-bromoacetanilide → p-bromoaniline
iv.Acetanilide → p-nitroacetanilide → p-nitroaniline
v.o-hydroxyacetophenone → o-benzyloxyacetophenone → o-hydroxy dibenzylmethane
vi. Benzophenone → benzophenone oxime → benzanilide
vii.Resorcinol → flouroscein → Eosin

C- Physical Chemistry

Adsorption (Any two)

i. To study the absorption of acetic acid or oxalic acid from aqueous solution by activated charcoal or animal charcoal and examine the validity of Freundlich and Langmuirs adsorption isotherms.
ii. To compare cleansing power of samples of two detergents.
iii. Study the variation of surface tension of solution of n-propyl alcohol with concentration and hence determine the limiting cross section area of alcohol molecule.
iv. To determine the radius of molecule by viscosity measurements (e.g.Glycerol)

Electrochemistry (any two)

i. Estimate the amount of halide ions present in a given solution by titration with silver nitrate conductometrically.
ii. Determine the solubility and solubility product of a sparingly soluble salt like $BaSO_4$, or $PbSO_4$ or AgCl in water conductometrically.
iii. Determine equivalent conductance of the strong electrolytes (KCl, HNO_3, HCl etc.) at several concentrations and verify the Onsagar's equation and also find the values of a and b in the equation.
iv. Determine the equivalent conductance of acetic acid at infinite dilution and calculate its degree of dissociation at different dilutions as well as dissociation constant at the room temperature.

Phase Equilibrium (any one)

i. Determine the solubility diagram for a three component liquid system chloroform, acetic acid and water or toluene, acetic acid in water or benzene, ethanol and water. Discuss the diagram in a light of phase, component and degree of freedom.

ii. Nernst Distribution Law

To determine the formula of a complex formed between silver and ammonia.

Potentiometry

i. Determine the concentration of ferrous ion in the given solution by titrating against N/10 $Cr_2O_7^{--}$ or Ce^{+4} ion solution. Determine the equivalence point by plotting E v/s V, ΔE v/s ΔV and $\Delta^2E/\Delta V^2$ v/s ΔV.

Books suggested:

1. Vogel's Text Book of Practical Organic Chemistry, Fifth Edition, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell; Adission – Wesley Longman Ltd., England, 1998.
2. Practical Organic Chemistry, Fourth Edition; P.C. Mann, B.C. Sounders; Orient Longman Ltd.
3. Experimental Organic Chemistry, Vol. I, P.R. Singh, D.S. Gupta, K.S. Bajpai, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1980.
4. Advanced Practical Physical Chemistry; Twenty-second Edition; J.B.Yadav; Goel Publishing House, Merrut, 2005.
5. Experimental Physical Chemistry, first edition, V. D. Athawale, Parul Mathur, New age International Publisher 2011.

ENG109

COMMUNICATIVE ENGLISH

L-T-P-C Structure 2-0-0-2 **Course Type: Skill Enhancement Course**

Module–I

Communicative Skills- Process, Purpose, Types and Importance of Communication, Effective Speaking-Paralinguistic Features, Barriers to Speaking, Types of Speaking, Persuasive Speaking, Public Speaking

Module-II

Listening and Speaking- Introduction, Conversation, Telephonic Conversation and Etiquettes, Dialogue Writing, Case Study Method of Learning- Discussion & Presentation

Module-III

Building Advanced Vocabulary- Word Formation, Synonyms, Antonyms, Homonyms, Homophones, Words often Confused, One Word Substitution, Phrasal Verbs, Idiomatic Expressions, Developing Technical Vocabulary, Eponyms

Module –IV

Writing Skill- Writing reviews, Writing Reports-its Process, Structure , Kinds, Objectives and Layout, Writing Research Paper, Dissertation and Thesis

Module-V

Soft Skills- How Communication Skills and Soft Skills are inter-related, Leadership Skills, Group Dynamics, Negotiation Skills.

Books Suggested:

1. K Bhardwaj, Professional Communication, IK Int Pub House, New Delhi, 2010.

2. Krizan Merrier, Logan and Williams, Effective Bussiness Communication, New Delhi

3. Penrose , Bussiness Communication for Managers, Cengage, New Delhi

4. Business Communication Today, Bovee et al, Pearson, 2010.

5. Business Communication, Lesiker, et al. Mc Graw Hill, 2010.

Semester II

M.SC. CHEMISTRY SCHEME EFFECTIVE FROM 2018-19		
SEMESTER II		
Course Code	University Course Type	Course Name
CHY 171	Core Theory	Advanced Inorganic Chemistry-II
CHY 172	Core Theory	Advanced Organic Chemistry -II
CHY 173	Core Theory	Advanced Physical Chemistry -II
CHY 176	Department Specific Elective-1	Biology for Chemist (for students with PCM in B.Sc)
CHY 177		Mathematics for Chemist (for students with CBZ in B.Sc)
CHY 174	Core Practical	Applied Chemistry Lab
CHY 175	Core Practical	Chemistry Practical-II

CHY171

ADVANCED INORGANIC CHEMISTRY-II

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module–I

Reaction mechanism of transitions metal complexes: Energy profile of a reaction (transition state or activated complex) nucleophilic and electrophilic substitution, factors responsible for including SN_1 and SN_2 reaction.

Electron Transfer Reactions: Outer sphere reaction and inner sphere reaction. Mechanism of one electron transfer reaction and two electron transfer reaction. Synthesis of coordination compounds using electron transfer reactions, mixed valance complexes and internal electron transfer.

Module- II

Metal π-complexes: carbonyls and nitrosyls:
Metal carbonyls: Preparation, structure and bonding in metal carbonyls, vibrational spectra of metal carbonyls for bonding and structural elucidation.
Metal nitrosyls: Preparation, bonding, structure and important reactions of transition metal nitrosyl.

Module-III

Metal Clusters: Definition, types, Carbonyl cluster of low nuclearity (M=Mn, Fe, Co, Ru, Os), high nuclearity (M=Rh, Ru, Ni) and Carbon encapsulated clusters (M=Fe, Ru, Os). Carbonyl cluster: synthesis and reactions (reduction, oxidation and ligand substitution) Halide type Cluster :di, tri, tetra & hexa nuclear halide cluster.

Module- IV

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

Module-V

Charge Transfer Spectra and Magnetic Properties of Transition Metal Complexes: Charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their sterochemical information, ORD- circular dichroism (CD) and magnetic properties of transition metal complexes, anomalous magnetic moments, magnetic exchange coupling and spin crossover.

Books Suggested

1. Chemical Applications of Group Theory, Third Edition; F.A. Cotton; John Wiley and Sons, Singapore, 1999.
2. Advanced Inorganic Chemistry, Fifth Edition; F.A. Cotton and G. Wilkinson; John Wiley and Sons, USA, New York, 1988.
3. Inorganic Chemistry; Third Edition; Gary L. Miessler and Donald A. Tarr; Pearson Education Inc. Singapore, 2007.
4. Inorganic Electronic Spectroscopy; Second Edition; A.B.P. Lever; Elsevier Science Publishing Company Inc., New York, 1984.
5. Coordination Compounds; S.F.A Kettle; Thomson Nelson and Sons Limited, 1975.

CHY172

ADVANCED ORGANIC CHEMISTRY-II

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module- I

Free Radical Reactions: Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance, reactivity for aliphatic and aromatic substrates at a bridgehead, reactivity in the attacking radicals, the effect of solvents on reactivity, allylic halogenation (NBS), oxidation of aldehydes to carboyxlic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. free radical rearrangement, Hunsdiecker reaction.

Module-II

Aliphatic Electrophilic Substitution: Bimolecular mechanisms S_E2 and S_E1, The S_E1 mechanism, electrophilic substution accompanied by double bond shifts, effect of substrates, leaving groups and the solvent polarity on the reactivity.

Aromatic Electrophilic Substitution: The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reaction, Gatterman-Koch reaction

Module-III

Molecular Rearrangements: General mechanistic consideration – nature of migration, migratory aptitudes, memory effects, Pinacol-pinacolone rearrangement, Wagner-Meerwein rearrangement, Demjanov rearrangement, Benzil-benzilic acid rearrangement, Favorskii rearrangement, Arndt-Eistert rearrangement, Neber rearrangement, Beckmann rearrangement, Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt rearrangement, Wolff rearrangement, Baeyer-Villiger oxidation, Shapiro reaction, Dienone- phenol rearrangement, Wittig rearrangement, Stevens rearrangement.

Module IV

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 bounds, hydrogenation of aromatic rings, hydroboration, Michael reaction, sharpless asymmetric epoxidation.

Module V

Pericyelic Reactions: Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system, classification of periycyclic reactions, Woodward-Hoffmann correlation diagrams. FMO and PMO approach, electrocyclic reactions-conrotatory and disrotatory motions, 4n ,4n+2 and allyl systems. Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and chelotropic reactions. Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic involving carbon moieties, 3,3- and 5,5-sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements. Fluxional tautomerism, Ene reaction.

Books Suggested:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March,John Wiley, 1992.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum, 2001.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.

CHY173

ADVANCED PHYSICAL CHEMISTRY-II

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module- I

Classical Thermodynamics I: Thermodynamics law, state and path functions and their applications, thermodynamics description of various types of processes, Maxwell's relations, spontaneity and equilibria temperature and pressure dependence of thermodynamics quantities,

Module–II

Classical Thermodynamics II: Le-chetelier principle, Concept of fugacity and determination of fugacity, activity & activity coefficient, Debye Huckel theory for activity coefficient of electrolytic solutions, determination of activity and activity coefficients, ionic strength.

Module-III

Partition Function: Molecular partition function for an ideal gas, translational partition function, rotational partition function, vibrational partition function, electronic partition function, nuclear partition function, translational energy of the gas, translational entropy of a monoatomic gas, translational enthalpy, translational heat capacity, translational Helmholtz function.

Module- IV

Chemical Kinetics I: Methods of determining rate laws, collision of transition state theory of reaction rate, steric factor, activated complex theory and Arrhenius equation, kinetic salt effects steady state kinetics, kinetic and thermodynamic control of reaction

Module- V

Chemical Kinetics II: Treatment of unimolecular reactions and dynamic of unimolecular reaction, kinetics of enzyme reactions, homogenous catalyst, photochemical reactions (hydrogen bromine and hydrogen chloride), general features of fast reaction, study of fast reaction by flow method, relaxation method.

Books Suggested:

1. Physical chemistry. P.W. Atkins, ELBS, 2002.
2. Principal of physical chemistry, Puri, Sharma and Pathania, Vishal Publications, 2008.
3. Chemical Kinetics, 3rd Edition; K.J. Laidler; Pearson Education Pvt. Ltd., Singapore, 2004.
4. Kinetics and Mechanisms of Chemical Transformation, 1st Edition; J. Rajaram and J.C. Kuriokose; Macmillan India Ltd., Delhi, 1965.

CHY174

APPLIED CHEMISTRY LAB

L-T-P-C Structure 0-0-6-3 **Course Type: Core Practical**

A-Water Analysis (any three)

1. To determine D.O. in given water sample
2. To determine B.O.D. in given water sample
3. To determine C.O.D. in given water sample
4. To determine fluoride content in given water sample
5. To determine phosphate content in given water sample
6. To determine turbidity of given water sample
7. To determine sodium, potassium and calcium in given water sample

B-Oil Analysis (any two)

1. To determine acid value of given oil sample
2. To determine saponification value of given oil sample
3. To determine iodine value of given oil sample
4. To determine relative viscosity of given oil

C-Drug Analysis (any two)

1. To determine amount of Ascorbic acid content in given pharmaceutical sample
2. To determine Aspirin in given pharmaceutical sample
3. To prepare the standard curve of paracetamol tablets
4. To determine amount of sulphur drug present in given sulpha drug sample

D-Instrumental Techniques (any two)

1. Quantitative estimation and absorption spectrum of potassium permanganate.
2. Potentiometric titration of amino acids
3. Determination of the carbonate content of a soda-ash sample.
4. Compare the cleansing powers of two samples of detergent
5. To determine a acetic acid content of vinegar sample.

Books suggested:

1. Vogel's Text Book of Practical Organic Chemistry, Fifth Edition, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell; dission – Wesley Longman Ltd., England, 1998.
2. Advanced Practical Physical Chemistry; Twenty-second Edition; J.B.Yadav; Goel Publishing House, Merrut, 2005.
3. Experimental Physical Chemistry, first edition, V. D. Athawale, Parul Mathur, New age International Publisher 2011.

CHY175

CHEMISTRY PRACTICAL-II

L-T-P-C Structure 0-0-6-3 **Course Type: Core Practical**

A-Inorganic Chemistry

Synthesis: (any two)

Preparation of selected inorganic complexes and their study by IR spectra

i. Metal complexes of dimethyl sulphoxide, $CuCl_2.2DMSO$
ii. Metal oxalate hydrate complexes, Nickel dioxalate
iii. Phosphine, Ph_3P and its transition metal complexes
iv. Bis acetalacetonate cobalt (II)
v. Trisacetylacetonato iron (III)
vi. Cis and trans bis glycinato copper (II) monohydrate
vii. $[VO(acac)_2]$

Spectrophotometric Estimations (any three)

i. Manganese/chromium in steel.
ii. Nickel/Iron by extractive spectrophotometric method.
iii. Flouride/nitrite/phosphate
iv. Iron-phenanthroline complex: Job's methods of continuous variation.
v. Zirconium-alizarin Red-S complex: Mole ratio method.

B-Organic Chemistry

Qualitative analysis

Separation, purification and identification of components of a mixture of two organic compounds (one liquid and one solid or two solids) and three organic compounds (one liquid and two solids or three solids) using TLC for checking the purity of separated compounds.

Quantitative analysis (any three)

1. Determination of the percentage or number of hydroxyl groups in an organic compounds by acetylation method.
2. Estimation of amines/phenols using bromate-bromide solution or acetylation method.
3. Estimation of sulphur by Messenger or Fusion method.
4. Determination of Iodine and Saponification values of an oil sample.
5. Determination of neutralization equivalent of the acid
6. Estimation of halogen by Fusion or Stepnow's method
7. Estimation of nitrogen by Kjeldahl's method.

C- Physical Chemistry

Chemical kinetics(any two)

i. Determine the rate constant, energy of activation and entropy of activation in the oxidation of benzyl alcohol ($C_6H_5CH_2OH$) by potassium permanganate in acidic medium
ii. Determine the formation constant for the (Ce^{+4}-H_3PO_2)intermediate complex and also its decomposition rate constant at the room temperature.

iii. Determine the rate constant for the bleaching of malachite green in basic medium at room temperature spectrophotometrically.
iv. Determine the relative strength of two acids (hydrochloric acid and sulphuric acid) by studying the hydrolysis of an ester (methyl acetate or ethyl acetate) at the room temperature).
v. Determine the rate constant of the hydrolysis of an ester such as methyl acetate catalyzed by an acid (0.5N HCl or 0.5N H_2SO_4) and determine the energy of activation.
vi. Study the kinetics of the reaction between $K_2S_2O_8$ (potassium persulphate) and KI (potassium iodide) and determine the rate constant and the energy of activation of the reaction.
vii. Study the kinetics of saponification of ethyl acetate by sodium hydroxide and determine the rate constant.

potentiometry/pH metry (any three)

1. Determination of strengths of halides in a mixture potentimetrically .
2. Determination of the valancy of mercurous ions potentiometrically .
3. Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter.
4. Determination of temperature dependence of EMF of a cell .
5. Determination of the formation constant of silver -ammonia complex and stoichiometry of the complex potentionmetrically.
6. Acid-base titration in a non-aqueous media using a pH meter .
7. Determination of activity and activity coefficient of electrolytes.
8. Determination of the dissociation constant of acetic acid in DMSO,DMF,acetone and dioxane by monobasic/dibasic acid by albert-serjeant method.

Polarimetry(any one)

1. Determination of rate constant for hydrolysis/inversion of sugar using a polarimetre.
2. Enzyme kinetics-inversion of sucrose .

Books suggested:

1. Vogel's Text Book of Practical Organic Chemistry, Fifth Edition, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell; Adission – Wesley Longman Ltd., England, 1998.
2. Practical Organic Chemistry, Fourth Edition; P.C. Mann, B.C. Sounders; Orient Longman Ltd.
3. Experimental Organic Chemistry, Vol. I, P.R. Singh, D.S. Gupta, K.S. Bajpai, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Advanced Practical Physical Chemistry; Twenty-second Edition; J.B.Yadav; Goel Publishing House, Merrut, 2005.
5. Monograph on Green Chemistry- Laboratory Experiments- Laboratory Task Force Committee , DST
6. Experimental Physical Chemistry, first edition, V. D. Athawale, Parul Mathur, New age International Publisher 2011.

CHY176

BIOLOGY FOR CHEMIST

(FOR MATHEMATICS BACKGROUND STUDENTS)

L-T-P-C-Structure 3-1-0-4 **Course Type: DSE-1**

Module- I

The Matrix of Life: Origin of life, elementary idea of prokaryotic and eukaryotic cell, difference between plant and animal cell, cell organelles and their functions: plasma membrane, chloroplast, mitochondria, golgi bodies, endoplasmic reticulum, lysosomes, ribosomes, nucleus.

Module- II

Proteins: Amino acids, essential and non essential, structure of zwitter ions, synthesis of amino acids by reductive amination , GS-GOGAT system and transamination,

Structure of proteins: primary, secondary-α helix and β pleated sheets, tertiary and quaternary structure.

Module- III

Carbohydrates: Classification, structure and functions of monosaccharides, disaccharides, polysaccharides - starch, cellulose, glycogen, chitin and pectins. Glycoconjugates: proteoglycans, glycoproteins and glycolipids

Module- IV

Lipids: Monosaccharides, disaccharides and polysaccharides; structure, function and derivatives, structural and storage polysaccharides, gluconjugates, proteoglycans, glycoproteins and glycolipids. Lipids: fatty acids, essential fatty acids; triglycerols, steroids, cholesterol, sphingolipids and prostaglandins; structural lipids in membranes.

Module-V

Nucleic Acids: DNA- Double helical structure of DNA, types of DNA -A, B, C and Z forms, replication, RNA structure and its types- rRNA, mRNA, and tRNA, ribozymes

Books Suggested:

1. Principles of Biochemistry; Third Edition; A.L. Lehninger; McMillan Press Limited, London, 2002.

2.Biochemistry; Fifth Edition; L. Stryer; W.H. Freeman and Company, 2002.

3.Biochemistry; First Indian Reprint;J. David Rawn, Tanima Publishing Corporation, New Delhi, 2004.

4.Biochemistry; Second Edition; Voet and Voet; John Wiley and Sons Inc., New York, 1995.

5. Outline of Biochemistry; Fourth Edition; E.E. Conn and P. K. Stumpf, John Wiley & Sons, 1976.

CHY177

MATHEMATICS FOR CHEMIST

(FOR BIOLOGY BACKGROUND STUDENTS)

L-T-P-C-Structure 3-1-0-4 **Course Type: DSE-1**

Module- I

Matrix Algebra: Matrix addition and multiplication, adjoint, transpose and inverse of matrices, special matrices (symmetric, skew-symmetric, unit, diagonal) determinants (examples from Huckel theory)

Module- II

Differential Calculus: Rules for differentiation, applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution etc.) partial differentiation, co-ordinate transformations.

Module- III

Integral calculus: Integral calculus: basic rules for integration, integration by substitution, integration by parts and through partial fraction.

Module- IV

Permutation, Probability, Vector Algebra and Calculus: Permutations and combinations, probability and probability theorems, curve-fitting (including least squares fit etc.) with a general polynomial fit.

Scalars and vectors, additional and subtraction of vectors, multiplication of vectors – scalar and vector product, vector operators – gradient, divergence and curl. (Expressions only).

Module- V

Elementary Differential Equations: Order and degree of differential equation solution of first order and first degree linear differential equation by variable-separable; homogenous and linear equations; applications to chemical kinetics, secular equilibria, quantum chemistry etc.

Books Suggested::

1. The Chemistry Mathematics Book; E. Steiner; Oxford University Press.
2. Basic Mathematics for Chemicals; Tebbutt; J. Chem. Educ., John Wiley and Sons., 1995.

Semester III

M.SC. CHEMISTRY SCHEME EFFECTIVE FROM 2018-19		
SEMESTER III		
Course Code	University Course Type	Course Name
CHY 178	Core Theory	Advanced Inorganic Chemistry-III
CHY 179	Core Theory	Advanced Organic Chemistry -III
CHY 180	Core Theory	Advanced Physical Chemistry -III
CHY 181	Core Practical	Advanced Chemistry Lab-I
CHY 182	Core Practical	Chemistry Practical-III
CHY 183	Department Specific Elective-2	Natural Product Chemistry
CHY 184		Group Theory
CHY 186		Analytical Chemistry
CHY 187		Biochemistry
CHY 195		Thermal & photochemistry

CHY178

ADVANCED INORGANIC CHEMISTRY-III

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module I

Chemistry in Non- aqueous solvents: classification of solvents, properties, leveling effect, type of reactions in solvents, chemistry of liquid ammonia, liquid dinitrogen tetraoxide and anhydrous sulphuric acid with respect to properties, solubilities and reactions.

Module II

Inorganic Reaction Mechanisms: Mechanisms of substitution reactions of tetrahedral, square planar, trigonal bipyramidal and octahedral complexes, potential energy diagrams, transition states and intermediates, isotope effects, Berry's pseudo rotation mechanism ,factor affecting the reactivity of square planar complexes, Swain-Scott equation, trans effect and its applications to synthesis of complexes.

Module III

Nuclear Chemistry: classification of nuclides, nuclear stability, binding energy, nuclear radius, nuclear models – liquid drop model, fermi gas model, optical model, shell model. Decay scheme, decay kinetics, nuclear reactions, fusion and fission, radioanalytical techniques and activation analysis. counters – Geiger counter, scintillation counter, proportional counter, semi conductor detector.

Module IV

Bioinorganic Chemistry: Role of metal ions in biological processes, structure and properties of metallo proteins in electron transport processes, cytochromes, ferrodoxins and iron sulphur proteins, ion transport across membranes, biological nitrogen fixation, PSI, PS – II, oxygen uptake proteins.

Module V

Electronic, Electric and Optical behavior of Inorganic materials: Metals, Insulators and semiconductors, electronic structure of solid, band theory, band structure of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors, doping of semiconductors and conduction mechanism, band gap, temperature dependence of conductivity, carrier density and carrier mobility in semiconductors, synthesis and purification of semiconducting materials, single crystal growth, zone refining, fractional crystallization, semiconductor devices, rectifier transistors, optical devices, photoconductors, photovoltaic cells, solar batteries.

Books Suggested:

1. Cullen Dolphin and James, Biological aspects of Inorganic Chemistry, 1977.
2. Williams, An Introduction to Bioinorganic Chemistry,1976.
3. M. N. Hughes, Inorganic Chemistry of Biological Processes,1973.
4. L. V. Azoroff, J. J. Brophy, Electronic processes in materials, Mc Craw Hill, 1963.
5. Willam L. Jooly, Modern Inorganic Chemistry, Ed. 2, 1984.
6. D.K.Chakraburty, Soild State Chemistry, New Age International,2000.
7. S. J. Lippard, J.M . Berg, Principles of bioinorganic Chemistry, University Science Books 10, 1994.
8. J. J. Loppard, Progress Inorganic Chemistry , Vol 38, Wiley online library.

CHY179

ADVANCED ORGANIC CHEMISTRY-III

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module I

Enzymes: Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation, nomenclature and classification, extraction and purification, Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis, enzyme kinetics, Michaelis-Menten and Lineweaver-Burk plots, reversible and irreversible inhibition

Module II

Kinds of Reactions Catalyzed by Enzymes: Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes, transfer of sulphate, addition and elimination reactions, enolic intermediates in isomerization reactions, (β-cleavage and condensation, some isomerization and rearrangement reactions, enzyme catalyzed carboxylation and decarboxylation, examples of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxy peptidase.

Module III

Carbohydrate Metabolism: Glycolysis, fate of pyruvate under anaerobic conditions, citric acid cycle, oxidative phosphorylation (electron transport system), gluconeogenesis and glucogenolysis, C4 pathway, pentose phosphate pathway and photosynthesis.

Module IV

Protein Metabolism and Disorders: Degradation of amino acids (C3, C4, C5 family), urea cycle, uric acid and ammonia formation, proteins (structure and functions): primary, secondary, tertiary and quaternary structure; enzymes, active sites, allosteric sites and mechanisms of their actions, e.g., chymotrypsin, carboxypeptidase, lipases, etc; enzyme immobilization and their application, enzyme as target for drug design.

Module V

Nucleic Acids: Chemical and enzymatic hydrolysis, structure and functions of DNA, RNA (m-RNA, t-RNA, r-RNA), an overview of gene expression (replication, transcription and translation), genetic code (origin, Wobble hypothesis and other important features), genetic errors, carcinogenesis and recombinant DNA technology.

Books Suggested

1. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Herman Dugas and C. Penny, Springer Verlag.
2. Principles of Biochemistry, Third Edition; A.L. Lehninger; McMillan Press, U.K, 2002.
3. Biochemistry; J. David Rawn, Tanima Publishing Co., New Delhi, 2004.
4. Biochemistry, Second Edition; Voet and Voet; John Wiley and Sons, U.S.A., 1995
5. Biochemistry, Fourth Edition; E.E. Conn and P.K. Stumpf; John Wiley and Sons, New Delhi, 1994.

CHY180

ADVANCED PHYSICAL CHEMISTRY-III

L-T-P-C Structure 3-1-0-4 **Course Type: Core Theory**

Module-I

Electro-Chemical Energy Storage: Properties of electrochemical energy storers, measure of battery performance, Charging and discharging of batteries, Storage density, Energy density.Classical Batteries: i) Lead Acid ii) Nickel-Cadmium iii) Zinc-Mangnese dioxide.Modern Batteries: i) Zinc-Air ii) Nickel-Metal hydride iii) Lithium Bettery. Future electricity storers. Styorage in i) Hydrogen ii) alkali metals iii) Non-aquous solutions.

Module –II

Bioelectrochemistry: Membrane potential, simplistic and modern theory, Electrical conductance in biological organisms. Electrochemical mechanism of nervous systems,enzymes as electrodes, Biosensors, Bioelectrocatalysis.

Module –III

Corrosion and Stability of Metals: Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals; Measurement of corrosion rate: (i) Weight Loss method, (ii) Electrochemical Method.

Module –IV

Inhibiting Corrosion: Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by charging the corroding method from external source, anodic Protection, Organic inhibitors, The fuller Story Green inhibitors.

Passivation:Structure of Passivation films, Mechanism of Passivation, Spontaneous Passivation Nature's method for stabilizing surfaces.

Module –V

Solid State Chemistry: Introduction to the solid state, Defects of solids, Classification of imperfection, Electronic defects, Atmotic defects, Lattice imperfections, Thermodynamics of Schottky defect and Frenkel defect. Solid state reactions: general principles, types; sintering; nucleation; Factors influencing the reactivity of solids; co-precipitation as a precursor to solid state reactions, Kinetics of solid state reactions.

Books Suggested:

1. Modern Electrochemistry Vol. I, IIa, Vol. IIB J'OM Bockris and A.K.N. Reddy, Plenum Publication, New York.
2. Polarographic Techniques by L. Meites, Interscience.
3. "Fuel Cells :Thjeir electrochemistry". McGraw Hill Book Company, New York.
4. "Electroaalytical Chemistry by Basil H. Vessor& Galen W. ; Wiley Interscience.
5. Electroanalytical Chemistry by Basil H. Vessor&alen w. ; Wiley Interscience
6. Solid state chemistry and its Application; A.R. West; John Wiley and Sons, Singapore,2004.
7. Priciples of Solid State, First Edition; H.V.Keer; New Age International Publishers, New Delhi ,2002

CHY181

ADVANCED CHEMISTRY LAB-I

L-T-P-C Structure 0-0-6-3 **Course Type: Core Practical**

Any 8 experiments from the list:

1. Separation of amino acids by paper chromatography
2. To determine the concentration of glycine solution by formylation method.
3. Study of titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. To synthesize aspirin by acetylation of salicylic acid and compare it with the ingredient of an aspirin tablet by TLC.
7. Estimation of amount of available chlorine in bleaching powder and household bleaches
8. Iodimetric estimation of ascorbic acid in fruit juices.
9. Gravimetric estimation of sulphate as barium sulphate.
10. Preparation of the following: potash alum, chrome alum, tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).
11. Determination of protein by the Biuret reaction.

Books Suggested :

1. Vogel's Textbook of Practical Organic Chemistry, ELBS.

2. Ahluwalia V.K. & Aggarwal R. Comprehensive Practical Organic Chemistry, University Press.

3. Svehla G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012

4. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.

CHY182

CHEMISTRY PRACTICAL-III

L-T-P-C Structure 0-0-6-3 **Course Type: Core Practical**

A-Inorganic Chemistry

Quantitative determination of a three components mixture: (any two)

One volumetrically and two gravimetrically

a. Cu^{+2} , Ni^{+2} , Zn^{+2}
b. Cu^{+2} , Zn^{+2} , Mg^{+2}
c. Cu^{+2} , Fe^{+2}, Pd^{+2}

Chromatographic separation (any one from each)

i) Paper chromatography

a. Cadmium and Copper
b. Zinc and Magnesium
c. Nickel and Cobalt
d. Nickel and Manganese

ii) Thin layer Chromatography

i. Separation and determination of Rf value of mixture containing metal ions-nickel, manganese, cobalt and zinc.

iii) Column chromatography (Practice Exercise)

i. Separation of metal ions by column chromatographic techniques followed by their quantitative determinations.

B-Organic Chemistry

Extraction of organic compounds from natural resources (any two)

i. Isolation of caffeine from tea leaves
ii. Isolation of casein from milk
iii. Isolation of lactose from milk
iv. Isolation of nicotine dipicrate from tobacco

Spectroscopy

Identification of organic compounds by the analysis of their spectral data.by IR and Raman data

C- Physical Chemistry

Polarography

1. Determine the half wave potentials of Cd^{+2} and Zn^{+2} ions 0.1 M KCl solution and show that half wave potential is independent of the concentration.

Spectrophotometry(any two)

1. Determine the acid dissociation constant (pK value) of methyl red.
2. Determine the stability constant of $FeSCN^{+2}$ complex ion keeping ionic strength constant.

3. Determine the composition and stability constant of the complex Fe (III)/salicylic acid system by jobs variation method.

Phase Equilibrium (any one)

1. Determine the solubility diagram for a three component liquid system chloroform, acetic acid an water or toluene, acetic acid in water or benzene ethanol and water. Discuss the diagram in a light of phase, component and degree of freedom.
2. Nernst Distribution Law

Thermochemistry(any two)

1. Determine the partial molal volume of solute (KCl or NaCl) and solvent in a binary mixture at normal temperature and pressure.
2. Determine the partial molar volume of methanol/ethanol-water system at normal temperature and pressure.
3. Determine the solubility of benzoic acid at two temperature in water-DMSO mixture (4:1) and calculate the enthalpy change of the dissolution process.
4. Determine the lattice energy of calcium chloride from its heat of solution using Born-Haber cycle. You are provided the Enthalpy changes for Ca^{+2} (g) → Ca(g) $2Cl^{-}$ (g) → 2Cl (g), Ca (g) → Ca (s), 2Cl (g) → Cl_2 (g) and Ca (s) + Cl (g) → $CaCl_2$ (s) as -451.1, 174.3, -38.8, -58.0 and -190.0 Kcal/mole respectively

Books Suggested:

1. Vogel's Text Book of Practical Organic Chemistry, Fifth Edition, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell; Adission – Wesley Longman Ltd., England, 1998.
2. Practical Organic Chemistry, Fourth Edition; P.C. Mann, B.C. Sounders; Orient Longman Ltd.
3. Experimental Organic Chemistry, Vol. I, P.R. Singh, D.S. Gupta, K.S. Bajpai, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Advanced Practical Physical Chemistry; Twenty-second Edition; J.B.Yadav; Goel Publishing House, Merrut, 2005.
5. Monograph on Green Chemistry- Laboratory Experiments- Laboratory Task Force Committee , DST
6. Experimental Physical Chemistry, first edition, V. D. Athawale, Parul Mathur, New age International Publisher 2011.

CHY183

NATURAL PRODUCT CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-2**

Module –I

Terpenoids and Carotenoids-I: Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule ,stereochemistry and synthesis of following molecules-Citral, Geraniol, α-Terpeneol and Menthol

Module–II

Terpenoids and Carotenoids-II: Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule, stereochemistry and synthesis of the following representative molecules: Farnesol,Zingiberene,Santonin Phytol, Abietic acid and β-Carotene.

Module–III

Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry and synthesis of the following: Ephedrine, (+)-Coniine, Nicotine, Atropine, Quinine and Morphine.

Module–IV

Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon, Stereochemistry , Isolation, structure determination and synthesis of Cholesterol and Bile acids.

Module–V

Plant Pigments: Occurrence, nomenclature and general methods of structure determination. Isolation structure and synthesis of Luteolin,Quercetin, Myrcetin,Quercetin-3-O-glucoside,Butein,Cyanidin chloride, Vitexin, Diadzein, Aureushin.

Books Suggested:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthrope and J.B. Harborne, Longman, Essex, 1994.

2. Organic Chemistry, Vol. 2 I.L. Finar, ELBS. 1964.

3. Stereoselective Synthesis: A Practical Approach, M. Norgradi, VCH, 1994.

4. Chemistry of Natural Products: S.V.Bhat, B.A.Nagasampagi and M.Sivakumar,Narosa publishing House, 2005.

CHY184

GROUP THEORY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-2**

Module–I

Molecular Rearrangement Processes: Electron transfer reactions(outer and inner sphere).HOMO and LUMO of oxidant and reductant, chemical activation. precursor complex formation and rearrangement, nature of bridge ligands, fission of successor complexes, Two electron transfer, Synthesis of coordination compounds using electron transfer reactions, mixed valence complexes and internal electron transfer.

Module–II

Symmetry and Group theory in Chemistry-I: Symmetry elements and symmetry operation, definition of group, subgroup, conjugacy relation and classes. Point symmetry group. Schnofilies symbols, representations of groups by matrices (representations for the Cnh , Cnv etc. group to be worked on explicitly).

Module–III

Symmetry and Group theory in Chemistry-II: Character of representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use, spectroscopy. Derivation of character table for C2v and C3v point group. Symmetry aspects of molecular vibrations of water molecule.

Module–IV

Electronic Spectra of Transition Metal Complexes: Spectroscopic ground states, correlation, Orgel and Tanabe Sugano diagrams for transition metal complexes (d1 to d9 states) and calculation of Dq, B and β parameters.

Module–V

Charge Transfer Spectra and Magnetic Properties of Transition Metal Complexes: Charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their sterochemical information, ORD- circular dichroism (CD) and magnetic properties of transition metal complexes, anomalous magnetic moments, magnetic exchange coupling and spin crossover.

Books Suggested

1. Inorganic chemistry, Principle of structure and reactivity, 4th edition by James E., Huheey: Elleu A. keiter.1993.
2. Advanced Inorganic Chemistry by F.A. Cotton and G.Wilkinson, 1980.
3. Theoretical inorganic Chemistry by day and Selbin,1962.
4. Concepts and Models in Inorganic Chemistry by Doughlas mc. Daniel.

.

CHY195

THERMAL AND PHOTOCHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-2**

Module –I

Basics of Photochemistry: Electromagnetic radiation, photochemical excitation – interaction of electromagnetic radiation with organic molecules, types of excitations ($\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ etc.) fate of excited molecules - Jablonskii diagram, intersystem crossing, energy transfer, photosensitization, quenching, quantum yield, Frank-condon principle Stern-Volmer equation.

Module –II

Photochemical Reactions of Carbonyl Compounds: Photochemical reactions of ketones – alpha cleavage or Norrish type I cleavage, gamma hydrogen transfer or Norrish type II cleavage; photo reductions; Paterno-Buchi reactions; photochemistry of α,β-unsaturated ketones, β,γ-unsaturated ketones, cyclohexadienones (cross conjugated and conjugated).

Module –III

Photochemistry of Alkenes and Aromatic Compounds:

Photochemistry of alkenes: intramolecular reactions of the olefinic bond – cis-trans isomerisation (stilbene), cyclization reactions, rearrangement of 1, 4 and 1, 5-dienes, di-π methane rearrangement.

Photochemistry of aromatic compounds: photochemical rearrangement, photostationary state, 1, 3, 5 – trimethyl benzene to 1, 2, 4-trimethyl benzene

Module –IV

Pericyclic Reactions-I: General characteristics, classification, molecular orbital symmetry. Electrocyclic reactions: theories of explanation (FMO, Woodword-Hoffmann and PMO approach), Frontier orbitals of ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene and allyl systems, valence tautomerism.

Module –V

Pericyclic Reactions –II :*Cycloaddtion Reactions*: 2+2, 4+2 cycloaddition, 1, 3-dipolar cycloaddition and cheletropic reactions; stereoselectivity (endo, exo), stereospecific and regioselective hydrogen reactions, Lewis-acid catalysis in Diels' Alder reaction.

Sigmatropic rearrangements: suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3, 3- and 5, 5-sigmatropic rearrangements; Claisen, Cope and Aza-Cope rearrangements; isomerization of divinyl cyclopropane; fluxional tautomerism (bullvalene); ene reaction.

Books Suggested

1. Fundamentals of Photochemistry; First Edition; K.K. Rohatagi – Mukherjee; New Age International Publishers Pvt. Ltd., New Delhi, 2005.
2. Molecular Reactions and Photochemistry; First Edition; Charles H. Depuy and Orville L. Chapman; Prentice-Hall of India Pvt. Ltd, New Delhi, 1988.
3. Reaction Mechanism in Organic Chemistry; Third Edition; S.M. Mukherjee and S.P. Singh; Macmillan, India Ltd., New Delhi, 1999.
4. Advanced Organic Chemistry Part A & B; Fourth Edition; Francis A. Carey and Richard J. Sundberg; Kluwer Academic/Plenum Publishers, New York, 2000.

CHY186

ANALYTICAL CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-2**

Module –I

Fundamentals of Analytical Chemistry

Errors in chemical analysis, classification of errors, accuracy and precision, minimization of errors, significant figures : statistical analysis- mean and standard deviation; relative standard deviation; coefficient of variance, sampling in analysis, rejection of results, presentation of data.

Module –II

Separation Techniques: Chromatography - I

Column chromatography: Basic principles, elution chromatogram, methods of improving column performance, migration rates of solutes- distribution constant, retention time, column efficiency, variables that affect column efficiency, column resolution, applications (separation of methylene blue and fluorescein).

Thin layer chromatography*:* principle, technique and applications (separation of vitamins).

Paper Chromatography: principle, R_f value, technique and applications (separation of amino acid mixtures).

Module –III

Separation Techniques: Chromatography -II

Principle, instrumentation, and applications of gas chromatography, high pressure liquid chromatography and ion exchange chromatography.

Module –IV

Optical Methods of Analysis

Lambert's and Beer's law, verification, derivation, signification of λmax and molar absorptivity, theory of fluorescence and phosphorescence.

Spectrophotocolorimetry: single beam and double beam spectrophotometers, functions of the components, applications.

Atomic absorption spectroscopy: principle, instrumentation, spectral interferences and chemical interferences in atomic absorption spectroscopy, applications in quantitative analysis (analysis of Zn^{2+}, Cu^{2+} and Pb^{2+}).

Flame photometry: principle, instrumentation, interferences in flame photometry, applications in quantitative analysis,comparison of atomic absorption and flame emission spectroscopy

Module –V

Instrumental Techniques

Principle, instrumentation and basic principles of – conductometric, potentiometry,

pH metry, electrochemistry, colorimetry and polarography

Books Suggested :

1. Analytical Chemistry – Theory and Practice, First Edition; U.N. Dash; S. Chand and Co, New Delhi, 1995.
2. Fundamentals of Analytical Chemistry, Seventh Edition; D.A. Skoog, D.M. West and F.J. Holler; Saunders College Publishing Philadelphia, 1991.
3. Instrumental Methods of Analysis, Seventh Edition; H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle; CBS Publishers, New Delhi, 1986.
4. Basic Concepts of Analytical Chemistry Second Edition; S.M. Khopkar; New Age International Publisher, New Delhi, 2000.
5. Chemical Analysis and Instrumental approach, Third revised Edition; A.K. Srivastava and P.C. Jain; S. Chand & Company, New Delhi, 1997.
6. Vogel's Textbook of Quantitative Chemical Analysis; Fifth Edition; G.H. Jeffery, J. Bassett. J. Mendham, R.C. Denney; Longman Scientific and Technical Publication, England, 1991.
7. Quantitative Analysis, Sixth Edition; R.A. Day, A.L. Underwood; Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
8. Handbook of Instrumental Techniques for Analytical Chemistry; F. Settle; Prentice-Hall, Inc. United States of America, 1997.

CHY187

BIOCHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-2**

Module –I

Respiration: Glycolysis, regulation of Glycolysis, fermentation, aerobic respiration, pyruvate oxidation, Kreb's cycle, regulation of kreb's cycle, Shuttle system- Malate aspartate shuttle, Glycerol-3-phisphate shuttle, electron transport chain and oxidative phosphorylation- complex I, complex II, complex III and IV structure, Inhibition of electron transport chain reaction, mechanism of oxidative phosphorylation- chemiosmotic theory, respiration qiotient and respiratory substrate, Glyoxalate cycle- an anabolic variant of the citric acid cycle, Pentose Phosphate Pathway- oxidative phase.

Module –II

Photosynthesis-I: Brief account of photo synthesis reaction and its organ, Light harvesting photosynthetic pigment molecules, accessory pigments, Fate of light energy absorbed by photosynthetic pigments, concept of photosynthetic unit, Hill reaction, Oxygenic and anoxygenic photosynthesis,

Module –III

Photosynthesis-II: Concept of pigment system, Pigment systems- P.S. I and P.S. II, Photophosphorylation- Noncyclic photophosphorylation- Z scheme cycle, ATP synthesis by phosphorylation, cyclic phosphorylation, Calvin cycle, Control of calvin cycle, Photorespiration, C_4 – photosynthesis, Leaf anatomy of C_4 plants and CAM pathway.

Module –IV

Amino acids: Brief account of amino acids, amino acids can act as acids and bases, optical properties of amino acids, absolute configuration and standard amino acids, non standard amino acids, titration of amino acids, amino acids analysis- Ninhydrin test, peptide bond.

Module –V

Protein structure: Primary, Secondary and Tertiary structure of proteins, super secondary structure, solubility of proteins, fibrous and globular proteins – collagen, elastin, keratin, hemoglobin, myoglobin, protein sequencing and purification of proteins- Chromatography – Gel filtration, partition, Ion exchange , Electrophoresis – SDS polyacrylamide gel electrophoresis, Native PAGE , Two dimensional gel electrophoresis.

Books Suggested

1. Biochemistry, Voet and Voet.4 th edition.
2. Biochemistry, Lehninger. 6 th edition
3. Molecular biology of Cell, Alberts, 3rd edition.1994.
4. Fundamentals of Biochemistry, Jain and Jain, 2011.

Semester IV

M.SC. CHEMISTRY SCHEME EFFECTIVE FROM 2018-19		
SEMESTER I		
Course Code	University Course Type	Course Name
CHY 188	Department Specific Elective -3	Organic Synthesis
CHY 190		Organotransition Metallic Chemistry
CHY 192		Biophysical & Surface Chemistry
CHY 194		Nuclear & Radiation Chemistry
CHY 196		Mineral Based Industrial Chemistry
CHY 189	Department Specific Elective -4	Heterocyclic Chemistry
CHY 191		Bioinorganic Chemistry
CHY 193		Chemical Dynamics
CHY 185		Pharmaceutical chemistry
CHY 197		Green Chemistry
CHY 198	Core Practical	Advanced Chemistry Lab-II
CHY 199	Core Course	Seminar
CHY 200	Core Course	Project

CHY188

ORGANIC SYNTHESIS

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-3**

Module I

Disconnection Approach: An introduction to synthons and synthetic equivalents, disconnection approach, functional group interconversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reactions, amine synthesis.

Module II

One and Two Group C-C Disconnections: One group C-C disconnection involving Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, uses of alkynes and aliphatic nitro compounds in organic synthesis Diels' Alder reaction, 1,3-difunctionalised compounds, α,β-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds; Michael addition and Robinson annelation.

Module III

Ring synthesis – I: Introduction to ring synthesis of saturated heterocycles. General strategy and stereoselectivity. Three membered rings; cyclisation and insertion reactions. Rearrangements in synthesis. 4- membered rings: photocycloadditions and use of ketenes.

Module IV

Ring synthesis – II: Five membered rings; from 1,4 and 1,6 dicarbonyl compounds. Pericyclic rearrangements and special methods. Six membered rings: carbonyl condensation, Diels Alder reaction, reduction of aromatic compounds.

Module V

Protecting groups: Principle of protection of alcohols, amines, carbonyl and carboxyl groups, simple practice exercise

Suggested books:

1. Designing Organic Synthesis; First Edition; S. Warren; John Wiley and Sons, Great Britain, 2002.
2. Organic Synthesis- Concepts, Methods and Starting Materials; J. Fuhrhop and G.Penzillin; Verlage VCH.
3. Some Modern Methods of Organic Synthesis; Third Edition; W. Carruthers; Cambridge Univ. Press, UK,1987.
4. Advanced Organic Chemistry: Reactions, Mechanisms and Structure; Fourth Edition; Jerry March; John Wiley and Sons Asia Private Limited, New Delhi, 2007
5. Principles of Organic Synthesis; Third Edition; R.O.C. Norman and J.M. Coxon; Nelson Thornes, UK, 2003.
6. Advanced Organic Chemistry Part A & B; Fourth Edition; Francis A. Carey and Richard J. Sundberg; KluwerAcademic/Plenum Publishers, New York, 2000.
7. Organic Chemistry, Vol 2; Fifth Edition; I.L. Finar; Longman Scientific and Technical, Singapore, 1997.

CHY190

ORGANOTRANSITION METAL CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-3**

Module I

Alkyls and Aryls of Transition Metals

Types, routes of synthesis, stability of organometallic compounds and decomposition pathways; organocopper in organic synthesis, transition metal compound with bonds to hydrogen.

Module II

Metal-Carbon Multiple bonded organometallics: Preparation, properties, structure and bonding of - carbene and carbyne complexes(both Fischer and Schrock types) , h^2- alkene and alkyne complexes, h^3- allyl complexes, fluxionality and dynamic equilibria in compounds such as h^2- olefin and h^3- allyl complexes.

Module III

π-Bonded Organometallics: Preparation properties, structure and bonding of h^4- diene complexes, h^5- dienyl complexes, h6- arene & triene complexes(nucleophilic and electrophilic substitution), fluxionality and dynamic equilibria in dienyl complexes.

Module IV

Principles and Important Reactions of Transition Metal Organometallics: Co-ordinative unsaturation; oxidative addition, C-H bond activation; reductive elimination; insertion; reactions on co-ordinated ligands.

Module V

Catalysis by Organotransition Metal Complexes: Classification, nomenclature and general characteristics of organometallic compounds.

Homogeneous catalysis: hydrogenation of alkenes, hydrosilylation of alkenes, metathesis of alkenes, oligomerization and polymerization of alkenes and alkynes, hydroformylation of alkenes, acetic acid synthesis and other carbonylation reactions, oxidation reactions of alkenes.

Heterogeneous catalysis: Fischer Tropsch process- Methanation reaction, synthesis of Methanol, Gasoline production, water gas shift reaction- Role of ZnO/Cr_2O_3 in the reaction, acetic acid synthesis, role of CO catalyst.

Suggested Books:

1. Organometallic Chemistry: A Unified Approach; Second Edition; R.C. Mehrotra and Singh; New Age International Private Limited, New Delhi, 2005.
2. Inorganic Chemistry; Third Edition; Gary L. Miessler and Donald A. Tarr; Pearson Education Inc. Singapore, 2005.
3. Inorganic Chemistry, Principles of Structure and Reactivity; Fourth Edition; J.E. Hueey, E.A. Keiter and R.L. Keiter; Addison-Wesley Publishing Company, New York, 1993.
4. Advanced Inorganic Chemistry, Fifth Edition; F.A. Cotton and G. Wilkinson; John Wiley and Sons, USA, New York, 1988.

CHY192

BIOPHYSICAL AND SURFACE CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-3**

Module I

Corrosion Science: Theories of corrosion, kinetics of corrosion, Evan's diagram thermodynamics of corrosion- Pourbaix diagram, forms of corrosion, prevention of corrosion- modification of materials, corrosion inhibitors, cathodic and anodic protection

Module II

Biological Cell and Bioenergetics: Biological cell, structure and functions of proteins, enzymes, standard free energy change in biochemical reactions, exergonic, endergonic.

Module III

Statistical Mechanics in Biopolymers: Evaluation of size, shape, molecular weight and extent of hydration of biopolymers by various experimental technique, sedimentation equilibrium, hydrodynamic methods, diffusion, sedimentation velocity, viscosity, electrophoresis and rotational motions. Chain configuration of macromolecules, statistical distribution end to end dimensions, calculation of average dimensions for various chain structures. polypeptide and protein structures, introduction to protein folding problem.

Module IV

General Properties of Liquids: Liquids as dense gases, liquids as disordered solids, some thermodynamic relations, internal pressure and its significance in liquids. Equations of state, critical constants, different types of intermolecular forces in liquids, different potential functions for liquids, additivity of pair potential approximation.

Module V

Supercooled and Ionic liquids: Supercooled and Ionic liquids, theories of transport properties, non-arrhenius behaviour of transport properties, Cohn-Turnbull free volume model, configurational entropy model, glass transition in supercooled liquids.

Suggested Books:

1. Engineering Chemistry; Krishnamurthy, N. Vaillinayagan; Prentice Hall of India Pvt. Ltd. 2006.
2. Biophysical Chemistry, Vol,. I-III, Twelth Edition; Cantor, C.R. & Schimmel, Paul R.; W.H. Freeman & Company, U.S.A., 2002
3. Principles of Biochemistry, Third Edition; Lehninger, A. L., Nelson, D.L. & Cox, M. M. Lehninger; McMillan Press Ltd., London, 2002.
4. An Introduction to Liquid State, P.A.Egeistaff, Academic Press.

CHY194

NUCLEAR AND RADIATION CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-3**

Module I

Atomic Nucleus: Sub-nucleons, classification of nuclides, nuclear stability, binding energy, nuclear radius, orbital, spin and total angular momentum of nucleons, electric quadrupole moment of nuclides; nuclear models – liquid drop model, fermi gas model, optical model, shell model.

Module II

Radioactivity: Decay scheme, decay kinetics, parent-daughter decay growth relationship, branching decay, alpha emission, beta emission – type of beta decay, electron capture, neutrino, double beta decay, nuclear deexcitation – gamma emission, gamma transition, internal conversion, auger effect; artificial radioactivity,

Module III

Nuclear Reactions: Types, special nuclear reaction – evaporation, spallation, fission, fragmentation; reaction cross section; compound nucleus mechanism for nuclear reaction, high energy, photo and thermo nuclear reaction; fission – process and product, fission energy, theory of nuclear fission, nuclear reactor, breader reactor in India, fusion and its scope.

Module IV

Elements of Radiation Chemistry: Interaction of radiation with matter, radiolysis of water, chemical and biological effect of radiation, units for measuring radiation absorption.

Module V

Applications of Radio Nuclides: Tracer method, isotope dilution analysis, activation analysis, diffusion studies, structure determination, reaction mechanism, radio pharmaceuticals, dating techniques, neutron activation analysis.

Suggested Books:

1. Essentials of Nuclear Chemistry, IV Edition; H.J. Arnikar; New Age International (P) Ltd., New Delhi, 1995.
2. Source book on Atomic Energy II Edition; S. Glasstone; Van Nostrand Co. Inc., New Jersey.
3. Nuclear Chemistry for B.Sc. and M.Sc. Students of Indian Universities, I Edition; C.V. Shekhar; Dominant Publishers and Distributors, New Delhi, 2003.

CHY196

MINERAL BASED INDUSTRIAL CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-3**

Module –I

Industrial chemistry: Ferrous and non ferrous industries-quality control method general principles applied in studying an industry manufacture of iron steel and special steels metallurgy of gold and silver

Module –II

Cement: Classification of cement manufacture of portland cement –setting and hardening of cement chemical constitution of portland cement and their characteristics-special cements and their uses

Module –III

Ceramics: Classification of ceramics basic raw material-application of colour to pottery porcelain and china ware manufacture glassraw materials manufacture of special glass-optical borosilicate flint and coloured glasses

Module –IV

Poisions-I: Industrial poisons and their classfication solid liquid and guseous poisons –their identification –physiological activity

Module –V

Poisions-II: Control solids Pb as Hg asbestos textile fibres liquids organic solvents gases oxides of Sn and H_2S cyanides aldehydes ketones and hydrocarbons.

Books Suggested

1. Chemical process Industries; N.D. Shreeve.
2. Applied Chemistry for Engineer; Diamont.
3. Indrutrial Poisons and Solvent; Jacobs.
4. Chemistry of Engineering Materials; Jain & Jain.
5. Engineering Chemistry; B.K. Sharma.

CHY189

HETEROCYCLIC CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-4**

Module I

Five membered Heterocycles with more than two Heteroatoms: Synthesis and reactions of triazoles, tetrazoles, oxadiazoles and thiadiazoles

Meso-ionic Heterocycles: General classification, chemistry of some important meso ionic heterocycles of type A and B and their applications

Module II

Six-Membered Heterocycles with one Heteroatoms: Synthesis and reactions of pyrilium salts, pyrones coumarins and chromones.

Module III

Six-Membered Heterocycles with two or more heteroatoms: Synthesis and reactions of diazines, triazines, tetrazines

Module IV

Seven Membered Heterocyclic Compounds: Azepines, Oxepins and Thiepins

Diazepines: 1,4 or 1,5 benzodiazepnies

Thiazepines: 1,4 or 1,5 benzothiazepnies

Thiazines: 1,4-benzothiazines and phenothiazines

Module V

Bicyclic Ring Systems Derived from Pyridine: Quinoline and Isoquinoline, Acridines and Phenanthridines

Suggested Books:

1. Heterocyclic Chemistry Vol. 1-3; First Edition; R.R. Gupta, M. Kumar and V. Gupta; Springer Verlag, Berlin, Heidelberg, 1998.
2. Heterocyclic Chemistry; Fourth Edition; J.A. Joule and K.Mills; Blackwell Science Ltd., London, 2000.
3. Heterocyclic Chemistry; T.L. Gilchrist; Longman Scientific and Technical.
4. An Introduction to the Chemistry of Heterocyclic Compounds; Second Edition; R.M. Acheson; John Wiley and Sons, New Delhi, 1976.
5. Contemporary Heterocyclic Chemistry; G.R. Newkome and W.W. Paudler; Wiley Interscience.

CHY191

BIOINORGANIC CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-4**

Module –I

Metalloenzymes--Structure and functions of the following enzymes: Carbohydrates, carboxy peptidase, alcohol dehydrogenase, catalase and peroxidase, cytochrome P-450, super oxide dismulatase and xanthin oxidase, coenzyme, Vitamin B_{12}.

Module –II

Metal Storage and transport: Iron storage and transport – transferrin, ferritin and siderophores, other storage and transport systems ceruloplasmin and serum albumin for copper, metallothioneins and phytochepatins vanadium storage and transport.

Module –III

DNA and RNA: Metal complexes of polynucleotides, nucleosides and nucleic acids (DNA and RNA), template temperature, stability of DNA.

Module –IV

Metal Deficiency and Diseses-I: Iron, zinc and copper deficiency- metal ion toxicity – copper over load and Wilson's disease, iron toxicity of arsenic, cadmium, mercury and lead, metal complexes in medicine.

Module –V

Metal Deficiency and Diseses-II: chelation therapy, BAL, penicillamine, polyamino carboxyclic acids and desferrioxamine, gold compounds and rheumatoid arthiritis, platinum complexes as anticancer, drugs-metal complexes in radio diagnosis and magnetic resonance imaging.

Books Suggested

1. Principles of Bioinorganic chemistry, S.J Lippard, & J.M. Berg, University Science
2.Bioinorganic Chemistry, I Bertini, H. B. Gray. S.J. Lippard and J. S. Valentine, University Science Books.
3. Inorganic Biochemistry Volumes I and II Ed. G.L. Eichhoin Elsevie

CHY193

CHEMICAL DYNAMICS

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-4**

Module –I

Principles of Reactivity.Mechanistic significance of entropy, enthalpy and Gibb's free energy. Arrhenius equation. transition state theory, uses of activation parameters, Hammond's postulate, Bell-Evans-Polanyi principle, potential energy surface model. Marcus theory of electron transfer, reactivity and selectivity principles.

Module –II

Kinetic Isotope Effect. : Theory of isotope effects. primary and secondary kinetic isotope effects, heavy atom isotope effects, tunneling effect, solvent effects.

Module –III

Structural Effects on Reactivity: Linear free energy relationships (LFER), the Hammett equation, substituent constants, theories of substituent effects. Interpretation of σ-values. reaction constant ρ, deviations from Hammett equation, dual-parameter correlations, inductive substituent constant, the Taft model, σl-and σR-scales.

Module –IV

Chemical Dynamics-I: Methods of determining rate laws, Arrhenius equation, collision theory of reaction rates, steric factor, activated complex theory, ionic reactions, kinetic and thermodynamic control of reactions.

Module –V

Chemical Dynamics –II: Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and oscillatory reactions, homogeneous catalysis, kinetics of enzyme reaction.

Books Suggested

1. Physical Organic Chemistry, Jack Hine, McGraw Hill.
2. Mechanism-An introduction to the study of organic reactions, R.A. Jackson, Oxford Chemistry, Series
3. Medicinal Chemistry, P. Paramoo, CBS, India.
4. Introduction to medicinal chemistry, A.Griguage,Wiley VCH.
5. Chemical Kinetics, K.J. Laidler, Tata McGrawHill, New Delhi.
6. Chemical Kinetics, E.S. Espenson, Tata McGrawHill, New Delhi

CHY 185

PHARMACEUTICAL CHEMISTRY

L-T-P-C Structure3-1-0-4 **Course Type: DSE-4**

Module –I

Structure and activity: Relationship between chemical structure and biological activity (SAR). Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between FreeWilson analysis and Hansch analysis.

Module –II

Pharmacodynamics-Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

Module –III

Antibiotics and antibacterials-Introduction, Antibiotic β ,Lactam type , Penicillins, Cephalosporins, Antitubercular . Streptomycin, Broad spectrum antibiotics . Tetracyclines, Anticancer – Dactinomycin (Actinomycin D)

Module –IV

Antifungal polyenes, Antibacterials- Ciprofloxacin, Norfloxacin, Antiviral. Acyclovir Antimalarials. Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine

Module –V

Non-steroidal Anti-inflammatory Drugs- Diclofenac Sodium, Ibuprofen and Netopam Antihistaminic and antiasthmatic agents : Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.

Books Suggested

1. Introduction to Medicinal Chemistry, A Gringuage , Wliey, VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed. R.F. Dorge.
3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age International,1997.
4. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
5. Strategies for Organic Drug Synthesis and design, D. Lednicer, John wiley.1998.

CHY197

GREEN CHEMISTRY

L-T-P-C Structure 3-1-0-4 **Course Type: DSE-4**

Module I

Introduction, Principle and Concepts of Green Chemistry: What is Green Chemistry? Need for Green Chemistry. Inception and evolution of Green Chemistry. Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Green chemistry in day to day life.

Module II

Non-Traditional Greener alternative approaches: Different approaches to green synthesis (a) Uses of green reagents in green synthesis- dimetyl carbonate, polymer supported reagents- peracids and chromic acids. (b) Green catalysis, oxidation catalysts, basic catalyst and polymer supported catalyst. (c) Phase transfer catalyst in green synthesis; advantages of PTC reactions to green synthesis, application of PTCs in N/C- alkylation, Darzen's reaction, Wittig reaction, heterocyclic compounds -3- alkylcoumarins, flavanones, oxidation using hydrogen peroxide under PTC conditions, use of crown ethers in esterifications, aromatic substitutions and elimination reactions (d) Biocatalysts in organic synthesis: Introduction ,microbial oxidation and reduction, production of fine chemicals.

Module III

Application of non conventional energy sources:Microwave induced and Ultrasound assisted green synthesis: Introduction of Microwave induced organic and inorganic synthesis; Microwave activation equipment, time and energy benefits, limitations. (a) Synthesis of N-O/ S donor ligands and their coordination complexes; synthetic organic transformations under microwaves (b) reactions in organic solvents- Esterification reactions, Fries rearrangement, Diels- Alder reaction, decarboxylation.(c) Solvent free reactions (Solid state reactions) -Deacetylation, deprotection, saponification of esters, alkylation of reactive methylene compounds, synthesis of nitriles from aldehydes, heterocyclic synthesis –β- Lactums, pyrrole, quinoline. Ultrasound assisted green synthesis: introduction, instrumentation, physical aspects, oxidation, reduction,addition, substitution reactions and synthesis of chromenes.

Module IV

Environmentally Benign solution to organic solvents (focus on water and ionic liquids): Ionic liquids as green solvents – Introduction, properties and types of ionic liquids: synthetic applications- : Diels-Alder Reaction, Heck reaction, epoxidation, preparation of pharmaceutical compounds; enzyme catalysed synthesis.

Module V

Aqueous Phase Reactions- Introduction, pseudo organic solvents.

i) Application in oxidation of nitro, aromatic and carbonyl compounds, reduction of carbon-carbon multiple bonds, Claisen rearrangement, Michael reaction, Knoevenagel reaction, benzoin condensation

ii) Electrochemical Synthesis – Introduction, synthesis of sebacic acid, adiponitrile.

Introduction on role of florus solvents and supercritical carbon diooxide in green chemistry.

Suggested Books:

1. Green Chemistry: Theory and Practice. P.T. Anastas and J.C. Warner. Oxford University Press.
2. New trends in green chemistry, V.K. Ahluwalia and M. Kidwai.
3. Green Chemistry: Introductory Text. M. Lancaster Royal Society of Chemistry (London)
4. Introduction to Green Chemistry. M.A. Ryan and M.Tinnesand, American Chemical Society (Washington)
5. Real World Cases in Green Chemistry. M.C. Cann and M.E. Connelly. American Chemical Society(Washington)
6. Real World Cases in Green Chemistry (Vol 2). M.C. Cann and T.P.Umile. American Chemical Society(Washington)
7. Green Chemistry : Environmental Benign Reaction, V.K.Ahluwalia Ane Books, New Delhi ,2009
8. Green Chemistry : Environmental Friendly Alternatives ,Rashmi Sanghi ,M.M.Srivastava , Narosa Publishing House ,2006
9. Green Chemistry : Environmental Benign Reaction, V.K.Ahluwalia Ane Books, New Delhi ,2009
10. Green Chemistry : Environmental Friendly Alternatives ,Rashmi Sanghi ,M.M.Srivastava , Narosa Publishing House ,2006

CHY198

ADVANCED CHEMISTRY LAB-II

L-T-P-C Structure 0-0-8-4 **Course Type: Core Practical**

Multi-step Synthesis of Organic Compound(Any 6)

1) Photochemical reaction Benzophenone->Benzpinacol->Benzpinacolone

2) Beckman Rearrangement : Benzanilide from benzene

Benzene->Benzophenone->Bhezenophenone oxime->Benzanilide

3) Benzilic acid rearrangement : Benzilic acid from benzoin

Benzoin->Benzil->Benzilic acid

4)Synthesis of heretocyclic compounds

5) Skraup synthesis : Preparation of quinoline from aniline

6) Fisher Indole synthesis : Preparation of 2-phenylindole from phenylhydrazine .

7) Enzymatic synthesis, Enzymatic synthesis,

8) Enzymatic reduction : reduction of ethyl acetoacetate using baker's yeast to yield enantiomaric excess of S (+) ethyl-3-hydroxybutanoate and determine its optical purity.

9)Biosynthesis of ethanol from sucrose.

10) Synthesis using microwave Alkylation of diethyl malonate with benzyl chloride.

11) Synthesis using phase transfer catalyst.

12) Alkylation of diethyl malonate or ethyl acetoacetate with an alkyl halide.

Any 3 experiments from the list

1. Estimation of the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oxinate in a given solution gravimetrically.

2. Estimation of Mg^{2+}or $Zn^{2+}$by complexometric titrations using EDTA.

3. Estimation of total hardness of a given sample of water by complexometric titration.

4. Determination of the composition of the Fe^{3+}- salicylic acid complex / Fe^{2+}-phenanthroline complex in solution by Job's method

5. Preparation of any two of the following complexes and measurement of their conductivity:
(i) tetraamminecarbonatocobalt (III) nitrate
(ii) tetraamminecopper (II) sulphate
(iii) potassium trioxalatoferrate (III) trihydrate

Suggested Books:

1. Vogel's Text Book of Practical Organic Chemistry, Fifth Edition, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell; Adission – Wesley Longman Ltd., England, 1998.
2. Practical Organic Chemistry, Fourth Edition; P.C. Mann, B.C. Sounders; Orient Longman Ltd.
3. Experimental Organic Chemistry, Vol. I, P.R. Singh, D.S. Gupta, K.S. Bajpai, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Advanced Practical Physical Chemistry; Twenty-second Edition; J.B.Yadav; Goel Publishing House, Merrut, 2005.
5. Monograph on Green Chemistry- Laboratory Experiments- Laboratory Task Force Committee , DST
6. Experimental Physical Chemistry, first edition, V. D. Athawale, Parul Mathur, New age International Publisher 2011.

CHY199

SEMINAR

L-T-P-C Structure 0-0-4-2 **Course Type: Core Course**

To enhance communication skill of the M.Sc students seminars have been incorporated in the syllabi in Semester IV .The candidates will have to choose a topic from the syllabi for seminar preparation. They will be expected to submit a write up pertaining to that topic and at the end of semester, a presentation will have to be made in presence of panel of experts from different fields of chemistry.

CHY200

PROJECT

L-T-P-C Structure 0-0-16-8 **Course Type: Core Course**

To give an exposure of research to candidates, dissertation has been introduced in semester IV. Candidate is required to carry out minor research project on any topic of choice under the supervision of an allotted research supervisor. The marking scheme of dissertation will include synopsis ,attendance, literature review, presentation and project report.