Course No: CH15101CR
Title: Inorganic Chemistry (03 Credits)

Max. Marks: *75* ***Duration:*** *48 Contact hours (48L)*
End Term Exam: *60 Marks* ***Continuous Assessment****: 15 Marks*

Unit-I Stereochemistry and Bonding in the Compounds of Main Group Elements (16 Contact hours)

Valence bond theory: Energy changes taking place during the formation of diatomic molecules; factors affecting the combined wave function. Bent's rule and energetics of hybridization.

Resonance: Conditions, resonance energy and examples of some inorganic molecules/ions.

Odd Electron Bonds: Types, properties and molecular orbital treatment.

VSEPR: Recapitulation of assumptions, shapes of trigonal bypyramidal, octahedral and pentagonal bipyramidal molecules / ions. (PCl_5, VO_3^-, SF_6, $[SiF_6]^{2-}$, $[PbCl_6]^{2-}$ and IF_7). Limitations of VSEPR theory.

Molecular orbital theory: Salient features, variation of electron density with internuclear distance. Relative order of energy levels and molecular orbital diagrams of some heterodiatomic molecules /ions. Molecular orbital diagram of polyatomic molecules / ions.

Delocalized Molecular Orbitals: Butadiene, cyclopentadiene and benzene.

Detection of Hydrogen Bond: UV-VIS, IR and X-ray. Importance of hydrogen bonding.

Unit-II Metal-Ligand Equilibria in Solution (16 Contact hours)

Stepwise and overall formation constants. Inert & labile complexes. Stability of uncommon oxidation states.

Metal Chelates: Characteristics, Chelate effect and the factors affecting stability of metal chelates.

Determination of formation constants by pH- metry and spectrophotometry.

Structural (ionic radii) and thermodynamic (hydration and lattice energies) effects of crystal field splitting. Jahn -Teller distortion, spectrochemical series and the nephleuxetic effect.

Evidence of covalent bonding in transition metal complexes.

Unit-III Pi-acid Metal Complexes (16 Contact hours)

Transition Metal Carbonyls: Carbon monoxide as ligand, synthesis, reactions, structures and bonding of mono- and poly-nuclear carbonyls. Vibrational spectra of metal carbonyls for structural diagnosis.

Prepration, reactions, structure and bonding of transition metal nitrosyls, dinitrogen and dioxygen complexes.

Tertiary phosphine as ligand.

Books Recommended

1. Principles of Inorganic Chemistry; 1st edn.; Brain W. Pfennig; Wiley; 2015.
2. Advanced Inorganic Chemistry; 5th. and 6th edn; F.A. Cotton , G. Wilkinson; Wiley; 1998/1999.
3. Inorganic Chemistry; 4th edn; J. E. Huheey; E. A. Keiter; Harper Collins; 2009.
4. Inorganic Chemistry; G. Wulfsberg; Viva; 2002.
5. Chemistry of the Elements; 2nd edn; N. N. Greenwood, A. Earnshaw; Butterworth; 1997.
6. Inorganic Chemistry; 3rd edn; D. F. Shriver; P. W. Atkins; Oxford; 1999.
7. Inorganic Chemistry; K.F. Purcell, J.C Kotz; Saunders; 1977.
8. Coordination Chemistry; D. Banerjea; Tata McGraw Hill; 1993.

Course No: CH15102CR
Title: Organic Chemistry (03 Credits)

Max. Marks: *75* ***Duration:****48 Contact hours (48L)*
End Term Exam: *60 Marks* ***Continuous Assessment****: 15 Marks*

Unit-I Delocalized Chemical Bonding and Introduction to Determination of Reaction Mechanism (16 Contact hours)

Overview: Conjugation, cross conjugation, rules of resonance, steric inhibition of resonanace.

Aromaticity**:** Huckel rule and concept of aromaticity, molecular orbital description of aromaticity and antiaromaticity. Relation between NMR and aromaticity. Annulenes (Two to more than ten π -electron systems), aromaticity of hetero annulenes and fullerenes (C-60). Homoaromaticity.

Hyperconjugation**:** Explanation of hyperconjugative effect, isovalent and sacrificial hyperconjugations

Tautomerism: Different types including valence tautomerism.

Reactive Intermediates: Generation, Structure, fate and stability of carbocations, (classical and non- classical) carbanions, free radicals, carbenes, nitrenes and radical ions.

Determination of Reaction Mechanism**:** Methods of determination of reaction mechanism, identification of products, determination of presence of intermediate, isotopic labeling, kinetic evidence and stereochemical evidences.

Unit-II Stereochemistry (16 Contact hours)

Chirality**:** Introduction, chirality due to chiral centre, molecules with more than one chiral centres, Threo and erythro isomers, convention for configurations D, L & R, S systems. Optical activity due to chiral axis, stereo plane and helicity. Chirality involving atoms other than carbon. Chirality in metallic complexes. Enantiotopic and diastereotopic atoms, groups and faces.

Asymmetric Synthesis: Introduction and principle of asymmetric synthesis, principal categories of asymmetric synthesis: Use of chiral substrates. Diastereo-selectivity in aldol reactions, Stereospecificity and Stereoselectiviy of enzymes.

Conformations*:* Origin of conformational energy, Angle and Pitzer strain, conformational analysis of cycloalkanes and decalines. Effect of conformation on reactivity in acylic and cyclic systems. Conformation of sugars, anomeric effect. Conformation of cyclohexene and cyclo- hexanones. Conformation of bicyclo heptane -a bridged system.

Unit-III Mechanistic Study of Organic Reactions (16 Contact hours)

Aliphatic Nucleophilic Substitutions

Mechanism and stereochemical implications of S_N2, S_N1, S_Ni and neighbouring Group Participation (by π and σ-bonds) reactions. Comparison of S_N1 and S_N2 reactions.Effect of substrate structure, attacking nucleophile, leaving group and solvent on the rates of S_N1 and S_N2 reactions. Mixed S_N1 and S_N2 reactions. Nucleophilic substitution at allylic, benzylic, aliphatic trigonal and vinylic carbons. Nucleophilic substitution in alcohols, Mitsunobu

reactions.Substitutions on other elements. Functional group transformation using S_N2 reactions in organic synthesis. Nucleophilic substitutions in biological systems

***Elimination reactions*:** Factors affecting elimination reactions, Mechanism of E1, E2, E1cB and E2C reactions. Competition between substitution and elimination reactions. Stereochemistry and regioselectivity of E2 eliminations, Elimination in cyclic systems and vinyl halides. Mechanism and orientation in pyrolytic eliminations, Shapiro reaction.

Aliphatic Electrophilic Substitutions

General mechanism of S_E1, S_E2 and S_Ei reactions. Mechanisms of reactions involving migration of double bond. Effect of substrate, leaving group and solvent on reactivity. Stork-enamine reaction.

Books Recommended

1. Advanced Organic Chemistry Reactions, Mechanism and Structure; 6th edn; Jerry March; Wiley; 2012.
2. Advanced Organic Chemistry; 5th edn; F. A. Carey and R. J. Sundberg; Plenum; 2007.
3. A Guide Book to Mechanism in Organic Chemistry; 6th edn; Peter Sykes; Longman; 1996.
4. Structure and Mechanism in Organic Chemistry; 2nd edn; C. K. Ingold; CBS; 1994.
5. Reaction Mechanism in Organic Chemistry; 3rd edn; S.M. Mukherjee and S.P. Singh; Macmillan; 1998.
6. Stereochemistry of Organic Compounds; 2nd edn; D. Nasipuri; New Age Inter; 1994.
7. Stereochemistry of Carbon Compounds; E.L.Eliel; TMH; 1995.
8. Stereochemistry of Organic Compounds; 3rd edn; P.S. Kalsi; New Age Inter; 1995.
9. Organic Chemistry; J. Hornback; Brooks/Cole; 1998.
10. Fundamentals of Organic Chemistry; 10th edn; Solomons; Wiley; 2012.
11. Organic Chemistry, 5th Edn; John McMurry; Brooks/Cole; 2000.

Course No: CH15103CR
Title: Physical Chemistry (03 Credits)

Max. Marks: *75* ***Duration:*** *48 Contact hours (48L)*
End Term Exam: *60 Marks* ***Continuous Assessment****: 15 Marks*

Unit-I Quantum Chemistry (16 Contact hours)

Exact Quantum Mechanical Results: Time-independent and time-dependent Schrodinger equation. Postulates of quantum mechanics. Operator concept, quantum mechanical operators in Cartesian and Spherical polar co-ordinate systems, some properties of quantum mechanical operators. Review of particle in a box problem. The solution of problems of harmonic oscillator & the rigid rotator. Tunneling effect.

Born-Oppenheimer approximation. Solution of the Hydrogen-like atom problem- radial and angular wave functions.

Unit-II Equilibrium Thermodynamics (16 Contact hours)

Maxwell Relations and thermodynamic equations of state.

Phase Equilibria: Phase equilibria of three component systems: $CHCl_3$-H_2O-H_2O, NH_4Cl-$(NH_4)_2SO_4$-H_2O and Pb-Bi-Sn systems. First and second order phase transitions.

Ion solvent Interactions*:* Non structural (Born) treatment and an introduction to structural (Ion-dipole, Ion-quadruple) treatments of ion-solvent interactions.

Ion-Ion Interactions: Activity and activity co-efficients. Debye-Huckel theory of activity coefficients of electrolyte solutions; derivation of Debye-Huckel limiting law, validity and extension to high concentrations; ion-pair formation-Bjerrum model.

Unit-III Chemical Kinetics (16 Contact hours)

Theories of Chemical Reactions: Activated complex theory of reaction rates, statistical & thermodynamic formulations, Applications of activated complex theory for determination of rate constants, comparison with collision theory. Theories of unimolecular reactions (Lindman, Hinshelwood, RRK and RRKM theories), Introduction to potential energy surfaces.

Fast reactions: General features of fast reactions, study of fast reactions by flow method, relaxation method, NMR method and flash photolysis.

Chain reactions: Steady-state approximation. Thermal and photochemical hydrogen-bromine reaction. Explosive reactions.

Books Recommended

1. Physical Chemistry; P. W. Atkins; ELBS; Oxford; 1997.
2. Physical Chemistry-A Molecular Approach; D. A. McQuarie & J. D. Simon; University Science Books; 1997.
3. Introduction to Quantum Chemistry; A. K. Chandra; TataMcGraw Hill; 1997.
4. Quantum Chemistry; Ira. N. Levine; Prentice Hall; 2000.
5. Quantum Chemistry; Prasad; New Age Publishers; 2000.
6. Chemical Kinetics; K. J. Laidler; Mcgraw-Hill; 1987.
7. Chemical Kinetics and Dynamics; J.I.Steinfeld; J. S. Francisco; W.L. Hase; Prentice Hall;1989.
8. Chemical Kinetics and Catalysis; R.I. Masel; Wiley; 2001.
9. Molecular Thermodynamics of Electrolyte Solutions; Lioyd L Lee; World Scientific; 2008.
10. An Introduction to Aqueous Electrolyte Solutions; Margaret Robson Wright; Wiley; 2007.
11. Modern Electrochemistry; 1, 2A, 2^{nd} edn; J.O M. Bokris and A. K. Reddy; Kluwer Academic/Plenum Publishers; New York.

Course No: CH15104CR
Title: Laboratory Course in Chemistry (03 Credits)

Max. Marks: *75* ***Duration:*** *96 Lab hours (96P)*
End Term Exam: *60 Marks* ***Continuous Assessment****: 15 Marks*

Unit-I Laboratory Course in Inorganic Chemistry (32 Lab hours)

A ***Gravimetry:***

Skill and importance of weighing in Chemistry, Gravimetreric calculations.

Precipitation process in homogenous mixtures, Precipitating agents & conditions of precipitation. Precipitate processing (Digestion, Ignition), reducing precipitation errors (co- and post precipitation).

B ***Titrimetry:***

Types and skill of titration, concept of complexometric titrations, calculations.

Metallochromic Indicators: Selection, structure, and mechanism of action.

Role and selection of buffers in complexometric titrations, EDTA back titrations.

C ***Separation and Estimation of following binary Metal ion systems using Gravimetry & Titrimetry simultaneously:***

1. Silver (Ag^{+}) as AgCl and Nickel (Ni^{2+}) as $[Ni(EDTA)]^{2-}$ complex.
2. Barium (Ba^{2+}) as $BaSO_4$ and Zinc as $[Zn(EDTA)]^{2-}$ complex.
3. Barium (Ba^{2+}) as $BaSO_4$ and Nickel (Ni^{2+}) as $[Ni(EDTA)]^{2-}$ complex.
4. Nickel (Ni^{2+}) as $Ni(dmg)_2$ complex and Magnesium (Mg^{2+}) as $[Mg(EDTA)]^{2-}$ complex.
5. Copper (Cu^{2+}) as CuSCN and Magnesium (Mg^{2+}) as $[Mg(EDTA)]^{2-}$ complex.

Unit-II Laboratory Course in Organic Chemistry (32 Lab hours)

A Qualitative Analyses of Organic Compounds

Physical Properties: Physical state, colour, odour, solubility behavior and melting / boiling points.

Chemical Properties:

(i) ***Flame test***

(ii) ***Detection of elements*****:** Nitrogen, Sulphur and Halogens

(iii) ***Detection of Functional Groups:*** Detection of Carbohydrates, Unsaturation, Carboxylic acids, Carbonyl compounds, Phenols, Alcohols, Halides, Amines, Amides, Imides, Ureas, Thioureas, Nitrocompounds and Hydrocarbons.Group tests for compounds of natural origin (Carbohydrates,amino acids,steroids,alkaloids,terpenes and flavonoids.

Preparation and Crystallization of the Derivatives of above mentioned group of Compounds.

B Identification of Single Organic Compounds with Multiple Functionalities.

C Quantitative Estimation of the following:

(a) Carbohydrates

(b) Glycine
(c) Carboxylic acids
(d) Phenols/Aniline

Unit-III Laboratory Course in Physical Chemistry (32 Lab hours)

A. ***Chemical Kinetics:***

1. Study of kinetics of hydrolysis of an ester catalysed by Dil. HCl.
2. Determination of order of reaction between $K_2S_2O_8$ and KI by Initial rates method.

B. ***Viscometry:***

1. Investigation of variation of viscosity with conc. and determination of unknown concentration.
2. Estimation of molecular radius of a solute using viscometry.

C. Calorimetery

1. Determination of heat of neutralisation of a strong acid and weak acid with a strong base·

2. Determine the integral heat of solution of KNO_3.

Books Recommended

1. Vogel's Textbook of Quantitative Chemical Analysis; 5th edn; Jeffery, Bassett; ELBS; 1989.
2. Quantitative Analysis; 6th edn; Day, Underwood; Printice Hall; 1993.
3. Analytical Chemistry; 6th edn; D. Christian; Wiley; 2008.
4. Microscale and Macroscale Organic Experiments; K.L. Williamson; D.C. Heath and Co; 1989.
5. Advanced Practical Organic Chemistry; 2nd edn; N.K. Vishnoi; Vikas; 1999.
6. Vogel's Textbook of Quantitative chemical Analysis; 5th edn; Jeffery, Bassett; ELBS; 1989.
7. Practical Physical Chemistry; Findley, Kitchener; Longman;1977.
8. Advanced Practical Physical Chemistry; Yadav; Goel Pub; 1994.
9. Experiments in Physical Chemistry; 5th edn; Schoemaker et al MGH; 1989.
10. Experimental Physical Chemistry; Arthur M. Halpern, George C. McBane; Freeman; 2006.

Course No: CH15104DC
Title: Bonding in Inorganic Compounds (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
End Term Exam: *40 Marks* ***Continuous Assessment****: 10 Marks*

Unit-I Bonding in Boron Clusters (08 Contact hours)

Structural classification and topology, types of bonds, isolobal analogy, empirical rules for bonding in boron clusters, Selected examples of bonding in higher boranes , Carboranes and Metallacarboranes. Boranes as ligands.

Unit-II Bonding in Non Metal Nitrogen Compounds (08 Contact hours)

Bonding in Boron–Nitrogen Compounds (Borazine), Phosphorous–Nitrogen (Cyclophosphazenes, polyphosphazenes and phosphonitrillic halides), Sulphur-Nitrogen compounds (polythiazyls and Sulphur Nitrides)

Unit-III Molecular Orbital Treatment of Bonding in Metal Complexes (08 Contact hours)

Molecular orbital treatment of bonding in octahedral, tetrahedral and square planar coordination compounds. Effect of Pi Bonding in ML_6 type octahedral Systems. Applications of CFT from MOT. Molecular orbital treatment of bonding in Metallocenes with reference to Ferrocene.

Unit-IV Bonding in Metal Clusters and Polymetallates (08 Contact hours)

Factors favoring metal –metal bond, bonding in di- and trinuclear metal clusters, cotton rationale and quadruple bonding, selected examples of bonding in homo dinuclear metal clusters . Bonding in transition metal poly and hetero-polymetallates.

Books Recommended

1. Principles of Inorganic Chemistry; 1st edn.; Brain W. Pfennig; Wiley; 2015.
2. Advanced Inorganic Chemistry; F.A. Cotton & G. Wilkinson; 3rd & 5th edn; Wiley; 1988/1999.
3. Inorganic Chemistry; J.E. Huheey , E.A Keiter; 4th edn; Harper Collins; College Publisher; 1993.
4. Organometallics; C. Elschenbroich & A. Salzer; 2nd edn; Wiley; VCH; 1992.
5. Advanced Inorganic Chemistry; F.A. Cotton, G. Wilkinson, C.A. Murillo & M. Bochmann; 6th edn; John Wiley; 1999.
6. Chemistry of Elements; N. N. Greenwood & E. A. Earnshaw; 2nd edn; Pergamon Press; 1997.

Course No: CH15105DC
Title: Infrared, Raman and Electronic Spectroscopy (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
End Term Exam: *40 Marks* ***Continuous Assessment****: 10 Marks*

Unit-I Fundamentals of Spectroscopy (08 Contact hours)

Interaction of light with matter, transition probability, transition moment integral, derivation ofselection rules.

Intensity of spectral lines; Einstein's treatment of absorption and emission processes. Oscillatorstrength.

Natural spectral line width, broadening of spectral lines -Doppler and Collision effects.

Unit-II Infrared Spectroscopy (08 Contact hours)

Linear harmonic oscillator- classical and quantum treatment of vibrations, vibrational energies of

diatomic molecules, zero point energy, force constant and bond strength, anharmonicity, Morse potential energy levels. Fundamental bands, overtones and hot bands. Vibration-rotation spectra of diatomic molecules; P, Q and R branches;

Vibrations of polyatomic molecules: Normal vibrational modes, selection rules; combination and difference bands. Factors influencing the band positions and intensities. Group frequencies and finger print region.

Unit-III Raman Spectroscopy (08 Contact hours)

Classical and Quantum theories of Raman scattering, Molecular polarizability, rotational, vibrational, and vibrational-rotational Raman spectra. Selection rules; rule of mutual exclusion. Applications.

Unit-IV Electronic and Photoelectron Spectroscopy (08 Contact hours)

Electronic Spectroscopy: Vibronic transitions. Intensity of spectra—the Franck-Condon principle. Electronic spectra of organic molecules, chromophores, auxochrome, spectral shifts Different types of electronic transitions; nomenclature, symmetry labels of electronic states--spectra of formaldehyde. Effects of solvent, electron withdrawing and electron donating groups, conjugation and extended conjugation on the position of spectral bands.

Photoelectron Spectroscopy: Basic principles- photoionization process; ionization energies; Koopman's theorem.

Photoelectron spectra of simple molecules (N_2, O_2),

Books Recommended

1. Physical Methods for Chemists; R.S.Drago; 2nd edn; Saunders; 1992.
2. Fundamentals of Molecular Spectrsocopy; C.N.Banwell, E.M.Mc Cash; 4th edn; Tata McGrawHill; 1994.
3. Physical chemistry; P. W. Atkins; 6th edition; Oxford University Press; 1998.
4. Electronic Absorption Spectroscopy and related techniques; D N Sathyanarayna; Universities Press.

5. Introductory Raman Spectroscopy; J. R. Ferraro, K. Nakamoto & C. W Brown; 2nd edn; Academic Press 2005.
6. Theory and Applications of Ultraviolet Spectroscopy; H.H.Jaffe, M.Orchin; Wiley; 1962.
7. Molecular Spectroscopy; 1st edn; J L. McHale; Prentice Hall; 1999.
8. Modern Spectroscopy; J.M.Hollas; Wiley; 1987.
9. Basic Principles of Spectroscopy; R.Chang; McGraw Hill; 1971.
10. Structural Methods in Inorganic Chemistry; 2nd edn; E.A.V.Ebsworth, D.W.H.Rankin, S.Cradock; Blackwell; 1991.

Course No: CH15106DC
Title: Mathematics for Chemists (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
End Term Exam: *40 Marks* ***Internal Assessment****: 10 Marks*

Unit-I Probability and Vectors (08 Contact hours)

Probability: Variables, Discrete and continuous, sample space, event probability. Fundamental counting principles: permutations and combinations, binomial probabilities, Probability distribution functions, probability involving discrete & continuous variables**.** Average values, distribution moments and variance.

Vectors: Vectors, dot, cross and triple products with applications. Gradient, divergence and curl of a vector, vector calculus, Gauss' theorem, divergence Theorem

Unit-II Determinants and Matrix Algebra (08 Contact hours)

Determinants, basic concepts, types and properties

Matrices: rectangular, square, diagonal & triangular matrices, trace of a matrix; addition and multiplication of matrices, zero & identity matrix, transpose, adjoint & inverse of matrices, special matrices (symmetric, skew-symmetric, hermitian, skew-hermitian, unitary matrices.)

Matrix equations: Homogeneous and non-homogeneous linear equations and conditions for their solutions. Eigen-value problem

Unit-III Calculus (Differentiation and Integration) (08 Contact hours)

Functions & their continuity and differentiability. Rules for differentiation, applications of differential calculus including maxima & minima finding (Examples: Maximally populated rotational levels, Bohr's radius, most probable velocity from Maxwell distribution), exact and inexact differentials; applications to thermodynamic properties.

Integration, basic rules for integration, integration by substitution, by parts, partial fractions. Applications of integral calculus.

Unit-IV Elementary Differential Equations (08 Contact hours)

Partial differentiation, Co-ordinate transformations (Cartesian to spherical polar co-ordinates) Variables-separable and exact first order differential equations, homogeneous, exact and linear equation. Solutions of differential equation by power series method, Fourier series, second order differential equations and their solutions. (Applications to chemical kinetics and quantum chemistry.)

Books Recommended

1. Physical Chemistry; Thomas Engel & Philip Reid; Pearson Education;
2. The Chemistry Mathematics Book; E. Steiner; Oxford;
3. Mathematics for Chemistry; G. Doggett & B.T. Sutcliffe; Longmann; 1995.
4. Mathematics for Physical Chemistry; R. G. Mortimer; Esevier; 2005.
5. Mathematical Methods for Scientists and Engineers; D.A.McQuarie; University Science Books; 2003.
6. Chemical Mathematics; D. M. Hirst; Longman;
7. Basic Mathematics for Chemists; Tebbutt; Wiley;
8. Mathematics for Chemists; C. L. Perrin; Wiley; 1970.
9. Mathematical Techniques in Chemistry; J. B. Dence; Wiley; 1975.
10. Mathematical Method in Physical Science; 2^{nd} edn; M.L. Boas, John Wiley and Sons;

Course No: CH15107GE
Title: Chemistry of the Environment (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
End Term Exam: *40 Marks* ***Internal Assessment****: 10 Marks*

Unit-I Environment (08 Contact hours)

Introduction, Segments of Environment; Factors affecting environment. Biogeochemical cycles of C, N, P, S and O.

Nature and Composition of Soil: Air, Water, Inorganic Components, Organic matter and Humus. Macro and Micronutrients in Soil. Acid--Base and Ion exchange reactions in Soil.

Pollution: Fertilizers, Pesticides, Plastics and Metals.

Unit-II Hydrosphere (08 Contact hours)

Chemical Composition of Water Bodies: Lakes & rivers, Factors determining composition (thermal stratification, acid-base, pE concept).

Aquatic pollution: Inorganic, Organic, Pesticide, Agricultural, Industrial and Sewage.

Water quality parameters: Dissolved oxygen, Metals, Content of Chloride, Phosphate, Nitrate, and Microorganisms. Water quality standards.

Analytical Methods for determining BOD, DO, COD, and metals (As, Cd, Hg, Pb & Se) Choice of methods for determination.

Purification and treatment of water: Chlorination, Ozonation, UV radiation.

Unit-III Atmosphere-I (08 Contact hours)

Chemical Composition of the Atmosphere: Particles, ions, radicals and their formation.

Vertical profile of the atmosphere, Heat budget of earth's atmospheric system. Chemical and photochemical reactions in atmosphere, photochemical smog formation.

Oxides of N, C, S and their effects.

Ozone layer: Formation of ozone and mechanism of ozone depletion.

Unit-IV Atmosphere-II (08 Contact Hours)

Pollution by chemicals: Chlorofluorocarbons, hydrocarbons and ozone.

Green house effect: Cause, source and impact on global climate.

Consequences of Green house effect and remedial measures.

Acid rain: Chemical aspects, adverse effects and control.

Books Recommended

1. Environmental Chemistry; 5th edn; Colin Baird; Freeman & Co; 2012.
2. Environmental Chemistry; 9th edn.S.E.Manahan; Lewis Publishers;2009
3. A Textbook of Environmental Chemistry; O.D.Tyagi & M.Mehra; Anmol Publishers; 1990.
4. Environmental Chemistry; A.K.De; Wiley Eastern; 1995.
5. Environmental pollution Analysis; S. M.Khopkar; Wiley Eastern.
6. Environmental pollution; B.K.Sharma & H.Kaur; Goel Publishcrs;1996.
7. Environmental Chemistry; Nigel. J.Bunce; Wurez Publishers; 1991.
8. Environmental Toxicology; Ed.Rose; Gordon & Breach Science Publishers.

Course No: CH15108GE
Title: Surfactants and their Applications (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
End Term Exam: *40 Marks.* ***Continuous Assessment****: 10 Marks*

Unit-I Self-Assembly of Surfactants (08 Contact hours)

Surfactants and Micelles: Classification of Surfactants, Solubility of Surfactants: Kraft temperature and cloud point, Micellization of surfactants: critical micelle concentration (cmc), aggregation number, counterion binding, factors affecting cmc in aqueous media. Thermodynamics of micellization: pseudophase model and mass action models. Structure and shape of micelles: geometrical consideration of chain packing, variation of micellar size and shape with surfactant concentration.

Unit-II Micellar Solubilization and Catalysis (08 Contact hours)

Introduction, factors affecting micellar solubilization: nature of surfactant/solubilizate, effect of additive and temperature. Effect of solubilization on micellar structure, cloud point and cmc of surfactants. Solubilization of drugs into micelles and its importance in drug delivery systems and controlled release. Theoretical consideration of reactions in micellar media. Examples of micellar catalysis for hydrolysis, oxidation and reduction reactions

Unit-III Mixed Surfactant Systems (08 Contact hours)

Mixed micelle formation, mixed monolayer formation, synergism, various models of mixed micelle formation(Clint, Rubingh, Motamurra, Blankschtein, and Rubing-Holland models) and mixed monolayer formation(Rosen's model). Importance and practical applications of mixed surfactant systems.

Unit-IV Surfactant-Polymer Systems (08 Contact hours)

Effect of polymers on aggregation behavior of surfactants and the factors governing their interaction. Phase behavior of polymer-surfactant mixtures. Characterization of polymer-surfactant systems by various techniques like viscosity, light scattering, spectroscopic and conductance measurements. Applications of surfactant-polymers systems.

Books Recommended

1. Properties of Liquids and Solutions; J.N. Murell and E. H. Boucher; John Wiley & Sons Ltd; 1982.
2. Physical Chemistry; P.W. Atkins; ELBS; Oxford; 1994.
3. Principles of Colloid and Surface Chemistry; P.C. Heimenz; Marcel Dekker Inc; New York; 1986.
4. Surfactants and Interfacial Phenomena; M. J. Rosen; John Wiley & Sons; New York; 1989.
5. Colloid and Interface Chemistry; R. D. Vold and M. J. Vold; Addison-Wesley; 1982.
6. Surfaces, Interfaces and Colloid; D. Y. Meyer; VCH Publishers; Inc; 1991.
7. Surfactants and polymers in aqueous solution; Jonsson, Lindmann, Homberg and Kronberg; John Wiley and sons; 1998.
8. Advances in Colloid and Polymer Science; B.K.Paul & S.P.Moulik, Current Science,Vol.80,p 990-,2001; Vol.78,p 99,1998.
9. Critical Reviews in Food Science and Nutrition; John Flanagan & Harjinder Singh, ,Vol. 46, pp221-237, 2006.
10. Advanced Drug Delivery Reviews; M. J. Lawrence & G.D.Rees; Vol, 45, p 898, 2000.
11. Energy Fuels; T. N. Dantas, A.A.D, Netoetal; DOI:10.1021/ ef900952y; 2010.

Course No: CH15109GE
Title: Chemistry of Bio-molecules (02 Credits)

Max. Marks: **50** ***Duration:*** **32** *Contact hours*
End Term Exam: 40 *Marks* ***Internal Assessment****: 10 Marks*

Unit-I Carbohydrates (08 Contact hours)

Definition, classifications. Significance of right and left handedness.
Production through photosynthesis
Composition and functions of:
Monosaccharides: Glucose, Fructose and Galactose.
Disaccharides: Sucrose, lactose and Maltose. Invert Sugar.
Polysaccharides: Starch, glycogen and Cellulose.
Aerobic and Anaerobic metabolism

Unit-II Lipids (08 Contact hours)

Oils and Fats: Fatty acids and Triglycerides. Saturated and Unsaturated fatty acids (MUFA and PUFA). Rancidity of Oils & Fats. Absorption of toxic substances by fat.
Steroids: Cholesterol, transport of Cholesterol in blood stream. Cholesterol and heart diseases, Recommended values of HDL and LDL , Steroidal hormones and anabolic steroids

Unit-III Proteins and Enzymes (08 Contact hours)

Proteins: Introduction, Amino Acids: Structural features and classification.
Primary, Secondary, Tertiary and Quaternary structures of proteins and their significance.
Denaturation and Renaturation of proteins. Urea cycle.
Enzymes: Classification. Theories of mechanism of action of Enzymes ; Fisher Lock and Key Theory, Koshland's Induced Fit Theory. Mechanism of action of Chymotrypsin and Carboxypeptidase.

Unit-IV Nucleic Acids, Vitamins and Minerals (08 Contact hours)

Nucleic acids: Structural features of nucleotides, Nucleotides : DNA and RNA.
Vitamins: Classes of Vitamins and their functions. Vitamin deficiency diseases.
Minerals: Macro and Micro minerals. Their functions and diseases caused by their deficiencies.

Books Recommended

1. Organic Chemistry; 5th edn;. Vol.2,1.L. Finar (Addison Wesley Longman-2000).
2. Biochemistry, Biotechnology and Clinical Chemistry of Enzymes; Trevor Palmer (EWP). Organic Chemistry by I.L.Finar; Vol. II (ELBS Longamnn).
3. Lehninger's Principles of Bio-chemistry; D.L. Nelson; M.Cox Worth publications; 2000.
4. Introduction to Nucleic Acids and Related Natural Products; Ulbight; Oldborn Press.
5. Chemsitry of Natural Products; S.V. Bhat, B.A. Nagasampagi, M. Siva Kumar. Naroosa Publishing House; New Delhi.

Course No: CH15110OE
Title: Chemistry in Everyday Life-I (02 Credits)

Max. Marks: **50** ***Duration:*** **32** *Contact hours*
External Exam: 40 *Marks.* ***Internal Assessment****: 10 Marks*

Unit-I Household Chemicals (08 Contact hours)

Chemistry of Soaps, detergents, optical brighteners and bleaching agents, shampoos , conditioners , dyes, hair curling and permanents, deodorants and antiperspirants, perfumes, tooth pastes and sunscreen lotions.

Unit-II Water- An Amazing Chemical Stuff (08 Contact hours)

Molecular structure and its unique properties. Composition of natural water.
Hard and Soft water. Standards for drinking water. Major causes of water pollution. Contamination of water: Chemical substances affecting potability, color, turbidity, odour, taste, pH and conductivity of water. Methods of treatment of water for domestic and industrial purposes: Sedimentation, Coagulation, Filtration, Sterilization, Break point Chlorination, Flocculation & Fluorination, demineralization and reverse osmosis. Determination of alkalinity of water. Water born diseases.

Unit-III Fossil Fuels (08 Contact hours)

Coal: Formation of Coal deposits. Types & composition of coal. Fuel value of various coals. Analysis of coal: Proximate and ultimate analysis. Significance of fuel gas analysis. Carbonization of coal.

Oil & Natural Gas: Composition & chemical structures of petroleum products. Refining of petroleum, cracking & catalytic reforming. Octane & Cetane rating of fuels. Diesel engine fuel, Kerosene and Gasoline. Lead in petrol: its role, disadvantages & alternatives. LPG & CNG as fuel, addition of mercaptanes to natural gases for safety reasons.

Unit-IV Polymers and Plastics (08 Contact hours)

Characteristics and Types of Polymers.

The big six of Polymer: Low Density Polyethylene (LDPE) , High Density Polyethylene (HDPE), Polypropylene PP), Polystyrene (PS), Polyvinyl Chloride (PVC) and Polyethylene - Tetra phthalate (PET or PETE)- their chemical characteristics and uses.

Books Recommended

1. Industrial Chemistry; by B.K.Sharma; Goel publishing House.
2. Applied Chemistry; by K.Bagavathi; Sundan MJP Publishers; 4th edn; Applying Chemistry to Society; McGraw Hill; 2013.
3. Principles of Modern Chemistry; 2nd edn; Oxtoby and Nachtrieb; Saunders College Publications; 1987.
4. Chemistry Fundamentals An Environmental Prospective; 2nd edn; Buell and Girad; Jones and Barlett; 2013.
5. www.chemistryincontext; (American Chemical Society)