Course No: CH18201CR
Title: Inorganic Chemistry (04 Credits)

Max. Marks: *100* ***Duration:*** *64 Contact hours*
Continuous Assessment: *20 marks* ***End Term Exam:*** *80 Marks*

Unit-I Mechanism of Electron Transfer Reactions in Coordination Complexes:
(16 Contact hours)

Classification of Oxidation-Reduction reactions: Stoichiometric and Mechanistic.

Inner Sphere Electron Transfer Reaction Mechanism: Taube reaction. Elementary steps, Precursor and Successor complexes. Bridging Ligand Effects, Case of Multidentate Ligands, Electron transfer through extended bridges, Double bridged Intermediates.

Outer Sphere Electron Transfer Reaction Mechanism: Elementary steps, precursor and successor complexes. Chemical activation-Frank-Condon consideration. Elementary idea to Marcus Equation-Marcus Cross Equation. Orbital symmetry considerations.

Differentiation of inner sphere and outer sphere electron transfer reactions. Electron transfer reaction in metalloproteins (Elementary idea).

Unit-II Mechanisms of Ligand Substitution Reactions in Octahedral Metal Complexes:
(16 Contact hours)

Energy profile of a reaction; reactivity of metal complexes; inert and labile complexes.

Types of substitution reactions; mechanistic classification of substitution reactions:- Dissociative, Associative, Dissociative conjugate base and Interchange.

Empirical criteria to differentiate the mechanism of substitution reaction.

Substitution in octahedral complexes- Classification of metal ions based on water exchange rates. Metal-complex formation- the Eigen-Wilkins mechanism. Anation reactions.

Hydrolysis Reactions; Simple Acid hydrolysis, Acid catalysed and Base hydrolysis. Stereochemical changes in octahedral substitution reactions.

Substitution reactions without breaking of metal-ligand bond.

Unit-III Mechanism of Ligand Substitution Reactions in Square-Planar complexes:
(16 Contact hours)

Significance of the two-term rate^law, Mechanism, and Steric course of the substitution reactions.

Factors affecting the rate of substitution:- entering and leaving groups; nucleophilicity of entering group and the n_{pt} scale, central metal ion, solvent and the non-leaving groups.

The Trans effect: theories and applications in synthesis.

cis-trans isomerization in square planar complexes.

Unit-IV Organo Metallic Compounds: (16 Contact hours)

Introduction, nomenclature, classification and importance of organometallic compounds.
Nomenclature and classification of organometallic compounds.
Effective atomic number (18-Valance electron) rule and its significance.
Stability of Organometallic Compounds towards heat, oxidation and hydrolysis.
Preparation, properties, structure, bonding and applications of Alkyls and aryls of Li, B and Al.
Synthesis, Structure and bonding in Zeise's Salt.
Homogenous Catalysis using Organometallic Compounds: Catalysis, Terminology of Catalysis and Tolman Catalytic loop;
Oxidative addition, reductive elimination and migration (insertion) reactions.
Hydrogenation and Hydroformation reactions in alkenes.

Books Recommended:

1. Advanced Inorganic Chemistry, 6th ed. /5th ed. F.A. Cotton , G. Wilkinson (Wiley 1999/1988)
2. Inorganic Chemistry, 4th ed. J. E. Huheey, E. A. Keiter..... (Harper Collins, 1993)
3. Chemistry of the Elements 2nd ed. - N. N. Greenwood, A. Earnshaw (Butterworth, 1997)
4. Mechanisms of Inorganic Reactions - D. Katakis, G. Gordon (Wiley, 1987)
5. Reaction Mechanism of Inorganic and Organometallic systems, 2nd ed.- R. B. Jordan (Oxford, 1998)
6. Mechanisms of Inorganic Reactions, 2nd ed. - F. Basolo, R.G. Pearson (Wiley, 1967)
7. Inorganic Chemistry- K. F. Purcell, 1C. Kotz (Saunders, 1977).
8. Electronic Spectra of Transition Metal Complexes - D. Sutton (McGraw-Hill, 1968)
9. Elements of Magnetochemistry - R. L. Dutta, A. Syamal (Affiliated East -West, 1993).

Course No. CH18202CR
Title: Organic Chemistry (04 Credits)

Max. Marks: *100* ***Duration:*** *64 Contact hours*
Continuous Assessment: *20 marks* ***End Term Exam:*** *80 Marks*

Unit-I Aromatic Electrophilic Substitution (16 Contact hours)

Overview: Arenium ion mechanism, Sigma and pi – complexes, Energy profile diagram, Effect of leaving group. Orientation and reactivity in mono substituted benzene ring , *Ortho / Para ratio*, Ipso attack.

The Third substitution : Orientation of substitution in benzene ring with more than one substituent. Orientation in other ring systems. Carboxylation of aromatic rings with $COCl_2$ and amidation with NH_2COCl. Reversal of F.C. acylations. Synthetic application of F.C . acylation and nitration reactions (Toluene to nitro $^-$ benzoic acids, synthesis of *ortho & Para* nitro anilines)

Aromatic Nucleophilic substitution:

Discussion of different mechanism (S_N1, S_NAr, Benzyne and $S_{RN}1$). Structure reactivity relationships. Effect of leaving group and attacking nucleophile. Mechanisms of Von-Richter, Sommelet-Hauser and Smiles rearrangements and Chichibabin reaction.

Free Radical Substitution:

Free radical substitution mechanisms. Mechanisms at an aromatic substrate. Neighbouring Group Assistance in free radical reactions, Reactivity for aliphatic and aromatic substrates. Reactivity in the attacking radical. Effect of solvent on reactivity.

Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction, free radical rearrangements and Hunsdiecker reaction.

Unit-II Addition to multiple bonds. (16 Contact hours)

Addition to carbon-oxygen double bonds:

Overview of reactivity carbonyl compounds: Mechanisms of addition of water , hydrogen cyanide, alcohols , amines , organometallic reagents and hydrides to aldehydes and ketones. Mechanism of Wittig, Mannich , Aldol, Cross Aldol , Cannizarro's , Knoevenagel, Robinson annulation, Claisen, Dickman , Benzoin , Perkin and Stobbes reactions.

Addition to carbon-carbon multiple bonds:

General mechanism, reactivity, orientation and stereochemical implications of additions reactions involving electrophiles, nucleophiles and free radicals. Addition to cyclopropane ring. Hydrogenation of double/triple bonds and aromatic rings. Hydroboration, Ene-reaction, Michael reaction and Sharpless assymetric epoxidation.

Unit-III Molecular Rearrangements (16 Contact hours)

General mechanistic treatment of nucleophilic, electrophilic and free radical rearrangments. Nature of migration and migratory aptitude and memory effect. Detailed study of following rearrangements: Wagner-Meerwein, Pinacol- Pinacolone, Demyanov, Benzil-Benzilic acid, Favorskii, Arndt-Eistert, Neber, Hofmann, Curtius, Lossen, Schmidt, Beckmann, Baeyer-Villiger, Pyne and Dienone - phenol rearrangements.

Unit-IV Pericyclic reactions. (16 Contact hours)

Molecular orbital symmetry, Frontier orbitals of ethene, 1,3- butadiene, 1,3,5-hexatriene and allylic systems. HOMO, LUMO concept, FMO approach. Classification of Pericyclic reactions. Woodward Hofmann rules for the following pericyclic reactions. Cycloadditions: Thermal and Photochemical 2+2 and 4+2 cycloadditions. Suprafacial and antrafacial cycloadditions.

Electrocylic Reactions: Thermal and Photo-induced Electrocyclic reactions of 4n and 4n + 2 systems and their stereochemistry. Conrotatory and disrotatory motions.

Sigmatropic rearrangements: Classification, [1,3], [1,5] and [3,3] sigmatropic shifts. Cope and Claisen rearrangements. Suprafacial and antrafacial shifts of hydrogen atom.

Books Recommended

1. Advanced Organic Chemistry Reactions, Mechanism and Structure, 4th Ed.,Jerry March. (Wiley, 1999).
2. Advanced Organic Chemistry 4th Ed. - F. A. Carey and R. J. Sundberg. (Plenum, 2001).
3. A Guide Book to Mechanism in Organic Chemistry 6th Ed.- Peter Sykes. (Longman, 1996).
4. Structure and Mechanism in Organic Chemistry 2nd Ed. - C. K. Ingold. (CBS, 1994).
5. Modern Organic Reactions 2nd Ed. - H.O. House (Benjamin, 1972)
6. Principles of Organic Synthesis 2nd Ed. - R.O.C. Norman (Chapmann Hall, 1978)
7. Reaction Mechanism in Organic Chemistry 3rd Ed. - S.M. Mykherjee and S.P. Singh. Macmillan, 1998).
8. Organic Chemistry - J. Hornback,pk. (Brooks/Cole, 1998).
9. Fundamentals of Organic Cbemjstry , 5th ed.- Solomons. (Wiley, 1992).
10. Organic Chemistry, 5th Ed.- John McMurry. (Brooks/Cole, 2000).

Course No: CH18203CR
Title: Physical Chemistry (04 Credits)

Max. Marks: *100* ***Duration:*** *64 Contact hours*
Continuous Assessment: *20 marks* ***End Term Exam:*** *80 Marks*

Unit-I Quantum Chemistry (16 Contact hours)

General theory of angular momentum. Eigen functions and Eigen values of angular momentum operators. Ladder operators. Spin angular momentum, antisymmetry and Pauli's principle. Atomic term symbols, term separation of p^n and d^n configurations, spin-orbit coupling, Zeeman splitting.

Approximation methods: The Variation theorem, linear variation principle, application to hydrogen atom and helium atom. Perturbation theory: first order (non-degenerate & degenerate). Application of perturbation method to helium atom and anharmonic oscillator. Chemical Bonding: LCAO-MO approximation, H_2^+ molecular ion, brief introduction to H_2. Molecular term symbols. Valence bond treatment of hydrogen molecule, comparison of MO and VB methods in the light of hydrogen molecule.

Unit-II Equilibrium Thermodynamics (16 Contact hours)

Maxwell Relations and thermodynamic equations of state.

Thermodynamics of multicompoennet systems: Partial Molar properties, Partial molar free energy: concept Chemical Potential, Chemical potential variation with Temperature and Pressure, Determination of chemical potential, Applications of chemical potential (Henry's law, Raoult's law and Nernst distribution law), Chemical potential and Gibbs-Duhem equation, Gibbs-Duhem-Margules equation and its application (Konovalov's First and second laws).

Phase Equilibria: Phase equilibria of three component systems: $CHCl_3$-CH_3COOH-H_2O, NH_4Cl- $(NH_4)_2SO_4$-H_2O and Pb-Bi-Sn systems. First and second order phase transitions.

Unit-III Thermodynamics and transport properties of electrolytic solutions (16 Contact hours)

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-efficient. 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.

Conductance of electrolyte solutions: Mobility of ions, mobility and conductivity, Einstein relations, dependence of molar conductance on concentration, estimation of K and Λ^0 for weak electrolytes, Theories of Conductance: Debye-Huckel-Onsager conductance equation and brief idea of its extension.

Unit-IV Statistical Thermodynamics (16 Contact hours)

Concept of distribution, thermodynamic probability and most probable distribution. Sterling approximation.

Distribution Laws: Derivation of Boltzmann distribution law, Bose-Einstein and Fermi-Dirac laws (without derivation) and their comparison with Boltzmann distribution law.

Partition function & its significance. Translational, rotational, vibrational and electronic partition functions. Calculation of thermodynamic properties in terms of partition functions, application to ideal monoatomic & diatomic gases. Equilibrium constant in terms of partition functions with application to isomerization and atomization reactions.

Books Recommended:

1. Physical Chemistry –P. W. Atkins, 9th Edition, ELBS , Oxford, 2009.
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, 7th Edition, Pearson, 2009.
5. Quantum Chemistry, R. K. Prasad, 2nd Edition, New Age Publishers, 2001.
6. Modern Thermodynamics: From Heat engines to dissipative structures- Dilip Kondepudi, Ilya Prigogine.John Wiley and sons, reprinted, 2007.
7. Thermodynamics: Classical, Statistical and irreversible. Rajaram and Kuriocose, Dorling Kindersley Pvt Ltd, 2013.
8. A text book of Physical Chemistry, Thermodynamics and Chemical equilibrium; K.L. Kapoor, MacGraw Hill Education, vol. 2, Ed. 6th, 2019.
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, 2nd Edition, J. O`M. Bokris and A. K. Reddy, Kluwer Academic/Plenum Publishers, New York.
12. Statistical Thermodynamics, M.C.Gupta, New Age International, 1993.
13. Statistical Mechanics, Agarwal, Eisner, Wiley, 1991.

Course No: CH18204CR
Title: Green Chemistry (02 Credits)

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

Unit-I Green Chemistry-Theory (16 Contact hours)

Introduction: Need for Green Chemistry and the role of chemists. Principles of Green Chemistry. Tools of Green Chemistry: Selection of starting materials, Catalysts, Alternative Solvents, Appropriate reagents, Percentage atom utilization. Microwaves ,Sonication and Visible light. Green Solvents and Reaction conditions: Supercritical fluids, Aqueous reaction conditions, Immobilized Solvents and irradiative reaction conditions.Examples of Green materials, reagents and some specific reactions.

Unit-II Green Reactions (16 Contact hours)

Introduction

Acyloin Condensation with Mechanism, Acyloin Condensation using Co-enzyme- Thiamine.

Aldol condensation with Mechanism using green reagents -Ionic liquids, Super Critical Water and solid phase.

Baeyer-Villiger Oxidation in an aqueous medium, solid phase and enzyme catalyzed.

Baylis-Hillman Reaction using microwave technique, Supercritical carbon dioxide and polyethylene glycol.

Benzoin Condensation under green conditions.

Dakin Reaction with mechanism using Ultrasonic Irradiation.

Darzen Reaction with mechanism in presence of Phase Transfer Catalyst (PTC).

Green reactions involving synthesis of heterocyclic compounds (Benzofuran, Imidazopyridine, Benzothiazole -2 (3H)-one, Isocoumarins and Monobenzoylation reaction.

Books recommended

1. Green Chemistry- Environment Friendly Alternatives; Rashmi Sanghi & M. M Srivastava; Narosa; 2007.
2. Green Chemistry- An Introductory Text; IInd Edn.; Mike Lancaster; RSC; 2010.
3. Green Chemistry- Theory and Practice; P. T. Anastas and J. C. Warner; oxford; 2000.
4. Green Chemistry –Environmentally Benign Reactions; V.K.Ahluwalia, 2nd Edition, 2012
5. Green Chemistry, Rashmi Sanghi and M M Srivastava; 2003 1st Edition
6. Research papers 2012 to 2018, (Journals recommended, *Green Chemistry*, *Asia's Sustainable Chemistry, JOC, OL, Tetrahedron Letters, Catalysis Communications, JSCS, RSC Advances, NJC, Chemistry select, Molecular catalysis A chemical, Catalysis Letters.*

Course No: CH18205DCE
Title: Laboratory Course in Organic Chemistry (04 Credits)

Max. Marks: *100* ***Duration:*** *128 Contact hours*
Continuous Assessment: *20 marks* ***End Term Exam:*** *80 Marks*

1. Qualitative Analyses of Organic Compounds

(i) **Physical Properties:** Physical state, colour, odour, solubility behavior and melting / boiling points.

(ii) **Chemical Properties**

(a) **Flame test**

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

(c) **Detection of Functional Groups:** Detection of Carbohydrates, Unsaturation, Carboxylic acids, Carbonyl compounds, Phenols, Alcohols, Halides, Amines, Amides, Imides, Ureas, Thioureas, Nitrocompounds and Hydrocarbons.

(iii) **Preparation and recrystallization of the derivatives of above mentioned group of compounds.**

2. Separation, Purification and identification of Organic compounds from a three component mixture:

(a) **Separation based on solubility in water and organic solvents.**

(b) **Separation based on Chemical properties:** Solubility in Sodium bicarbonate, Sodium Hydroxide and Hydrochloric acid.

(c) **Identification of individual components using physico-chemical properties**

3. Detection of functional groups using IR spectroscopy (spectra to be provided)

4. Quantitative Estimation of the following compounds

(a) Glucose.

(b) Glycine

(c) Acetone

(d) Phenol.

(e) Ascorbic acid.

5. Organic Preparations

(a) Acetylation of Cholesterol or salicylic acid.

(b) Oxidation of Cyclohexanol by chromic acid to get adipic acid.

(c) Aldol condensation: Dibenzal acetone and benzaldehyde.

(d) Cannizarro's reaction of 4-Chlorobenzaldelyde.

(e) Aromatic electrophillic substitutions in benzene, benzoic acid or aniline.

(f) Beckman rearrangement starting from acetophenone.

(g) Haloform reaction: Preparation of Iodoform.

Books Recommended:

1. Experiments and Techniques in Organic Chemistry - D. Pasto, C. Johnson and M. Miller (Prentice-hall, 1992.)
2. Microscale and Macroscale Organic Experiments- K.L. Williamson (D.C. Heath and Co., 1989).
3. Advanced Practical Organic Chemistry, 2nd ed. - N.K. Vishnoi (Vikas, 1999).
4. Vogel's Textbook of Practical Organic Chemistry, 5th ed.- A.R. Tatchell (ELBS, • 1996)
5. Comprehensicve Practical Organic Chemistry, V. K. Ahluwalia and Renu Aggarwal, (University Press-2000)

Course No: CH18206DCE
Title: NMR and ESR Spectroscopy (02 Credits)

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

Unit-I NMR Spectroscopy (16 Contact hours)

Basic principles, Nuclear spin, spin angular momentum, quantization of angular momentum. Nuclear magnetic moment, precessional (Larmor) frequency, energy levels in a magnetic field, resonance absorption of radio frequency radiation. Population of energy levels, Relaxation processes (T1, T2). Shielding and deshielding of magnetic nuclei. Chemical shift, its measurement and factors influencing chemical shifts; local paramagnetic and diamagnetic shielding, neighboring group anisotropy and ring currents in aromatic systems

Spin- Spin coupling, coupling constants. Examples.

Vicinal coupling and electron correlation. Chemical equivalence and magnetic equivalence. Fermi contact and Dirac Vector Model. Effect of Chemical exchange on spectra.

Double resonance techniques; spin decoupling, nuclear overhauser enhancement.

Instrumentation; FT-NMR and its advantages. NMR studies of nuclei other than proton – ^{13}C, ^{19}F and ^{31}P.

Unit-II ESR spectroscopy (16 Contact hours)

Basic principles- electron spin, magnetic moment of an electron and its interaction with applied magnetic field. Splitting of spin energy states and absorption of microwave radiation.

Hyperfine coupling, Isotropic and anisotropic hyperfine coupling constants, Examples

Fermi contact, Spin polarization effects, Dipolar coupling, Mc Conell equation and calculation of spin densities in inorganic radicals such as $CO_2^{-\bullet}$, $CH_3^{\bullet}$, $BH_3^{-\bullet}$ and $F_2^{-\bullet}$.

Spin orbit coupling and significance of g tensors.

Zero field splitting and Kramer's degeneracy (fine structure),

Advance Applications

Books Recommended

1. Introduction to Electron Spin Resonance; H. M. Assenheim; Springer, 2014.
2. Introduction to Magnetic Resonance Spectroscopy ESR, NMR, NQR; 2nd edn.; D.N. Sathyanarayana; I K International Publishing House, 2013.
3. Understanding NMR Spectroscopy; 2nd edn.; J. Keeler; Wiley-Blackwell; 2010.
4. Introduction to Spectroscopy; 4th edn.; D. L. Pavia, G. M. Lampman, G. S. Kriz, J. Vyvyan; Cengage Learning, 2008.
5. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry; R. V. Parish; Ellis Horwood; 1990.
6. Nuclear Magnetic Resonance; P. J. Hore; Oxford; 1995.
7. Nuclear Magnetic Resonance Spectroscopy; A physicochemical View; R. K. Harris; Pitman Publishing1983,
8. Principles of Instrumental Analysis; 4th edn.; D. A. Skoog, J. J. Leary; Saunders; 1992.
9. Physical Methods for Chemists; 2nd edn.; R. S. Drago; Saunders; 1992.
10. Basic Principles of Spectroscopy; R. Chang; McGraw Hill; 1971.
11. Introduction to Magnetic Resonance; A Carrington, A. D. McLachlan; Harper & Row; 1967.
12. NMR and Chemistry; 2nd edn.; J. W. Akitt; Chapman and Hall; 1983.

Course No: CH18207DCE
Title: Solid State Chemistry (02 Credits)

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

Unit-I Structure and Theories of Solids (16 Contact hours)

Structure of solids: Miller indices; Bragg equation, Debye-Scherrer method of X-ray structural analysis of crystals, identification of cubic unit cells from systematic absences in diffraction pattern. *S*tructure factor and its relation to intensity and electron density.

Crystal defects and their types. Point defects: Schottky and Frenkel defects, Thermodynamics of Schottky and Frenkel defect formation, Colour centres, Dislocations and their types.

Theories of solids:

***Free electron theory of metals*:** The Drude Model, Lorentz modification, Sommerfield Model; Fermi-Dirac distribution function, Density of states, electronic heat capacity, Hall effect.

***Electron Energy Bands*:** Energy bands in general periodic potential-Kronig-Penney model. Qualitative band schemes for insulators, semiconductors and metals.

Unit-II Electric and magnetic properties of Solids (16 Contact hours)

***Semiconductors*:** Intrinsic & extrinsic semiconductor (n-type & p-type), temperature dependence of charge carriers, p-n junction- devices based on p-n junction (tunnel diode, injection laser).

Super conductors: Characteristic properties- Zero resistance, Meissner effect, Heat capacity, Thermal conductivity, absorption of em radiations and Josephson effect. BCS theory of superconductivity, applications of superconductors.

***Dielectric Properties of Solids*:** Dielectric constant, Polarization and Polarizability, Piezoelectricity, pyroelectricity and ferroelectricity, ferroelectric materials and their applications.

***Magnetic properties of solids*:** origin of magnetism in solids, Diamagnetism, paramagnetism (Langevin's and quantum mechanical formulations), ferromagnetism (Wiess theory), antiferromagnetism and ferrimagnetism. Temperature dependence of magnetization.

Books Recommended

1. Physical Chemistry; P. W. Atkins; Julio De Paula, Ed. 10th, Oxford University Press;2014.
2. Physical Chemistry- A Molecular Approach - D. A. McQuarie& J. D. Simon, University Science Books, 1997.
3. Introduction to Solids, Azaroff, Tata McGraw,1993.
4. SolidState Chemistry and its Applications, West, Wiley, 2014.
5. The Physical Chemistry of Solids, Borg, Biens, Academic press, 1992.
6. Solid State Reactions, Schmalzried, Academic press, 1995.
7. Solid State Physics, N.W.Ashcroft and N.D.Mermin, Saunders college, 2001.
8. Elements of Solid state Physics, J.P. Srivastava, Prentice Hall of India, 2003.

Course No: CH18002GE
Title: Metal Ions in Living Systems (02 Credits)

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

Unit-I Alkali and Alkaline Earth Metal-ions in Biosystems: (16 Contact hours)

Biomolecules and their Metal Coordination behavior.

Evidence of the presence of metal ions in biological systems (Direct / Indirect). Classification of metals and non-metals according to their action in biological systems.

Essential Elements: Concept of essentiality, criteria and classification of essential elements as per their role in living systems.

Alkali Metals: Role of Sodium and Potassium, mechanism of transport across the cell membrane. Role of Lithium in mental health.

Alkaline Earth Metals: Role of Calcium in muscle contraction and blood clotting. Role of Magnesium in chlorophyll.

Unit-II Biological Activity of Essential Trace Elements and Metallotherapy
(16 Contact hours)

Iron: Storage and transport through Ferritin and Transferrin.

Hemoglobin and Myoglobin: Structure, iron binding sites and role of iron in oxygen transport.

Copper in Biochemical systems: Electron transfer, oxidation and oxygenation of substrates. Dioxygen transport (Haemocyanin).

Zinc in Biosystems: Lewis acid catalyst, Enzyme activator in vitamin B_{12}.

Biochemical basis of essential metal deficient diseases and their therapies (Iron, Zinc, Copper and Manganese).

Metal complex as anticancer drugs: Platinum, Rhodium and Gold complexes.

Antibacterial, Antiviral and Antifungal activities of metal complexes: Labile and robust metal complexes; probable mechanism of action.

Books Recommended

1. Bioinorganic Chemistry-A Survey; Ei- Ichiro Ochiai; Academic Press; 2008.
2. Bio inorganic Chemistry- An introduction; Ochiai; Allyn and Bacon; 1977.
3. Inorganic Biochemistry; Vol. 1&2; Eichhorn; Elsevier, 1973.
4. Inorganic Aspects of Biological and Organic Chemistry; Hanzilik; Academic Pub.; 1976.
5. The Inorganic Chemistry of Biological processes; 2nd edn. ; Hughes ; Wiley; 1973.
6. A Text book of Medicinal aspects of Bio inorganic Chemistry; Das; CBS; 1990.
7. The Biological Chemistry of Elements; Frausto de Silva; Williams; Clarenden; 1991.
8. Principles of Bio inorganic Chemistry; Lippard, Berg; Univ. Science Books; 1994.

Course No: CH18002OE
Title: Chemistry of Bio-molecules (02 Credits)

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

Unit-I **(16 Contact hours)**

(a) Carbohydrates

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

(b) Lipids

Steroids: Cholesterol, transport of Cholesterol in blood stream. Cholesterol and heart diseases, Recommended values of HDL and LDL , Steroidal hormones and anabolic steroids

Unit-II **(16 Contact hours)**

(a) Proteins and Enzymes

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.

(b) Nucleic Acids, Vitamins and Minerals

Nucleic acids: Structural features of nucleotides, Nucleotides : DNA and RNA.
Vitamins: Classes of Vitamins and their functions. Vitamin deficiency diseases.

Books Recommended

1. Organic Chemistry; 5^{th} 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.