SEMESTER- III				
Part III Core V Physical Chemistry- I				
Code :15UCHC31Hrs./Week:4Hrs/ Sem 60Credits:4				

- To have an overall knowledge about different states of matter
- To understand the importance of colloids and application.
- To correlate the colligative properties with the molecular weight
- To understand the phase rule and distribution law.

## UNIT I GASEOUS STATE

Kinetic theory of gases-justification of postulates-statement of Charle's law, Boyle's law, Avogadro's law, ideal gas equation-Dalton's law of partial pressure- Maxwell's law of distribution of velocities (derivation)–Types of molecular velocities-root mean square velocity-average velocity- most probable velocity-relation between them-–graphical representation and its significance. Collision diameter – collision number – collision frequency – mean free path – viscosity of gases-calculation of mean free path and collision diameter from Chapman equation-Law of equipartition energy -degrees of freedom –molecular basis of heat capacities.

## UNIT II SOLID STATE

Crystalline and amorphous solids. Concept of space lattice and unit cell-the seven crystal systems and Bravais lattices.Cube-simple cubic-face centered cubic –body centered cubic lattices-types of packing – hexagonal close packing-cubic close packing – types of voids – tetrahedral and octahedral site. Determination of structure of crystals by rotating crystal method and powder method. Internal structural analysis of NaCl and KCl. Lattice energy of ionic crystal - Born-Haber cycle -calculation of lattice energy. Crystal defects-Frenkel, Schottky –. Crystal growth – from Melt (Czochralski method ) from solution (Hydro-thermal method) and gel method.

## **UNIT III COLLOIDS**

Classification of Colloids –comparison of lyophilic and lyophobic colloids.Preparation of sols-Dispersion method(Bredig's Arc method ) –Aggregation method(oxidation , reduction,

double decomposition)-Properties – Optical(Tyndall effect) – kinetic(Brownian movement) Electrical (electrical double layer) – Coagulation of colloids – Hardy Schulze law- Hoff meister series – protective colloids – gold number – Gels – classification, preparation , properties(imbibition,synerisis and thixotropy). Emulsion – types and their distinction. Emulsifiers – surfactants. Donnan membrane equilibrium – applications of colloids-food, medicine, thixotropic paints, clarification of municipal water, formation of delta.

## UNIT IV COLLIGATIVE PROPERTIES

Colligative Properties -definition- lowering of vapour pressure- its determination (Ostwald and Walker's Dynamic method). Raoult's Law – statement and derivation - elevation of boiling point and its determination.( Landsberger's method). Depression of freezing point and its determination. (Beckmann's method). Osmotic pressure and its determination (Berkely and Hartley's method). Osmotic pressure and vapour pressure lowering- laws of osmotic pressure. Isotonic solutions.Relation between colligative properties and molar mass of the solute – Van't Hoff factor –determination of degree of dissociation and degree of association-simple problems.

## **UNIT V PHASE RULE**

Mathematical statement – definition of terms used – thermodynamic derivation – application of phase rule to one component system – water, CO<sub>2</sub>, sulphur – two component systems – condensed system and reduced phase rule – simple eutectic – Ag-Pb system – Pattinson's process of desilverisation of lead. Freezing mixture -definition– principle of formation of freezing mixture using KI-H<sub>2</sub>O system.

Systems forming compounds with congruent (Zn - Mg) and incongruent melting points (sodium sulphate – water).

 $Solid - Vapour \ equilibria - CuSO_4.H_2O \ system - explanation \ of \ deliquescence$  and efflorescence on the basis of vapour pressure.

- 1. B.R.Puri. L.R. Sharma, Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2008.
- Arun Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, S. Chand & Company Ltd., New Delhi, 2008.

- 3. Sadhan Kr.Dutta Principles of Physical pharmacy and Biophysical Chemistry , Books and Allied(P) Ltd.Kolkata , 2007 .
- 4. Text book of Physical chemistry (A modern approach) incorporating SI units, P.L. Soni, O.P. Dharmaha, Sultan chand & sons publishers, Revised edition, 2010.

SEMESTER IV				
Part III	Core	Organic Chemistry II		
Code :15UCHC41	Hrs./Week:4	Hrs/ Sem :60	Credits:4	

- To acquire knowledge about the conformational analysis
- To study the mechanism and importance of molecular rearrangement.
- To appreciate the structure and reactions of carbohydrates
- To know the importance of organometallic compounds in synthesis
- To know the applications of dyes .

## UNIT I ALICYCLIC COMPOUNDS AND CONFORMATIONAL ANALYSIS

General methods of preparation– spectroscopic properties- general chemical characteristics-relative stability of cycloalkanes – Baeyer's strain theory – Sachse Mohr theory - coulson and moffit's concept– Conformational analysis –cyclohexane-monosubstituted cyclohexanes- synthesis of civetone and muscone

## UNIT II TAUTOMERISM AND MOLECULAR REARRANGEMENT

Resonance – definition – resonance energy – resonance theory.

Tautomerism – Definition – Types of tautomerism – Keto - enol, Nitro - acinitro, Lactam - lactim, p-Nitrosophenol - Quinone monoxime and amido - imido tautomerism.

Molecular Rearrangement – Mechanism of the following rearrangements Pinacol pinacolone rearrangement, Lossen rearrangement, Curtius rearrangement, Fries rearrangement, Benzidine rearrangement and Benzil - benzilic acid rearrangement.

## UNIT III CARBOHYDRATES

Introduction and classification – laboratory and industrial preparation of glucose and fructose – reactions of glucose and fructose – structure of glucose and fructose – open chain and ring structure – epimerisation – mutarotation – interconversion of glucose and fructose and vice versa – ascending and descending the series – (Kiliyani & Wohl's synthesis). Manufacture of sucrose – Structure of maltose, lactose and sucrose (elucidation not included) – Starch and cellulose – reactions –uses – differences between starch and cellulose.

# UNIT IV ORGANOMETALLIC COMPOUNDS AND REAGENTS OF SYNTHETIC IMPORTANCE

Organometallic Compounds – definition – examples. Organomagnesium compound (Grignard reagents) – preparation, general characteristics and synthetic applications – organo zinc compounds (diethyl zinc–Frankland reagent) – general characteristics and synthetic applications. Organo lead compounds (tetraethyl lead) -preparation and synthetic applications.

Synthetic applications of the following reagents in organic synthesis – Aluminium isopropoxide, N-Bromo succinimide (NBS), Lithium Aluminium hydride, Periodic acid, Sodamide and Selenium dioxide.

## UNIT V REACTIVE METHYLENE COMPOUNDS AND DYES

**Reactive methylene compounds** – preparation, synthetic applications and structure of acetoacetic ester and malonic ester.

**Dyes** – Theories of colour and constitution- Witt's chromophore –auxochrome theory, resonance theory and valence bond theory – requirements of a dye – classification of dyes based on chemical structure and based on method of application. Preparation and uses of nito dye- picric acid -azo dyes- Bismarck brown - triphenyl methane dye – malachite green- xanthenes dye- fluorescein -indigoid dyes – indigo-anthroquinone dye-alizarin

- Arun Bahl and B.S.Bahl, Advanced Organic chemistry, S.Chand and Company Ltd., Reprint 2005.
- K.S.Tewari,N.K.Vishnoi,S.N.Mehrotra. A Text Book of Organic Chemistry, 2<sup>nd</sup> Revised Editions, 1998.
- 3. C. D. George P.M.Thomas and C. D.Joseph, Physical and theoretical chemistry.
- N.Tewari, Advance Organic Reaction mechanism Books and allied (P) Ltd. Kolkata 700010 India Second revised edition 2005
- 5. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, Vishal Publishing Company, 2008.

SEMESTER V				
Part IIICore VIIOrganic Chemistry III				
Code :15UCHC51	Hrs/Week : 5	Hrs/ Sem : 75	Credits : 5	

- To know the concept of chirality and stereoisomerism..
- To understand aromatic substitution.
- To study specific name reactions.
- To have an idea on green chemistry.

## UNIT I STEREOISOMERISM

Stereoisomerism-Optical activity of compound with one and two chiral centres – Elements of symmetry – plane of symmetry, axis of symmetry and centre of symmetry. Enantiomers and diastereo isomers (d,l and meso forms) with examples- asymmetric and dissymmetric molecules. Cahn Ingold Prelog coversion DL and RS configuration- notations for compounds containing one and two asymmetric C-atoms- racemisation and methods of resolution of racemic mixture- Walden inversion – Stereochemistry of diphenyl compounds, allenes and spiranes with examples — Geometrical isomerism (Maleic and Fumaric acid)– definition – cis – trans and syn – anti concept E-Z notation. determination of configurationmethod of cyclisation- conversion of a compound into known configuration.

#### UNIT II AROMATICITY AND AROMATIC SUBSTITUTION:

The concept of aromaticity- Aromatic, antiaromatic and non-aromatic compounds- Huckel's rule for aromaticity – mechanism of electrophilic aromatic monosubstitution (nitration, halogenations, sulphonation, Friedel Craft's alkylation, acylation) – disubstituion. Orientation – Korner's absolute method of orientation – directive influence of substitution: o- , p- and m-directing – activating and deactivating influence of substituents – electronic interpretation – nucleophilic substitution – unimolecular and bimolecular reactions – elimination – addition mechanism (Benzyne mechanism)

#### **UNIT-III HYDROXY AND NITROGEN COMPOUNDS**

**Hydroxy compounds-** Acidic characters of phenol – effect of substituents on acidity of phenols – mechanism of Kolbe's reaction, Gattermann reaction, Riemer Tiemann reaction, Houben Hoesch reaction. Oxidation and reductions of phenols.

**Nitro compounds** – preparation of o-, and p-dinitrobenzene, trinitrobenzene (TNB), mnitrotoluene, trinitrotoluene (TNT) amines – effect of substituents (-NH<sub>2</sub>, -CH<sub>3</sub>,- NO<sub>2</sub>,-SO<sub>3</sub>H, -COOH and -X,) on the basicity of aromatic amines. Preparation and properties of o-, p- and mphenylene diamines. Diphenyl amines and triphenyl amines. Diazonium compounds – preparation of benzene diazonium chloride and its synthetic applications.

## UNIT IV AROMATIC CARBONYL COMPOUNDS AND CARBOXYLIC ACIDS

Carbonyl compounds-Mechanism of the following reactions- Claissen condensation – Reformatsky reaction – Benzoin condensation – Perkin reaction – Knoevenagel condensation – Wittig reaction – Willgerodt reaction – haloform reaction. Carboxylic Acid –Preparation of salicyclic acid, Phthalic acid, terephthalic acid, cinnamic and anthranilic acids.

#### **UNIT V GREEN CHEMISTRY**

Introduction – need for green chemistry – twelve principles of green chemistry – green chemistry in day-to-day life – dry cleaning, versatile bleaching agent – atom economy – green solvents – supercritical fluid CO<sub>2</sub>, ionic liquids and water

Microwave assisted organic synthesis – introduction – microwave assisted reactions in water – Hofmann elimination and hydrolysis of benzyl chloride – microwave assisted reactions in organic solvents – esterification and Fries rearrangement – microwave assisted reactions in solid state – deacylation, oxidation of alcohols using clayfen.

- 1. Bhupinder Mehta, Manju Mehta, Organic chemistry, PHI Learning pvt. Ltd., 2005.
- Arun Bahl and B. S. Bahl Advanced Organic chemistry, S. Chand and Company Ltd., Reprint 2005.

- K.S. Tewari, N.K. Vishnoi, S.N. Mehrotra. A Text Book of Organic Chemistry, 2<sup>nd</sup> Revised Editions, 1998
- Rashmi Sanghi, Green Chemistry Environmental Friendly Alternatives Editors M.M.Srivatsava Narosa Publishing House, Reprint 2008.
- V. Kumar, An introduction to green chemistry, Vishal Publishing Company, Jabudhar Delhi Edition, May 2007.
- 6. I.L.Finar Organic chemistry, The Fundamental Principles, Volume I, 6<sup>th</sup> edition, 1973.
- N.Tewari Advance Organic Reaction mechanism Books and allied (P) Ltd. Kolkata 700010 India Second revised edition 2005.
- M.K.Jain and S.C.Sharma Modern organic chemistry, Vishal publishing co.,2012 4<sup>th</sup> edition

SEMESTER V				
Part IIICore VIIIPhysical Chemistry II			y II	
Code :15UCHC52	Hrs/Week : 5	Hrs/ Sem : 75	Credits : 5	

- To study the various thermodynamic parameters and its applications in different physical states of the systems.
- To understand the kinetics of the reaction and to determine the reaction mechanism.
- To know the concepts of photochemical reactions.
- To understand the importance of nanochemistry

# UNIT I THERMODYNAMICS I

Terminology – thermodynamic equilibrium – types of thermodynamics system – thermodynamic processes – (Isothermal, adiabatic, isobaric, isochoric) – definition and example – sign conventions – first law of thermodynamics – enthalpy of a system – relation between  $\Delta H$  and  $\Delta E$  – molar heat capacities – definition – molar heat capacity at constant volume – molar heat capacity at constant pressure – relation between  $C_p$  and  $C_v$ . Joule Thomson effect – Joule Thomson coefficient – inversion temperature.

# UNIT II THERMODYNAMICS II

Limitations of first law of thermodynamics – second law of thermodynamics – different statements – concept of entropy – entropy changes in isothermal expansion of an ideal gas – entropy changes in reversible and irreversible processes – work function and free energy function – variation of free energy with temperature and pressure – Gibbs Helmholtz equation– derivation and significance – partial molar properties – chemical potential – Gibb's Duhem equation – derivation and significance.

## UNIT III THERMODYNAMICS III

Claussius-Claypeyron equation – application in ice skating – derivation (integral and differential forms) and significances – derivation of Van't Hoff isotherm and isochore. Concept of fugacity– fugacity of a gas in a gaseous mixture –physical significance of fugacity. Nernst heat theorem – third law of thermodynamics – statement – determination of absolute entropy of solids, liquids and gases – experimental verification of the third law of thermodynamics –

entropy change in chemical reactions – derivation of the Boltzmann entropy equation – residual entropy – zeroth law

#### UNIT IV CHEMICAL KINETICS

Reaction rate – measurement (graphical method)-units of rates – order and molecularity of a reaction. Differential and integrated forms of rate expressions for first, second and zero order reactions (derivation required) – examples. Time for half change for first and second order reactions. Pseudo unimolecular reactions – experimental determination of rate constant of inversion of cane sugar and alkaline hydrolysis of ester. Determination of order of the reactions ( integrated rate equation method, differential method, dilution method- graphical method, Van't Hoff dilution method and half life method).

Temperature dependence of reaction rate – Arrhenius equation – activation energy – and its significance – collision theory and derivation of rate constant of a bimolecular reaction– limitations of collision theory – Lindemann's theory of unimolecular reactions – absolute reaction rate theory – comparison of collision theory and absolute reaction rate theory

#### UNIT V NANOCHEMISTRY

Nano particles – definition – size relationship – nanoparticles of metals, semiconductors and oxides – synthesis of nano sized compounds(Bottom up and Top down Approach) – reduction methods, sol-gel method and chemical vapour deposition method – nanoclusters – nanorod – nano wire and uses. Carbon nanotubes – single walled nanotube- multiwalled nanotube – nano horns – Fullerite – torus – properties – (strength, kinetic and electrical) – inorganic nanotube (boron nitride) – and its uses. Application of nanochemistry in various fields.

- 1. Keith J. Laidler, Chemical Kinetics, 3<sup>rd</sup> edition, Harper International Ltd., New Delhi
- 2. B.S. Bahl, Arun Bahl & G.D. Tuli, Essential of Physical Chemistry, S.Chand & company
- Samuel Glasstone, Thermodynamics for chemists, Affiliated East-West Press (P)Ltd, New Delhi.
- 4. Rajaram and Kuriacose, Thermodynamics for students of chemistry.
- Patrick Solomon, A Hand Book of Nanochemistry, Dominant publishers and distributor New Delhi, 1<sup>st</sup> Edition, 2008.

SEMESTER VI				
Part III	Core IX Inorganic Chemistry II			
Code :15UCHC61	Hrs/Week: 6	Hrs/ Sem : 90	Credits : 5	

• To provide knowledge about zero, s, p, d and f block elements

# UNIT I ZERO GROUP ELEMENTS

Position of zero group in the periodic table – Ramsay- Rayleigh's method – Fisher-Ringe's method – separation of noble gases from liquid air –compounds of xenon – preparation, properties and structure (valence bond approach) of XeF<sub>2</sub>, XeF<sub>4</sub>, XeF<sub>6</sub>, XeO<sub>2</sub>F<sub>2</sub>, XeO<sub>3</sub>, XeO<sub>4</sub>, XeOF<sub>4</sub>, clathrates- type of clathrates –preparation, stability and structure of clathrates. Wrap around complexes (supra molecules).

#### **UNIT II** s and p- BLOCK ELEMENTS

General characteristics of alkali and alkalaine group elements – diagonal relationship of lithium with magnesium — extraction of lithium and beryllium. Sodium carbonate and sodium bicarbonate – manufacture – properties and uses – Preparation and uses of basic beryllium acetate, epsum salt, gypsum, plaster of Paris and lithopone.

Boron – preparation, structures and uses of diborane. Halogens – manufacture of fluorine – preparation and structure of interhalogen compounds.

## UNIT III d- BLOCK ELEMENTS I

General characteristics of d-block elements – comparative study of Ti,Zr,Hfextraction,properties and uses of titanium-preparation and uses of titaniumdioxide and titanium tetrachloride. Comparative study of V, Nb, Ta – extraction, properties and uses of vanadium – polyvalency of vanadium. Comparative study of Cr, Mo, W – polyvalency of chromiumextraction, properties and uses of molybdynum and tungsten.

# UNIT IV d- BLOCK ELEMENTS II

Group discussion of Fe, Co, Ni.(similarities and dissimilarities )

Iron - Preparation and uses of Ferric chloride, Potassium ferro and ferricyanidesCobalt - Extraction, properties and uses – Preparation and uses of sodium cobaltinitrite

**Platinum** - Extraction, properties and uses. Platinum sponge, platinum black, platinized asbestos and colloidal platinum, potassium chloroplatinate.

Group discussion of Zn, Cd, Hg .(similarities and gradation in properties of the elements and compounds)

Group discussion of of Cu, Ag, Au .(similarities and gradation in properties of the elements and compounds)

## **.UNIT V f- BLOCK ELEMENTS**

General characteristics of lanthanides – separation of lanthanides – precipitation – thermal reaction – fractional crystallization – complex formation – solvent extraction – valency change method – ion exchange method. Extraction of a mixture of lanthanides from monazite sand – applications of lanthanides and their compounds – lanthanide contraction – causes and consequences. General characteristics of actinides – comparison between lanthanides and actinides- extraction of Th and U. Preparation and uses of UF<sub>6</sub> and uranyl acetate.

- 1. B.R.Puri,L.R.Sharma,K.C.Kalia,Principlesof InorganicChemistry,Milestone publishers and distributers, Delhi.
- 2. R.D.Madan Modern Inorganic Chemistry, S.Chand & Co. Ltd.
- 3. Gurdeep Raja, Advanced inorganic Chemistry, Goel Publishing house1986.
- 4. Sathya Prakash and R.D. Madan, Advance Inorganic Chemistry 2005, Chand and Co.

SEMESTER VI				
Part III	Core	Organic Chemistry IV		
Code :15UCHC62	Hrs/Week : 6	Hrs/ Sem : 90	Credits : 5	

- To understand the important applications of photochemistry in organic compounds
- To know the importance of heterocyclic compounds, alkaloids and terpenes.
- To know and study the spectral applications in organic compounds.

# UNIT I ORGANIC PHOTOCHEMISTRY

Introduction – Photochemical vs thermal reactions – singlet and triplet states – allowed and forbidden transitions – Jablonski diagram – photosensitization – photochemical reaction – elimination reaction – Norrish type I and Type II – photolysis of cyclic ketone – photolysis of aldehyde – photolysis of compounds containing Nitrogen – Barton reaction – photocycloaddition–Paterno-Buchi reaction – photo induced reaction of  $\alpha,\beta$ -unsaturated ketone.

## UNIT II POLY NUCLEAR HYDROCARBONS

Isolated Systems – Preparation of diphenyl, triphenylmethane and 1,2-diphenyl ethane.

Condensed systems – Synthesis, reactions and structure of naphthalene and anthracene.

Phenanthrene – synthesis and structure of phenanthrene. Derivatives of naphthalene and anthracene – Naphthols - Naphthyl amines, Naphtha quinones, Anthraquinone. Alizarin - structural elucidation of alizarin.

## UNIT III HETEROCYCLIC COMPOUNDS

Introduction – preparation and reactions of furan, pyrrole and thiophene. Aromatic character and basic nature – comparative reactivity. Preparation and reactions of pyridine – preparation and reactions of quinoline, isoquinoline and indole. Structural elucidation of pyridine, quinoline and isoquinoline.

## **UNIT IV - ALKALOIDS AND TERPENOIDS**

Alkaloids – definition – classification – occurrence – extraction – general characteristics. General methods of identification –functional nature of oxygen, nitrogen. Oxidation, Hofmann's exhaustive methylation – structure and synthesis of coniine, piperine and nicotine

**Terpenoids** – introduction – classification – isolation of terpenoids – isoprene rule – general properties of terpenoids. General procedure for determining structure of terpenoids – synthesis and structure of geraniol, Citral, dipentene and menthol.

# UNIT V ORGANIC SPECTROSCOPY

UV Spectroscopy – Chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic and hypochrmic effect – instrumentation- types of electronic transitions – forbidden and allowed transitions. Woodward-Fieser rule for calculation of absorption maxima of dienes and  $\alpha$ ,  $\beta$  unsaturated ketones.

**IR Spectroscopy** – number of fundamental vibrations. Finger print region, characteristics of IR absorption frequencies, intermolecular and intramolecular hydrogen bonding.

**NMR** Spectroscopy – introduction – number of signals – internal standard(TMS) – chemical shift – factors influencing chemical shift – splitting of the signals, spin-spin coupling, coupling constant. NMR spectrum of ethanol, benzyl alcohol, propionic acid, anisole, benzaldehyde, 2,3-dibromopropene, ethyl methyl ketone and mesitylene. C<sup>13</sup> NMR -Applications of NMR spectroscopy.

- 1. I.L Finar Organic Chemistry Volume II, Stereochemistry and the Chemistry of Natural Products Edition V Reprint 1986.
- Y.R. Sharma, Elementary Organic Absorption spectroscopy –S.Chand & company Ltd, New Delhi 1998.
- 3. P.R. Singh & S. K. Dikshit, Molecular Spectroscopy, S. Chnad & Co., New Delhi, 1976.
- 4. Jerry March Advanced organic chemistry Wiley-Interscience Publication
- 5. Arun Bahl and B. S. Bahl Advanced Organic chemistry, S. Chand and Company Ltd., Reprint 2005.
- 6. K.S. Tewari, N.K. Vishnoi, S.N. Mehrotra. A Text Book of Organic Chemistry, Vikas publishing house (P) Ltd.2002.

SEMESTER VI				
Part III C	Core XI	Physical Chemist	ry III	
Code :15UCHC63	Hrs/Week : 5	Hrs/ Sem : 75	Credits : 4	

- To apply the concept of group theory to various molecules.
- To study the importance of electrochemistry and its applications.
- To apply phase rule to different physical states of system.
- To get an idea about the principle behind sonochemical reactions.

# UNIT I GROUP THEORY

Symmetry elements – explanation with examples – centre of symmetry, axis of symmetry and plane of symmetry. Symmetry operations – identity – inversion – rotation about an axis – order of symmetry. Reflection – types of planes – improper rotation. Point groups – classification – symmetry elements and point groups assigned to the following molecules – water, ammonia, methane and borontrifluoride. Group postulates and types of groups – finite and infinite – sub group – abelian and non-abelian groups – cyclic groups – order of a group – construction of multiplication table – general principle – multiplication table for  $C_{2V}$ .

# UNIT II ELECTROCHEMISTRY - I

An elementary treatment of Debye-Huckel theory of strong electrolytes – significance of Debye-Huckel Onsagar equation (Derivation not required) – transport number – determination by Hittorff's and moving boundary methods – abnormal transport numbers – absolute velocity of an ion and its determination – Kohlrausch's law and its applications – mobilities of hydrogen and hydroxyl ions .Hydrolysis – expression for hydrolysis constant and degree of hydrolysis for salts of different types – salts of strong acid-strong base, strong acid-weak base, weak acid-strong base and weak acid-weak base. Calculation of pH of salt solutions (due to hydrolysis). Buffers – types – (acid buffer, basic buffer and neutral buffer) buffer action – Henderson-Hasselbalch equation-significance.

## UNIT III ELECTROCHEMISTRY - II

Reversible cells – cell representation, cell reaction, single electrode potential – standard electrode potential. Types of electrodes – metal-metal ion – gas electrode – metal-insoluble metal salt electrode, membrane and redox electrodes.

EMF – definition – determination of EMF of a cell – electrochemical series and significance – thermodynamics of reversible / irreversible electrodes – electrical energy in galvanic cell – free energy of cell reaction. Relation between EMF and  $\Delta G$  of the cell reaction– determination of  $\Delta H$ ,  $\Delta G$ ,  $\Delta S$  of the cell reaction. Relation between EMF and equilibrium constant. Effect of concentration of electrolyte on cell potential – Nernst equation – derivation and applications. Concentration cells – electrode concentration cells – electrolyte concentration cells with and without transference. Applications of EMF – solubility product, pH (Using hydrogen, glass and quinhydrone electrodes)

#### UNIT IV CHEMICAL REACTIONS UNDER LIGHT AND SOUND

**Photochemistry** – Beer-Lambert law(derivation)– photochemical rate law – Grotthus – Draper law, Stark – Einsteins law of photochemical equivalence – quantum yield – validity of Einstein's law – reason for low and high quantum yield – determination of quantum yield using actinometer – flash photolysis.. Kinetics of decomposition of HI – combination of H<sub>2</sub> and Cl<sub>2</sub> reaction. Photophysical processes – explanation of fluorescence and phosphorescence using Jablonski diagrams. Luminescence – chemiluminescence – thermoluminescence – bioluminescence. **Sonochemistry** – Definition , principle-cavitation-sonoluminescence and applications.

## UNIT V SOLUTION

**Liquids in liquids** –completely miscible liquids- distillation of homogenous binary liquid mixtures -Theory of fractional distillation –Azeotropic distillation.

**Partially miscible liquids** – Phenol-water, Triethylamine-water and Nicotine-water systems – Variation of solubility with temperature – vapour pressure of partially miscible liquids-critical solution(consolute) temperature-upper, lower,upper and lower - influence of impurity on CST and applications.

**Immiscible liquid systems-** vapour pressure of mixtures of immiscible liquids- theory of steam distillation and its applications.

**Nernst distribution law** – statement–conditions - thermodynamic derivation –-deviations from the law(molecular association and dissociation) ---- applications-distribution indicators- study of complex ions-solvent extraction

- 1. P.K. Bhattacharya, Group Theory and its Chemical Applications, Himalaya Publishing House, Mumbai, 1988.
- K.V. Raman, Group Theory and its Application to Chemistry, Tata McGraw, Hill Publishing Company Ltd., New Delhi.
- Samuel Glasstone, An introduction to electrochemistry, Thermodynamics for chemists, Affiliated East-West Press (P)Ltd, New Delhi.
- 4. B.S. Bahl, Arun Bahl & G.D.Tuli, Essential of Physical Chemistry, S. Chand & Co.
- Puri, Sharma and Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co.
- 6.Timothy J. Mason Advances in Sonochemistry, Volume 5; JAI press INC, 5<sup>th</sup> Edition, 1999.
- 7. Margulis , Sonochemistry and Cavitation, Gordon and Breach publishers, 1993.

SEMESTER III & IV			
Core Practical II Inorganic Qualitative Analysis			
Code :15UCHCR2Hrs/Week : 2Hrs/ Sem : 30Credit			

Systematic qualitative analysis of a mixture containing two anions and two cations. One of the anions should be an interfering radical which should be eliminated. The two cations should be of different groups.

Principles of flame testing – concept of solubility and solubility product – concept of pH and Buffer action – common ion effect - theory of testing anions (Simple and interfering) – Principle of grouping of cations –Theory of testing cations.

The combination of mixture containing two halides,( sulphates along with lead, barium, strontium and calcium),(oxalate and carbonate), &(one oxidizing and one reducing group ), should be avoided.

# Anions:

(i) Carbonate (ii) Sulphide (iii) Sulphate (iv) Chloride (v) Bromide (vi) Iodide.

(vii) Nitrate (viii) Borate (ix) Oxalate (x) Fluoride (xi) Chromate (xii) Phosphate

# **Cations :**

(i) Lead (ii) Copper (iii) Bismuth (iv) Cadmium (v)Antimony (vi) Nickel (vii) Manganese

(ix) Zinc (x) Barium (xi) Strontium (xii) Calcium (xiii) Magnesium (xiv) Ammonium.

- J. N. Gurtu and R. Kapoor, Advanced Experimental Chemistry Volume II, S.Chand & Company Ltd.
- 2. A.O. Thomas, Practical Chemistry for B. Sc. Main students, Scientific book centre, Cannanore.

# SEMESTER V

Major Practical IIIGravimetry And Inorganic PreparationCode : 15UCHCR3Credits : 3

# **OBJECTIVE:**

• To enable the student to get analytical skills and help them to plan and execute experimental projects.

## a) Gravimetric Analysis

- 1. Estimation of Lead as Lead Chromate.
- 2. Estimation of Barium as Barium Chromate
- 3. Estimation of Zinc as Zinc Oxinate
- 4. Estimation of copper as copper (I) thiocyanate
- 5. Estimation of calcium as calcium oxalate.

## **b) Inorganic Preparations**

- 1. Preparation of Potash alum
- 2. Preparation of Hexamminenickel(II)chloride
- 3. Preparation of Tetramminecopper(II)sulphate
- 4. Preparation of Prussian blue.
- 5. Preparation of Potassiumtrioxalatochromate (III) trihydrate
- 6. Preparation of Potassiumtrisoxalatoferrate(III)
- 7. Preparation of Tristhioureacopper(I) sulphate

# **Course work**

- 1. Estimation of Nickel as Nickel DMG complex
- 2. Determination of physical constant(melting point/boiling point)

# **BOOKS FOR REFERENCE**

1.Advanced Practical Chemistry - Raghupati Mukhopadhyay, Pratul Chatterjee Books and Allied (P) Ltd. Third Edition-2007

- 2. Vogel's text book of quantitative chemical analysis. 7th edition, ELBS/Longman England, 1994.
- 3.Arthur I.Vogel, A text book of quantitative inorganic analysis including elementary instrumental analysis,Longman Group Ltd.ELBS edition,1975

	SEMEST	TER VI		
Major Practical IV Organic Analysis And Organic Preparations				
Code : 15UCHCR4Hrs/Week : 3Hrs/ Sem : 45Credits : 3				

• To enable the students to develop analytical skill in organic qualitative and quantitative analysis and to develop skill in preparing organic compounds.

# **1. Organic Analysis:**

Analysis of simple organic compounds

- a) Nature of the compound- Aromatic / Aliphatic
- b) Test for saturation/ unsaturation.
- c) Detection of element present/ absent

d) Characterization of functional groups (Acids, amide, amines, phenol, aldehyde, ketone, anilide, ester, carbohydrates, nitro compounds), Confirmation by preparation of a solid derivative.

# 2. Preparation of Organic compounds involving the following chemical conversions

- 1.Oxidation 2. Hydrolysis 3. Nitration 4. Bromination
- 5. Diazotization 6. Benzoylation 7. Osazone formation

# **3.Course work**

# **Organic Estimation and separation**

- i) Estimation of Phenol/Aniline
- ii) Determination of physical constants

# **BOOKS FOR REFERENCE**

1. Raghupati Mukhopadhyay, Pratul Chatterjee ,Advanced Practical Chemistry - Books and Allied (P) Ltd. Third Edition-2007

2. J.N. Gurtu and R. Kapoor, Advanced experimental chemistry, S.Chand and Co., 1987.

3.Arthur I.Vogel, A text book of practical organic chemistry including qualitative analysis, Longman Group Ltd. ELBS edition, 1975

4.N.S.Gnanapragasam,G.Ramamoorthy,Organic Chemistry Lab Manual,S.Viswanathan printers and publishers Pvt. Ltd.2007.

SEMESTER VI			
Major Practical VPhysical Chemistry Experiments			
Code : 15UCHCR5	Hrs/Week : 2	Hrs/ Sem : 30	Credits : 6

• To enable the student to get analytical skills and help them to plan and execute experimental projects.

# LIST OF EXPERIMENTS:

1.Critical solution temperature of phenol water system and effect of

impurities on CST.

- 2. Transition Temperature of a salt hydrate determination of molecular weight
- 3. Kinetics of Ester Hydrolysis
- 4. Conductometric Acid base Titration
- 5. Conductometric precipitation Titration
- 6. Potentiometric Redox Titration
- 7. Molecular weight determination by Rast Method
- 8. Phase Diagram Simple eutectic
- 9. Phase Diagram Compound formation
- 10. Heat of solution by solubility method (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>/ oxalic acid)
- 11. Adsorption kinetics of oxalic acids/acetic acid on charcoal. Determination of concentration of the given acid.

- 1. J.N. Gurtu and R. Kapoor, Advanced experimental chemistry, S.Chand and Co., 1987.
- Dr. S. Sundaram, Dr.Krishnan and Dr. P.S.Raghavan, S.Viswanathan, Practical chemistry, (Printers & Publishers), Pvt. Ltd., 2007
- 3. R.Mukhopadhyay P.Chatterjee Advanced practical chemistry, Books and allied (p)Ltd. Kolkata,Third Edition 2007.

SEMESTER V				
Part III Core Elective I Co-ordination and Bio-Inorganic Chemistry				
Code :15UCHE51Hrs/Week : 4Hrs/ Sem : 60Credits: 4				

- To study the formation and bonding in coordination compounds
- To study the reaction mechanism in complexes
- To know the importance of metals in biological systems and the application of metal chelates in various fields.

## UNIT I CO-ORDINATION COMPOUNDS I

Co-ordination compounds –definition –addition (or) molecular compounds double saltscomplex salts. Terminology – complex ions (central metal ion) coordination number- ligands types of ligands (monodentate– bidentate- polydentate- bridging ligands) – oxidation number, co-ordination sphere, effective atomic number (EAN). Nomenclature of coordination compounds – isomerism in co-ordination compound – structural and stereo isomerism. Hydrate isomerism – ligand isomerism – linkage isomerism – coordination isomerism – coordination position isomerism – polymerisation isomerism.

#### UNIT II CO-ORDINATION COMPOUNDS II

Valence bond theory (Pauling's theory) – salient features of valence bond theory. Valence Bond theory as applied to octahedral complexes (inner and outer orbital complexes ) – square planar and tetrahedral complexes. Limitation of valence bond theory – crystal field theory –postulates of Crystal field theory- CF splitting in tetrahedral, square planar and octahedral complexes. Strong and weak field ligands,Crystal field stabilization energy (CFSE) – factors influencing the magnitude of CF splitting — applications of crystal field theory - magnetic properties, colour of transition metal complexes – Jahn Teller theorem,

Consequences of Jahn- Teller distortion.

## UNIT III REACTION MECHANISM IN CO-ORDINATION COMPOUNDS

Stability of complexes in solution – thermodynamic stability-factors influencing the stability of complexes-kinetic stability – factors influencing the liability of complexes – stabilisation of

unusual oxitation states by complexation. – substitution reaction in octahedral complexes – dissociative( $S_N^2$ ), associative( $S_N^1$ ) mechanism. Substitution reactions in octahedral complexes (acid and base hydrolysis) and substitution reactions in square planar complexes. Trans effect- pi bonding theory of trans effect – uses of trans effect .

## UNIT IV METAL CARBONYLS

Definition – low oxidation state of metal ion in metal carbonyls – classification of carbonyls- based on the number of metal atoms present in carbonyl- based on the structure of carbonyls -General methods of preparation, properties of transition metal carbonyls.Nature of M-CO bonding in metal carbonyls.Evidences for back bonding. Structure of carbonyls on the basis of VB theory. Structure and bonding in metal carbonyls of mono, bi nuclear and poly nuclear carbonyls of Ni,V,Cr,Fe,Co and Mn [(Ni(CO)4.) V(CO)6, Fe(CO)5, Cr(CO)6, Co<sub>2</sub>(CO)8, Fe<sub>2</sub> (CO)9, Mn<sub>2</sub> (CO)10, and Fe<sub>3</sub>(CO)12 ].

## UNIT V BIO-INORGANIC CHEMISTRY

Role of metal ion in living systems (excess and deficiency of trace metals) – metalloproteins, metallo-enzymes – characteristics of metallo-enzymes – characteristics of metal activated enzymes – functions of metal in enzymes – elementary idea of metallo-porphyrins. Structure and function of haemoglobin, chlorophyll and vitaminB<sub>12</sub> Function of Na/K pump. Applications of co-ordination compounds in medicine, industry, biological systems and analytical chemistry.

- Puri B.R. Sharma L.R. Kalia Principles of Inorganic Chemistry K.K. Milestone Publishers & Distributors, Delhi-110002
- 2. Lee J.D. Concise Inorganic Chemistry, Blackwell Science, 5<sup>th</sup> Edn.1996.
- 3. P.Basalo and Johnson Benjamin ,Co-ordination Chemistry Ink,1964
- R.Gopalan V.Ramalingam, Concise co-ordination Chemistry Vikas Publishing House Pvt Ltd.
- 5. R.D.Madan Modern Inorganic Chemistry, S.Chand&Co,Ltd.

SEMESTER V				
Part III	<b>Core Elective</b>	П	Polymer Chemistry	
Code :15UCHE52	Hrs/Week: 4	Hrs/ Sem : 60	Credits : 4	

# **Objectives :**

- 1. To understand the chemistry and technology of different types of polymers.
- 2. To study their applications in various fields.

# UNIT I INTRODUCTION TO POLYMERS

Introduction-Classification based on chemical structure,mode of synthesis and composition –Characteristics of the polymers-nomenclature of polymers – Homopolymers and Hetero polymers — Conducting polymers- Tacticity – isotactic, atactic, syndiotactic polymers – Copolymer-types-statistical, random, alternating,block and graft copolymer.Plastics( thermoplast and thermosets)–elastomers –fibres. Degree of polymerization – functionality – linear, branched and cross linked polymers.

# UNIT II PROPERTIES OF POLYMERS

Glassy stage – glass transition temperature, factors affecting it crystallinity of polymers. Viscosity, solubility, optical, electrical, thermal and mechanical properties of polymers – Degradation of polymers of thermal, oxidative, mechanical and chemical methods.

Molecular mass – Number average, weight average, viscosity average moleculer mass and their determination– practical significance of moleculer mass distribution – size of polymers and carother's equation.

# UNIT III POLYMERIZATION AND POLYMERIZATION TECHNIQUES

Classification of polymerization reactions-addition polymerization , condenzation polymerization-difference between addition and condensation polymerization-ionic polymerization and coordination polymerization.Polymerization.techniques - bulk, suspension emulsion and solution polymerization.

# UNIT IV POLYMER REACTIONS

Initiators-types – azo, free radical, peroxide and redox initiators. Inhibitors and its applications. Retarders-definition and examples. Mechanism of ,anionic and cationic(Whitmore mechanism, Hunter and Yohe mechanism and Chmelir mechanism) polymerization. Kinetics of free radical ,anionic and Ziegler- Natta polymerisation.

# UNIT V SOME IMPORTANT SYNTHETIC RESINS AND POLYMERS

Outline of synthesis and their uses of the following

**Resins**-Phenol formaldehyde resin, Melamine – formaldehyde resin, Epoxy resins – grades, and curing process.

**Synthetic Polymers**:Poly olefins – Polyethylene – HDPE, LDPE, LDPE – Polypropylene – Polyvinyl chloride – grades of PVC – Teflon.Polymethylmethacrylate (pexiglass) polystyrene, polyamide – Nylon6, Nylon66, Nylon610 Nylon11, - polyester – polyurethanes – polycarbonates

Synthetic rubber – Styrene rubber, Nitrile rubber, Butyl rubber, Polysulphide rubber and Neoprene.

Biomedical Applications of polymers.

# **Books For Reference**

- 1. Introduction to polymers R.J.Young and P.A. Lovell,II Edition,Replika press Pvt.Ltd.India
- Polymer chemistry, M.G.Arora, M.Singh Anmol publications Pvt.Ltd. 4374/4B, Ansari Road, Daryaganj, New Delhi.
- 3. Applied Chemistry K. Bagavathi Sundari -MJP Publishers, Tamilnadu Book House Chennai
- 4. Polymer science V.R. Gowarikar, N. V. Viswanathan and J. streedhar
- Engineering chemistry –P.C. Jain andMonika Jain ,Eleventh Edition 1995,Dhanpat rai & sons. Delhi 110006

SEMESTER VI				
Part III   Core Elective III   Analytical Chemistry				
Code :15UCHE61	Hrs/Week : 5	Hrs/ Sem : 75	Credits : 5	

- To study the analytical uses of thermal, electrical and colorimetric methods.
- To study the applications of various spectral measurements in analysis.
- To study different types of chromatography and their application in analysis.
- To have a knowledge about the interpretation of experimental results.

# UNIT I SEPARATION AND PURIFICATION TECHNIQUES

Purification of solid organic compounds – recrystallization, use of miscible solvents – use of drying agents – sublimation – purification of liquids – distillation – fractional distillation – use of immiscible solvents –solvent extraction.

Chromatography – principle of adsorption and partition chromatography – column chromatography, adsorbents – classification of adsorbents – solvents – preparation of column, adsorption, recovery of substances. Thin layer chromatography – choice of adsorbent – choice of solvent – preparation of chromatogram.

# UNIT II COLORIMETRY AND SPECTROPHOTOMETRY

Visible colorimetry – Beer-Lambert Law – principles of colorimetric analysis– photoelectric colorimeter – spectrophotometer – UV spectroscopy – theory and instrumentation. Fluorometry – principle – instrumentation – applications. Flame photometry – principle – instrumentation – applications. Nephelometry and turbidimetry –theory and instrumentation – turbidimetric titrations and applications.

# UNIT III SPECTROSCOPY

Types of molecular spectra. Micro wave (rotational) spectra – theory – instrumentation and applications in the determination of bond distances in diatomic molecules –microwave oven. Vibrational (IR) spectra – theory – modes of vibrations – instrumentation – applications in the determination of bond strength. Raman spectra – theory – instrumentation and Mutual exclusion principle – applications to  $CO_2$  and HCN molecules. NMR spectra – theory – instrumentation – Magnetic Resonance Imaging. Types of NMR spectra .Atomic Absorption Spectra – basic principle only.

# **UNIT III THERMO ANALYTIC METHOD**

Thermo analytic method – principle of thermogravimetry, differential thermo analysis – instrumentation for TGA, DTA and DSC – characteristics of TGA and DTA curves – factors affecting TGA and DTA curves – applications – TGA of calcium oxalate monohydrate – DTA of calcium oxalate monohydrate – electrogravimetric analysis – electrolytic separation of metals – principle of separation of copper and nickel

## UNIT V ANALYTICAL TREATMENT OF EXPERIMENTAL DATA

Principles of gravimetric analysis – precipitation methods – conditions of precipitation– factors influencing the precipitation and solubility – co-precipitation and post precipitation – digestion, washing and drying, ignition of the precipitate.

Mean – median – mode – precision – accuracy – confidence limits – determinate errors– indeterminate errors – rules for improving accuracy of data deviation, standard deviation. Rejection of data – significant figure – reporting of data – presentation of tabulated data – scatter diagrams – method of least squares.

- R. Gopalan, P.S. Subramanian and K. Rengarajan ,Elements of Analytical Chemistry, Sultan Chand & Sons, Educational Publishers – New Delhi.
- Mahinder Singh, Analytical Chemistry, Instrumental Techniques Vol I, II Edition 2002, Dominant Publishers and Distributors.
- 3. Hobart H. Willard, Lynne L. Merritt, J.R., John A. Dean, Frank A. Settle, J.R., Instrumental Methods of Analysis, Sixth Edition, CBS Publishers & Distributors.
- 4. Douglas A. Skoog, Donald M. West, F. James Holler Harcourt, Fundamentals of Analytical Chemistry, Seventh Edition, College Publishers.
- 5. G. Aruldhas, Molecular Structure and Spectroscopy, 2005, Prentice Hall of India.

SEMESTER IV			
Part III	Non-Major Ele	ctive Industria	l Chemistry
Code :15UCHN41	Hrs/Week: 2	Hrs/ Sem : 30	Credits : 2

- To learn about the various ceramics and abrasives.
- To provide information about paints.
- To earn knowledge about the manufacture sugar and paper.

## UNIT I CERAMICS AND ABRASIVES

Ceramics-general properties-classification of ceramic products- raw materials for ceramics- outline of the manufacturing process- glazing- colouring- manufacture of porcelain. Abrasives- outline of the manufacture of calcium carbide, silicon carbide, boron carbide and their uses.

# UNIT II SURFACE COATING

Purpose of surface coating – Paint – characteristics of good paint - constituents of paints - classification of paints – fluorescent paints (traffic signal), fire retardant paints – Varnishes – constituents and their functions. Emulsion paints.

## UNIT III SUGAR AND PAPER INDUSTRY

Manufacture of sugar – recovery of alcohol from molasses – fermentation – beverages manufacture of beer and wine – Bagasse. Paper industry- Manufacture of paper.

# **Books for Reference**

- 1.Fundamental concepts of Applied chemistry, Jayashree Ghosh Edition 2006, S. Chand & company Ltd. New Delhi.
- 2. Engineering chemistry by P.C. Jain and Monika Jain Dhanpat Rai & Sons, New Delhi.
- 3. Industrial Chemistry B.K.Sharma Goel Publishing House, 2003, Meerut.

SEMESTER III			
Part IVSkill Based ElectiveBasic Computer Techniques in Chemistry			
Code :15UCHS	B1 Hrs./Week:	2 Hrs/ Sem 30	Credits:2

• To impart computer knowledge to chemistry students.

# UNIT I MS WORD

Introduction – File-create- save-copy-delete- typing in the document-selecting the styles – editing text – previewing the document – printing – inserting page number and date – formatting text and paragraphs.

Overview of page setup – changing page size and margin, create headers, footers and selection use columns – find and replace text – spellcheck – use of thesaurus-working with tables and graphics – entering and editing data in a table – insertion of a picture.

## UNIT II MS EXCEL

Introduction of MS Excel-define work book-create work sheet-Changing columns and rows —formatting-aligning and wrapping cell contents- border to cell-number formats. Mathematical functions -Create a chart with wizard-working with tables and graphs

# UNIT III MS POWERPOINT

Features and components of the power point-presentations-creating a power point presentation —add, insert and delete slides-adding text to slide-slide layout-enter and edit text to slides- animation effect.

# UNIT IV E-MAIL AND INTERNET

E-mail – creating an e-mail id – receiving incoming messages – sending messages.

# **UNIT V CHEMISTRY RELATED WEBSITES**

A brief study of Websites and softwares related to chemistry.

Drawing simple chemical structures using Chemdraw and Chem finder

# REFERENCES

- 1. MS-EXCEL in a Nutshell, Sanjay Saxena, Vikas Publishing House Pvt., Ltd., 2000
- 2. Create powerpoint presentations in a weekend, Brain Reilly, Galgotia publication Pvt., Ltd.,
- 3. Advanced Microsoft Office 2000, Meredith Flynn, Nita Rutkosky, BPB publications, First edition, 2000
- 4. Mashbra's Internet for Students, Sharat Jain, B.M.Agarwal, Mashbra Industries (P) Ltd.,2000.
- 5. Vikas Gupta, Windows XP with office 2007, Publishers, Dreamtech Press

SEMESTER IV				
Part III	Skilled Based Electiv	ve Pharma	Pharmaceutical Chemistry	
Code :15UCHS41	Hrs/Week : 2	Hrs/ Sem : 30	Credits : 2	

- To understand the concept of drug, its action common drugs and their uses.
- To know the causes of common diseases and their treatment
- To study the various clinical analysis and techniques for diagnosis.

# UNIT I CLASSIFICATION AND METABOLISM OF DRUGS

Classification of drugs – biological and chemical classification-metabolism of drugs- bio transformation-oxidative, reductive and hydrolytic biotransformations — conjugate reactions — glucuronides ,amino acids, ethereal sulphate, methylated and acetylated conjugations.

# UNIT II CAUSES OF COMMON DISEASES AND THEIR TREATMENT BY DRUGS

Common diseases and their treatment:

Insect borne diseases- Air borne diseases- Water borne diseases.

Important Indian medicinal plants and trees and their uses:

Hisbisscus Rosa-sinensis adathoda vasica, ocimum sanctum, mangifera indica, azadirachta indica, phyllanthus Niruri, solanum trilobatum.

# UNIT III CLINICAL CHEMISTRY

Determination of sugar (glucose) in serum-Folin and Wu's method — determination of serum cholesterol Sackett's method for total cholesterol --tests for cholesterol — estimation of glucose in urine-Benedict's test-detection of anemia — estimation of hemoglobin (Hb concentration).First aid for accidents-important rules — composition of first aid box — some common poisons and their antidotes.

## UNIT IV BLOOD PRESSURE AND CARDIO VASCULAR DRUGS

Hypertension- types of treatment. Functions and uses of the following drugscardiovascular drugs-antiarrhythmic drugs-quinidine-antihypertensive agents (hypotensive drugs) — clonidine and reserpine.

## UNIT V DIABETES AND SOME COMMON DRUGS

Diabetes- control-oral hypoglycemic drugs--tolubutamide, chlorpropamide, Anti Convulsant agents-structure and uses of Barbiturates- Anaesthetics- general Anaesthetics -advantages and disadvantages of vinyl ether, halothane.

# **Books for References**

I. Text Book of pharmaceutical chemistry Jayashree Ghosh —S.Chand and company

New Delhi, 2003

- 2. Pharmaceutical chemistry-Dr.S. Lakshmi, Sultan Chand & Sons, NewDelhi, Edition 2004
- 3. Medicinal chemistry- Ashutosh Kar New age International (P) Limited, Publishers,

New Delhi, 1997

4. General Organic & Biochemistry — Bettelheim Brown, Campbell and Farrell, Books/cole Cengage Learning, Publishers India Edition.

5.Fundamental Concepts of Applied chemistry Jayashree Ghosh , S.Chand and Company, New Delhi. 2006

SEMESTER V				
Part IV Skill Based Elective       Applied Chemistry				
Code :15UCHS51	Hrs./Week:4	Hrs/ Sem 30	Credits:3	

- To know the chemical aspects of soap and detergents
- To know the adverse effects of corrosion and study the means to prevent it.
- To be aware of the importance as well as the impacts of residual chemicals related with petroleum industry

## UNIT I PETRO CHEMICALS

Occurrence – composition of petroleum. Refining of petroleum – purification – cracking – types of cracking – catalytic cracking – thermal cracking – synthetic petrol – knocking and antiknocking properties – octane number – activation. Gasoline – cetane number – flash point. Petrochemicals – important hydrocarbons – derivatives and uses. Synthetic petrol. Important petro chemical industries in India.

#### UNIT II CORROSION AND PROTECTIVE COATING

Corrosion of metals – definition – disadvantages – types of corrosion-theories of corrosion (Direct Chemical corrosion, electrochemical corrosion) – methods of preventing corrosion-corrosion inhibitors

Types of protective coating (metallic, organic, organic lining and ceramic coating) paintcharacteristics of a good paint – constituents of paints and their functions varnish, resins and lacquers, their characteristics – uses – difference between paint, varnish and lacquer

## **UNIT III RUBBER INDUSTRY AND FIBRES**

Manufacture of rubber – rubber latex – coagulation – crude rubber, Gutta-parcha – properties of rubber – compounding of rubber – vulcanisation, properties of vulcanized rubber– synthetic rubber – SBR rubber, Neoprene rubber, Butyl rubber, Silicone rubber, and their properties. Reclaimed rubber and foam rubber –uses.

Difference between natural and synthetic fibres – manufacture of rayons – nylons and polyesters – uses.

#### UNIT IV FATS, OILS AND WAXES:

**Fats and oils** – definition – physical and chemical properties - Analysis of fats and oils– Saponification value, iodine value, acid value, Reichert-Meissel value – manufacture of vanaspathi or vegetable ghee.

Waxes – definition, manufacture and classification.

**Soaps** – definition – manufacture of different types of soaps – toilet soaps, transparent soaps and liquid soaps and their uses – cleansing action of soaps.

**Detergents** – classification of detergents (cationic, anionic and nonionic) – comparison of soaps and detergents.

## **UNIT V FOOD INDUSTRY**

Manufacture of sugar from beetroot and sugarcane – molasses – manufacture of alcoholic beverages – manufacture of vinegar food additives – baking soda – food color natural and artificial – intentional food additives – acid base and their salts – antioxidants – stabilizers– bleaching – maturing agents – leavening agents – humectants and preservatives.

- Jayashree Ghosh, Fundamental concepts of Applied chemistry Edition 2006, S. Chand & company Ltd New Delhi
- Harish Kumar Chopra, Anupama Parmar, Engineering Chemistry Narosa Publishing House New Delhi.
- 3. K.Bagavathi Sundari Applied Chemistry Mjp publishers, Tamil Nadu Book House Chennai
- 4. B.S.Bahl, Arun Bahl, Advanced Organic chemistry –S.Chand & company.
- Siva sankar B., Food processing and preservation Prentice-hall of India Pvt., ltd New Delhi 2002.
| SEMESTER- V                                       |  |  |  |  |
|---|--|--|--|--|
| Core VIII Organic Chemistry III                   |  |  |  |  |
| Code :18UCHC52 Hrs./Week:5 Hrs/ Sem: 75 Credits:4 |  |  |  |  |

Vision: Develop novel molecules and methods to synthesize Organic molecules

# Mission:

- Understand Retrosynthesis and its relay approach to synthesis
- Study Specific name reactions
- Have an idea on Green Chemistry

# **Course Outcome**

СО	Upon completion of this course, students will be	PSO	CL
No.	able to	addressed	
CO - 1	compare the general reactions of aldehydes and	5	Ap
	ketones		
CO - 2	explain the mechanism of Claisen, Benzoin, Perkin,	2	Un
	Knovenegal reaction- Wittig reaction-iodoform		
	reaction		
	explain the factors influencing strength of acid -		
	effect of substituent in benzene ring		
CO - 3	generalize the properties of carbonyl and carboxyl	1,6	Cr
	compunds		
CO - 4	classify the polynuclear hydrocarbons	1.5	Ap
	Structure Elucidation of alizarin		Cr
CO - 5	state synthons and synthetic equivalent- Protection	3	Re
	and deprotection of different groups		
CO - 6	explain Retrosynthesis of 5-hexanoic acid	1,3,6	Un
CO - 7	apply green chemistry in day-to-day life, dry	4,7	Ap
	cleaning, versatile bleaching agent		
CO - 8	implement an awareness about green chemistry and	3,8	Ар
	the methods of microwave assisted synthesis		

SEMESTER- V				
Core VIII Organic Chemistry III				
Code :18UCHC52 Hrs./Week:5 Hrs/ Sem: 75 Credits:4				

#### **Unit I- Carbonyl Compounds**

Aliphatic aldehyde& ketones-Reactivity of carbonyl groups-general reactions of aldehydes and ketones-mechanism of addition and condensation reaction- Cannizzaro reaction-Aldol condensation-Distinction between aldehydes and ketones-Reduction reaction-MPV reduction-Wolf-kishner- Clemmenson reaction

Aromatic aldehydes and ketones- general methods of preparation, reaction and test-Mechanism of Claisen, Benzoin, Perkin, Knovenegal reaction- Wittig reaction-iodoform reaction

#### Unit-II Carboxylic Acid And Their Derivative

Aliphatic monocarboxylic acid- general methods of preparation and reactions- acidic nature-factors influencing strength- dicarboxylic acid- Blanc's rule-Aromatic monocarboxylic acid-effect of substituent in benzene ring- Aromatic dicarboxylic acid-Reactions of phthalic acid –Test for Carboxylic acid – Aliphatic hydroxy acids – Preparation reactions of maleic acid and citric acid – Action of heat on hydroxy acid – aliphatic acid derivative- reaction of ester, acid halide and acid amide.

#### **Unit - III Polynuclear Hydrocarbons**

**Isolated Systems** – Preparation of diphenyl, triphenylmethane and 1,2-diphenyl ethane.**Condensed systems** – Synthesis, reactions and structure of naphthalene and anthracene. Phenanthrene – synthesis and structure of phenanthrene. Derivatives of naphthalene and anthracene – Naphthols - Naphthyl amines, Naphtha quinones, Anthraquinone. Alizarin -structural elucidation of alizarin.

#### **Unit-IV Organic Synthesis – An Introduction**

Synthons and synthetic equivalent (electrophilic and nucleophilic). Carbon-carbon bond forming reactions involving Michael and Dieckmann reaction-Protection of functional groups and removal of protecting groups-Application of Protection and deprotection to alcohols, aldehydes, ketones, acids, phenols and amines. Retrosynthetic analysis of 5hexanoic acid

## Unit – V Green Chemistry

Introduction – need for green chemistry – twelve principles of green chemistry – green chemistry in day-to-day life – dry cleaning, versatile bleaching agent – atom economy – green solvents – supercritical fluid CO<sub>2</sub>, ionic liquids and water

Microwave assisted organic synthesis – introduction – microwave assisted reactions in water – Hofmann elimination and hydrolysis of benzyl chloride – microwave assisted reactions in organic solvents – esterification and Fries rearrangement – microwave assisted reactions in solid state – deacylation, oxidation of alcohols using clayfen.

# **Text Books**

- K.S. Tewari, N.K. Vishnoi, S.N. Mehrotra. A Text Book of Organic Chemistry, 2<sup>nd</sup> Revised Editions, 1998
- 2. Arun Bahl and B. S. Bahl Advanced Organic chemistry, S. Chand and Company Ltd., Reprint 2005.

- 1. Bhupinder Mehta, Manju Mehta, Organic chemistry, PHI Learning pvt. Ltd., 2005.
- 2. Rashmi Sanghi, Green Chemistry Environmental Friendly Alternatives Editors M.M.Srivatsava Narosa Publishing House, Reprint 2008.
- 3. V. Kumar, An introduction to green chemistry, Vishal Publishing Company, Jabudhar Delhi Edition, May 2007.
- 4. V. K. Ahluwalia, Green Chemistry, Ane Books Pvt. Ltd; Second edition.2012
- 5. I.L.Finar Organic chemistry, The Fundamental Principles, Volume I, 6<sup>th</sup> edition, 1973.
- 6. N.Tewari Advance Organic Reaction mechanism Books and allied (P) Ltd. Kolkata 700010 India Second revised edition 2005.
- M.K.Jain and S.C.Sharma Modern organic chemistry, Vishal publishing co., 4<sup>th</sup> edition 2012.

SEMESTER V				
Core IX Physical Chemistry II				
Code :18UCHC53Hrs/Week : 5Hrs/ Sem : 75Credits : 4				

# Vision:

Educate the students about the chemistry behind living system and physical processes.

# Mission:

- Inculcate a wide understanding about
- Reaction kinetics and its applications
- Chemistry behind light and sound
- Concept of group theory to various molecule
- Probe into the importance of electrochemistry and its application

# **Course Outcome**

CO.No.	Upon completion of this course, students should be	PSO	CL
	able to	addressed	
CO - 1	understand the kinetics of the reaction and to	1	Un
	determine the reaction mechanism		
CO - 2	apply reaction kinetics to determine the rate of	2,3	Ap
	chemical reactions; understand the factors that		
	influence rates of reaction.		
CO - 3	summarize the chemical reactions under light and sound	3	Un
CO - 4	outline the principle behind sonochemical reactions	3	Re
CO - 5	apply the concept of group theory to various molecules	1	Ap
CO - 6	have a thorough knowledge of symmetry elements,	1, 2	Re
	symmetry operations and point groups		
CO - 7	build an Elementary treatment of Debye-Huckel theory	1,3	An
	of strong electrolytes ,conductometric titrations,		
	hydrolysis and calculation of pH.		
CO - 8	probe into the importance of electrochemistry and its	4	Ev
	application		

SEMESTER V					
Core IX Physical Chemistry II					
Code :18UCHC53Hrs/Week : 5Hrs/ Sem : 75Credits : 4					

#### Unit I Chemical Kinetics

Reaction rate –units of rates –rate laws- order and molecularity of a reaction– differences between order and molecularity of a reaction- Pseudo unimolecular reactions – examples- Experimental determination of inversion of cane sugar- Differential and integrated forms of rate expressions for first, second and zero reactions – first order reaction – examples- Experimental determination of rate constant of decomposition of  $N_2O_5$  in CCl<sub>4</sub> second order reaction—examples-experimental determination of alkaline hydrolysis of ester. Time for half change for first, second order reactions – determination of order of the reactions ( integrated rate equation method ,differential method, graphical method ,half life method)

Effect of temperature on reaction rate – Arrhenius equation – Activation energy and its significance. Collision theory and derivation of rate constant of a bimolecular reaction – Limitations of collision theory – unimolecular reactions and Lindemann's theory –Transition state theory –potential energy diagram for activation energy as applied to catalysis-endothermic and exothermic reaction.

#### Unit II Chemical Reactions under Light and Sound

**Photochemistry** – photochemical reaction – Beer-Lambert law(derivation)– photochemical rate law – Grotthus-Draper law, Starck-Einsteins law of photochemical equivalence – quantum yield – validity of Einstein's law – reason for low and high quantum yield – determination of quantum yield using actinometer – flash photolysis. Photolysis of NH<sub>3</sub> and chlorination of methane. Kinetics of decomposition of HI – combination of H<sub>2</sub> and Cl<sub>2</sub> reaction – kinetics of the H<sub>2</sub> and Br<sub>2</sub> reaction. Photophysical processes – explanation of fluorescence and phosphorescence using Jablonski diagrams. Incandescence – luminescence – chemiluminescence – thermoluminescence – bioluminescence. Applications of photochemistry.

Sonochemistry – definition, principle and applications.

## **Unit III Group Theory**

Symmetry elements and symmetry operations –centre of symmetry –axis of symmetry- plane of symmetry -proper axis of rotation- improper axis of rotation– Inversion and identity operations – symmetry elements in water, ammonia, boron trifluoride, benzene, allene and 1,2-dichloro ethylene. Group postulates and types of groups - abelian and non-abelian groups-cyclic groups-order of a group–sub group-multiplication table for $C_{2V}$  and  $C_{3V}$ – molecular point groups.

#### Unit IV Electrochemistry - I

An Elementary treatment of Debye-Huckel theory of strong electrolytes – Significance of Debye-Huckel Onsagar equation (Derivation not required) – Transport Number – Determination by Hittorff's and moving boundary methods – Abnormal transport numbers – Absolute velocity of an ion and its determination – Kohlrausch's law and its applications – Mobilities of hydrogen and hydroxyl ions – Conductometric titrations – Different types – Advantages – Hydrolysis – Expression for hydrolysis constant and degree of hydrolysis for salts of different types –Salts of strong acid-strong base,strong acid-weak base,weak acid-strong base and weak acid-weak base. Calculation of pH of salt solutions (due to hydrolysis). Buffers – types-(acid buffer,basic buffer and neutral buffer) buffer action –Henderson-Hasselbalch equation-significance.

#### Unit V Electrochemistry - II

Reversible cells – cell representation, cell reaction, single electrode potentialstandard electrode potential. Types of electrodes- metal – metal ion- gas electrode- metalinsoluble metal salt electrode(calomel), membrane and redox electrodes.

EMF –definition-determination of EMF of a cell Electrochemical series and significance – Thermodynamics of reversible / irreversible electrodes – Electrical energy in galvanic cell – Free energy of cell reaction. Relation between EMF and  $\Delta G$  of the cell reaction – Determination of  $\Delta H$ ,  $\Delta G$ ,  $\Delta S$  of the cell reaction. Relation between EMF and equilibrium constant. Effect of concentration of electrolyte on cell potential – Nernst equation – Derivation and applications. Concentration cells – Electrode concentration cells – Electrolyte concentration cells with and without transference liquid junction potential –salt bridge.

Applications of EMF- solubility product, pH (Using hydrogen, glass and quinhydrone electrodes) and Potentiometric titration (acid-base, redox and precipitation).

#### **Text Books**

- B.R.Puri. L.R. Sharma, Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2008.
- Arun Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, S. Chand & Company Ltd., New Delhi, 2008.
- 3.F.Albert Cotton, Chemical Applications of Group Theory,III Edition, John Wiley and Sons, 1999.

- 1. P.K. Bhattacharya, Group Theory and its Chemical Applications, Himalaya Publishing House, Mumbai, 1988.
- 2. Samuel Glasstone, An introduction to electrochemistry, Affiliated East-West Press (P)Ltd, New Delhi, 1965.
- 3. V.Ramakrishnan and M.S.Gopinathan, Group Theory in Chemistry, Vishal Publications, NewDelhi1991.
- 4. Morris Sylvin, Photochemistry and Sonochemistry, Ivy Publishing House, NewDelhi, 2003.

SEMESTER- VI				
Core X Inorganic Chemistry - II				
Code :18UCHC61 Hrs./Week:4 Hrs/ Sem: 60 Credits:4				

# Vision

Obtain an intense knowledge about coordinating chemistry and its applications in various fields

## Mission

- Know the theories behind the formation of coordination complexes.
- Understand the nature of metal carbonyls and their applications
- Identify the role of metal ions in biological systems

# **Course Outcome:**

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	acquire knowledge in the chemistry of coordination compounds and their properties.	1	Un
CO - 2	characterize and synthesize of coordination compounds	1, 5,6	Ар
CO - 3	explain the definition of coordination compounds, naming them and decide isomerism	1	Re
CO - 4	describe the formation and bonding in coordination compounds	1, 6	An
CO - 5	grasp the knowledge of bonding in metal carbonyls	1, 2	Re
CO - 6	identify the structure and bonding in metal carbonyls of mono, bi nuclear and poly nuclear carbonyls	3, 6	Ар
CO - 7	formulate independent research ideas in the field of bioinorganic chemistry	1, 3, 7	Cr
CO – 8	recall the importance of metals in biological systems and the application of metal chelates in various fields	1, 4, 8	Re

SEMESTER- VI				
Core X Inorganic Chemistry - II				
Code :18UCHC61Hrs./Week:4Hrs/ Sem: 60Credits:4				

#### Unit I Co-ordination Compounds I

Co-ordination compounds –definition –addition (or) molecular compounds double salts-complex salts. Terminology – complex ions (central metal ion) coordination numberligands - types of ligands (monodentate– bidentate-polydentate- bridging ligands) – oxidation number, co-ordination sphere, effective atomic number (EAN). Nomenclature of coordination compounds – isomerism in co-ordination compound – structural and stereo isomerism. Hydrate isomerism – ligand isomerism – linkage isomerism – coordination isomerism – coordination position isomerism – polymerisation isomerism.

#### Unit II Co-ordination Compounds II

Valence bond theory(Pauling's theory) – salient features of valence bond theory. Valence Bond theory as applied to octahedral complexes (inner and outer orbital complexes) – square planar and tetrahedral complexes. Limitation of valence bond theory – crystal field theory –postulates of Crystal field theory- CF splitting in tetrahedral, square planar and octahedral complexes. Strong and weak field ligands,Crystal field stabilization energy (CFSE) – factors influencing the magnitude of CF splitting — applications of crystal field theory - magnetic properties, colour of transition metal complexes – Jahn Teller theorem-Consequences of Jahn- Teller distortion.

## Unit III Reaction Mechanism in Co-ordination Compounds

Stability of complexes in solution – thermodynamic stability-factors influencing the stability of complexes-kinetic stability – factors influencing the lability of complexes – stabilisation of unusual oxitation states by complexation. – substitution reaction in octahedral complexes – dissociative( $S_N^2$ ), associative( $S_N^1$ ) mechanism. Substitution reactions in octahedral complexes (acid and base hydrolysis) and substitution reactions in square planar complexes. Trans effect- pi bonding theory of trans effect – uses of trans effect.

#### Unit IV Metal Carbonyls

Definition – low oxidation state of metal ion in metal carbonyls – classification of carbonylsbased on the number of metal atoms present in carbonyl- based on the structure of carbonyls -General methods of preparation, properties of transition metal carbonyls. Nature of M-CO bonding in metal carbonyls -Evidences for back bonding-Structure of carbonyls on the basis of VB theory. Structure and bonding in metal carbonyls of mono, bi nuclear and poly nuclear carbonyls of Ni,V,Cr,Fe,Co and Mn [(Ni(CO)<sub>4</sub>.) V(CO)<sub>6</sub>, Fe(CO)<sub>5</sub>, Cr(CO)<sub>6</sub>, Co<sub>2</sub>(CO)<sub>8</sub>, Fe<sub>2</sub> (CO)<sub>9</sub>, Mn<sub>2</sub> (CO)<sub>10</sub>, and Fe<sub>3</sub>(CO)<sub>12</sub>].

#### Unit V Bio-Inorganic Chemistry

Role of metal ion in living systems (excess and deficiency of trace metals) – metalloproteins, metallo-enzymes – characteristics of metallo-enzymes – characteristics of metal activated enzymes – functions of metal in enzymes – elementary idea of metallo-porphyrins. Structure and function of haemoglobin, chlorophyll and vitaminB<sub>12</sub> Function of Na/K pump. Applications of co-ordination compounds in medicine, industry, biological systems and analytical chemistry.

# Text book

1. Puri B.R. Sharma L.R. Kalia Principles of Inorganic Chemistry K.K. Milestone Publishers & Distributors, Delhi, 2016 – 2017.

- 1. Lee J.D. Concise Inorganic Chemistry, Blackwell Science, 5<sup>th</sup> Edn.1996.
- 2. P.Basalo and Johnson Benjamin ,Co-ordination Chemistry Ink,1964
- 3. R. Gopalan, V.Ramalingam, Concise co-ordination Chemistry Vikas Publishing House Pvt Ltd, 2001.
- 4. R.D.Madan Modern Inorganic Chemistry, S.Chand & Co,Ltd, 2005.

SEMESTER- VI				
Core XI Organic Chemistry-IV				
Code :18UCHC62Hrs./Week: 4Hrs/ Sem: 60Credits: 4				

**Vision**: Empathize the structure, reactions, properties Organic compounds and contribute to the future of humanity

# Mission:

- Understand the different applications of Photochemistry in Organic compounds
- Know the importance of Heterocyclic compounds, Alkaloids and Terpenes
- Analyze structure of different types of nucleotides

# **Course Outcome:**

CO No.	Upon completion of this course, students will be	PSO	CL
	able to	addressed	
CO -1	identify the type of the photochemical and thermal	1,7	Re
	reactions		
CO - 2	understand the important applications of	1	Un
	photochemistry in organic compounds		
CO - 3	illustrate the mechanisms of specific reactions	1	Ар
CO - 4	know about the importance of heterocyclic	1, 5	Re
	compounds, alkaloids and terpenes		
	Identify the nature of compounds in heterocyclic		
	compounds		
CO - 5	apply the methods of extraction of Alkaloids	1, 2,6	Ар
CO - 6	compare quinoline and isoquinoline	1,4	Ар
CO - 7	analyse amino acid spectrophotometrically	1, 2, 8,	An
CO - 8	recall the colour reactions of proteins	1, 3	Re
	Classify the structure of DNA and RNA	5	Un

SEMESTER- VI				
Core XI Organic Chemistry-IV				
Code :18UCHC62 Hrs./Week: 4 Hrs/ Sem: 60 Credits: 4				

## Unit – I Organic Photochemistry

Introduction – Photochemical vs thermal reactions – singlet and triplet states – allowed and forbidden transitions – Jablonski diagram – photosensitization – photochemical reaction – elimination reaction – Norrish type I and Type II – photolysis of cyclic ketone – photolysis of aldehyde – photolysis of compounds containing Nitrogen – Barton reaction – photocycloaddition– Paterno-Buchi reaction – photo induced reaction of  $\alpha,\beta$ -unsaturated ketone

#### Unit-II Name Reactions and their Mechanism

Reformatsky reaction-Birch reduction- Cope elimination- Bayer-villiger oxidation-Ritter reaction-Jones oxidation-Hell-Volhard –Zelinsky reaction-Dakin reaction- Darzens reaction.

#### **Unit- III Heterocyclic Compounds**

Introduction – preparation and reactions of furan, pyrrole and thiophene. Aromatic character and basic nature – comparative reactivity. Preparation and reactions of pyridine – preparation and reactions of quinoline, isoquinoline and indole. Structural elucidation of pyridine, quinoline and isoquinoline.

## **Unit-IV Alkaloids and Terpenoids**

Alkaloids – definition – classification – occurrence – extraction using soxhelet apparatus pigment analysis using flame photometer-extraction of oil from plants using Clevenger-general characteristics. General methods of identification –functional nature of oxygen, nitrogen. Oxidation, Hofmann's exhaustive methylation – structure and synthesis of coniine, piperine and nicotine

Methods of extraction –Qualitative analysis of phytochemicals –Quantitative estimation of tannin, phenolic compounds.

**Terpenoids** – introduction – classification – isolation of terpenoids – isoprene rule – general properties of terpenoids. General procedure for determining structure of terpenoids – synthesis and structure of geraniol, Citral, dipentene and menthol.

#### **Unit-V Amino acids and Proteins**

Amino acids - classification, general methods of preparation and reactions of amino acids, zwitter ion - isoelectric points, action of heat on and and amino acids. Peptides and proteins - Peptide linkage - polypeptide - classification of proteins - synthesis of peptides - Merrifield synthesis - primary structure - end group analysis - Dangyl chloride, Edman method - secondary structure - tertiary structure - denaturation - colour reactions of proteins – nucleotides- Structure of DNA-Watson and Crick model- structure and types of RNA.

Estimation of folic acid, amino acid and protein by colorimetry/spectrophotometrically

# **Text Books**

- 1.K.S. Tewari, N.K. Vishnoi, S.N. Mehrotra. A Text Book of Organic Chemistry, Vikas publishing house (P) Ltd.2002.
- 2.Arun Bahl and B. S. Bahl Advanced Organic chemistry, S. Chand and Company Ltd., Reprint 2005.
- 3. Organic Reaction Mechanisms, V. K. Ahluwalia and Rakesh Kumar Parashar, 2011,Narosa Publishing House, New Delhi

- 1. I.L Finar Organic Chemistry Volume II, Stereochemistry and the Chemistry of Natural Products Edition V Reprint 1986.
- 2. Jerry March, Advanced Organic Chemistry, Reactions Mechanisms and Structure, 4<sup>th</sup> Edition. 2013

SEMESTER VI				
Core XII Physical Chemistry III				
Code :18UCHC62Hrs/Week : 5Hrs/ Sem : 75Credits : 4				

# Vision:

Inspiring and educating the students the core concepts in Physical Chemistry

## Mission:

Enable the young Chemistry buds to sustain a deep knowledge in thermodynamics, solutions and thermochemistry

# **Course Outcome**

CO No.	Upon completion of this course, students	PSO	CL
	should be able to	addressed	
CO - 1	study various thermodynamic parameters and its	1,2,3	Re
	applications in different physical states of the		
	systems		
CO - 2	understand the kinetics of the reaction and to	1,2,4	Re
	determine the reaction mechanism		
CO - 3	apply reaction kinetics to determine the rate of	1,2,3,5	Ap
	chemical reactions; understand the factors that		
	influence rates of reaction.		
CO - 4	catagorise fundamental uniqueness of the	1,2,3,5	An
	chemical and physical properties of nanomaterials		
	and their potential impact in science, engineering,		
	medicine, and the environment		
CO - 5	outline the concepts of top down and bottom up	2, 3,5,6	An
	methods of nanomaterials preparation		
CO - 6	have a thorough Learning of miscible and	2,3,4	Re
	immiscible liquids		
<u> </u>		2.2	•
0-7	comparison of vapour pressure of partially	2,3	An
	miscible liquids and mixture of immiscible liquids		
	and understand the theory of fractional		
	distination and steam distination and its		
	applications.		
<u> </u>	outline the statement of Nernst distribution law	1 2 3 4	Δn
0-0	its deviations and applications	1, 2, 3, 7	
			1

SEMESTER VI				
Core XII Physical Chemistry III				
Code :18UCHC62Hrs/Week : 5Hrs/ Sem : 75Credits : 4				

## Unit I Thermodynamics I

Terminology – thermodynamic equilibrium – types of thermodynamic system – thermodynamic processes – (Isothermal, adiabatic, isobaric, isochoric) – definition and example – sign conventions – first law of thermodynamics – enthalpy of a system – relation between  $\Delta H$  and  $\Delta E$  – molar heat capacities – definition – molar heat capacity at constant volume – molar heat capacity at constant pressure – relation between  $C_p$  and  $C_v$ . Joule Thomson effect – Joule Thomson coefficient – inversion temperature.

#### Unit II Thermodynamics II

Limitations of first law of thermodynamics .Second law of thermodynamics – Different statements – Concept of entropy – Entropy changes in isothermal expansion of an ideal gas – Entropy changes in reversible and irreversible processes – Work function and free energy function – Variation of free energy with temperature and pressure – Gibbs Helmholtz equation – Derivation and significance – Partial molar properties – Chemical potential – Gibb's Duhem equation – Derivation and significance ...

#### Unit III Thermodynamics III

Claussius-Claypeyron equation – application in ice skating – derivation (integral and differential forms) and significances – derivation of Van't Hoff isotherm and isochore. Concept of fugacity– fugacity of a gas in a gaseous mixture –physical significance of fugacity. Nernst heat theorem – third law of thermodynamics – statement – determination of absolute entropy of solids, liquids and gases – experimental verification of the third law of thermodynamics – derivation of the Boltzmann entropy equation – residual entropy – zeroth law – energy relations in living systems.

#### **Unit IV Solution**

**Liquids in liquids** –completely miscible liquids- ideal and non-ideal mixtures-Raoult's law - distillation of homogenous binary liquid mixtures -Theory of fractional distillation – Azeotropic distillation.

**Partially miscible liquids** – Phenol-water, Triethylamine-water and Nicotine-water systems –Variation of solubility with temperature – vapour pressure of partially miscible liquids-critical solution(consolute) temperature-upper, lower,upper and lower - influence of impurity on CST and applications.

**Immiscible liquid systems-** vapour pressure of mixtures of immiscible liquids- theory of steam distillation and its applications.

**Nernst distribution law** – statement–conditions - thermodynamic derivation –-deviations from the law(molecular association and dissociation) ---- applications-distribution indicators-study of complex ions-solvent extraction

## Unit V Chemical Equilibrium

Reversible reactions- nature of chemical equilibrium- characteristics-law of mass action-explanation of the law of mass action based on the molecular collision theory-equilibrium constant; equilibrium law-relationship between  $K_c$  and  $K_p$ -Application of law of mass action to the equilibria involving the formation of NH<sub>3</sub>, dissociation of CaCO<sub>3</sub> and the dehydration of CuSO<sub>4</sub>.5H<sub>2</sub>O. Lechatelier's principle – statement-application to the formation of NH<sub>3</sub>

## **Text Books**

 B.R.Puri. L.R. Sharma, Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2008.

 Arun Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, S. Chand & Company Ltd., New Delhi, 2008.

- 1. Samuel Glasstone, Thermodynamics for chemists, Affiliated East-West Press (Pvt.) Ltd, New Delhi, III printing, 2010.
- 2.Sadhan Kr.Dutta, Principles of Physical Pharmacy and Biophysical Chemistry, Books and Allied (P) Ltd. Kolkata, 2007
- 3. P.L.Soni, O.P.Dharmaha, Text Book of Physical Chemistry( A Modern Approach), Sultan Chand and Sons Publishers, Revised Edition, 2010.
- 4. Iran. Levine, Physical Chemistry, Mc Graw Hill, Kogakusha Ltd. 1978.

SEMESTER V				
Core Practical III Physical Chemistry Experiments				
Code : 18UCHCR3Hrs/Week : 5Hrs/ Sem : 75Credits : 3				

**Objective:** Enable the student to get analytical skills and help them to plan and execute experimental projects.

## List of Experiments:

- 1.Critical solution temperature of phenol water system and effect of impurities on CST.
- 2. Transition Temperature of a salt hydrate determination of molecular weight
- 3. Kinetics of Ester Hydrolysis
- 4. Conductometric Acid base Titration
- 5. Conductometric precipitation Titration
- 6. Potentiometric Redox Titration
- 7. Molecular weight determination by Rast Method
- 8. Phase Diagram Simple eutectic
- 9. Phase Diagram Compound formation
- 10. Heat of solution by solubility method ( $K_2Cr_2O_7$ / oxalic acid)
- 11. Adsorption kinetics of oxalic acids/acetic acid on charcoal. Determination of concentration of the given acid.

## **Course Work**

1. Verification of Beer's Law using spectrophotometer.

- 1. J.N. Gurtu and R. Kapoor, Advanced experimental chemistry, S.Chand and Co., 1987.
- 2. Dr. S. Sundaram, Dr.Krishnan and Dr. P.S.Raghavan, S.Viswanathan, Practical chemistry, (Printers & Publishers), Pvt. Ltd., 2007
- 3. R.Mukhopadhyay P.Chatterjee Advanced practical chemistry, Books and allied (p)Ltd. Kolkata, Third Edition 2007.

	SEMESTE	R V & VI			
Core Practical IV Organic Analysis and Organic Preparations					
Code : 18UCHCR4Hrs/Week : 3Hrs/ Sem : 45Credits : 3					

**Objective:** Enable the students to develop analytical skill in organic qualitative and quantitative analysis and to develop skill in preparing organic compounds.

## 1. Organic Analysis:

Analysis of simple organic compounds

- a) Nature of the compound- Aromatic / Aliphatic
- b) Test for saturation/ unsaturation.
- c) Detection of element present/ absent
- d) Characterization of functional groups (Acids, amide, amines, phenol, aldehyde,

ketone, anilide, ester, carbohydrates, nitro compounds), Confirmation by preparation of a solid derivative.

## 2. Preparation of Organic compounds involving the following chemical conversions

1.Oxidation 2. Hydrolysis 3. Nitration 4. Bromination

5. Diazotization 6. Benzoylation 7. Osazone formation

# **3.** Determination of physical constant(melting point/boiling point)

## 4.Course work

i) Extraction of various phytochemicals using soxhelet apparatus and to analyse plant pigments

using flame photometer

ii) Extraction of oil from plants using Clevenger apparatus.

- 1. Raghupati Mukhopadhyay, Pratul Chatterjee ,Advanced Practical Chemistry Books and Allied (P) Ltd. Third Edition-2007
- 2. J.N. Gurtu and R. Kapoor, Advanced experimental chemistry, S.Chand and Co., 1987.
- 3.Arthur I.Vogel, A text book of practical organic chemistry including qualitative analysis, Longman Group Ltd. ELBS edition, 1975
- 4.N.S.Gnanapragasam, G.Ramamoorthy, Organic Chemistry Lab Manual, S.Viswanathan printers and publishers Pvt. Ltd.2007

SEMESTER VI				
Core Practical V Gravimetry and Inorganic Preparation				
Code : 18UCHCR5Hrs./Week:5Hrs/ Sem: 75Credits : 2				

## **Objective:**

Enable the student to get analytical skills and help them to plan and execute experimental projects.

## a) Gravimetric Analysis

- 1. Estimation of Lead as Lead Chromate.
- 2. Estimation of Barium as Barium Chromate
- 3. Estimation of Zinc as Zinc Oxinate
- 4. Estimation of copper as copper (I) thiocyanate
- 5. Estimation of calcium as calcium oxalate.

## **b)** Inorganic Preparations

- 1. Preparation of Potash alum
- 2. Preparation of Hexamminenickel(II)chloride
- 3. Preparation of Tetramminecopper(II)sulphate
- 4. Preparation of Prussian blue.
- 5. Preparation of Potassiumtrioxalatochromate (III) trihydrate
- 6. Preparation of Potassiumtrisoxalatoferrate(III)
- 7. Preparation of Tristhioureacopper(I) sulphate

## **Course work**

- 1. Estimation of Nickel as Nickel DMG complex
- 2. Estimation of Iron/ Nickel by spectrophotometer.

SEMESTER- V				
Core Integral I Essentials of Inorganic Chemistry				
Code :18UCHI51 Hrs./Week:4 Hrs/ Sem: 60 Credits:4				

# Vision

Acquire knowledge about the different groups present in periodic table

# Mission

- Have a profound understanding of carbon and nitrogen group elements
- Know the chemistry behind d and f block elements

# **Course Outcome:**

CO No.	Upon completion of this course, students will	PSO	CL
	be able to	addressed	
CO - 1	provide knowledge about non-aqueous solvents	1	Un
CO - 2	helps to learn the positions of the zero, d- and f-	1	Ev
	block elements in the periodic table		
CO - 3	explain the general characteristics of non-	1	Ар
	aqueous solvents d– and f–block elements and the		
	general horizontal and group trends in them		
CO - 4	recall relevant oxidation states for the zeros, d	1	Re
	and f block elements		
CO - 5	appreciate the relative stability of various	1, 7	Ev
	oxidation states in terms of electrode potential		
	values		
CO - 6	derive equations for reactions of compounds of	1, 2, 8	Cr
	the zero, d and f block elements		
CO - 7	describe the synthesis of the zeros, d and f block	3, 5, 6	Ар
	elements		
CO - 8	recall the structures, the properties, applications	1, 2	Re
	of silicones and silicates		

SEMESTER- V				
Core Integral I Essentials of Inorganic Chemistry				
Code :18UCHI51 Hrs./Week:4 Hrs/ Sem: 60 Credits:4				

#### Unit I Reactions in non-aqueous solvents

Solvent- definition- water as a universal solvent - classification of solvents – factors affecting the solvating ability– liquid range-dielectric constant – dipole moment and viscosity.

Liquid  $NH_3$  as non aqueous solvent-reason –auto ionisation – ammono acid and bases. Reactions - neutralization, precipitation, solvolysis, complex formation and redox reactions. Advantages and disadvantages of liquid  $NH_3$  as a solvent.

Liquid SO<sub>2</sub> as non aqueous solvent – reason. Reactions- precipitation, neutralization, solvolysis, complex formation and redox reactions. Advantages and disadvantages of liquid SO<sub>2</sub> as a solvent.

#### **Unit II Zero Group Elements**

Position of zero group in the periodic table – Ramsay- Rayleigh's method – Fisher-Ringe's method – separation of noble gases from liquid air –compounds of xenon – preparation, properties and structure (valence bond approach) of XeF<sub>2</sub>, XeF<sub>4</sub>, XeF<sub>6</sub>, XeO<sub>2</sub>F<sub>2</sub>, XeO<sub>3</sub>, XeO<sub>4</sub>, XeOF<sub>4</sub>, clathrates - type of clathrates –preparation, stability and structure of clathrates

#### **Unit III d- Block Elements**

General characteristics of d-block elements – comparative study of Ti,Zr,Hfextraction,properties and uses of titanium-preparation and uses of titanium dioxide and titanium tetrachloride. polyvalency of vanadium. Comparative study of Cr, Mo, W – polyvalency of chromium-extraction, properties and uses of molybdynum and tungsten. Platinum-Extration,properties and uses. Platinum sponge, Platinum black,platinized asbestos and colloidal Platinum, potassium chloroplatinate. Comparative study of Cu,Ag,Au.(similarities and dissimilarities)

#### Unit IV f- Block Elements

General characteristics of lanthanides – separation of lanthanides – precipitation – thermal reaction – fractional crystallization – complex formation – solvent extraction – valency change method – ion exchange method. Extraction of a mixture of lanthanides from monazite sand – applications of lanthanides and their compounds – lanthanide contraction – causes and consequences. General characteristics of actinides – comparison between lanthanides and actinides- extraction of Th and U. Preparation and uses of  $UF_6$  and uranyl acetate.

## Unit V Inorganic materials

Inorganic polymers – general properties - Classification of inorganic polymers - polymer containing phosphorous – preparation, properties and structure of polyphosphonitrilic chloride - polymer containing sulphur - preparation, properties and structure of polymeric sulphur nitride - polymer containing boron – preparation, properties, structure of borazine, substituted borazine – boron nitride and polycarbonates – polymer containing silicon - preparation, properties, structure and uses of silicone fluids, silicone rubbers and silicon resins. Silicates – classification and structure of silicates.

## Text book

1. B.R.Puri, L.R.Sharma, K.C.Kalia, Principles of Inorganic Chemistry, Milestone publishers and distributers, Delhi. 2016 – 2017.

- 1. R.D.Madan Modern Inorganic Chemistry, S.Chand& Co. Ltd, 2005
- 2. Gurdeep Raj, Advanced inorganic Chemistry, Goel Publishing house1986.
- 3. Sathya Prakash and R.D. Madan, Advance Inorganic Chemistry, Chand and Co. 2005.

SEMESTER- VI					
Core Integral II Spectroscopy					
Code : 18UCHI61	Code : 18UCHI61Hrs/Week : 4Hrs/ Sem : 60Credits : 4				

## Vision:

Aware of the excitement of science behind electromagnetic radiation and structural elucidation of molecules

## Mission:

Understand how molecules and materials behave, interact and transform at molecular, atomic and electronic level.

Discover the applications of spectroscopic techniques which fundamentally relate to the interaction of light with matter.

## **Course Outcome**

CO	Upon completion of this course, students should be able to:	PSO	CL
No.		addressed	
CO - 1	have a basic knowledge of electromagnetic spectrum and various	1,2,3	Re
	types of spectra		
CO - 2	understand the theory, instrumentation and applications of	1, 2	Un
	rotational spectroscopy		
CO - 3	know the types of electronic transitions and various selection	1,3	Re
	rules		
CO - 4	apply Woodward-Fieser rule for calculation of absorption	2, 3,6	Ap
	maxima of dienes and $\alpha$ , $\beta$ unsaturated ketones and enumerate		
	the applications of UV spectroscopy in coordination complexes.		
CO - 5	generalise the theoretical principle, selection rules and	1, 2,4,6	Cr
	instrumentation of IR and Raman spectroscopy		
CO - 6	categorise IR absorption frequencies and applications of IR and	1,2,4	An
	Raman spectroscopy		
CO - 7	assess C <sup>13</sup> NMR and the principle behind 31P, 19F and 15N	1 ,2 ,4,6,7,8	Ev
	NMR, Magnetic Resonance Imaging and applications of NMR		
	spectroscopy.		
CO - 8	know the basic principles and instrumentation of mass	3,7,8	Re
	spectrometry		

SEMESTER- VI				
Core Integral II Spectroscopy				
Code : 18UCHI61Hrs/Week : 4Hrs/ Sem : 60Credits : 4				

#### **Unit-I Electromagnetic Spectrum and Rotational Spectroscopy**

Regions of electromagnetic spectrum - interaction of radiation with matter – Different types of energy levels in molecules – rotation, vibration and electronic levels. Various types of spectra – atomic spectroscopy – molecular spectroscopy.

Rotational spectroscopy - Micro wave (rotational) spectra – theory – instrumentation and applications in the determination of bond distances in diatomic molecules –microwave oven

#### Unit-II UV Spectroscopy

Theory – types of electronic transitions - selection rules – forbidden and allowed transitions - Chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic and hypochrmic effect – instrumentation – Woodward - Fieser rule for calculation of absorption maxima of dienes and  $\alpha$ ,  $\beta$  unsaturated ketones ( simple problems can be asked using Woodward-Fieser rule)

#### Unit-III IR Spectroscopy and Raman spectroscopy

Vibrational (IR) spectra – theoretical principle – harmonic oscillator and unharmonicity – modes of vibrations – selection rules – Number of fundamental vibrations – Force constant – Fermi resonance – zero point energy - instrumentation.. Finger print region, characteristics of IR absorption frequencies, intermolecular and intramolecular hydrogen bonding. – Applications in the determination of bond strength.

Raman spectra – theoretical principle – selection rules – stokes and anti stokes line – PQR branches – instrumentation and Mutual exclusion principle – applications to  $CO_2$  and HCN molecules.

#### Unit-IV NMR Spectroscopy

Introduction – spin moment-theory – number of signals - instrumentation - internal standard (TMS) –chemical shift – factors influencing chemical shift – splitting of the signals, spin-spin coupling, coupling constant. NMR spectrum of ethanol, benzyl alcohol, propionic acid, anisole, benzaldehyde, 2,3-dibromopropene, ethyl methyl ketone and mesitylene.  $C^{13}$  NMR - Applications of NMR spectroscopy-Magnetic Resonance Imaging.

#### **Unit-V Mass spectrometry**

Basic Principles - instrumentation- isotope abundance - techniques of Ion production - EI, CI - Base peak- molecular ion - meta stable ion - daughter ion--calculation of molecular formula - fragmentation pattern of various classes of organic compounds- hydrocarbons, alcohols, amines, aldehyde, ketone, ether, ester, acids and phenols- Mc-Lafferty rearrangement.

# **Text Books**

- B.R.Puri. L.R. Sharma, Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2008.
- Arun Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, S. Chand & Company Ltd., New Delhi, 2008.
- P.S.Kalsi, Spectroscopy of Organic compounds, IV Edition, New Age International (P) Ltd., New Delhi, 1999.
- 4. B.K.Sharma, Spectroscopy, Goel Publishing House, Fourteenth Edition, 2000.

- 1. C.N.Banwell, Fundamentals of Molecular Spectroscopy, Mc.graw Hill, Fourth Edition, 2003.
- 2. John.R.Dyer, Applications of Absorption Spectroscopy of organic compounds, Sixth Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 1984.
- 3. Jag Mohan, Organic Spectroscopy- Principles and Applications, Second Edition, Alpha Science International Limited, Harrow, U.K., 2000.
- 4. Robert.M.Silverstein, G.Clayton Bassler, Terrence .C. Morrill, . Spectroscopic Identification of Organic Compounds John Wiley and Sons, Inc., Newyork, 1974.

SEMESTER- VI			
Core Integral III Selected Topics In Chemistry			
Code :18UCHI62Hrs/Week:5Hrs/ Sem: 75Credits: 4			

# Vision

Provide adequate knowledge about the chemistry behind the products that we use in our daily life.

## Mission

- Grasp the principles behind milk processing, corrosion and polymer processing
- Employ the separation process effectively for solid and liquids in our daily life
- Recognize the nature and the function of food additives in our food.

# **Course Outcome :**

СО	Upon completion of this course, students should be able to	PSO	CL
No.		addressed	
CO - 1	have a basic knowledge about milk and its composition	1,2,3	Re
CO - 2	understand the theory behind fermented milks	1, 2	Un
CO - 3	know the types of different types of purification techniques	1,3	Re
CO - 4	apply Chromatographic techniques for the recovery of Organic	2, 3,6	Ap
	substances		
CO - 5	generalize the types of corrosion	1, 2,4,6	Cr
CO - 6	categorize the constituents of paint and its uses	1,2,4	An
CO - 7	assess the properties of conductive polymers	1 ,2 ,4,6,7,8	Ev
CO - 8	know the preparation of synthetic polymers	3,7,8	Re

SEMESTER- VI			
Core Integral III Selected Topics In Chemistry			
Code :18UCHI62	Hrs./Week:5	Hrs/ Sem: 75	Credits: 4

#### **Unit I – Dairy Chemistry**

Milk – definition – composition and constituents of milk – factors affecting the composition of milk – properties of milk – physical state – flavour – aroma – acidity – density – viscosity – boiling point – freezing point – acid-base equilibria – estimation of acid number – saponification number – iodine number – RM number – estimation of fat in milk – Babcock method – Majonnier method – nutritive value of milk.

Non-Fermented milks – definition and manufacture of special milks – sterilized milk – flavoured milk – sterilized-flavoured milk – irradiated / vitaminised milk – standardised milk – reconstituted milk – recombined milk – toned milk – condensed milk.

#### Unit II Separation and Purification Techniques

Purification of solid organic compounds – recrystallization, use of miscible solvents – use of drying agents – sublimation – purification of liquids – distillation – fractional distillation – use of immiscible solvents –solvent extraction.

Chromatography – principle of adsorption and partition chromatography – column chromatography, adsorbents – classification of adsorbents – solvents – preparation of column, adsorption, recovery of substances. Thin layer chromatography – choice of adsorbent – choice of solvent – preparation of chromatogram.

#### Unit III Corrosion and Protective Coating

Corrosion of metals – definition – disadvantages – types of corrosion-theories of corrosion (Direct Chemical corrosion, electrochemical corrosion ) – methods of preventing corrosion-corrosion inhibitors

Types of protective coating (metallic, organic, organic lining and ceramic coating) paint-characteristics of a good paint – constituents of paints and their functions varnish, resins and lacquers, their characteristics – uses – difference between paint, varnish and lacquer

## Unit IV Food Chemistry

Manufacture of sugar from beetroot and sugarcane – molasses – manufacture of alcoholic beverages – manufacture of vinegar food additives – baking soda – food color natural and artificial – intentional food additives – acid base and their salts – antioxidants – stabilizers– bleaching – maturing agents – leavening agents – humectants and preservatives.

#### **Unit V Polymer Chemistry**

Introduction-Classification based on chemical structure, mode of synthesis and composition – Characteristics of the polymers - nomenclature of polymers – Homopolymers and Hetero polymers — Conducting polymers- Tacticity – Copolymer - types.Plastics( thermoplast and thermosets)–elastomers – fibres. Degree of polymerization.

**Synthetic Polymers**:Poly olefins – Polyethylene – HDPE, LDPE, LDPE – Polypropylene – Polyvinyl chloride – grades of PVC – Teflon.Polymethylmethacrylate

(pexiglass) polystyrene, polyamide – Nylon6, Nylon66, Nylon610 Nylon11, - polyester – polyurethanes – polycarbonates

# Text books

- 1. K. Bagavathi Sundari, Applied Chemistry MJP Publishers, Tamil Nadu Book House, Chennai, 2006.
- Jayashree Ghosh, Fundamental concepts of Applied chemistry Edition, S. Chand & company Ltd New Delhi, 2006.

- 1. Siva Sankar B, Food processing and preservation, Prentice, Hall of India Pvt., Ltd., New Delhi 2002.
- 2. Arora M.G., Singh M., Polymer Chemistry-Anmol Punblications Pvt.Ltd., New Delhi, 2002.
- 3. B.K. Sharma, Industrial Chemistry Goel Publishing House, , Meerut, 2003.

SEMESTER III			
Core Skill Based Agricultural Chemistry and Water Management			ment
Code :18UCHS31	Hrs./Week:4	Hrs/ Sem : 60	Credits:4

## Vision

Facilitate the students to know the basic knowledge about agriculture and soil

# Mission

- Realize the importance of agriculture
- Understand the chemistry behind fertilizers and pesticides
- Idea to create vermincompost
- Analyze the quality of drinking water

## **Course Outcome**

CO No.	Upon completion of this course, students will be	PSO	CL
	able to	addressed	
CO - 1	understand the importance of soil its constituents,	1,7	Un
	fertility and to promote agriculture.		
CO - 2	know the preparation and importance of fertilizers in	1,7	Re
	agriculture		
CO - 3	realize the importance of pesticides and insecticides	1, 7	Ар
CO - 4	understand the water quality standards and water	2, 3, 7	Un
	quality parameters.		
CO - 5	aware of the harmful effects of pollutants	2, 3, 8	An,Cr
	Produce vermi compost and gobar gas		
CO - 6	understand the processes used for purification of	4	Un
	municipal water		
CO - 7	treat waste water by using different methods	4, 7, 8	Cr
CO - 8	estimate the amount of carbonate, chloride, nitrate,	4, 7	Ар
	phosphate, zinc and calcium present in soil.		
1			1

SEMESTER III			
Core Skill Based Agricultural Chemistry and Water Management			
Code :18UCHS31	Hrs/Week:4	Hrs/ Sem 60	Credits:4

# Unit I Soil Nature and Plant Nutrients

Saline, alkali and acid soils. Buffering capacity of soil - Soil reclamation. Liming of soil – measurement of soil pH - Soil fertility – essential plant nutrients and their functions – deficiency symptoms – macro and micro nutrients & their functions. Natural and synthetic manures-qualities of a good fertilizer- classification of fertilizers – nitrogeneous fertilizers - Preparation and importance of urea, calcium cyanamide - phosphatic fertilizers - preparation and importance of super phosphate, triple super phosphate- potash fertilizers - preparation and importance of potassium chloride and potassium nitrate -complex fertilizers - preparation and importance of DAP, mixed fertilizers (NPK) and human effluent from gobar gas plant as a manure. Vermiculture -vermi compost.

# Unit II Pesticides

Pesticides, Insecticides, Repellants, Fungicides- Definition-classification – on the basis of their mode of action, target organisms they control, method of application- environmental hazards - preparation and uses of DDT, BHC, lead arsenate, bordeaux mixture, dithiocarbamates.

# Unit III Water Quality Parameters

Water quality standard for drinking water (WHO)- Water quality parameters-pH, EC, alkalinity, Total acidity, hardness, DO, BOD, COD, salinity, nitrate (Methaemoglobinemia), phosphate and fluoride content – Eutrophication- Toxic metals - Heavy metal pollution –Hg, As, and Cd. Case studies (Minamata, arsenic poison in West Bengal, Itai-itai)

# Unit IV Water Treatment

Waste water treatment-methods and equipments used-preliminary treatment (screening, skimming) - primary treatment (sedimentation, coagulation) - secondary treatment (trickling filters, oxidation pond, anaerobic digestion)-tertiary treatment (adsorption, ion-exchange, reverse osmosis, electrodialysis, disinfection)-treatment of water of municipal purposes-domestic sewage treatment-industrial waste water treatment.

# Unit V LABORATORY WORK (Using Water analyzer and HPLC) (Internal Evaluation Only)

- 1. Analysis of carbonate, chloride, nitrate, phosphate, zinc and calcium in soil.
- 2. Determination of Total Organic Carbon (TOC) in soil.
- 3. Determination of pH and conductivity of water from different sources.
- 4. Determination of DO, COD and hardness of water.
- 5. Samples will be collected from agro ecosystem. Presence of pesticides are recorded / Analysis using HPLC

# **Industrial Visit**

A visit may be made to an industry or a premier institution.

\*A report of the industrial visit may be submitted as an assignment.

# **Text Books**

- 1. Text Book of pharmaceutical chemistry Jayashree Ghosh S.Chand and company, New Delhi 2003
- 2. K.Bagavathi Sundari, Applied Chemistry, MJP Publishers.2008

- 1.B.K.Sharma, Industrial Chemistry, Goel Publishing House, Fifth Edition., 1993-94
- 2.P.S. Sindhu, Environmental Chemistry, New Age International Publishers.2010

SEMESTER III		
Self Study I Applied Chemistry		
Code :18UCHSS1 (Optional)		Credit : +2

Vision: Create awareness for employability in cottage industries

**Mission:** Develop a knowledge about the manufacture of soaps, paper, beverages and house hold articles

# **Course Outcome**

CO No.	Upon completion of this course, students will be	PSO	CL
	able to	addressed	
CO - 1	describe the process of manufacture of soaps	1,7	Re
CO - 2	aware of comparison of soaps and detergents.	5	Ар
CO - 3	list out the characteristics of good paint	1,7	Re
CO - 4	understand the constituents of varnishes and their	2,7	Un
	functions		
CO - 5	describe the manufacture of sugar	2,5	Re
CO - 6	understand the manufacture of paper	2, 5,7	Un
CO - 7	know the chemistry of oils, fats and waxes and their	1,7	Re
	manufacturing process		
CO - 8	know the government regulations required for the	1,5,7	Re
	usage of food additives in food products.		

SEMESTER III		
Self Study I	Applied	Chemistry
Code :18	UCHSS1 (Optional)	Credit : +2

## Unit I Soaps and Detergents

Soap – definition and types – manufacture of different types of soaps (toilet soaps, transparent soaps and liquid soaps) and their uses – cleansing action of soaps. Detergents – classification of detergents (cationic, anionic and non-ionic) – comparison of soaps and detergents.

## Unit II Paint and Varnishes

Purpose of surface coating – Paint – characteristics of good paint – constituents of paints – classification of paints – fluorescent paints (traffic signal), fire retardant paints – Varnishes – constituents and their functions. Emulsion paints.

# Unit III Sugar and Paper Industry

Manufacture of sugar – recovery of alcohol from molasses – fermentation. Beverages preparation of beer and wine. Paper industry – Manufacture of paper.

# Unit IV Pigments and Perfumes

**Pigments** – Definition – Examples – colours imparted by the pigments and their uses (lithopone, titanium dioxide, ultramarine blue, Red lead, chrome green)

Perfumes – Ingredients of perfumes- Isolation of essential oils – Artificial flavours – apple, grape, banana, pineapple, jackfruit (Naming of a few compounds only structure not needed)

# Unit V Articles Of Day Today Life

An Outline of the preparation and uses of the following:

i) Candle	ii) Tooth paste	iii) Blackboard chalk	iv) Moth balls
v) boot polish	vi) Phenoyle	vii) Cleaning powder	viii) Face powder
ix) Lipstick	x) Eyetex		

# Text book

1. Fundamental concepts of Applied chemistry, Jayashree Ghosh Edition S. Chand & company Ltd. New Delhi, 2006,

# **Books for Reference**

1. Engineering chemistry by P.C. Jain and Monika Jain Dhanpat Rai & Sons, New Delhi, 1995.

2. Industrial Chemistry B.K.Sharma Goel Publishing House, Meerut, 2003.

SEMESTER V			
Self study	Chemistry For Co	npetitive Examination	
Code :18UCHSS	53 (Compulsory)	Credits : 2	

Vision: Prepare students to face competitive examinations

# Mission:

- Classify the elements based on electronic configuration
- Know the importance of fullerenes in Nanoscience
- Know the importance of Hydrogen bonding in day today life

# **Course Outcome :**

CO	Upon completion of this course, students should be able to	PSO	CL
No.		addressed	
CO - 1	classify homogeneous and heterogeneous mixtures	1	Re
CO - 2	understand the separation principles used in metallurgy	1, 7	Un
CO - 3	know the Rutherford, J.J Thomson and Bohr's atomic models	1	Re
CO - 4	apply the principles governing the filling up of electrons in the	1	Ap
	orbitals		
CO - 5	classify elements into s, p, d and f block	1, 3	Un
CO - 6	categorise Ionic, Covalent and Coordinate bond	1, 3	An
CO - 7	assess the difference between diamond and graphite.	1 ,6	Ev
CO - 8	know the desalination of water using Reverse Osmosis	5,7	Re

SEMESTER V				
Self Study Chemistry for Competitive Examination				
Code :18U	CHSS3 (Compulsory)	Credits : 2		

## **Unit I Matter**

Definition— classification — physical classification, properties of solids, liquids and gases changes of physical state — chemical classifications — elements, compounds, mixtures — elements — definitions and their classifications viz. metals, non-metal and metalloids with example — physical states of some important elements. Compounds — definition — classifications viz. inorganic and organic compounds with examples. Some important compounds and their common names and uses — characteristics of compounds. Mixtures — definitions- classifications — homogenous and heterogeneous — examples — properties of mixtures — differences between compounds and mixtures. Separation of mixtures — techniques, principles and examples : Handpicking, sieving, magnetic separation, sublimation, sedimentation; Decantation, filtration, evaporation, Distillation, Crystallization.

#### **Unit II Structure of Atoms**

Atoms – Definition – Dalton's atomic theory - sub atomic particles - charges of sub atomic particles discoveries of subatomic particles - atomic and mass number - isotopes -- symbols for elements - principles governing filling up of electrons in the orbitals -Electronic configurations of first twenty elements. Rutherford; J.J Thomson and Bohr!s atomic models - valency; formula and naming of compounds - Molecular mass and mole concept.

## Unit III Classification of Elements and Periodicity of Properties

Classification of elements Doberiner, Newlands, Mendeleev and modern Periodic tables - Groups & Periods - classifications of elements into s, p, d and f block with examples - periodicity of properties - metallic character, atomic - ionic radii, ionization potential energy, electron affinity and electronegativity.

#### **Unit IV Chemical Bonding and Non - Metals**

Need for the Chemical bond formation - introduction to ionic bond, covalent bond, coordinate bond and metallic bond - ionic bond formation - definition, and explanation using NaCl, - covalent bond - definition and explanation using  $H_2$ ,  $O_2$ ,  $N_2$ ,  $CH_4$ , Properties of ionic and covalent compounds Noble gases and their applications -Halogens and their applications preparation and uses of hydrogen, phosphorus and sulphur, Differences between diamond and graphite.- Fullerenes.

## Unit V Air and Water

Atmosphere - different layers of atmosphere and their compositions - composition of air - uses of various components of air - air pollution - sources, effects and control measures - water - abnormal properties of water and its explanation using H-bonding - Hard and soft water - temporary and permanent. hardness - Removal of hardness - Boiling, Clarks process, washing soda process, Calgon - Reverse osmosis -preparation and uses of distilled water.

## **Reference: Question Bank**

SEMESTER- V							
Core VII (Common Core) Solid State and Material science							
Code : 18UPCC51	Hrs/Week: 6	Hrs/ Sem : 90	Credits : 4				

Vision: Understand the usage of the appropriate materials while designing electronic system.

**Mission:** Enrich the students to know the background theory and properties of different materials.

# **Course Outcome**

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL	
CO - 1	understand the basic symmetry elements and operations of crystals.	1, 2	Un	
CO - 2	distinguish the types of crystals and enumerate the various crystal imperfections.	3,4	An	
CO - 3	get a clear knowledge about metallic glasses, ceramics and biomaterials.	1, 3, 5,7, 8	Re	
CO - 4	justify the wave nature of matter and its experimental study.	1,3	Ev	
CO - 5	apply Bragg's law for x-ray study.	2	Ap	
CO - 6	distinguish magnetic materials based on susceptibility.	2	An	
CO - 7	usage of magnetic materials in various field.	2	Ap	
CO - 8	discuss the synthesis methods of nano materials.	2	Un	
SEMESTER- V				
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Core VII (Common Core) Solid State and Material science				
Code : 18UPCC51Hrs/Week : 6Hrs/ Sem : 90Credits : 4				

#### Unit-I Crystal structure and crystal imperfections

Crystal lattice -primitive and unit cell- Basic symmetry elements and operations -Plane of symmetry, centre of symmetry & axis of symmetry -Types of crystals - Bravais lattices - Simple cubic, body centered cubic, FCC, structures with an example - miller indices, inter planar spacing – crystal imperfections – point defects – Schottky and Frenkel defects – line defects – Edge & screw dislocations – surface defects – volume defects (imperfection).

#### **Unit-II New materials**

New materials – metallic glasses – Fiber reinforced plastics – Fiber reinforced metals – Bio materials – Ceramics – Cements – High temperature materials – intermetallic compounds - Alloys - Smart materials.

#### Unit-III Wave nature of matter and X-ray diffraction

Wave nature – introduction – De Broglie Hypothesis – experimental study of matter waves – Davison – Germer's experiment – Heisenberg's Uncertainity principle.

Bragg's law – Derivation of Bragg's equation - Experimental methods of X-ray study – Laue, rotating crystal and powder methods.

#### **Unit-IV Magnetic and dielectric materials**

Classification of magnetic materials – Langvein theory of diamagnetism – theory of paramagnetism – Domain theory of ferromagnetism – Antiferro magnetic materials – Application of Different magnetic materials.

Dielectric materials – Types of dielectric materials – different types of electric polarization —Internal field – Clausius-Mossotti equation – Frequency and temperature dependence of dielectric constant.

#### **Unit- V Nanomaterials**

Nanomaterials- Synthesis- Plasma arcing – Chemical vapour deposition – Sol gels-Electro deposition – Ball milling –Properties of nano particles and applications. Carbon nanotubes fabrication – Arc method –Pulsed laser deposition- Chemical vapour deposition-Structure- Properties- Applications.

#### Text books

1. M.Arumugam, Material Science, Anuradha Publication 2008.

- 2. C M Sri Vasta & C Srinivasan, Science of Engineering materials, New Age International (P) Ltd, Second Edition, 1999.
- 3. P. K. Palanisamy, Solid state Physics Copyright (2003), Scitech Publication (India) Pvt Ltd Chennai, 3<sup>rd</sup> reprint 2008.

- 4. R.Mureghesan, Modern Physics, Kiruthiga Sivaprasath, S.Chand & Co Ltd, 17<sup>th</sup> Edition, 2013.
- 5. Dr. P.Mani, A Text Book of Engineering Physics, Dhanam Publications Chennai, Revised Edition, 2008.

# **Books for Reference**

- 1. Charles Kittel, Introduction to solid state Physics, John Wiley and Sons 2010
- P. K. Palanisamy, Material Science, Scitech Publication (India) Pvt Ltd., Chennai, 2005.
- 3. M.H Fulekar, Nano Technology Importance and applications, I.K International Publishing House Pvt Ltd,2010.

SEMESTER I					
Part III Allied – I Allied Biochemistry -I					
Course Code: 21UCBA11Hrs/Week : 4Hrs/ Sem : 60Credits : 3					

# **OBJECTIVES:**

- To acquire knowledge about the chemical composition of life.
- To Understand fundamental biochemical processes.
- To knowledge about vitamins and their deficiency.
- To study the functions of hormones.

# **Course Outcomes**

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	explain about the chemical composition and the elements of life.	1	Un
CO 2	differentiate direct and indirect method for the determination of energy requirement of man.	2	Un
CO 3	express the importance of bioenergetics.	7	Un
CO 4	compare the biological reaction such as exergonic reaction and endergonic reaction.	3	An
CO 5	demonstrate about the various energy rich compounds such as adenosine triphosphate, guanosine triphosphate, uridinetriphosphate, cytidinetriphosphate and acyl phosphate.	5	Ар
CO 6	distinguish water soluble and fat-soluble vitamins and analyze their composition, functions and deficiency symptoms.	3	An
CO 7	interpret the hormones producing organs and their functions and to know about the plant as well as animal hormones.	3,5	Cr ,Re
CO 8	identify the antibiotics which are all responsible for affecting cell wall synthesis, cytoplasmic membrane and enzyme systems.	7	Re

SEMESTER I					
Part III Allied – I Allied Biochemistry -I					
Course Code: 21UCBA11Hrs/Week : 4Hrs/ Sem : 60Credits : 3					

#### **UNITI: Introduction to Biochemistry**

Introduction to biochemistry - scope – chemical composition of life – elements of life – water – biological importance – Energy requirements of the body – Measurement of energy value of foods – Determination of energy requirement of man – Direct method, Indirect method, Respiratory quotients (RQ) of food stuffs – Total heat production – Significance of RQ Basal metabolism – Definition – Conditions for measurement – Factors influencing, Measurement, Significance, Specific dynamic action.

#### **UNIT: II Bioenergetics**

Introduction – Importance of bioenergetics - Energy and work – thermodynamic principles - Biological reactions – Exergonic reaction – Endergonic reaction – Energy and its forms - Energy rich compounds – Adenosine triphosphate – Guanosine triphosphate – Uridine triphosphate – Cytidine triphosphate – Acyl phosphate - Energy coupling.

#### **UNIT: III VITAMINS**

Introduction – definition - Sources of vitamin – Deficiency diseases – provitamins – biological functions - Properties of Vitamins – Classification of vitamins - water soluble (Vitamin B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>5</sub>, B<sub>6</sub>, B<sub>7</sub>, B<sub>9</sub> and B<sub>12</sub>Vitamin C) and fat soluble vitamins (Vitamin – A, D, E and K) and their composition, functions and deficiency symptoms.

#### **UNIT:IV Hormones**

Introduction –Definition – Properties – Biological Functions – Chemical Nature – Hormones secreting glands – Hormones producing organs and their functions - Classification of hormones: based on chemical nature – Functions of Hormones – Plant hormones(Auxins, Gibberllins, Cytokinins, Ethylene, Traumatic acid, Absicisic acid, Morphactins) – Animal hormones (STH, TSH, FSH, LH, LTH, Insulin)

#### **UNIT:V** Antibiotics

Introduction – Definition – Antibiotics affecting cell wall synthesis ( pencillin, cephalosporin ) – Antibiotics affecting the cytoplasmic membrane – Antibiotics interfering with Nucleic acid function – Antibiotics inhibiting protein synthesis ( streptomycin, erythromycin, neomycin)– Antibiotics affecting enzyme systems – Drug resistance.

# **Text Books:**

- 1. Dulsy Fatima, Narayanan L.M, MeyyanPillai R.P, Nallasingam K, Prasanna Kumar S and Arumugam N. *Biochemistry*.Saras Publications, 2010.
- 2. Patricia trueman. *Nutritional Biochemistry*. MJP publisher, 2011.
- 3. Veerakumari L. Biochemistry. MJP Publishers, 2010.

# **Reference Books:**

- 1. Dr. Deb A.C. Concepts of *Biochemistry*.Kolkatta:New Central Book Agency, 2001.
- 2. Powar C.B, Chatwal G.R, *Biochemistry*. Himalaya Publishing Ltd, 2002.

SEMESTER II					
Part III Allied - I Allied Biochemistry –II					
Course Code: 21UCBA21	Hrs/Week : 4	Hrs/ Sem : 60	Credits : 3		

# **OBJECTIVES:**

- To achieve broad based knowledge in concepts and principles of biochemistry.
- To provide an opportunity in acquiring knowledge about nutritional biochemistry.
- To understand the various pathways involved in cell respiration.
- To grasp in-depth knowledge about the biochemistry of blood and respiration.
- To familiarize the learners with the techniques involved in biochemistry.

## **Course Outcomes**

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	discuss in detail about the nutritional values of milk, egg, meat, fish, vegetable foods, fruits, tea, coffee, cocoa and alcohol.	1	U
CO 2	demonstrate the theories of biological oxidation decarboxylation, electron transport system and oxidative phosphorylation.	5	С
CO 3	describe the functions of blood and to discuss in brief about red blood cells, white blood cells, blood platelets, plasma and plasma protein.	1	An
CO 4	formulate how the minerals are important in our life.	1	U
CO 5	relate the physical and chemical transport of blood.	1	U
CO 6	interpret the various minerals and their recommended levels in food.	2	R
CO 7	compare the relation between optical and electron microscope.	1	Е
CO 8	identify the separated components using paper as well as gel electrophoresis.	6	Ар

SEMESTER II					
Part III Allied - I Allied Biochemistry –II					
Course Code: 21UCBA21	Hrs/Week : 4	Hrs/ Sem : 60	Credits : 3		

## **UNIT I: Nutritional Biochemistry**

Nutritive value ofMilk – Egg – Meat - Fish – Vegetable food (Cereals, Pulses, Nuts, Roots and Tubers, Green leafy vegetables) – Fruits – Tea – Coffee – Cocoa – Alcohol – Principles in balancing a diet - Bioavailability – absorption –effect of drugs on food intake, body weight, nutrient requirements and growth, vitamins and minerals – Energy yielding, Body building and Protective foods.

#### **UNIT II: Cell Respiration and Biological Oxidation**

Introduction – Importance of Biological oxidation – Theories of biological oxidation : oxygen activation theory, hydrogen activation theory – Hydrogen acceptors – Nicotinamide nucleotide – Flavin nucleotide – Cytochrome – Sites – Pathways – Oxidative decarboxylation – Electron transport system – Oxidative Phosphorylation – Energetics of Biological oxidation.

#### **UNIT III: Biochemistry of Blood**

Introduction –Composition -Colour of Blood - Functions of Blood – (Homeostatic functions, Blood as transport system)- Red Blood Cells – White Blood Cells – Blood Platelets – Plasma – Plasma proteins – Albumin, Globulin (alpha, beta and gamma), Fibrinogen – Functions of plasma proteins - Blood groups – Prevention of Blood Loss -Hemoglobin – Variation in structure Hemoglobin with reduced solubility, altered oxygen affinity.

#### **UNIT IV: Minerals**

Introduction – Classification (Macro elements, Micro elements) –Functions, Distribution, Content level in blood , sources, Recommended Dietary allowances, Absorption and excretion, Factors affecting absorption, Deficiency Disease of Calcium, Phosphorous, Sodium, Potassium, Iron, Copper, Iodine, Fluorine, Zinc and Chromium.

#### **UNIT V: Biochemical Techniques**

Introduction –Cell Fractionation (Homogenization, Centrifugation) - Centrifuge – Principle, types – Hand Centrifuge, High Speed Centrifuge – pH meter – Principle, Electrodes used, Applications – Microscopy: Optical and electron Microscope – comparison – Ion probe analysis – Electrophoresis – Paper electrophoresis, Gel electrophoresis – Applications.

# **Text Books:**

- Dulsy Fatima, Narayanan L.M, MeyyanPillai R.P, Nallasingam K, Prasanna Kumar S and Arumugam N. *Biochemistry*. Saras Publications, 2010.
- 2. Patricia trueman. *Nutritional Biochemistry*. MJP publisher, 2011.
- 3. Veerakumari L. *Biochemistry*. MJP Publishers, 2010.

## **Reference Books:**

- 1. Dr. Deb A.C. Concepts of Biochemistry. Kolkata: Central Book of Agency, 2001.
- 2. Powar C.B, Chatwal G. R. *Biochemistry*. Himalaya Publishing Ltd, 2002.

SEMESTER I					
Part III Allied - I Allied Chemistry -I					
Course Code: 21UCH A11	Hrs/Week :4	Hrs/ Sem : 60	Credits : 3		

# Objective

- To develop an appreciation of Chemistry and its application in daily life.
- To understand the importance of quantum numbers.
- To know the fundamental concepts in organic chemistry.
- To know the basic concepts of nuclear reactors.
- To recognize the significance of Chromatography.
- To develop skills to separate the plant materials using Chromatographic technique.

# **Course Outcomes**

CO No.	Upon completion of this course, students will be able to	PSO address ed	CL
CO 1	Know the quantum numbers and electronic configuration	1	Un
CO 2	Compare the configuration of H <sub>2</sub> ,N <sub>2</sub> ,O <sub>2</sub>	2	Ар
CO 3	Understand hybridization of different organic molecules	1	Un
CO 4	Differentiate resonance and tautomerism	1	An
CO 5	Know the difference between chemical reaction and nuclear reaction	1	Re
CO 6	Identify the importance of rock dating and carbon dating	3	An
CO 7	Describe the configuration of D-glucose, D-fructose, D-mannose and D-galactose and recognize the test for identification of proteins	5	Ар
CO 8	Identify the good adsorbent for Chromatographyand Correlate the importance of chromatography in the field of phytochemistry	3, 5	An

#### **UNIT I: Atomic Structure and Chemical Bonding**

Quantum numbers and their significance- Pauli's exclusion principle – Aufbau principle – Hund's rule – Electronic configuration of elements (atomic number 1 to 36)

Lattice energy – Born-Harber cycle–Factors affecting the dissolution of ionic compounds – M.O. Theory of covalent bond – Bonding, antibonding and non bonding orbital – M.O. Configuration of  $H_2$ , $N_2$ , $O_2$ -Bond order – Band theory of metallic bond- Conductors, insulators, semi conductors- Hydrogen bonding – types and effects – Vander Wall's London forces.

#### **UNIT II: Basic Concepts in Organic Chemistry**

Hybridization -Hybridization in methane(sp3), ethylene (sp2), acetylene(sp). electrophilies – nucleophilies –Types of organic reactions- Substitution – Addition – ,elimination- polymerization reactions – Aromaticity - Huckel's rule - benzenoid and nonbenzenoid- aromatic compounds-Examples.

Isomerism-Optical isomerism-symmetry-elements of symmetry-cause of optical activity- Resolution-racemisation- Geometrical isomerism-illustrated by maleic and fumaric acid-keto enol tautomerism-examples- difference between resonance and tautomerism.

#### **UNIT III: Nuclear Chemistry**

Fundamental particles of nucleus - isotopes, isobars, isotones and nuclear isomers. Differences between chemical reactions and nuclear reactions-fusion and fission and its applications - radioactive series, group displacement law- mass defect- Applications of radio isotopes-carbon dating-rock and medicinal applications.

# **UNIT IV Biomolecules**

Carbohydrates- classification- configurations of D-glucose, D-fructose, D-mannose and D-galactose (structures only) – interconversions of glucose and fructoseinterconversions of arabinose and glucose-epimerisation- muta rotation- general study of starch and cellulose. Amino acids - classification-essential amino acids-isolation from proteins- peptide linkage-polypeptides. Proteins- classification- colour reactions- structure.

#### **UNIT V Chromatography**

Chromatography-Classification-AdsorptionChromatography-Principle–Adsorbents Characteristics of good Adsorbents- Principle, Experimental method and applications of Column Chromatography- -Thin layer Chromatography- Ion Exchange Chromatography

#### **Text Books:**

 Arun Bahl and Bahl. B.S. *Advanced Organic Chemistry*. S.Chand and Company Ltd, Reprint, 2005.

- Puri B.R, Sharma L.R and Kalia K.C. *Principles of Inorganic Chemistry*. Delhi: Milestone Publishers and Distributers, 2010.
- Arun Bahl B.S. and Bahl, Tuli. G.D. *Essentials of Physical Chemistry*, New Delhi: S.Chand & Company Ltd, 2008.

# **Books for Reference :**

- Jerry March. Advanced Organic Chemistry, Reactions Mechanisms and Structure. 4<sup>th</sup> Edition, 2013.
- Tewari, K.S., Vishnoi, N.K. and S.N.Mehrotra. *A Text Book of Organic Chemistry*. 2<sup>nd</sup> Revised Edition, 1998.
- Puri B.R, Sharma L.R and Madan Pathania S. *Principles of Physical Chemistry*. Vishal Publishing Co, 2008.
- 4. Jain M.K and Sharma S.C.Modern Organic chemistry. Vishal Publishing Co., 2012.

SEMESTER II					
PartIIIAllied - I ALLIED CHEMISTRY -II					
Course Code: 21UCHA21	Hrs/Week :4	Hrs/ Sem : 60	Credits : 3		

# Objective

- To acquire an appropriate knowledge and understanding in Chemistry underlying inmetallurgical process and industrial important polymers.
- To knowledge on steps involved in metallurgical process
- To know the importance of colloids in day to-day life
- To know the importance of synthetic reagents in organic chemistry.
- To appreciate the importance of nanochemistry in various fields.

# **Course outcomes**

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO 1	Explain the methods of purification of ores and differentiate ores and minerals.	1	Un
CO 2	Know the types of furnaces.	1	Un
CO 3	Correlate the importance of colloids in day to day life.	5	An
CO 4	Know the types of emulsions and emulsifiers.	4	Re
CO 5	Know the importance of synthetic reagents.	1	Re, Un
CO 6	Know the importance of Saccharin- chloramine-T-Salicylic acid –Aspirin.	1	Un
CO 7	Determine the structure of various alkaloids and know the importance of isoprene rule in terpenoids.	4, 1	ApRe , Un
CO 8	Describe the synthesis methods of nano materials and Correlate the importance of nanochemistry in various fields.	5	Un, An

#### **UNIT I: Metallurgy**

Ores and Minerals- types of ores – methods of ore dressing- roasting –calcination, reduction of metal oxide by aluminium (aluminothermic process)-smelting- flux and slag -purification by electrolysis and ion exchange method - oxidative refining- zone refining- Kroll process - van Arkel de Boer method- types of furnaces – kilns – blast – reverberatory- muffle and electric furnace. Extraction, properties and uses of titanium and vanadium. Preparation of Titanium tetrachloride and Vanadium pentoxide.

#### **UNIT II: Colloids and Emulsions**

Definition- Classification of Colloids -comparison of lyophilic and lyophobic colloids-Preparationof sols-Dispersion method(Bredig's Arc method ) -Aggregation method(oxidation, reduction, double decomposition)-Properties - Optical(Tyndall effect) kinetic(Brownian movement)Electrical (electrical double layer) - Coagulation of colloids -Hardy Schulze law - protective colloids - gold number - Gels - classification, preparation properties(imbibition,synerisis and thixotropy). Emulsion and their types distinction.Emulsifiers - surfactants- applications of colloids-food, medicine, thixotropic paints, clarification of municipal water, formation of delta.

# **UNIT III: Synthetic Reagents and Some Important Organic Compounds**

Synthetic reagents-preparation, properties of ethyl zinc-methyl lithium-diethyl malonate and tetra ethyl lead (TEL)

Preparation and properties and uses of Saccharin- chloramines -T-Salicylic acid-Aspirin.

#### **UNIT IV: Alkaloids and Terpenoids**

Alkaloids-Definition-General methods of structure determination- Hoffmann's exhaustive methylation with coniine as example- structure and synthesis of coniine and nicotine.

**Terpenes**-Definition-classification-examples-isoprene rule-general methods of structure determination- structure and synthesis of citral and menthol.

#### **UNITV** Nanochemistry

Nanoparticles – Definition – Types– nanoparticles of metals, semiconductors and oxides – Synthesis of nano sized compounds – reduction methods, sol-gel method– nanoclusters – nanorod- nano wire and uses . Carbon nanotubes – single walled nanotube- multiwalled nanotube. Application of nanochemistry in various fields.

## **Text Books:**

- 1. Arun Bahl and Bahl B.S. *Advanced Organic Chemistry*. S.Chand and Company Ltd. Reprint, 2005.
- Puri B.R, Sharma L.R. and Kalia K.C. *Principles of Inorganic Chemistry*. Delhi: Milestone Publishers and Distributers, 2010.
- 3. Arun Bahl B.S. and Bahl, Tuli G.D. *Essentials of Physical Chemistry*. S.Chand& Company Ltd.New Delhi, 2008.

# **Books for Reference :**

- Jerry March. Advanced Organic Chemistry, Reactions Mechanisms and Structure. 4<sup>th</sup> Edition,2013.
- Tewari N, Vishnoi K.S, and Mehrotra S.N. A Text Book of Organic Chemistry. 2<sup>nd</sup> Revised Edition,1998.
- 3. Puri B.R, Sharma L.R and Madan S. Pathania. *Principles of Physical Chemistry*. Vishal Publishing Co, 2008.
- 4. Jain M.K. and Sharma S.C. Modern Organic chemistry. Vishal Publishing Co., 2012.

SEMESTER III				
Part III Allied - I ALLIED CHEMISTRY -I				
Course Code:21UCHA31	Hrs/Week :4	Hrs/ Sem : 60	Credits : 3	

Vision : Develop an appreciation of Chemistry and its application in daily life

# Mission :

- Understand the importance of quantum numbers.
- Know the fundamental concepts in organic chemistry.
- Know the basic concepts of nuclear reactors.
- Recognize the significance of Chromatography.
- Develop skills to separate the plant materials using Chromatographic technique.

# **Course Outcomes**

CO No.	Upon completion of this course, students will be able to	PSO address ed	CL
CO 1	Know the quantum numbers and	1	Un
	electronic configuration		
CO 2	Compare the configuration of H <sub>2</sub> ,N <sub>2</sub> ,O <sub>2</sub>	2	Ар
CO 3	Understand hybridization of different organic molecules	1	Un
CO 4	Differentiate resonance and tautomerism	1	An
CO 5	Know the difference between chemical reaction and nuclear reaction	1	Re
CO 6	Identify the importance of rock dating and carbon dating	3	An
CO 7	Describe the configuration of D-glucose, D-fructose, D-mannose and D-galactose	5	Ар
CO 8	Recognize the test for identification of proteins	1	Re
CO 9	Identify the good adsorbent for Chromatography	3	An
CO 10	Correlate the importance of Chromatography in the field of phytochemistry	5	An

#### UNIT I ATOMIC STRUCTURE AND CHEMICAL BONDING

Quantum numbers and their significance- Pauli's exclusion principle – Aufbau principle – Hund's rule – Electronic configuration of elements (atomic number 1 to 36) Lattice energy – Born-Harber cycle–Factors affecting the dissolution of ionic compounds – M.O. Theory of covalent bond – Bonding, antibonding and non bonding orbital – M.O. Configuration of H<sub>2</sub>,N<sub>2</sub>,O<sub>2</sub>-Bond order – Band theory of metallic bond- Conductors, insulators, semi conductors- Hydrogen bonding – types and effects – Vander Wall's London forces

# UNIT II BASIC CONCEPTS IN ORGANIC CHEMISTRY

Hybridization -Hybridization in methane(sp3), ethylene (sp2), acetylene(sp). electrophilies – nucleophilies –Types of organic reactions- Substitution – Addition – ,elimination- polymerization reactions – Aromaticity - Huckel's rule - benzenoid and nonbenzenoid- aromatic compounds-Examples.

Isomerism-Optical isomerism-symmetry-elements of symmetry-cause of optical activity- Resolution-racemisation- Geometrical isomerism-illustrated by maleic and fumaric acid-keto enol tautomerism-examples- difference between resonance and tautomerism

# **UNIT III NUCLEAR CHEMISTRY**

Fundamental particles of nucleus - isotopes, isobars, isotones and nuclear isomers. Differences between chemical reactions and nuclear reactions-fusion and fission and its applications - radioactive series, group displacement law- mass defect- Applications of radio isotopes-carbon dating-rock and medicinal applications.

# UNIT IV BIOMOLECULES

Carbohydrates- classification- configurations of D-glucose, D-fructose, D-mannose and D-galactose (structures only) – interconversions of glucose and fructose- interconversions of arabinose and glucose-epimerisation- muta rotation- general study of starch and cellulose

Amino acids - classification-essential amino acids-isolation from proteins- peptide linkage-polypeptides. Proteins- classification- colour reactions- structure.

## **UNIT V CHROMATOGRAPHY**

Chromatography-Classification-AdsorptionChromatography-Principle–Adsorbents Characteristics of good Adsorbents- Principle, Experimental method and applications of Column Chromatography- -Thin layer Chromatography- Ion Exchange Chromatography

## **Text Books:**

1. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry. S.Chand and Company Ltd., Reprint, 2005.

2. Puri, B.R., Sharma, L.R. and K.C.Kalia, Principles of Inorganic Chemistry. Milestone Publishers and Distributers, Delhi, 2010.

3. Arun Bahl, B.S. and Bahl, G.D.Tuli, Essentials of Physical Chemistry. S.Chand & Company Ltd., New Delhi, 2008..

## **Books for Reference :**

1. Jerry March, Advanced Organic Chemistry, Reactions Mechanisms and Structure. 4th Edition, 2013.

2. Tewari, K.S., Vishnoi, N.K. and S.N.Mehrotra, A Text Book of Organic Chemistry. 2 nd Revised Edition, 1998..

3. Puri, B.R., Sharma, L.R. and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co, 2008.

4. Jain, M.K. and S.C.Sharma, Modern Organic chemistry. Vishal Publishing Co. 2012

SEMESTER IV					
Part III Allied - I ALLIED CHEMISTRY - II					
Course Code: 21UCHA41	Hrs/Week :4	Hrs/ Sem : 60	Credits : 3		

**Vision :** Acquire an appropriate knowledge and understanding in Chemistry underlying inmetallurgical process and industrial important polymers.

# Mission :

Knowledge on steps involved in metallurgical process

Know the importance of colloids in day to-day life

Significance of synthetic reagents in organic chemistry.

Importance of nanochemistry in various fields.

# **Course outcomes**

CO No.	Upon completion of this course, students	PSO	CL
	will be able to	addressed	
CO 1	Explain the methods of purification of ores	1	Un
	and differentiate ores and minerals		
CO 2	Know the types of furnaces	1	Un
CO 3	Correlate the importance of colloids in day	5	An
	to day life		
CO 4	Know the types of emulsions and	4	Re
	emulsifiers		
CO 5	Know the importance of synthetic reagents	1	Re,
			Un
CO 6	Know the importance of Saccharin-	1	Un
	chloramine-T-Salicylic acid -Aspirin		
CO 7	Determine the structure of various	4	Ар
	alkaloids		
CO 8	Know the importance of isoprene rule in	1	Re,
	terpenoids		Un
CO 9	Describe the synthesis methods of nano	5	Un
	materials.		
CO 10	Correlate the importance of nanochemistry	5	An
	in various fields		

# UNIT I METALLURGY

Ores and Minerals- types of ores – methods of ore dressing- roasting –calcination, reduction of metal oxide by aluminium (aluminothermic process)-smelting- flux and slag -purification by

electrolysis and ion exchange method - oxidative refining- zone refining- Kroll process - van Arkel de Boer method- types of furnaces – kilns – blast – reverberatory- muffle and electric furnace. Extraction, properties and uses of titanium and vanadium. Preparation of Titanium tetrachloride and Vanadium pentoxide

## UNIT II COLLOIDS AND EMULSIONS

Definition- Classification of Colloids -comparison of lyophilic and lyophobic colloids-Preparation of sols-Dispersion method (Bredig's Arc method) - Aggregation method(oxidation , reduction, double decomposition)-Properties - Optical (Tyndall effect) - kinetic (Brownian movement)Electrical (electrical double layer) - Coagulation of colloids - Hardy Schulze law number – Gels – classification, protective colloids – gold preparation properties(imbibition,synerisis and thixotropy). Emulsion \_ types and their distinction.Emulsifiers - surfactants- applications of colloids-food, medicine, thixotropic paints, clarification of municipal water, formation of delta.

# UNIT III SYNTHETIC REAGENTS AND SOME IMPORTANT ORGANIC COMPOUNDS

Synthetic reagents-preparation, properties of ethyl zinc-methyl lithium-diethyl malonate and tetra ethyl lead (TEL)

Preparation and properties and uses of Saccharin- chloramines -T-Salicylic acid - Aspirin

#### UNIT IV ALKALOIDS AND TERPENOIDS

Alkaloids-Definition-General methods of structure determination- Hoffmann's exhaustive methylation with coniine as example- structure and synthesis of coniine and nicotine

**Terpenes**-Definition-classification-examples-isoprene rule-general methods of structure determination- structure and synthesis of citral and menthol

## UNIT V NANOCHEMISTRY

Nanoparticles – Definition – Types– nanoparticles of metals, semiconductors and oxides – Synthesis of nano sized compounds – reduction methods, sol-gel method– nanoclusters – nanorod- nano wire and uses . Carbon nanotubes – single walled nanotube- multiwalled nanotube. Application of nanochemistry in various fields.

# **Text Books:**

1. Arun Bahl and B.S. Bahl.. Advanced Organic Chemistry. S.Chand and Company Ltd., Reprint, 2005

2. Puri, B.R., Sharma, L.R. and K.C.Kalia, Principles of Inorganic Chemistry. Milestone Publishers and Distributers, Delhi, 2010.

3. Arun Bahl, B.S. and Bahl, G.D.Tuli. Essentials of Physical Chemistry. S.Chand & Company Ltd., New Delhi, 2008..

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1. Jerry March, Advanced Organic Chemistry, Reactions Mechanisms and Structure. 4th Edition, 2013.

2. Tewari, K.S., Vishnoi, N.K. and S.N.Mehrotra. A Text Book of Organic Chemistry. 2 nd Revised Edition, 1998..

3. Puri, B.R., Sharma, L.R. and Madan S. Pathania, Principles of Physical Chemistry. Vishal Publishing Co, 2008.

4. Jain, M.K. and S.C.Sharma, Modern Organic chemistry. Vishal Publishing Co. 2012.

SEMESTER- I				
Part IIICore IGeneral Chemistry - I				
Course Code :21UCHC11		Hrs/Week:6	Hrs/ Sem: 90	Credits:5

# Objectives

- To apply methods of balancing redox reactions
- To communicate the concepts and results of their laboratory experiments clearly and concisely to both chemists and non-chemists through effective writing and oral communication skills
- To inculcate the students the basic principles and concepts in Chemistry.
- To understand the basic chemical principles in Inorganic, Organic and Physical Chemistry.

# **Course Outcome :**

CO No.	Upon completion of this course, students will be	PSO	CL
	able to	addressed	
CO 1	explain the periodic properties of the different groups	1	Un
	of compounds focusing on production methods.		
CO 2	know the nomenclature of different class of organic	1	Re
	compounds.		
CO 3	associate polarization of a bond with	1	Un
	electronegativity.		
CO 4	know the basic knowledge about the fundamental	1	Un
	concept of quantum mechanics.		
CO 5	understand quantum numbers and to know the rules for	4	Ev
	filling up of orbitals and predict electronic arrangement in		
	orbits.		
CO 6	understand the basis of fundamental particles , natural	1	Un
	and artificial radioactivity, nuclear forces and nuclear		
	stability.		
CO 7	apply the theory of radioactivity and nuclear reactions in	3	Ap
	various fields.		
CO 8	apply the knowledge about interfering radicals,	8	Ар
	common ion effect and solubility product.		

SEMESTER- I				
Part IIICore IGeneral Chemistry - I				
Course Code :21UCHC11		Hrs/Week:6	Hrs/ Sem: 90	Credits:5

#### **UNIT I: Periodic Properties and Concept Of Electron Transfer**

Modern periodic law- long form of periodic table – merits and demerits– Abundance of elements- cosmic, terrestrial and relative abundance – classification of elements based on their electronic configuration- Major trends in periodic table – Slater's rule- calculation of effective nuclear charge - periodic properties – trends in ionic and covalent radii , ionization energy, electron affinity and electro negativity –factors affecting ionization energy, electron affinity - scales of electro negativity – Alfred-Rochow's scale – Pauling scale – Mulliken approach – applications of electro negativity.

Concept of electron transfer -Oxidation and reduction – Oxidation number concept of oxidation and reduction- Rules for assigning oxidation number –Electronic concept in inorganic reactions – Redox reactions – oxidant- Important Oxidants and their reduction half reaction – Fe(III) and KMnO<sub>4</sub>–Reductant -important reductants and their oxidation half reaction Fe(II) and oxalic acid. Methods of balancing redox reactions ion electron method, oxidation number method.

### UNIT II: Basic Concepts of Organic Chemistry

Classification and nomenclature of organic compounds – Open chain and closed chain compounds- systems of naming organic compounds- rules of IUPAC system of nomenclature branched alkanes, cyclo alkanes – alkenes, alkynes and substituents-compounds having functional groups, poly functional groups.

Molecular weight determination of organic acids and bases by silver salt and platinic chloride methods. Problems arriving empirical and molecular formula using percentage composition of elements and molecular weight.

Structural formula – Shapes of organic molecules.  $sp^3$ ,  $sp^2$  and sp hybridization in organic compounds with suitable examples.

Polar effects – Inductive (+I, –I), Electromeric effect-Resonance/Mesomeric effect (+R, -R, +M, –M) – examples- Hyper conjugation (Baker Nathan effect) and steric effect.

Bond fission – homolytic and heterolytic fission. Reaction intermediates – carbocation, carbanion, free radicals and carbenes – their generation, shapes and stability. Types of reaction-substitution- elimination –addition – polymerisation-definition and examples.

#### **UNITIII: Basic Quantum Chemistry**

Dual character of an electron-de Broglie equation- Heisenberg's uncertainty principle-Introduction to quantum mechanics-fundamental postulates-Schrodinger wave equation- – eigen value – eigen function – significance of  $\psi$  and  $\psi^2$ -charge cloud concept and orbitals-Shapes of s, p and d atomic orbitals-nodal planes-g and u character in atomic orbitals-Radial and angular parts of the wave functions and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation)-radial and angular nodes and their significance.

Quantum numbers-origin-principal – orbital – angular momentum and spin quantum number-Significance of quantum numbers-Rules for filling electrons in various orbitals-Pauli's exclusion principle-Hund's rule-Aufbau principle- sequence of filling up of orbitalsschematic representation of electronic configuration- anomalous electronic configurations.

#### **UNIT IV: Nuclear Chemistry**

Isotopes, isobars and isotones – unit of radioactivity--half-life period – radioactive equilibrium – SoddyFajan's displacement law – Theory of radioactivity – radioactive series – artificial transmutation of elements – natural and induced radioactivity – Constitution of nuclei – stability of nuclei and (n/p) ratio – magic number, mass defect, mass energy relationship, binding energy and calculation of binding energy from mass defect-nuclear fusion and fission reactions – Plutonium and Hydrogen bombs – applications of Radioactivity in medicine-industry-agriculture– tracer technique- carbon dating-rock dating-neutron activation analysis-particle accelerators: linear accelerator – cyclotron.

#### **UNIT V: Analytical Methods**

Analytical Chemistry - Chemical Analysis - Types of Chemical Analysis – Qualitative and Quantitative Analysis- Volumetric Analysis – Principle – Standard Solutions – Normality and Molarity – Principles of Titrations – Theory of Indicators - Types of Titrations – Acidimetry, Alkalimetry, Permanganometry, Dichrometry, Iodometry, Argentometry, Complexometry.

Principles of gravimetric analysis – precipitation methods – conditions of precipitation – coprecipitation and post precipitation

Qualitative Inorganic Analysis – Dry Test, Flame Test, Wet Test – Common ion effect and solubility product- Testing of Simple and Interfering Acid Radicals- Test for sulphide, sulphate, nitrate (brown ring test), bromide and iodide (silver nitrate test),chloride and chromate (chromyl chloride test), oxalate and fluoride (calcium chloride test), borate (ethyl borate test), phosphate ( ammonium molybdate test) – Elimination of Interfering Acid Radicals – Chromate-Oxalate- fluoride – phosphate -Identifying the Groups of Basic Radicals – Testing of the Basic Radicals belonging to different Groups - Test for lead, copper, cadmium, antimony, bismuth, cobalt, nickel, manganese, zinc, barium, strontium, calcium, magnesium and ammonium-

Error analysis: Accuracy – Precision – Error – Types of Errors – Mean – Median – Mode – Standard Deviation – Variance – Normal Distribution Curve

#### **Text Books:**

- Puri B.R, Sharma L.R., Kalia K.C.. *Principles of Inorganic Chemistry*. Delhi : Milestone publishers and distributers, 2010.
- Tewari K.S, Vishnoi N.K, Mehrotra S.N. A Text Book of Organic Chemistry. Vikas Publishing2<sup>nd</sup> Revised Editions 1998.
- 3. ArunBahl, B.S.Bahl, G.D.Tuli. Essentials of Physical Chemistry. New Delhi: S.Chand

and Company Ltd., Revised edition 2008.

# **Books for Reference:**

- Puri , Sharma B.R, , Madan L.R S. Pathania. *Principles of Physical Chemistry*. Vishal Publishing Co, 2008.
- Arun Bahl and Bahl B.S. Advanced Organic chemistry.S.Chand and Company Ltd., Reprint 2005.
- 3. Tewari N. *Advance Organic Reaction mechanism Books and allied (P) Ltd.* Kolkata : Second revised edition 2005.
- 4. Jain M. K and Sharma S. C. *Modern Organic Chemistry*. Vishal Publishing Company, 2008.

SEMESTER- II					
Part III Core II General Chemistry-II					
Course Code :21UCHC22Hrs/Week:6Hrs/ Sem: 90Credits:5					

# Objectives

- To recall the basic methods of purification of ores.
- To understand the basic concepts of Stereochemistry.
- To know the importance of halogen compounds.
- To have an idea about the properties of alkenes, alkynes and aromatic substitution.
- To acquire knowledge in colligative properties.

# **Course Outcomes**

СО	Upon completion of this course, students will be able to	PSOs	CL
No.		addressed	
CO 1	recall the methods of purification of ores	1	Re
CO 2	understand the concept behind the different types of furnaces	1	Un
CO 3	explain the general characteristics and digital relationship of alkali and alkaline earth metals	2	Un
CO 4	discuss the preparation and uses of some alkali and alkaline earth metal compounds	3	Un
CO 5	interpret the elements of symmetry, chirality, Newman projection ,Sawhorse & Fischer formulae Know about the conformational analysis	1	Un
CO 6	apply the Cahn Ingold Prelog rule for ascertaining the geometric configuration (cis or trans and/or E or Z)	2	Un
CO 7	predict the mechanism of aromatic substitution reactions and effect of 0,m& p directing group and discriminate terminal & non-terminal alkynes, the acidic nature of acetylenic hydrogen	3, 6	Cr An
CO 8	apply the principle of colligative properties in day to day life like kidney dialysis, reverse osmosis and know the experimental methods of determining the colligative properties	4	Re Ap

#### **UNITI: General Principles of Extraction of Metals**

Minerals and ores -different steps of metallurgy – crushing and grinding of the ore – concentration of the ore – hand picking - gravity separation (Hydraulic Washing) -

electromagnetic separation – electrostatic separation – froth flotation process – leachingcalcination – roasting –difference between calcination and roasting – reduction to free metals – reduction by displacement, thermal decomposition, carbon (smelting), heating in air, an electro positive metal (Gold Schmidt's aluminothermic process) – Kroll's process. Refining of impure metals – thermal refining - distillation, liquation – vapour phase refining - Van Arkel process - Mond's process- electrolytic process- zone refining process. Elingham diagram- Types of furnaces – Fuel fired – blast, reverberatory, vertical retort and muffle – Electric furnace – Arc furnaces – types - resistance furnace.

#### **UNIT II: s and p Block Elements**

General characteristics of IA and IIA group elements – diagonal relationship of lithium with magnesium – anomalous behaviour of lithium and beryllium – extraction of lithium and beryllium. Sodium carbonate and sodiumbicarbonate – manufacture – properties and uses – principle of fire extinguisher.Boron – classification and nomenclature of boron hydrides – preparation, structure and uses of diborane – boron trihalides as Lewis acid – relative strength of boron trihalides. Oxo compounds of boron – ortho boric acid – preparation, properties and uses Borax bead test. Carbides – Classification with examples – Preparation, Properties, uses and structure of Calcium Carbide, Boron Carbide, Aluminium Carbide and Silicon Carbide –Preparation, Properties and uses of fluorine – manufacture of fluorine – etching on glass. Hydrides of halogens (hydrogen halides) - Interhalogen compounds – preparation and structure of interhalogen compounds. Pseudohalogenpolyhalides and basic nature of iodine.

### **UNIT III: Stereochemistry**

Stereoisomerism – Optical activity of compound with one and two chiral centres. Elements of symmetry – Plane of symmetry, axis of symmetry and centre of symmetry. Enantiomers and diastereo isomers (d, 1 and meso forms) with examples – asymmetric and dissymmetric molecules.

Conventions used in stereochemistry: Newman, Sawhorse and Fischer notations and their interconversions.

Cahn Ingold Prelog conversion DL and RS configuration.-notations for compounds containing more than one asymmetric C-atoms racemisation and methods of resolution of racemic mixture – Walden inversion – Stereochemistry of diphenyl compounds and allenes with examples. Geometrical isomerism – Definition – cis – trans and syn – anti concept E-Z notation. conformational analysis of cyclohexane.

#### **UNIT IV: Hydrocarbons and Halogen Compounds**

Alkenes – Mechanism of addition reaction to alkenes – Markanikow's rule- Peroxide effect epoxidation – ozonolysis. Dienes Classification –Conjugated dienes –(1,2 &1,4addition )- Diel's Alder reaction. Alkynes – terminal & non-terminal alkynes – acidic nature of acetylenic hydrogen atom. Aromatic hydrocarbon- Concept & Condition – Huckel's Rule-Aromatic, antiaromatic & non- aromatic compounds – Mechanism of aromatic electrophilic & Nucleophilic substitution reactions- Orientation (Electronic concept) – direct influence of substitution o,m & p directing – Benzyne mechanism.

Aliphatic halogen compounds –Mechanism of  $S_N1$ ,  $S_N2$ , E1, E2 reaction – Halogen derivatives- Preparation and properties of Vinyl chloride – Allyl chloride – Preparation & uses of Chloroprene- Aromatic halogen compounds – Preparation and reaction of benzyl chloride – Nuclear & Side chain halogen compounds distinction- relative reactivities of alkyl,aryl, vinyl and allyl halides.

#### **UNIT V: Colligative Properties**

Definition- lowering of Vapour Pressure-- Raoult's Law - measurement of vapour pressure lowering-- Ostwald and Walker's Dynamic method - Elevation of boiling point and its determination- Landsberger -walker method. Depression of freezing point and its

determination -Rast's Camphor method -Abnormal molecular masses of electrolytes -

Relation between Van't Hoff factor and degree of association and dissociation

Osmosis-Definition - -Some Interesting Experiments Demonstrating Osmosis-Silica Garden- Semipermeable Membranes -Preparation of Cupric Ferrocyanide Membrane -Osmotic Pressure -Kidney Dialysis-Determination of Osmotic Pressure-Berkeley And Hartley's Method –Modern Osmometer –Isotonic Solutions -Theories of Osmosis -Membrane Solution Theory -Vapour Pressure Theory- Reverse Osmosis-Desalination of Sea Water By Hollow-Fibre Reverse Osmosis-Nanotube Membranes- Laws of Osmotic Pressure –Boyle Van't Hoff Law For Solutions - Charles'-Van't Hoff Law For Solutions- Van't Hoff Equation For Solutions -Avogadro-Van't Hoff Law For Solutions -Van't Hoff Dilute Solutions - Calculation of Osmotic Pressure-Determination of Molecular Weight – Relation Between Vapour Pressure And Osmotic Pressure Osmotic Pressure of Electrolytes.

## **Text Books:**

- Puri B.R, Sharma L.R, Kalia K.C. Principles of Inorganic Chemistry. Delhi: Milestone Publishers and distributers, 2010.
- Tewari K.S, Vishnoi N.K, Mehrotra S.N. A Text Book of Organic Chemistry. 2<sup>nd</sup> Revised Editions, 1998.
- 3. Kalsi P.S. Stereochemistry Conformation and Mechanism. New Age International, 2005.
- ArunBahl, Bahl B.S, Tuli G.D. Essentials of Physical Chemistry.New Delhi:S.Chand and Company Ltd., Revised edition 2008.

#### **Books for Reference:**

- Puri B.R, Sharma L.R, Madan Pathania S. *Principles of Physical Chemistry*. Vishal Publishing Co. 2008.
- Arun Bahl and Bahl B.S. *Advanced Organic chemistry*.S.Chand and Company Ltd. Reprint, 2005.
- 3. Tewari N. *Advance Organic Reaction mechanism*.Kolkata: Books and allied (P) Ltd.Second revised edition 2005.
- Jain M. K and Sharma S. C. *Modern Organic Chemistry*. Vishal Publishing Company, 2008.

SEMESTER- III					
Core IIIPhysical Chemistry-I					
Course Code : 21UCHC31	Hrs/Week : 4	Hrs/ Sem : 60	Credits : 4		

# **Objectives:**

- To appreciate the surface phenomenon in industry and biological systems.
- To have an overall knowledge about gaseous and liquid states of matter.
- To understand the importance of colloids in day to day life

# **Course Outcome:**

CONo.	Upon completion of this course, students should be able to	PSOaddre ssed	CL
CO- 1	enumerate the general characteristics of adsorption and have thorough knowledge of the theory behind physisorption and chemisorptions	1,2,5,7,8	Ар
CO- 2	prioritise the phenomenon of catalysis in industry and biological systems and learn the basic concepts of adsorption and its applications in various walks of life	1 ,2,7	Re
CO- 3	Gainextensive knowledge about kinetic theory of gases and its relation with temperature and velocity of a gas	1,3	Un
CO-4	understand the deviation of gases from ideal behaviour using Van der Waal's equation	1,2 , 3	Re

CONo.	Upon completion of this course, students should be able to	PSOaddre ssed	CL
CO- 5	classify, compare and discuss the preparation method and properties of colloids and also know the importance of colloids in day to day life,	1,2,5	Un
CO-6	have a thorough learning of miscible and immiscible liquids and outline the statement of Nernst distribution law, its deviations and applications	2,3,4	Re
CO- 7	compare the vapour pressure of partiallymiscible liquids and mixture of immiscible liquids and understand the theory of fractional distillation and steam distillation and its applications.	2,3	An
CO-8	appreciate the chemistry behind the reversible reactions and nature of chemical equilibrium and apply Lechatelier's principle in various aspects.	1,2,3,4,	Ар

# Unit I Surface Chemistry

Adsorption – types- physisorption and chemisorption – adsorption of gases by solids adsorption isotherm – derivation and significance of Freundlich and Langmuir isotherms – BET isotherm (no derivation) – applications of adsorption – adsorption indicator-production of high vacua-gas mask-removal of colouring matter from solutions- chromatographic analysis.

Catalysis - General characteristics of catalytic reactions – acid-base catalysis and enzymecatalysis– Fischer Lock and key theory – characteristics of enzyme catalysis. Mechanism andkinetics of enzyme catalysed reaction (Michaelis-Menton equation). Activation energy and catalysis – theories of homogeneous and heterogeneous catalysis – mechanism of thehydrogenation of ethene on nickel surface. Acid base catalysis –

mechanism – promoters –promotion action – catalytic poisoning – negative catalysis – mechanisms of negative catalysis, autocatalysis and photocatalysis.

#### **Unit II Gaseous State**

Kinetic theory of gases – justification of postulates-derivation of kinetic gas equation deduction of gas laws from the kinetic gas equation-Charle's law, Boyle's law, Avogadro's law, ideal gas equation – Dalton's law of partial pressure – Graham's law of diffusion-kinetic theory and temperature – Maxwell's law of distribution of velocities (no derivation) – types of molecular velocities – graphical representation and its significance- collision diameter –collision number – collision frequency – mean free path - deviations from ideal behavior compressibility factor- effect of pressure and temperature on deviation-explanation of deviation-volume correction-pressure correction – Van der Waal's equation—limitations liquefaction of gases-critical phenomenon—Andrew's isotherms of CO<sub>2</sub>- Van der Waal'sequation and critical constants-experimental determination- law of corresponding states.

#### **Unit III Colloids**

Definition-Types of colloidal system –lyophilic and lyophobic colloids-characteristics and comparison- Sols- Preparation-Dispersion method (Bredig's Arc method, peptization) – Aggregation method-(double decomposition, reduction, oxidation, Hydrolysis,Change of solvent)-purification of Sols-Dialysis-Properties – Optical (Tyndall effect) – kinetic (Brownianmovement) Electrical (electrical double layer) – Coagulation of colloids – Hardy Schulze law-Hoffmeister series – protective colloids – gold number.

Emulsion – types and their distinction-Emulsifiers – surfactants– Gels – classification, preparation, properties (imbibition, synerisis and thixotropy). Applications of colloids-food, medicine, thixotropic paints, clarification of municipal water, formation of delta.

#### **Unit IV Solution**

Liquids in liquids –Completely miscible liquids- Ideal and non-ideal solution-Raoult's law distillation of homogenous binary liquid mixtures -Theory of fractional distillation – Azeotropic distillation.

Partially miscible liquids – Phenol-water-Triethylamine-water and Nicotine-water systems– Variation of solubility with temperature – Vapour pressure of partially miscible liquids-Criticalsolutiontemperature-upper, lower,upper and lower - influence of impurityon CST (Crismer Test) and applications.

Immiscible liquid systems- Vapour pressure of mixtures of immiscible liquids- Theory ofsteam distillation and its applications.

Nernst distribution law – Statement–Conditions - Thermodynamic derivation – Deviationsfrom the law(molecular association and dissociation) –Applications-Distribution indicators-solvent extraction.

#### **Unit V Chemical Equibrium**

Reversible reactions- nature of chemical equilibrium- characteristics-law of mass actionexplanation of the law of mass action based on the molecular collision theory-equilibrium constant; equilibrium law-relationship between  $K_c$  and  $K_p$ -Application of law of mass action to the equilibria involving the formation of NH<sub>3</sub>, dissociation of CaCO<sub>3</sub> and the dehydration of CuSO<sub>4</sub>.5H<sub>2</sub>O. Lechatelier's principle – statement-application to the formation of NH<sub>3</sub>

### **Text Books:**

- 1. Puri B.R, Sharma L.R, Madan S. Pathania. *Principles of Physical Chemistry*. VishalPublishing Co., 2008.
- Arun Bahl, Bahl B.S, Tuli G.D. *Essentials of Physical Chemistry*. New Delhi: S. Chand &Company Ltd., 2008.

#### **Books for Reference:**

- 1. Malligarjunan U.M . *Principles of Physical Chemistry*. SreeVinayaga Publications. First Edition, 2020.
- 1. Soni P.L, Dharmaha O.P. *Text Book of Physical Chemistry (A Modern Approach)*.SultanChand and Sons Publishers, Revised Edition 2010.

SEMESTER- IV					
CoreIV OrganicChemistry-I					
Course Code :21UCHC41	Hrs/Week:4	Hrs/ Sem: 60	Credits:4		

# **Objectives:**

- To gain knowledge about the importance of nitro and amino compounds
- To study the synthetic importance of active methylene compounds and know the conformational analysis
- To appreciate the applications of organometallic compounds in synthesis
- To know the laboratory and industrial importance of Carbohydrates
- To understand the concepts of tautomerism &molecular rearrangements

Course	<b>Outcome:</b>

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO -1	compare alcohols, nitroalkanes and alkyl nitrites,Differentiate1°, 2°&3° amines by reactions.	1,3	An
CO - 2	justify the effect of substituent on the basicity of aromaticamines.	1,3	Cr
CO - 3	synthesize and Characterize acetoacetic ester and malonic ester.	5,7	Cr
CO- 4	define Sachse Mohr theory – Newman projection ,Sawhorse & Fischer formulaeKnow about the	1	Re

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
	conformational analysis.		
CO - 5	recall the synthetic importance of organometalliccompounds, RecogniseFrankland reagent and its significance.	1,6,7	Re
CO - 6	know the preparation and properties of Thioalcohols and Mustard gas.	1	Re
CO- 7	classify carbohydrates and compare and contrast the reactions and structure of glucose and fructoseIllustrate the structure and reactions of carbohydrate and discuss epimerization and mutarotation.	5,6,1	Un
CO - 8	illustrate the theory of resonance and tautomerism and identify the product of rearrangement reactions such as pinacol-pinacolone, Benzil-Benzilic acid, Curtius,Lossen,Favorskiiand Friesrearrangement.	1,3	Un, An

#### Unit I: Nitro compounds and Amino compounds

Preparation and reaction of nitrile and isonitrile – distinction between nitroalkane and alkyl nitrites – reduction reaction of nitroalkane – NEFreaction. Preparation of o, p,m-dinitrobenzene- trinitrobenzene.

Aliphatic amine – separation of mixture of amine –(Hoffmann, Heisenberg method)-Comparison of 1°, 2°&3° amines- Mustard oil reaction- Mannich reaction – ascending and descending of amines.

Aromatic amines – effect of substitutents on the basicity of aromatic amines- preparation and properties of phenylenediamine

Diazonium compounds- Preparation of diazonium chloride and its synthetic applications.

#### Unit II: Reactive Methylene compounds and Conformational Analysis

Active methylene compounds –preparation, synthetic applications of acetoacetic ester and malonic ester.

**Conformational Analysis** Definition – Bayer's strain theory – Sachse Mohr theory – Newman projection - Sawhorse & Fischer formulae –examples- butane, 1,2-diol, - difference between conformation and configurations. Conformation analysis of ethane, 1,2 – dichloro ethane andcyclohexane (boat form, Chair form)—dihedral angle (torsional angle) – factors affecting stability of conformation – Dipole - Dipole interaction, bond opposite strain- factors affecting conformational stability

## Unit III: Organometallic compounds and Organosulphur Compounds

Definition – examples- Organomagnesium compound (Alkyl magnesium halides) – preparation, general characteristics and synthetic applications (Nucleophilic substitution reactions, addition reaction and miscellaneous reactions.) Organozinc compounds (Diethyl Zinc-Frankland reagent)- preparation, properties and synthetic applications (Nucleophilic substitution and addition reactions). Preparation and uses of TEL.

Preparation and properties of thioalcohols and thioethers – sulphonal-mustard gas and sulphones.

#### **Unit IV: Carbohydrates**

Introduction and classification – laboratory and industrial preparation of glucose and fructose – reactions of glucose and fructose – structure of glucose and fructose – open chain and ring structure – epimerisation – mutarotation – interconversion of glucose and fructose and vice versa – ascending and descending the series – (Kiliyani& Wohl's synthesis). Manufacture of sucrose – Structure of maltose, lactose and sucrose (elucidation not included) – Starch and cellulose – reactions –uses – differences between starch and cellulose.

#### **Unit V: Tautomerism and Molecular Rearrangement**
Resonance – definition – resonance energy – resonance theory. Tautomerism – Definition – Types of tautomerism – Keto-enol, Nitro -acinitro, Lactam - lactim, p-Nitrosophenol-Quinone monoxime and amido-imidotautomerism.

#### **Molecular Rearrangement**

a) Rearrangement involving migration to electron deficient carbon- Pinacolpinacolone rearrangement, Benzil-benzilicacidrearrangement

b)Rearrangement involving migration to electro deficient nitrogen-Curtiusrearrangement, Lossen rearrangement

c) Rearrangement involving carbanion intermediate -Favorskiirearrangement

Rearrangement involving migration from oxygen to aromatic ring-Friesrearrangement.

# **Text Books:**

1. Tewari K.S, Vishnoi N.K . A Text Book of Organic Chemistry. 2<sup>nd</sup> Revised Edition, 2017.

2.Arun Bahl and Bahl. B.S. *Advanced Organic Chemistry*.S.Chand and Company Ltd., Reprint, 2017.

#### **Books for Reference:**

1. Ernest l. Eliel. Stereochemistry of Organic compounds.New Delhi: Tata McGRAW-

Hill Publication company Ltd., 1975.

- 2. Nasipuri D. *Stereochemistry of Organic Compounds Principles and Applications*. New Age International Publishers, 1994.
- Kalsi S. Stereochemistry-Conformation and Mechanism. New Age International Publishers, 2008.
- Anup Pathak, AnupaSaha. Organic Chemistry. Kolkata: Books and Allied Pvt Limited, Volume I, 2015.
- 5. Jain M.K and Sharma S.C. Modern Organic chemistry. Vishal Publishing Company,

2017.

- Jerry March. Advanced Organic Chemistry Reactions Mechanisms and Structure. 4<sup>th</sup> Edition 2013.
- Tewari N. .*Advance Organic Reaction mechanism*.Kolkata:Books and allied (P) Ltd.
   Second revised edition, 2017.

SEMESTER I & II					
Core Practical I Quantitative Analysis					
Course Code : 21UCHCR1Hrs/Week : 2Hrs/ Sem : 30Credits : 2					

# **QUANTITATIVE ANALYSIS (VOLUMETRIC METHODS)**

A double titration involving the preparation of a primary standard, standardization of the link solution, making up of the given solution and its estimation. Concepts of acids, bases, oxidants, complex formation — Theory of Indicators. (Use of digital balance is permitted).

### TITRIMETRIC QUANTITATIVE ANALYSIS:

Su	bstance to	be estimated	Primary Standard
I Acidimetry and alkalimetry.	1. NaOH/ Na <sub>2</sub> CO <sub>3</sub>		Na <sub>2</sub> CO <sub>3</sub>
	2. HC1/H	I <sub>2</sub> SO <sub>4</sub> /oxalic acid	Oxalic acid
II Permanganometry	3. Oxalic	acid	Oxalic acid
4. Mohr's salt		Mohr's Salt	
	5. $Fe^{2+}$	Mohr's Salt	
III Dichrometry - External in	dicator met	hod	
	6. $Fe^{2+}$	Mohr's Salt	
IV Iodometry	7.CuSO <sub>4</sub> /]	$K_2Cr_2O_7$	$K_2Cr_2O_7$
	8. KMnO <sub>4</sub>		CuSO <sub>4</sub>
V Complexometry	9. $Zn^{2+}$		ZnSO <sub>4</sub> .7H <sub>2</sub> O
	10. $Pb^{2+}$	Pb(NO <sub>3</sub> ) <sub>2</sub>	
	11. Mn <sup>2+</sup>		MnSO <sub>4</sub> .H <sub>2</sub> O
	12. Ni <sup>2+</sup>		ZnSO <sub>4</sub> .7H <sub>2</sub> O

### VI Estimation of Phenol /Aniline

### VIICourse work (Not for external examination)

1. Estimation of acetic acid in vinegar samples.

- 2. Estimation of oxalate content in vegetables and fruits such as tomato, guava, grapes, etc.
- 3. Estimation of sodium carbonate and sodium Bicarbonate in a mixture.
- 4. Estimation of Total Hardness of water.

# **BOOKS FOR REFERENCE:**

- 1. Arthur D. Vogel. *Vogel's Textbook of Quantitative Chemical Analysis*. Longman's Green & Co Ltd, London, sixth Edition2004.
- 2. RaghupatiMukhopadhyay, Pratul Chatterjee. *Advanced Practical Chemistry*. Books and Allied (P) Ltd., Third Edition 2007.

# **SEMESTER III & IV**

Core Practical II Semi-micro Inorganic Qualitative Analysis				
Course Code :21UCHCR2	Hrs/Week : 2	Hrs/ Sem : 30	Credits : 2	

Systematic qualitative analysis of a mixture containing two anions and two cations. One of the anions should be an interfering radical which should be eliminated. The two cations should be of different groups.

Principles of flame testing – concept of solubility and solubility product – concept of pH and Buffer action – common ion effect - theory of testing anions (Simple and interfering) – Principle of grouping of cations –Theory of testing cations.

The combination of mixture containing two halides,(sulphates along with lead, barium, strontium and calcium), (oxalate and carbonate) & (one oxidizing and one reducing group), should be avoided.

# Anions:

(i) Carbonate	(ii) Sulphide	(iii) Sulphate	(iv) Chloride	(v) Bromide (vi) Iodide.
(vii) Nitrate	(viii) Borate	(ix) Oxalate	(x) Fluoride	(xi) Chromate (xii) Phosphate

# **Cations:**

(i) Lead (ii) Copper (iii) Bismuth (iv) Cadmium (v)Antimony (vi) Nickel (vii) Manganese (ix) Zinc (x) Barium (xi) Strontium (xii) Calcium (xiii) Magnesium (xiv) Ammonium.

# **Course Work:**

Detection of sodium and potassium ions by flame photometer

# **Books for Reference:**

- 1. J. N. Gurtu and R. Kapoor. *Advanced Experimental ChemistryVolume II*. S. Chand & Company Ltd, 1980.
- 2. A.O. Thomas. *Practical Chemistry for B. Sc. Main students*. Scientific Book Centre, Cannanore, 1992.

SEMESTER-III				
NMEI Everyday Chemistry				
Course Code :21UCHN31	Hrs/Week:2	Hrs/ Sem: 30	Credits:2	

# **Objectives:**

- To study the purification process for drinking purpose.
- To classify solid, liquid and gaseous fuels.
- To study the constituents of paints and varnishes.
- To appreciate the manufacture of sugar.
- To know the preparation of candles, toothpowder.

# **Course Outcome:**

CO No.	Upon completion of this course, students will be	PSO	CL
	able to	addressed	
CO - 1	understand the biological importance of water.	2	Un
CO -2	aware of the ill effects of water borne diseases and prevention.	2, 5	Ap
CO - 3	know the ignition temperature and flash point of fuels.	1	Re
CO – 4	know the characteristics of solid liquid and gaseous fuels.	1	Re
CO – 5	know the fundamental knowledge about constituents of paints and varnishes and their functions.	2, 5	Re

CO No.	Upon completion of this course, students will be	PSO	CL
	able to	addressed	
CO-6	aware of fluorescent paints (traffic signal ) and fire	2, 5	Ар
	retardant paints.		
CO – 7	understand the recovery of alcohol from molasses	2, 5	Un, Re
	and know the chemistry of manufacture of paper.		
CO – 8	outline the preparation and uses of	1, 2,5	Re
	Candle,ToothPowder,Liquidblues,Blackboard chalk,		
	Moth ballssoap, shampoo, lipstick		

### **UNIT I: Water**

Water as universal solvent-Hard and soft water-Purification of water for drinking purpose. Desalination, reverse osmosis, mineral water, pH of water for drinking purpose. Biological importance of water-waterbalance and electrolyte balance in human body. Water borne diseases and prevention.

### **UNIT II: Fuels**

Definition-Classification with examples (solid, liquid and gas)- calorific Value-Ignition temperature-Flash point. Characteristics of solid, liquid, and gaseous fuels and their applications.Nuclear fuels- Rocket fuels- Biofuels.

### **UNIT III: Surface Coating**

Pigments, purpose of surface coating. Constituents of paints and varnishes and their functions. Emulsions.Different kinds of paints-fluorescent paints (traffic signal ), fire retardant paints.

#### **UNIT IV: Sugar and Paper Industry**

Manufacture of sugar, recovery of alcohol from molasses, fermentation, manufacture of beverages. Bagasse. Paper industry- Manufacture of paper.

### UNIT V: Chemicals in Day to Day Use

An Outline of the preparation and uses of the following:

- a) Candle b) Tooth Powder c) Liquid blues d) Blackboard chalk e) Moth balls f) Soap
- g) Shampoo h) Lipstick i) Phenoyle j) Eyetex k) Cleaning powder l) Face powder

#### **Books for Reference:**

- Jayashree Ghosh. Fundamental concepts of Applied chemistry. Edition, New Delhi:S. Chand & company Ltd., 2006.
- Jain P.C and Monika Jain. *Engineering chemistry*. New Delhi:Dhanpat Rai & Sons, 2020.
- 3. Prakash Shetty. *Science and Technology of Printing materials*. Chennai: MJP Publishers, 2019.
- 4. Sharma B.K. Industrial Chemistry. Meerut: Goel Publishing House, 2003.

SEMESTER- IV					
NME II Industrial Chemistry					
Course Code :21UCHN41     Hrs/Week:2     Hrs/ Sem: 30     Credits:2					

**Objectives:** 

- To know the constituents of petrochemicals.
- To study the importance of reclaimed rubber.
- To know the analysis of fats and oils.
- To identify the nature of artificial and natural food colorants.
- To know the specification and standards in quality control.

# **Course Outcome:**

CO.No.	Upon completion of this course, students will be	PSOaddressed	CL
	able to		
CO-1	know the composition of petroleum and refining of petroleum.	1	Un
CO-2	define and explain the octane number and cetane number.	1	Re, Un
CO-3	employ the manufacture of rubber and Gutta-percha.	1	An
CO-4	know the importance of reclaimed rubber and foam rubber.	1	Un
CO-5	analyze fats and oils.	8	An
CO-6	acquire the knowledge about saponification value and RM value.	5	Un
CO-7	understand the characteristics of food colorants and examine the artificial and natural food colorants.	6, 5, 8	Un,An
CO-8	attain the knowledge of PFA, FPO, FDA, drug licence and aware of essential commodities act, consumer protection act, AGMARK.	2,5	Un Ap

SEMESTER- IV NME II Industrial Chemistry					
					Course Code :21UCHN41     Hrs/Week:2     Hrs/ Sem: 30     Credits:2

### **Unit I: Petro Chemicals**

Occurrence – composition of petroleum – Refining of petroleum – purification – cracking – types of cracking – catalytic cracking – thermal cracking – knocking andantiknocking properties – octane number – activation. Gasoline – cetane number – flash point –synthetic petrol

#### **Unit II: Rubber Industry and Fibres**

Manufacture of rubber, Gutta-percha –properties of rubber – compounding of rubber – vulcanization – properties of vulcanized rubber– synthetic rubber – SBR rubber and Neoprene rubber – Reclaimed rubber and foam rubber –uses.

Fibres - Difference between natural and synthetic fibres

#### Unit III: Fats, Oils and Waxes

Fats and oils - definition - physical and chemical properties - Analysis of fats and oils-

Saponification value, iodine value, acid value, Reichert-Meissel value– manufacture of vanaspathi or vegetable ghee. Waxes – definition and classification.

#### **Unit IV: Food Additives**

Baking soda – food color natural and artificial – intentional food additives – acid base and their salts – antioxidants – stabilizers– bleaching – maturing agents – leavening agents – humectants and preservatives.

### **Unit V: Quality control**

Quality control – Specification and standards : PFA, FPO, FDA, drug licence, WHO standards, IS specification packing and label requirements, essential commodities act, consumer protection act, AGMARK

# **Books for Reference:**

- Siva Sankar B. *Food processing and preservation*.New Delhi:Prentice Hall of India Pvt.Ltd., 2002.
- BagavathiSundari K. *Applied Chemistry*. Chennai: MJP Publishers, TamilNadu Book House, 2006.
- Agarwal. Natural Products Volume II (Organic). Meerut: Krishna Prakashan Media P. Ltd 2015.