

**Under- Graduate Programme
in Chemistry**

Courses of Study, Schemes of Examinations & Syllabi
(Choice Based Credit System)



**PG & RESEARCH DEPARTMENT OF CHEMISTRY
(DST – FIST sponsored)
Bishop Heber College (Autonomous)
TAMIL NADU, INDIA**

2017

Structure of the Curriculum

Parts of the Curriculum	No. of Courses	Credits
Part – I : Language	4	12
Part – II : English	4	12
Part – III		
Major		
Core (Theory)	9	51
Core (Practical)	6	14
Elective	2	9
Allied		
Allied (Mathematics/ Zoology)	3	12
Allied (Physics)	3	10
Group Project	1	3
Part – IV		
SBEC	3	6
NMEC	2	4
VLOC	1	2
Env. Studies	1	2
SBC	1	1
Part – V		
Extension Activities	1	1
Gender Studies	1	1
Total	42	140

B.Sc. Chemistry – Programme Description

(For the students admitted from the year 2016 onwards)

Sem	Part	Course	Course Code	Course Title	Pre requisites	Hrs./ week	Credits	Marks		
								CIA	ESA	Total
I	I	Tamil I/*	U15TM1L1	செய்யுள், உரைநடை, மொழிப்பயிற்சி		6	3	25	75	100
	II	English I	U16EGNL1	English Communication Skills-I		6	3	40	60	100
	Core I	Core I	U16CH101	General Chemistry- I		6	6	25	75	100
		Core Prac. I	U16CH1P1	Volumetric Analysis and Physical Constant Determination		3	2	40	60	100
	III	Allied I	U14MAC11 / U16ZYY11*	Algebra and Calculus /* Biology of Invertebrates and Chordates		5 5*	4 5*	25 25*	75 75*	100 100*
		IV	Env. Studies	U15EST 11	Environmental Studies		2	2	25	75
	VLOC		U14VL1:1 U14VL1:2	Value Education (RI/MI)		2	2	25	75	100
II	I	Tamil II/*	U15TM2L2	செய்யுள், சிறுகதைத்திருட்டு, மொழிப்பயிற்சி		6	3	25	75	100
	II	English II	U16EGNL2	English Communication Skills-II		6	3	40	60	100
	Core II	Core II	U16CH202	General Chemistry- II		5	5	25	75	100
		Core Prac. II	U16CH2P2	Analytical Chemistry Practical and Chemical calculations through Virtual Lab.		3	2	40	60	100
	III	Allied II	U14MAC22 / U16ZYY22*	Vector Calculus and Trigonometry/*Human Physiology and Commercial Zoology		4 4*	4 4*	25 25*	75 75*	100 100*
		Allied III / *Allied Prac.I	U16MAC23/ U16ZYYP1*	Differential Equations and Laplace Transforms/*Biology of Invertebrates, Chordates Human Physiology & Commercial Zoology		4 4*	4 3*	25 40*	75 60*	100 100*
	IV	SBEC I	U16CH2S1	Textile Chemistry		2	2	25	75	100
III	I	Tamil III/*	U15TM3L3	செய்யுள், நாடகம், மொழிப்பயிற்சி		6	3	25	75	100
	II	English III	U16EGNL3	English for Competitive Examinations		6	3	40	60	100
	Core III	Core III	U16CH303	General Chemistry- III		6	5	25	75	100
		Core Prac. III	U16CH3P3	Inorganic Semi Micro Analysis		3	2	40	60	100
	III	Allied IV/III	U16PHY33	Mechanics, Sound, Thermal Physics and Optics		4	3	25	75	100
		Allied Prac.II	U16PHYP1	Allied Physics Practical		3	-	-	-	-
	IV	NMEC I		<i>To be selected from the courses offered by other departments</i>		2	2	25/ 40	75/ 60	100

Sem	Part	Course	Course Code	Course Title	Pre requisites	Hrs./week	Credits	Marks		
								CIA	ESA	Total
IV	I	Tamil IV/*	U15TM4L4	செய்யுள், நாவல், மொழிப்பயிற்சி		5	3	25	75	100
	II	English IV	U16EGNL4	English through Literature		5	3	40	60	100
	III	Core IV	U16CH404	Inorganic Chemistry- I	U16CH101 U16CH103	6	5	25	75	100
		Core Prac.IV	U16CH4P4	Organic Analysis		3	2	40	60	100
		Allied V/ Allied IV	U16PHY44	Electricity, Atomic Physics and Digital Electronics		4	4	25	75	100
	IV	Allied Prac.II	U16PHYP1	Allied Physics Practical		3	3	40	60	100
		NMECII		<i>To be selected from the courses offered by other departments</i>		2	2	25/ 40	75/ 60	100
	V	SBC	U16LFS41	Life Skills		2	1	100	--	100
		Extension Activities	U16ETA41				1	-	-	-
		V	III	Core V	U16CH505	Organic Chemistry- I	U16CH101 U16CH102	6	6	25
Core VI	U16CH506			Physical Chemistry - I	U16CH102 U16CH103	6	6	25	75	100
Core Prac.V	U16CH5P5			Gravimetric Analysis, Organic and Inorganic preparation	U16CH404	6	3	40	60	100
Elective I	U16CH5:1			Biochemistry		4	4	25	75	100
Group Project	U16CH5PJ					4	3	40	60	100
IV	SBEC II		U16CH5S2	Pharmaceutical Chemistry		2	2	25	75	100
	SBEC III	U16CH5S3	Industrial Chemistry		2	2	25	75	100	
VI	III	Core VII	U16CH607	Inorganic Chemistry- II		6	6	25	75	100
		Core VIII	U16CH608	Organic Chemistry- II		6	6	25	75	100
		Core IX	U16CH609	Physical Chemistry - II		7	6	25	75	100
		Core Prac.VI	U16CH6P6	Physical Chemistry Practical	U16CH506	5	3	40	60	100
		Elective II	U16CH6:3	Analytical Chemistry		6	5	25	75	100
	V		U16GST 61	Gender Studies			1	20	80	100
			Extra Credits - Internship*			2*				
TOTAL							140			4100

SBEC- Skill Based Elective Course
VLOC- Value added Life Oriented Course
CIA- Continuous Internal Assessment

NMEC- Non Major Elective Course
SBC- Skill Based Course
ESA- End Semester Assessment

* Other Languages	Hindi	Sanskrit	French		Hindi	Sanskrit	French
Semester I	U14HD1L1	U15SK1L1	U14FR1L1	Semester III	U14HD3L3	U15SK3L3	U14FR3L3
Semester II	U14HD2L2	U15SK2L2	U14FR2L2	Semester IV	U14HD4L4	U15SK4L4	U14FR4L4

CORE COURSE I: GENERAL CHEMISTRY –I

Semester: I
Credits : 6

Code : U16CH101
Total Hrs. : 90

General Objectives

1. To understand the nature of bonding and shapes of molecules.
2. To learn the fundamentals of atoms and various theories associated with it.
3. To understand the nomenclature of organic molecules
4. To learn the periodic properties of elements.
5. To understand the various states of matter.
6. To understand the atomic structure and periodicity of elements
7. To learn the various theories of bonding
8. To know the basic principles of volumetric analysis

Unit-I Atomic Structure and Periodicity

1.1 Atomic structure

Atomic Model of Bohr - Spectrum of hydrogen - drawbacks of Bohr's theory. Dual nature of electron- Concept of Quantization - Principles of quantum Theory - de Broglie equation, Heisenberg uncertainty principle, Schrodinger equation (Derivation not required), significance of ψ and ψ^2 .

1.2 Periodic Properties:

Modern periodic Table - grouping of elements into different blocks, Variation of atomic volume, atomic and ionic radii, Effective nuclear charge - Slater's rule - ionization potential, comparison of IE of N and O; Mg and Al; Be and B, electron affinity and electro negativity along the periods and groups - Pauling's and Mulliken's scales of electronegativity. - Factors affecting periodic properties - Aufbau's principle - Hund's rule

Unit-II Main Block Elements

2.1 s - block elements

Comparative study of alkali and alkaline earth metal compounds - size of ions and atoms - Electronegativity- Ionization potential- Solubility of oxides, halides, hydroxides, carbonates and sulphates. Diagonal relationship between Li and Mg- Anomalous behavior of Be, Hydrogen.

2.2 Zero group elements

Isolation of Noble gases from atmosphere and uses. Special properties of Helium - Compounds of Xenon - XeF_2 , XeF_4 , XeF_6 , XeO_3 , XeOF_4 ,- preparation, structure and uses. Clathrates - types and uses.

2.3 Introduction to p - block

General trends in periodic properties - Electron affinity - Electronegativity -Ions and their properties - polarisability - polarizing power - Inert pair effect - Transition from non - metallic to metallic character - oxidation states - Fajan's rule in p - block- catenation .

Unit-III Theories of Chemical Bonding

3.1 Types of chemical bonds - nature and properties – characteristics of ionic bonds -Lattice energy and Born-Haber Cycle - NaCl. Polarizing power and Polarisability of ions: Partial ionic character - Transition from ionic to covalent character and vice versa - Fajan's rule.

3.2 Hydrogen bonding: Nature, types and consequences. Intermolecular forces - London forces, van der Waals forces.

3.3 Theories of Bonding - VSEPR Theory: Shapes of simple inorganic molecules (BeCl_2 , BF_3 , SiCl_4 , PCl_5 , SF_6 , IF_7 , H_2O , ICl , ICl_2 , BrF_3 , IF_5 , ICl_2^- , NH_3 , XeF_6) containing lone pair and bond pairs of electrons.

3.4 MO Theory -Qualitative MO energy level diagram of homo nuclear diatomic (N_2 and O_2) and hetero nuclear diatomic (CO and NO) molecules

Unit-IV Bonding in Organic Compounds

4.1 Bond Formation -The Octet rule - Lewis Structures -Multiple bonds and their characteristics - bond length, bond angle, bond energy, bond polarity of some important bonds (C-C, C-O, C-N, C=C, C-Cl, C=O, H-H, O-H, N-H and S-H - Hybridisation and geometry of molecules (sp , sp^2 , sp^3)(methane, ethane, ethylene and acetylene) - sigma and pi bonds. Rigidity of pi bonds - Rotation of single bonds - Electronegativity and Bond Polarity - Dipole moments of simple organic compounds

4.2 Electron displacement effects with atleast 5 examples each - inductive, electromeric, resonance &Hyperconjugation

4.3 Cleavage of bonds - homolytic and heterolytic fission of carbon - carbon bonds. Reaction intermediates - Stabilities of free radicals, carbocations and carbanions (primary, secondary, tertiary)

Unit-V Principles of Volumetric Analysis

5.1 Acids and bases : Modern theory of acids and bases - Bronsted -Lowry concept and Lewis concept, factors that influence the strength of acids and bases. Definition of pH and pKa. Buffers - mechanism of buffer action - Henderson - Hasselbach equations. (problems also)- Hydrolysis of salts – neutralization. Hydrolysis of salts of strong acid and weak base and salt of weak acid and strong base- derivation of K_a , K_b and K_w problems.

5. 2 Redox Reactions

Oxidation and reduction reactions - oxidation number concept, balancing redox equations by oxidation number method and ion electron method - equivalent weight of oxidizing and reducing agents.

5.3 Mole concept, Equivalent weight, atomic weight, molecular weight, concentration terms - ppm, mole fraction , normality, molarity, molality. Principle of titration - neutralisation point & end point - standard solutions - primary and secondary standards - types of titrimetric analysis- neutralization, redox, complexometric and precipitation titrations. Indicators - fluorescent indicators, redox indicator, universal indicators.

Reference Books

1. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers, New Delhi, 2007 **(Unit I, II, III)**
2. Arun Bahl and B.S. Bahl, *Advanced Organic Chemistry*, S. Chand & Co. Ltd., New Delhi, 2005 **(Unit IV)**
3. B.R. Puri, L.R. Sharma and Madan S. Pathania, *Principles of Physical Chemistry* Vishal Publishing Co., Jalandhar, 2005 **(Unit V)**
4. P.L.Soni, H.M. Chawla, *Text Book of Organic Chemistry*, Sultan Chand & Sons, New Delhi, 2004
5. R.L. Madan and G.D. Tuli, *Inorganic Chemistry*, S. Chand Co. Ltd., New Delhi, 2003
6. Gurdeep Raj, *Advanced Physical Chemistry*, Goel Publishing House, Meerut, 2000

CORE PRACTICAL I: VOLUMETRIC ANALYSIS AND PHYSICAL CONSTANT DETERMINATION

Semester: I
Credits : 2

Code : U16CH1P1
Total Hrs. : 45

General Objectives

1. To understand the application of chemistry in quantitative analysis
2. To develop analytical skills in volumetric estimation.

Volumetric Analysis

I. Acidimetry – Alkalimetry

1. Estimation of Hydrochloric acid
2. Estimation of Sodium hydroxide

II. Permanganometry

3. Estimation of ferrous ion in Mohr's salt
4. Estimation of oxalic acid

III. Iodometry and Iodimetry

5. Estimation of copper
6. Estimation of potassium permanganate

IV. Applied Experiments

7. Estimation of total hardness of water
8. Quantitative Estimation of Biomolecules. (Demonstration)

Physical constant determination

I. Theory of measurement of physical parameters

Principle of physical measurements -Checking the purity of samples, handling of chemicals and the apparatus.

2. Determination of Physical Constant

Determination of melting and boiling points of simple organic compounds.

Reference Books

1. V. Venkateswaran, R. Veerasamy, A.R. Kulandaivelu, Basic principles of Physical Chemistry Second edition, Sultan Chand & Sons, New Delhi, 2006.
2. Vogel, Text Book of Quantitative Chemical Analysis, 5th edition, ELBS/ Longman England, 1989.

CORE COURSE II: GENERAL CHEMISTRY – II

Semester: II
Credits : 5

Code : U16CH202
Total Hrs. : 75

General Objectives

1. To comprehend about the halogen family and pseudo halogens.
2. To understand the chemistry of alkene and alkyne
3. To understand the chemistry of hydroxyl compounds & ethers
4. To understand the various electrical and magnetic properties.

Unit – I Hydrocarbons

1.1 IUPAC nomenclature of cyclic & acyclic alkanes -General structure of IUPAC names- Parent name - Root name- locants- branched and unbranched alkanes, alkyl groups, alkenes, dienes and alkynes (upto 20 carbon system).

1.2 Alkanes

Physical properties of Alkanes - Structure and reactions of C-C bonds - Oxidation, Aromatization, Pyrolysis and free radical substitution. Petroleum and petrochemicals- cracking, synthetic petrol, refining of gasoline, reforming, knocking, diesel engine fuel and cetane number.

1.3 Cycloalkanes

Preparation using Wurtz reaction, Dieckmann's ring closure and reduction of aromatic hydrocarbons – Substitution and ring opening reactions - Baeyer's strain theory.

1.4 Alkenes

Physical Properties of alkenes - electrophilic and free radical addition reactions (with mechanism) addition reactions of hydrogen, hydrogen halides, (Markownikoff's rule), hydrogen bromide (peroxide effect) and Water. Hydroboration, formation of diols using Bayer's reagent, peroxybenzoic acid and OsO₄, oxidation of alkenes (ozonolysis and acidic KMnO₄), allylic substitution by NBS.

Unit-II Chemistry Of Unsaturated Hydrocarbons

2.1 Dienes

Classification - isolated, conjugated and cumulated dienes - butadiene - preparation, chemical reactions - 1, 2 and 1,4 additions, Thiel's theory - Diels-Alder reaction.

2.2 Alkynes

Preparation using CaC₂, dehydrohalogenation of vicinal dihalides - Kolbe's electrolysis method - Properties - Addition of H₂O, HCN, Halogens and HX, reduction using Lindlar's catalyst, Na and liq. NH₃ - Cyclisation of acetylene, ozonolysis and oxidation with hot alk. KMnO₄ and chromic acid - acidity of alkynes.

Unit-III Chemistry of Alcohols, Ethers and Organohalogenes

3.1 Alcohols

Classification and nomenclature of monohydric alcohols - Preparation by reduction of aldehydes, ketones, carboxylic acids and hydrolysis of esters. Hydrogen bonding, acidic nature, Reactions of alcohols - etherification, alkylation reaction of halogen acids, dehydrogenation, oxidation. Dihydric & trihydric alcohols, Glycerol-preparation, chemical reactions, cleavage reactions of polyhydric alcohols with $\text{Pb}(\text{OAc})_4$, HIO_4 , OsO_4 , uses of glycerol, Glyceryl trinitrate- Preparation, properties and uses.

3.2 Ethers

Nomenclature, preparation, chemical reactions-cleavage and auto oxidation, Zeisel's method - Epoxides - preparation and reactions.

3.3 Organohalogenes

Nomenclature - Aliphatic halogen compounds - preparation, properties and uses of CHCl_3 , CCl_4 and vinyl chloride - Commercially important halogen compounds - Westorn and freon - Synthesis and uses of DDT and BHC.

Unit -IV States Of Matter -I

4.1 Gaseous state - laws of gases - Avagadro's law - Ideal gas equation - R in different units. Kinetic theory of gases. *van der Waals* equation of state - modification of the equation at high, low and moderate pressures and temperature, -law of corresponding states - critical states (**with derivation**) - determination of critical constants.

4.2 Liquid state - vapour pressure - Trouton's rule. Liquid crystals - types, applications of liquid crystals.

UNIT -V STATES OF MATTER -II

5.1 Colloidal state -Classifications of colloids - Methods of preparation of colloids -peptisation, coagulation - Applications - reverse osmosis - desalination of sea water - dialysis - delta formation - artificial rain - purification of water (addition of polyvalent electrolytes), Amphoteric nature and micelle formation of soap - detergent action of soap - sewage disposal- Cottrell's precipitator.

5.2 Solid state - Elements of symmetry, space lattice and Unit cell, Bravais lattice - seven crystal systems - lattice energy - law of rational indices - Miller indices - X-ray diffraction - Bragg's equation **with derivation**. Determination of crystallite size using powder XRD

Reference Books

1. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand Co Ltd., New Delhi, 2005. **(Unit I, II, III)**
2. B.R. Puri and L.R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar, 2005 **(Unit IV, V)**
3. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi, 2007 **(Unit V)** .
4. P.L. Soni, H.M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2004.
5. R.L. Madan and G.D. Tuli, Inorganic Chemistry, S. Chand Co . Ltd., New Delhi, 2003.
6. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, Meerut, 2000.
7. Vogel, Text Book of Qualitative Chemical Analysis, 5th edn., ELBS/ Longman England, 1989.

SBEC I: TEXTILE CHEMISTRY

Semester: II
Credits : 2

Code : U16CH2S1
Total Hrs. : 30

General Objectives

1. To understand the classification, structure, properties of various textile fibres.
2. To know the various dyes which are used in textile industries.
3. To gain knowledge about the interaction between dye and textile fibres.
4. To learn about types of fibres, dyeing processes and after treatment techniques.

Unit-I Structure of Fibres

- 1.1 Introduction - General properties of textile fibres.
- 1.2 Classification of fibres: natural, synthetic and Semi synthetic fibres, Differences between cellulose and synthetic fibres.
- 1.3 Structure of textile fibres: Cotton, wool, silk, nylon, polyester, polyacrylamide and Hydrophilic and hydrophobic fibres.
- 1.4 Physical, chemical and biological properties and uses of cellulose fibre(cotton), protein fibre(silk and wool) and synthetic fibres (nylon and polyester).

Unit-II Manufacture and Processing of Fibres

- 2.1 Semi - synthetic fibres: Rayon - manufacture of viscose rayon, cuprammonium rayon and Acetate rayon.
- 2.2 Synthetic fibres: Preparation, properties and Uses of Nylon 6, Nylon 66, Polyester, and polyacrylamide
- 2.3 Mercerization- Manufacture of mercerized cotton and its applications.

Unit-iii Dyes

- 3.1 Dyes - Requisites of a dye -Theories of colour - Witt Theory and Modern theory.
- 3.2 Classification of dyes with examples - according to application and structure. (Preparation not required)
- 3.3 Dye-Fibre interactions: Ionic, Covalent, van der Waals, H-bonding interactions.
- 3.4 Dyeing assisting agents: NaOH, Na₂CO₃, aluminium sulphate, chromic sulphate.

Unit–IV Principles Of Dyeing Processes

4.1 General concept of dyeing process: affinity of a dye, conditions for dyeing, selection of dye stuff.

4.2 Dyeing methods - Direct dyeing, Top dyeing, Stock dyeing, Yarn dyeing, piece dyeing and garment dyeing,

4.3 Silk dyeing.

Unit– V Treatment Processes

5.1 After treatment processes :- Stripping of dyes, low temperature dyeing.

5.2 Sizing: sizing agents and applications.

5.3 Bleaching: Types of bleaching, Reductive bleaching, oxidative bleaching agents.

5.4 Brightening: Optical brightening agents -Types and uses

Reference Books

1. B.K. Sharma, Industrial Chemistry, Goel Publishing Co., 1997 **(Unit- I, II, III)**
2. Jain and Jain, Engineering Chemistry, Dhanpat Rai & Sons, 1995 **(Unit- IV, V)**
3. Bernard. P. Corbman, Textile (Fibre to fabric), The Gregg / Mcgraw-Hill, Marketing series, 1983
4. J N.Chakraborty, Fundamentals and practices in colouration of Textiles, Woodhead publishing India , 2010
5. Arora , Textile chemistry, Abishek publications, 2011
6. Rajbirsingh, Synthetic dyes, Mittal publications, 2002

CORE PRACTICAL II: ANALYTICAL CHEMISTRY PRACTICAL & CHEMICAL CALCULATIONS THROUGH VIRTUAL LAB

Semester: II
Credits : 2

Code : U16CH2P2
Total Hrs. : 45

General Objectives

1. To develop the analytical skills in physical quantity measurements
2. To develop the analytical techniques in qualitative and quantitative measurements
3. To get trained in using the computational tools

Experiments

1. Verification of Beer - Lambert's law and construction of standard graph using photo colorimeter.
2. Preparation of Buffer solutions and determination of pH.
3. Determination of buffer capacity by pH meter.
4. Determination of distribution coefficient of metals by paper chromatography.
5. Monitoring a reaction progress using Thin Layer chromatographic technique.
6. Determination of Complex formation by Job's method.
7. Determination of percentage of Ca in commercial milk powder by EDTA titration method.

Demonstrative/ group experiments

8. Determination of Avagadro's number of Cu or Ag salt
9. Preparation of distilled and de-ionized water
10. Determination of water of crystallization (or) Determination of the salt formula of compound containing water of crystallization.
11. Determination of dissolved oxygen in water (Winkler's method)

Virtual Lab experiments

1. Calculations of heats of formation of conformers.
2. Calculation of strain energies of alicyclic rings
3. Visualization of Molecular orbitals and lone pairs in simple molecules.
4. Calculation of bond energies, bond orders and bond lengths of delocalized and resonance stabilized bonds.
5. Introduction to chemistry drawing tools -Application of computational tools in chemistry - ISIS draw, Chem. sketch, Chemdraw, Chemdoodle - Drawing chemical structure, writing chemical equation (Demonstration and Lab)-Use of chemistry software.

Reference Books

1. Vogel, Text Book of Quantitative Chemical Analysis, 5th edition, ELBS/ Longman England, 1989.
2. Guy H. Grant & W. Graham Richards, Computational Chemistry, Oxford University Press, 2005.
3. Donald A. McQuarrie, John D. Simon, Physical Chemistry: A Molecular Approach, 2005.

CORE COURSE III: GENERAL CHEMISTRY – III

Semester: III
Credits : 5

Code : U16CH303
Total Hrs. : 90

General Objectives

1. To gain knowledge about zero group elements, alkali and alkaline earth metals.
2. To understand basic idea about inner transition elements.
3. To understand the concepts in aromaticity.
4. To know the chemistry of aromatic compounds.
5. To learn the principles of chemical kinetics.

Unit-I Chemistry Of Group III ,V & VI Elements

1.1 Boron family

Comparative study of boron family, inert pair effect, preparation, properties, structure and uses of boric acid, borax, diborane and borazole. **(Self study: compounds of Al, precious gems, alums)**

1.2 Nitrogen family

A comparative study of halides and oxides of nitrogen group elements- Oxy acids of nitrogen (HNO_2 and HNO_3) - Oxy acids of phosphorous (H_3PO_3 , H_3PO_4 , $\text{H}_3\text{P}_2\text{O}_7$) - preparation, properties and structure of hydrazine

1.3 Oxygen family

Anomalous behavior of oxygen- preparation, properties, structure and uses of sulphuric acid, Caro's acid, Marshall's acid and oleic acid. Classification of oxides based on chemical behaviour (acidic, basic, amphoteric and neutral oxides) and based on oxygen content (normal, peroxide, superoxide, suboxide and mixed oxide). Preparation, oxidizing and reducing character of H_2O_2 .

Unit-II Chemistry of Halogens and d-block elements

2.1 Halogens & Interhalogens

Diatomic nature -oxidizing property - Electron affinity - Electronegativity - size effect. Anomalous behavior of Fluorine -Chemical properties of haloacids and oxyhalides. Interhalogens - Preparation - structure and bonding of AX , AX_3 , AX_5 and AX_7 type interhalogens - uses. Pseudo-halogens - Comparison with halogens - Preparation, properties and uses of cyanogens and thio-cyanogen, Chemistry of Astatine

2.2 d block elements:

First, Second and Third transition series - general characteristics (metallic character, atomic and ionic radii, oxidation states, colour, complex formation and magnetic properties). Preparation, properties and uses of some important compounds (Zeigler- Natta catalyst, Prussian blue, sodium nitroprusside, Turnbull's blue, Wilkinson's catalyst, KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$)

2.3 Coinage and Zinc group metals

General characteristics of coinage metals - copper, silver and gold - Comparative study of zinc group elements - Galvanization.

Unit-III Aromatic Compounds

3.1 Aromaticity

Nomenclature of benzene derivatives, structure of benzene - molecular formula and Kekule structure - Stability and C-C bond length of benzene, MO picture, MOT of aromaticity, Huckel's rule of benzene, naphthalene and anthracene.

3.2 Effects of substituent in benzene ring - Reactivity and orientation - Theory of reactivity-Electrophilic substitution reactions - Mechanism of nitration, halogenations, sulphonation, Mercuration, Friedel-Crafts alkylation and acylation.

3.3 Phenols: Acidity, Preparation, properties and reactions - Coupling reaction. Preparation, properties and reactions of Resorcinol, Catechol and Quinol.

Unit-IV Kinetics & Catalysis

4.1 Definition - concentration versus time curves to determine rate - rate laws for zero, first, second and third order reactions - rate constant - unit of rate constants - order and molecularity - **derivation of expressions** for rate constants for zero, first, second and third order reactions - half - life period and problems - pseudo first order reaction, methods of determination of order of reactions - integration, graphical, half-life and Ostwald's isolation methods. Factors affecting rate of reaction.

4.2 Temperature dependence of reaction rate - Arrhenius parameters and calculations -Theories of reaction rate-simple collision theory - limitations -ARRT - thermodynamic derivation of rate constant. Steady state approximation-Lindemann's hypothesis of unimolecular reactions.

4.3 Adsorption

Types of adsorption - Freundlich and Langmuir adsorption isotherms.

4.4 Catalysis

Types of catalysis - intermediate complex and adsorption theories of catalysis- Factors affecting the catalytic reactions - promoters and poisons - enzyme catalysis - Michaelis - Menten equation.

Unit V Electrical and Magnetic Properties

5.1 Induced dipole moment - polarisability, polarization of a molecule in an electric field - Clausius - Mosotti equation and Debye equation (**derivation not required**) - measurement of dipole moment for molecules - vapour temperature method, dilute solution method. Bond moments-bond angle relationship, dipole moment and molecular structure (CO₂, NH₃, CCl₄ and *o*, *m* and *p*-dichlorobenzene)

5.2 Magnetic permeability, magnetic flux, density (B), magnetic field intensity (H), B and H relationship, magnetic susceptibility, magnetic moment(M), Diamagnetism, Paramagnetism,

Ferromagnetism , anti - ferromagnetism, measurements of magnetic susceptibility - Gouy Method
-number of unpaired electrons-spin only value for magnetic moment - application to **structural problems** of $K_3[Fe(CN)_6]$, $K_4[Fe(CN)_6]$ and $[Ni(CO)_4]$.

5.3 Principles of Qualitative Analysis

Reactions involved in the detection of anions F^- , Cl^- , Br^- , NO_3^- , CO_3^{2-} , SO_4^{2-} , PO_4^{3-} , $C_2O_4^{2-}$, BO_3^{3-} -
Reactions involved in the detection of cations - solubility product, common ion effect, complexation reactions - Pb^{2+} , Cd^{2+} , Bi^{3+} , Cu^{2+} , Fe^{2+} , Al^{3+} , Ni^{2+} , Co^{2+} , Zn^{2+} , Ca^{2+} , Ba^{2+} , Sr^{2+} , Mg^{2+} and NH_4^+ ions. Interfering and Non-Interfering radicals ,principle involved in group separation, preparation of Na_2CO_3 extracts.

Reference Books

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers, New Delhi, 2007 (**Unit- I, II, V**)
2. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand Co. Ltd., New Delhi,2005 (**Unit-III**)
3. B.R. Puri, L.R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar, 2005 (**Unit- IV**).
4. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall, New Delhi, 2000.
5. P.L. Soni, H.M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2004.
6. R.L. Madan and G.D. Tuli, Inorganic Chemistry, S.Chand Co. Ltd., New Delhi,2003.
7. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, Merrut, 2000.
8. V.B. Patania,Chemical Kinetics, Campus Publications, New Delhi, 2004.

CORE PRACTICAL III: INORGANIC SEMI MICRO ANALYSIS

Semester: III
Credits : 2

Code : U16CH3P3
Total Hrs. : 45

General Objectives

1. To learn the basic principles involved in inorganic qualitative analysis.
2. To develop the analytical skills required for identifying the cations and anions in a mixture.

Analysis of a mixture containing two cations and two anions of which one will be an Interfering one. Semi-micro methods using the conventional schemes with sodium sulphide may be adopted.

I. Cations to be analysed:

Lead, Copper, Bismuth, Cadmium, Iron, Aluminium, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

II. Anions to be analysed:

Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate and Phosphate

Reference Books

1. V. Venkateswaran , R. Veeraswamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry, S. Chand & Co., New Delhi, 1997.
2. Vogel, Text Book of Quantitative Chemical Analysis, 5th edition, ELBS Longman England, 1989.

CORE COURSE IV: INORGANIC CHEMISTRY- I

Semester: IV
Credits : 5

Code : U16CH404
Total Hrs. : 90

General Objectives

1. To learn about the various concepts in coordination chemistry.
2. To gain knowledge on binary compounds and organometallic compounds.
3. To understand the basic concepts of gravimetric analysis.

Unit – I Coordination Chemistry – I

- 1.1 Types of ligands, IUPAC nomenclature.
- 1.2 Werner theory - Sidgwick theory - EAN rule - Valence bond theory - postulates. sp^3 , dsp^2 , and sp^3d^2 hybridisations with examples and limitations.
- 1.3 Crystal field theory -shapes of d-orbitals-postulates- splitting of t_{2g} and e_g levels, CFSE, octahedral and tetrahedral splitting, with examples and limitations.
- 1.4 Molecular orbital theory - postulates, application to octahedral complexes only.

Unit-II Coordination Chemistry – II

- 2.1 Isomerism - stability of complexes - factors affecting the stability of complexes.
- 2.2 Unimolecular and bimolecular nucleophilic substitution reactions in octahedral and square planar complexes - Trans effect and its applications.
- 2.3 Biologically important co-ordination compounds - chlorophyll, hemoglobin and vitamin B₁₂ - their structure and application (Elucidation is not required)
- 2.4 Application of co-ordination compounds - detection of potassium ions, separation of copper and cadmium ions.

Unit-III f-Block Elements

- 3.1 Lanthanides -general study of lanthanides involving electronic configuration, oxidation states, and complexation behavior, Lanthanides - separation by Ion-exchange and solvent extraction methods - lanthanide contraction.
- 3.2 Actinides - occurrence - electronic configuration - oxidation states and complexation behaviour - extraction of thorium and uranium - and uses.

Unit-IV Organo Metallic Compounds

- 4.1 **Pi acceptor ligands - Introduction** - Metal carbonyls - Mono - and polynuclear carbonyls of Ni, Fe, Cr, Co and Mn - synthesis, reactions, structure and uses.
- 4.2 Nitrosyl compounds - classification, preparation, properties and structure of nitrosyl chloride and sodium nitroprusside.

4.3 Metal olefins (Zeise's salt) - Cyclopentadienes (Ferrocene)- preparation, aromatic character, reactions of the aromatic rings, structure and bonding.

Unit-V Binary Compounds and Gravimetry

5.1 Binary compounds, Classification and uses

Hydrides:- Types-salt like, covalent, diamond like, interstitial hydrides and uses **Nitrides:-**

Types-salt like, covalent, diamond like, interstitial, nitride complexes and uses

Carbides:- Types-salt like, covalent, interstitial and applications

Borides:- Borides having isolated B atoms, Borides having chain of B atoms, Borides having extended 2-dimensional network, Borides having 3- dimensional network and uses

5.2 Characteristics of precipitating agent - choice of precipitants - types of precipitants - condition of precipitation - Use of sequestering agents -Precipitation from homogeneous solution. Digestion, washing and ignition of the precipitate. Co-precipitation and post precipitation.

Reference Books

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers, New Delhi, 2007 **(Unit- I-V)**
2. R.D. Madan, Modern Inorganic Chemistry, S.Chand & Co., New Delhi, 2003. **(Unit I-IV)**
3. J.D. Lee, Concise Inorganic Chemistry, E.L.B.S., 2001
4. Gurdeep Chatwal and M.S. Yadav , Coordination Compounds, Himalayan Publications, 2003.
5. Gurdeep Raj, Advanced Inorganic Chemistry, Goel publishing, Meerut, 2002.
6. Kamallesh Bansal, Coordination Chemistry, Campus Publications, New Delhi, 2003.
7. G.S. Sodhi, Inorganic Chemistry, Viva Books, New Delhi, 2006.
8. D. Banerjee, Coordination Chemistry, Asian Books, 2007.

CORE PRACTICAL IV: ORGANIC ANALYSIS

Semester: IV
Credits : 2

Code : U16CH4P4
Total Hrs. : 45

General Objectives

1. To know the principles of qualitative analysis of organic compounds
2. To identify the alkaloids and flavanoids
3. To analyse the drugs present in pharmaceuticals
4. To comprehend the nature of biomolecules

I. Theory of Organic Analysis

Principles of qualitative analysis- handling of apparatus and hazardous chemicals like bromine, sodium, NaNO_2 , concentrated acids and bases, etc. - theory of the various chemical reactions / tests- techniques of derivatization- scientific reporting.

II. Organic analysis

Analysis of simple organic compounds

Characterisation of organic compounds by their functional groups and confirmation of functional groups and preparation of derivatives.

III Demonstrative Experiments

- a) Identification of alkaloids and flavonoids
- b) Limit test - for chlorides and sulphates
- c) Identification of drugs in tablets.
- d) Qualitative analysis of various biomolecules (Glucose, Aminoacids, Lipids).

Reference Books

1. V.Venkateswaran, R.Veerasingam, A.R. Kulandaivelu, Basic Principles of Practical Chemistry- Second Edition, Sultan Chand & Sons, New Delhi, 2006
2. Vogel, Text Book of Quantitative Chemical Analysis, 5th Edition, ELBS / Longman, England, 1989
3. The Indian Pharmacopoeia, 3rd edition, Volume-II, Quality Specifications World Health Organization, 1981
4. A. V. Kasthuri, S. G. Wadodkar, S. B. Gokhale, Practical Pharmaceutical Chemistry-I, Nirali Publications, 13th Edition, 2007

CORE COURSE V: ORGANIC CHEMISTRY – I

Semester: V
Credits : 6

Code : U16CH505
Total Hrs. : 90

General Objectives

1. To know the concepts in stereochemistry
2. To understand the chemistry of carbohydrates
3. To know the chemistry of carbonyl compounds and carboxylic acids

Unit-I Stereochemistry – I

1.1 Stereoisomerism - Definition - Classification into optical and geometrical isomerisms.

1.2 Optical isomerism - Optical activity - Optical and specific rotations - conditions for optical activity - Asymmetric centre - chirality - Achiral molecule - meaning of (+) and (-) and D and L notations - Elements of symmetry - racemization - methods of resolution (Mechanical separation, seeding, biochemical and conversion to diastereo isomers) - Asymmetric synthesis (partial and absolute asymmetric synthesis) - Walden inversion - van't Hoff's rule - Freudenberg's rule of shift.

Unit-II Stereochemistry – II

2.1 Projection Formula - Fischer, Flying Wedge, Sawhorse and Newmann-Notations for optical isomers - Cahn - Ingold - Prelog rules - R,S notations for optical isomers with one asymmetric carbon – Erythro and Threo representations.

2.2 Geometrical isomerism - Cis-Trans, Syn-Anti and E-Z notations, Geometrical isomerisms in Maleic, Fumaric acids and in unsymmetrical Ketoximes - Methods of distinguishing geometrical isomers (Dipolemoment, dehydration, heat of hydrogenation, cyclization, melting points) - Methods of determining the configuration of geometrical isomers.

Unit-III Carbonyl Compounds - Aldehydes and Ketones

3.1 Structure - Nomenclature- Methods of preparation, Physical properties, chemical properties- nucleophilic addition- acid- base catalysed reaction - acidity of α -hydrogens

3.2 Addition reactions - sodium bisulphate, hydrogen cyanide, ammonium ion.

3.3 Reduction reaction - reduction to alcohol and alkane using Grignard reagent and LiAlH_4 - Introduction to organometallic reagents like Organo Zn- Organo lithium and Organo Copper compounds – orbital structure of C- metal bonds, ionic character, preparation, structure and synthetic uses.

3.4 Oxidation reaction - Oxidation of aldehydes and ketones.

3.5 Naming reactions involving carbonyl compounds - Haloform, Reformatsky and Wittig Reaction.

Unit-IV Carboxylic Acids and Derivatives

4.1 Monocarboxylic acid - Nomenclature- methods of preparation by oxidation of primary alcohol , aldehydes, hydrolysis of nitriles, hydrolysis of esters, carboxylation of alkenes- Acidity of carboxylic acid – acidity constant - chemical properties of mono carboxylic acids- salt formation -formation of acid halides- formation of amides- formation of esters.

4.2 Dicarboxylic acids - preparation and properties of oxalic, malonic, succinic, glutaric and adipic acids.

4.3 Malonic and acetoacetic esters - characteristics of reactive methylene group - synthetic uses of malonic and acetoacetic esters.

Unit-V Chemistry of Nitrogen Compounds

5.1 Nitrogen compounds - nomenclature - nitro alkanes - synthetic uses and reactions of nitroalkanes - alkyl nitrites - differences between nitroalkanes and alkyl nitrites

5.2 Aromatic nitro compounds

Physical and chemical properties of aromatic nitro, di and trinitro compounds - preparation and reduction of nitro benzene under different conditions. Chemistry of Picric acid

5.3 Amino compounds - Classification of Aliphatic and aromatic amines- effect of substituents on basicity and comparison of aliphatic and aromatic amines- mechanism of carbylamine reaction and diazotization- preparation and synthetic importance of benzene diazonium chloride.

Reference Books

1. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S.Chand & Co., Ltd., New Delhi, 2005. **(Unit- III, IV, V).**
2. M.K. Jain and S.C. Sharma, Modern Organic Chemistry, Vishal Publishing & Co, 2011 **(Unit- III, IV, V)**
3. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International, New Delhi, 2005 **(Unit- I, II).**
4. R.T. Morrison and R.N. Boyd, Organic Chemistry, 6th Edition, Prentice Hall, New Delhi, 2009
5. Bhupinder Mehta & Manju Mehta, Organic Chemistry, PHI Learning Pvt. Ltd., 2005
6. P.S. Kalsi, Stereochemistry, Conformation and Mechanism, Wiley Eastern Limited, New Delhi, 1993
7. Ernest L. Eliel, Stereochemistry of Carbon Compounds, Tata McGraw Hill, New Delhi, 2003
8. L.C. Wade, Organic Chemistry, Pearson Education, New Delhi, 2004.
9. Paula Yurkanis Bruice, Organic Chemistry, Pearson Education, New Delhi, 2003.
10. P.L. Soni, H.M. Chawla, Organic Chemistry, 28th Rev. Ed., Sultan Chand & Sons, New Delhi, 2004.
11. Raj K. Bansal, Text Book of Organic Chemistry, New Age International Ltd., New Delhi, 2003.

CORE COURSE VI: PHYSICAL CHEMISTRY – I

Semester: V
Credits : 6

Code : U16CH506
Total Hrs. : 90

General Objectives

1. To understand the concepts of thermodynamics and apply it to physical and chemical systems.
2. To know the relation between colligative properties and molecular weight of solutes
3. To understand the effect of pressure and temperature on phase equilibrium.

Unit-I First Law of Thermodynamics

1.1 Definition of thermodynamic terms-system and surrounding - isolated, closed and open systems - intensive and extensive variables. Thermodynamic processes - reversible and irreversible, isothermal and adiabatic – state and path functions.

1.2 Laws of thermodynamics. The zeroth law and the first law of thermodynamics-statements - definition of internal energy (E) enthalpy (H) and Heat capacities , relation between C_p and C_v - calculation of $q, W, \Delta E$ and ΔH for expansion of ideal gases under isothermal and adiabatic conditions for reversible and irreversible processes. (problems) Joule - Thomson effect as an isoenthalpic process. Relationship between μ, τ for ideal and real gases - inversion temperature.

1.3 Thermochemistry - Enthalpy change in chemical reactions - relation between ΔE and ΔH of reactions, - Hess's law and its applications Standard states - standard enthalpy of formation, enthalpy of combustion, enthalpy of neutralization, Bond energy and its calculation from thermochemical data. Temperature dependence of ΔH - Kirchoff's equation

Unit-II Second Law of Thermodynamics

2.1 Second law of thermodynamics - need for the law - different statements of the law - cyclic process - heat engine - Carnot's cycle and its efficiency.(problems)

2.2 Concept of entropy-entropy definition-Claussius inequality-entropy as a criterion of spontaneous and equilibrium process in isolated systems- entropy as a function of P,V and T - entropy change in phase changes, entropy of mixing.

2.3 Gibbs and Helmholtz functions - ΔA and ΔG as function of P, V and T. Maxwell's relations - Gibbs – Helmholtz equation and its applications - thermodynamic criteria for spontaneity and equilibrium.

Unit-III Third Law, Thermodynamic Applications and Partial Molar Properties

3.1 Third law of thermodynamics - statement - evaluation of absolute entropy from heat capacity data, Exception to third law (CO, N₂O) - Nernst Heat theorem and its expression.

3.2 Equilibrium constant and standard free energy change, van't Hoff isotherm (van't Hoff equation) - Thermodynamic derivation of law of mass action-van't Hoff's isochore - Thermodynamic interpretation of Le Chatelier's principle.

3.3 Partial molar properties - chemical potential and its significance- Gibbs - Duhem equation - variation of chemical potential with T,P and X (mole fraction)

Unit-IV Phase Rule and its Applications

4.1 Meaning of the terms - phase, component and degree of freedom- derivation of Gibb's phase rule. Phase equilibria of one component systems - CO₂, water and sulphur systems. Phase equilibria of two component systems - simple eutectic systems - (Pb - Ag), Compound formation with congruent melting point (Mg-Zn) and incongruent melting point (Na-K), Freezing mixtures. (NaCl - water) - efflorescence and deliquescence.

4.2 Partially miscible liquid pairs - phenol-water, trimethylamine - water and nicotine-water systems (systems with lower and upper CST), Effect of impurities on miscibility temperature - immiscible liquids - principle and application to steam distillation, Nernst distribution law (thermodynamic derivation) and its applications.

Unit-V Solutions

5.1 Dilute solutions and colligative properties of solutions, determination of molecular weight - relative lowering of vapour pressure. Laws of osmotic pressure and its applications. Thermodynamic derivation of elevation of boiling point and its derivation, depression of freezing point , osmotic pressure.

5.2 Binary liquid mixtures. Henry's law, Raoult's law deviation from Raoult's law - ideal liquid mixtures (benzene and toluene) , fractional distillation , non ideal systems, azeotropes (HCl- water and ethanol-water systems).

Reference Books

1. B.R. Puri, L.R. Sharma and Madan S. Pathania, Elements of Physical Chemistry, Vishal Publishing Co., Jalandhar, 2008 **(Unit I - V)**
2. K.K.Sharma and L.K. Sharma, A Text Book of Physical Chemistry, 4th Edn., Vikas Publishing House (P) Ltd., New Delhi, 2002**(Unit I - V)**
3. K.L. Kapoor, A Text Book of Physical Chemistry, Macmillan, New Delhi, 2005
4. G.W. Castellan, Physical Chemistry, 3rd Edn., Narosa Publishing House, New Delhi,2002
5. B.R. Puri, L.R. Sharma and Madan S Pathania, Principles of Physical Chemistry 42nd Ed., Vishal Publishing Co., Jalandhar, 2007
6. K. Kundu and S.K. Jain,Physical Chemistry, S.Chand Co. Ltd., New Delhi, 2003
7. B.S. Bhal, G.D. Tuli and Arun Bhal, Essentials of Physical Chemistry,S. Chand and Co. Ltd., New Delhi, 2004
8. P. Atkins and J. Paula, Physical Chemistry, Oxford, New Delhi, 2002

ELECTIVE COURSE I: BIOCHEMISTRY

Semester: V
Credits : 4

Code : U16CH5:1
Total Hrs. : 60

General Objectives

1. To learn the basic concepts in human biochemistry
2. To know the various metabolisms involved in human life.

Unit-I

1.1 Living Systems

Cells, structure of cell (diagram), nucleus, mitochondria, chloroplast, cytoplasm, ribosomes, golgi bodies, lysosomes.

1.2 Amino Acids

Essential and non-essential aminoacids, isoelectric point, Zwitter ions, peptide bond, function of a few peptides (Enkephalins, Bradykinin, Gramicidin-S, aspartame, glutathionine), Protein- primary, secondary and tertiary structures and function - Ramachandran plot and significance of ψ and ϕ values.

Unit-II

2.1 Carbohydrates

As a basic building block- role of mono and disaccharides in biological systems - glycolysis and glycogenesis - a detailed study of glycolysis - glycogen storage, deficiency diseases - hypoglycemia - Cori's disease - Andersen's disease.

2.2 Lipids and fatty acids

Classification of lipids- simple lipids(Fats), compound lipids (phospho, glyco, sulpho lipids and lipo proteins)and derived lipids(fatty acids and glycerol) -chemical composition (simple and triglycerides) and biological significance of fats. Fatty acids -types(saturated, unsaturated and cyclic) -Essential and non essential fatty acids. Cholesterol - LDL, VLDL and HDL - Hypercholesterolemia.

Unit-III

3.1 Major metabolic pathways of life

Importance of catabolism ,anabolism , aerobic metabolism vs. an aerobic metabolism, TCA Cycle , Cancer cell Metabolism.

3.2 Enzymes and hormones

Simple, apoenzyme and holoenzymes, classification of enzymes-Enzyme regulation, competitive and non-competitive inhibitors - function of a few enzymes in pancreatic juice. Hormones - importance, function and structure of a few autocrine, paracrine and endocrine hormones (adrenalin, thyroxin, insulin, estrone and testosterone)

Unit-IV Nucleic Acids

4.1 Nucleotides - Nucleosides - heterocyclic bases and sugars in nucleic acids-RNA & DNA

4.2 Structure of DNA - Replication - transcription - translation (a detailed study)

4.3 m-RNA, r-RNA and t-RNA - structure and functions

Unit-V Nitrogen Metabolism and Neurotransmitters

5.1 Nitrogen metabolism - introduction - urea cycle.

5.2 Neurotransmitters - Neurotransmission - Importance - structure and function of acetyl choline - GABA.

Reference Books

1. L. Veerakumari, Biochemistry, MJP Publishers, Chennai, 2004 **(Unit I-V)**.
2. B.D. Hames and N.N. Hooper, Instant Notes on Biochemistry, 2nd Edn., Viva Books Pvt. Ltd., 2003
3. Donal Voet and Judith G. Voet, Biochemistry, John Wiley & Sons Inc., New York, 1990
4. Patricia Trueman, Nutrient Biochemistry, MJP publishers, Chennai, 2006
5. Albert, L. Lehninger, Michael, M. Cox, David L. Nelson, Principles of Biochemistry, Prentice Hall, Second Edition, Worth Publishers, 2000
6. Eric E. Conn, Paul K. Stumpf, George Bruening and Roy H. Doi, Outlines of Biochemistry, Wiley Student Edition, Singapore, 2006

PROJECT

Semester: V
Credits : 3

Code : U16CH5PJ
Total Hrs. : 60

General Objective

1. To get trained in applying the knowledge and skills to solve a problem, give inferences and record the findings as a scientific report

Group projects for a duration of 4 hours per week.

Components for evaluation

- Preparation of report (20 marks)
- Innovation in choice of problem (20 marks)
- Skills in systematic analysis and recording. (20 marks)
- Regularity and involvement (20 marks)
- Viva - voce (20 marks)

****INTERNSHIP: EXTRA CREDITS- 2**

Extra credits (2 credits) can be earned by taking up internship during summer or winter vacation on submission of a Project Report and Attendance Certificate.

SBEC II: PHARMACEUTICAL CHEMISTRY

Semester: V
Credits : 2

Code : U16CH5S2
Total Hrs. : 30

General Objectives

1. To understand the terminology used in pharmaceuticals
2. To know about the drugs derived from chemical compounds
3. To study the natural and synthetic drugs.
4. To understand pharmacological action of the drugs.

Unit-I

1.1 Terminology used in pharmaceutical chemistry

Definition and explanation: Drug, pharmacopoeia, chemotherapy, pharmaceuticals, LD50 values. Routes of administration - oral, parenteral, Bacteria - positive and negative.

1.2 Heterocyclic Drugs

Structure and uses of drugs derived from the following derivatives - Pyridine derivatives - Tripelennamine and mepyramine, Quinoline derivatives - Chloroquine and primaquine, Pyrimidine derivatives - barbiturates.

Unit-II Blood & Its Composition

2.1 Composition of blood and blood plasma-function of Haemoglobin, Transport of Oxygen, Rh factor. Blood Pressure - Normal, high, low and its control mechanism.

2.2 Clinical estimation of Glucose, cholesterol and haemoglobin.

Unit-III

3.1 Medicinally important compounds

Compounds of Al, As and Fe - preparation and application.

3.2 Chemistry of sulphonamides - sulphadiazine and prontosil - preparation and uses.

Unit-IV

4.1 Organic diagnostic agents

X-ray contrast media (radio opaque) Iodipamide, Evan's blue, Histamine, Xylose, CT and MRI scan (Basics only)

4.2 Structure and uses of i) Narcotic drugs - Morphine and SAR of morphine ii) Non-Narcotic drugs - ibuprofen Antibiotics - structure and mechanism of penicillin, structure of semi-synthetic penicillin's - ampicillin, structure and uses of Chloramphenicol

Unit-V

5.1 Anesthetics

Stages of anesthesia - Preparation and uses of general and local gaseous anesthetics - Ether, halogenated Hydrocarbons - chloroform and trichloroethylene - Local anesthetics - Cocaine and its any two derivatives , intravenous anesthetics - thiopentone sodium and propounded - Structure and uses only.

5.2 Anti-neoplastic agents - Alkylating agents (Busulfan) -Ethylene imines - Nitrogen mustards - Cyclophosphamide. Antimetabolites - Purine analogues, Immunotherapy

Reference Books

1. S. Jayashree Ghosh, Text book of Pharmaceutical Chemistry, S.Chand, 2008(**Unit I-V**)
2. Bentley and Drivers, A Text book of Pharmaceutical Chemistry, 14th edition, Oxford university Press, 1996
3. Indian Pharmacopoea, Govt. of India , Indian Pharmacopoean Commission, Vol.I,2010
4. N. Murugesan, A Text book of Pharmacology- 6th edition, Sathya Publishers, 2004
5. S. Lakshmi, Pharmaceutical Chemistry-2nd edition, S. Chand, 1998.
6. Alfred Burger, Medicinal Chemistry- 6th edition, Wiley - Interscience Publication,2003

SBEC III: INDUSTRIAL CHEMISTRY

Semester: V
Credits : 2

Code : U16CH5S3
Total Hrs. : 30

General Objectives

1. To know about basic ingredients in cosmetics.
2. To gain knowledge on the importance of polymer
3. To learn the steps involved in the industrial manufacturing processes.

Unit-I Cosmetic Chemistry

Cosmetics - Introduction about raw materials in cosmetics - (oil, waxes, colour, preservative, fragrance). **Application of cosmetics - skin and hair** - skin lighteners, sun screen lotions- skin toners- anti wrinkling creams .Lip care - lip gloss - lipsticks - lip liners, moisturizers - crack creams-Hair-Shampoo, hair dye (raw materials and uses only)

Unit-II Polymer Chemistry

Classification of polymers based on microstructures, macrostructures and applications (thermosetting and thermoplastics). Determination of molecular mass of polymer number average molecular mass (M_n) and weight average molecular mass (M_w) methods. Zeigler - Natta polymers. Degree of polymerization- General preparation, properties and uses - Teflon, PAN, PVC.

Unit-III Sugar and Paper

Sugar-double sulphitation process-refining and grading of sugar, saccharin. Manufacture and uses of sugar. Paper industries - Manufacture of paper production of sulphite pulp and conversion to paper (bleaching, filling, sizing and calendaring).

Unit-IV Glass, Cement and Ceramics

Glass- Types of glass, composition, manufacture and uses. Cement- Manufacture wet and dry processes, composition of portland cement, setting of cement, Concrete and RCC Ceramics- Types-raw materials - white wares, manufacture and uses.

Unit-V Protective Coating

Organic coating- Paints- requisites- constituents -Formulation of paint-uses. Varnishes - types- constituents of varnish and uses. Enamels - constituents and uses. Lacquers- constituents and uses Emulsion paints- constituents and uses. Special paints-(luminous paint, heat resistant paint, fire resistant paint, cellulose paint, coal-tar paint, cement paint, anti-fouling paint, aluminium paint, water repellent paints and distemper)

Internal component

Inplant training: One day visit to be an industry involving chemical technology in and around Tiruchirappalli, (Sugar,Cement,Textile,Paper Industries,etc) and submission of a mini report.

Reference Books

1. Sharma B.K., Polymer Chemistry, Goel Publishing House, Meerut, 1989 **(Unit- II)**
2. B.K. Sharma, Industrial Chemistry, Goel Publishing Co., 1997 **(Unit- I, III, IV, V)**
3. Jain and Jain, Engineering Chemistry, 15th Edition, Dhanapat Rai Publishig company, New Delhi, 2010
4. Arora M.G M. and Yadav M.S., Polymer Chemistry, 2nd revised edition, Anmol Publications Private Ltd., New Delhi, 1989

CORE PRACTICAL V: GRAVIMETRIC ANALYSIS, ORGANIC AND INORGANIC PREPARATION

Semester: V
Credits : 3

Code : U16CH5P5
Total Hrs. : 90

General Objectives

1. To know the basic principles of Gravimetric analysis
2. To acquire analytical skills through preparing organic and inorganic compounds

I. Theory of Gravimetry

Principles of quantitative precipitation - Conditions for precipitation - Methods of digestion - Quantitative filtrations - Techniques of drying - Theory of weighing - Handling of Chemical balance.

II. Gravimetric Estimation

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of sulphate as barium sulphate

III. Inorganic Preparation

1. Preparation of a coordination complex.
 - Preparation of Prussian Blue
 - Preparation of tetraamine copper(II)
 - Preparation of Lead tetraacetate
2. Recording the UV spectrum of a complex prepared to appreciate the d-d transition. (demonstration only)

IV. Organic Preparation

Preparation of an organic compound by a single stage and recrystallization of the compound.

- Preparation of Salicylic acid from methyl salicylate
- Preparation of acetophenone oxime from acetophenone
- Preparation of m-nitro methyl benzoate from methyl benzoate
- Preparation of benzoic acid from benzaldehyde

Reference Books

1. V.Venkateswaran, R.Veerasingam, A.R. Kulandaivelu, Basic Principles of Practical Chemistry - Second Edition, Sultan Chand & Sons, New Delhi, 2006
2. Vogel, Text Book of Quantitative Chemical Analysis, 5th Edition, ELBS / Longman, England, 1989

CORE COURSE VII: INORGANIC CHEMISTRY-II

Semester: VI
Credits : 6

Code : U16CH607
Total Hrs. : 90

General Objectives

1. To know the principles of radioactivity and nuclear chemistry.
2. To know the nature of chemical bonds in a given inorganic compound.
3. To learn about the existence of special types of compounds with weak chemical forces.
4. To gain knowledge about some metallurgical processes.

Unit- I Nuclear Chemistry

1.1 Introduction - composition of nucleus, fundamental particles and nuclear forces - Meson field theory.

1.2 Nuclear stability - n/p ratio, mass defect, binding energy, packing fraction and magic numbers, Harkin's rule, shell and liquid drop models.

1.3 Isotopes, Isobars, isotones and isomers with examples. Detection of Isotopes - (Aston and Dempster methods and separation of isotopes, whole number rule. Deviation of atomic weights from whole numbers.

Unit-II Radioactivity and Nuclear Transformations

2.1 Radioactivity - discovery, Types - detection and measurements (Wilson cloud chamber). Radioactive emanations - Theories of decay - Geiger Nuttal rule- Range of alpha particles- units of radioactivity-rate of radioactive disintegration - half life - average life.

2.2 Nuclear transmutations - Use of projectiles - Q-value of nuclear reactions - thermonuclear reactions -Types of nuclear reactions -Nuclear reactors- Breeder reactors- transuranic elements- Stellar energy.

2.3 Radioactive disintegration series (U, Th, Ac, Np) - Applications of radio isotopes - Carbon dating - Radioactive waste disposal.

Unit-III Bonding in Metals

3.1 Theories of metallic bonding - electron gas, Pauling and band theories, Semi conductors - Extrinsic and intrinsic, n-type and p-type semiconductors and their applications - Packing of atoms in metal (bcc,ccp,hcp) - crystal defects - Frenkel and Schottky defects

3.2 Structure of alloys - Substitutional and interstitial solid solutions - Hume Rothery rules

Unit- IV Metallurgy and Silicon Polymers

4.1 Metallurgy: Occurrence of metals, Types of ores, various metallurgical operations -concentration, calcination, roasting, smelting and refining.

4.2 Silicones - manufacture, structure, properties and uses.

4.3 Silicates - Classification into discrete anions, one, two and three dimensional structures with typical examples, composition, properties and uses of beryl, asbestos, molecular sieves, talc, mica, zeolites and ultramarines.

Unit-V Industrial Products

5.1 Gaseous fuels , Non -petroleum fuels: Introduction - Natural gas and CNG- composition and uses; Coal gas-manufacture, composition and uses. Water gas - manufacture, composition and uses ; Producer gas- manufacture, composition and uses; Power alcohol- manufacture, composition and uses; Liquefied petroleum gases (LPG), gobar gas, Benzol and semiwater gas -composition and uses

5.2 Fertilizers - Manufacture of N, P, K and mixed fertilizers, Micronutrients and their role in plant life.

5.3 General Characteristics of Safety matches, fireworks and manufacture of important explosives (TNT, Amatol, nitoglycerine NG or GTN and RDX).

Reference Books

1. B.R. Puri, L.R.Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi, 2007 **(Unit I- V)**
2. R.D. Madan and G.D. Tuli, Inorganic Chemistry, S. Chand & Co., New Delhi, 2005 **(Unit I-V)**
3. P.L. Soni and Mohan Katyal, Text Book of Inorganic Chemistry, Sultan Chand & Co., New Delhi, 2004
4. Gurdeep Raj, Advanced Inorganic Chemistry, Goel Publications, Meerut, 2002
5. J.D. Lee, Concise Inorganic Chemistry, New Delhi, 2001

CORE COURSE VIII: ORGANIC CHEMISTRY-II

Semester: VI
Credits : 6

Code : U16CH608
Total Hrs. : 90

General Objectives

1. To understand the mechanism of organic reactions
2. To comprehend the structure and importance of carbohydrates
3. To know the chemistry of natural products and heterocyclic compounds

Unit- I Substitution and Elimination Reactions

1.1 Aliphatic nucleophilic substitutions - mechanism of S_N1 , S_N2 and S_Ni reactions - stereochemistry aspects involved in S_N1 , S_N2 and S_Ni .

1.2 Elimination reactions-Hoffmann and Saytzeff's eliminations-trans elimination: Mechanism of E1 and E2 reactions. Elimination versus substitution.

1.3 Aromatic Nucleophilic substitution reactions - Benzyne mechanism and intermediate complex formation mechanism.

1.4 Aromatic Electrophilic substitution reactions-Nitration, Bromination, Sulphonation.

Unit- II Molecular Rearrangements

2.1 Classification - anionotropic, cationotropic, intermolecular and intramolecular

2.2 Pinacol - pinacolone rearrangement (Mechanism, Evidence for carbocation intermediate formation - Migratory aptitude). Beckmann, Benzidine, Hoffmann, Curtius, Benzilic acid rearrangements (Mechanism only) Claisen rearrangement (sigmatropic rearrangement), Cope rearrangement.

Unit- III Natural Products and Chemistry of Nitrogen Compounds

3.1 Natural products

Terpenes- classification - Isoprene rule - general reactions of terpenes - structure of citral, geraniol, nerol, menthol and terpineol. α - pinene (**structure elucidation not required**).

3.2 Alkaloids - General methods of isolation and general methods of structural determination- and structure elucidation of conine, piperine and nicotine.

Unit- IV Carbohydrates

4.1 Classification of carbohydrates - Monosaccharides - preparation, properties and structural elucidation of glucose and fructose, epimerisation, interconversion of glucose and fructose, chain lengthening, chain shortening of aldoses, mutarotation and α , β - glycoside linkages, cyclic structure, pyranose and furanose forms of D -Glucose

4.2 Disaccharides - Sucrose - Manufacture, properties and structure. Polysaccharides - structure

of starch and cellulose (**Elucidation not required**).

Unit– V Heterocyclic Compounds

5.1 Aromatic characteristics and basicity of heterocyclic compounds.

5.2 Five membered heterocyclic systems- preparation, properties and uses of furan, pyrrole, thiophene and imidazole

5.3 Six membered heterocyclic systems-structure, synthesis and reactions of pyridine, piperidine, purine and pyrimidine - Comparative basic characters of pyrrole, pyridine, piperidine with amines.

5.4 Fused rings- Synthesis of Quinoline, isoquinoline and indole by Skraup, Bischler Napieralski and Fischer Indole synthesis respectively and their reactions.

Reference Books

1. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand & Co. Ltd., New Delhi, 2005 (**Unit- I, II**)
2. MK Jain and SC Sharma, Modern Organic Chemistry, Vishal Publishing &Co.,2011 Bhupinder (**Unit- III, IV, V**)
3. R.T. Morrison & R.N.Boyd, Study Guide to Organic Chemistry,Prentice Hall, New Delhi, 2000.
4. I.L. Finar,Organic Chemistry vol 2 (3rd.ed.), Longmans Green & Co,1964
5. Mehta& Manju Mehta,Organic Chemistry , PHI Learning Pvt. Ltd., 2005
6. L.G. Wade, Organic Chemistry, Pearson Education, New Delhi,2004
7. Seyhan N.Ege Organic Chemistry: Structure and Reactivity, Houghton Mifflin Harcourt (HMH); 5th edition 2003
8. Paula Yurkanis Bruice, Organic Chemistry, Pearson Education, New Delhi, 2003
9. Gurdeep Chatwal, Organic Chemistry of Natural Products, Himalaya Publications,Mumbai, 2000
10. P.L. Soni and H.M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2004

CORE COURSE IX: PHYSICAL CHEMISTRY – II

Semester: VI
Credits : 6

Code : U16CH609
Total Hrs. : 105

General Objectives

1. To understand the laws of electrochemistry and their applications
2. To learn the principles of Molecular Spectroscopy

Unit– I Electrical Conductance

1.1 Conduction in metals and in electrolyte solution, specific conductance and equivalent conductance, Measurement of equivalent conductance, variation of equivalent conductance with concentration.

1.2 Migration of ions -Kohlrausch's law and its applications to determine λ_0 of weak electrolyte-Arrhenius theory of electrolytic dissociation - weak and strong electrolytes according to Arrhenius theory - Ostwald's dilution law - its uses to determine K_a of weak acids and K_{sp} of a sparingly soluble salt and limitations. The elementary treatment of Debye - Huckel Onsagar equation for strong electrolytes. Conductometric titrations - acid -base , precipitation with examples. Transport number and Hittorf's rule-determination by Hittorf's method and moving boundary method.

UNIT– II Equilibria In Electrochemical Cells

2.1 Electrolytic and galvanic cells-Reversible and irreversible cells. Conventional representation of electrochemical cells. Electromotive force of a cell and its measurements - Computation of cell e.m.f.- Calculation of thermodynamic quantities of cell reactions (ΔG , ΔH , ΔS and K) problems

2.2 Derivation of Nernst equation, single electrode potential and Applications of Nernst equation standard electrode potentials- Electrochemical series and its significance. Types of reversible electrodes - construction- cell reaction with Nernst equation - Reference electrodes- standard hydrogen electrode and calomel electrode- construction and cell reaction with Nernst equation - Western Cadmium cell

2.3 Concentration cells - emf of concentration cells with and without transference and its derivation - liquid junction potential and its derivation - applications of concentration cells - determination of valency, transport number and solubility product.

2.4 Batteries - Primary and Secondary storage batteries - Fuel cell (Hydrogen-oxygen cell only).

Unit– III Molecular Spectroscopy – I

3.1 Definition of spectrum. Electromagnetic radiation, quantization of different forms of energies in molecules (translational, rotational vibrational and electronic), Born Oppenheimer approximation, factors affecting line width and intensity.

3.2 UV-Visible spectroscopy - types of electronic transitions - Franck Condon principle -predissociation spectra and dissociation energy. Applications - Beer Lambert's law - OD, chromophore, auxochrome, bathochromic and hypsochromic shifts and effect of substituents

Unit– IV Molecular Spectroscopy - II

4.1 Infrared spectroscopy - modes of vibration of diatomic, tri-atomic linear (CO_2) and non-linear tri-atomic (H_2O) molecules. Stretching and bending vibrations - selection rules, expression for vibrational frequency (derivation not needed). Calculation of force constant - Applications of IR spectra (group frequencies, finger print and hydrogen bonding only).

4.2 Raman spectroscopy-conditions -Rayleigh and Raman scattering, selection rules Classical and quantum theory - Stokes and Antistokes lines. Differences between Raman and IR spectroscopy - Rotational Raman spectra of non-centrosymmetric molecule(HCl only). Mutual exclusion principle (CO_2 and N_2O).

Unit– V Molecular Spectroscopy - III

5.1 NMR Spectroscopy - magnetic and non - magnetic nuclei- selection rules - principle of nuclear magnetic resonance - ring current - shielding mechanism-chemical shift - factors affecting chemical shift - number of signals - spin-spin coupling - splitting of signals - NMR spectra of methyl halides, ethylene, acetylene and benzene - Chemical exchange - NMR spectrum of ethyl alcohol in detail.

5.2 ESR spectroscopy - selection rules - theory of ESR spectra - hyperfine splitting - ESR spectra of simple radicals CH_3 , CD_3 , naphthalene radical ions only.

Reference Books

1. B.R.Puri, L.R.Sharma and Madan. S. Pathania, Principles of Physical Chemistry 42nd Edition, Vishal Publishing Co., Jalandhar, 2007 (**Unit I-V**)
2. B.S. Bhal G.D. Tuli and Arun Bhal,Essentials of Physical Chemistry, S. Chand & Co., New Delhi, 2004 (**Unit- I, II**)
3. Gurdeep Raj, Advanced Physical Chemistry, Goel publishing House, Meerut, 2000
4. P.Atkins and J.Paula, Physical Chemistry, Oxford university press, New Delhi, 2006
5. G.W.Castellan, Physical Chemistry, 3rd Edition, Narosa Publishing House, New Delhi, 2002
6. K. Kundu and S.K. Jain, Physical Chemistry, S. Chand & Co., Ltd., New Delhi, 2003
7. K.L. Kapoor, Text Book of Physical Chemistry, Macmillan, New Delhi, 2005
8. G.Aruldas, Molecular structure and Spectroscopy, Prentice Hall of India, New Delhi, 2005

ELECTIVE COURSE II: ANALYTICAL CHEMISTRY

Semester: VI
Credits : 5

Code : U16CH6:3
Total Hrs. : 90

General Objectives

1. To get awareness over the laboratory risky issues.
2. To know the different types of errors.
3. To understand the principles of some analytical techniques.

Unit- I

1.1 Good Laboratory Practices (GLP)

Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals. Simple first aid procedure for accidents - acid in eye, alkali in eye, acid burns, alkali burns, bromine burns, poisoning, inhalation of gases and heat burns.

1.2 Green Chemistry

Introduction and basic principles of green chemistry - green solvents - green reactions - microwave induced green synthesis.

Unit- II

2.1 Organic estimations

Principles and methods to estimate glucose, phenol, aniline, ketone, Estimation of oils and fats, Iodine value, saponification value.

2.2 Methods of purification- steam distillation, vacuum distillation, fractional distillation, solvent extraction. crystallization and sublimation.

2.3 Data Analysis

Errors in chemical analysis, classification of errors, determinate errors- instrumental errors, Personal errors, constant errors and proportional errors. Indeterminate Errors-Precision, accuracy and rejection of data questioned. Significant figures, Mean deviation and standard deviation - t-test and Q-test.

UNIT- III

3.1 Thermo-analytical Methods

Principles involved in thermogravimetric analysis and differential thermal analysis - instrumentation. Characteristics of TGA (CaC_2O_4 , H_2O , $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) and DTA curves (CaC_2O_4 , H_2O) - Factors affecting TGA and DTA curves.

3.2 Analytical electrochemistry

Potentiometry (redox titration), conductometry (acid-base titration), electro - gravimetry (estimation of copper and silver)

Unit- IV

4.1 Colorimetric analysis

Laws of colorimetry, principle, instrumentation, construction of standard graph and applications of colorimetry. Estimation of nickel using DMG and aluminium using oxine. Structure of EDTA and its complexes.

4.2 Complexometric titrations - principle and applications, sequestering agents, masking agents.

4.3 Techniques for kinetics study

Principles and techniques used to follow the kinetics of ordinary, fast and photo chemical Reactions (volumetry, polarimetry, actinometry - one example for each method) and flash photolysis

Unit- V Chromatography

5.1 Column chromatography - Principle, types of adsorbents, preparation of column, elution, one application-separation of 2,4-dinitrophenyl hydrazones of butanone and acetophenone, R_f value and its significance, factors affecting R_f value.

5.2 Paper chromatography - principle, selection of solvents, development of chromatogram, application - separation of amino acids only.

5.3 Thin layer chromatography-principle, choice of adsorbent, preparation of plates, development and application - separation of 2,4-dinitrophenylhydrazones of butanone and acetophenone only.

5.4 Ion exchange chromatography - principle, types of resins, separation of lanthanides.

Reference Books

1. R. Gopalan, P.S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand & Sons, New Delhi, 1997 (**Unit I-V**)
2. B.K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publishing House, Meerut, 1999 (**Unit- II, III**)
3. Douglas A Skoog, Donald M. West, F. James Holler, Stanely R. Crouch, Fundamentals of Analytical Chemistry, Thompson Books, Bangalore, 2004
4. H.H: Willard, D. Merrit and John A Dean, Instrumental methods of Analysis D. Van Nostrand Company, New York, 1966

CORE PRACTICAL VI: PHYSICAL CHEMISTRY PRACTICAL

Semester: VI
Credits : 3

Code : U16CH6P6
Total Hrs. : 75

General Objectives

1. To learn the fundamentals of conductometric and potentiometric titrations.
2. To understand the method of determination of critical solution temperature, transition temperature and rate constant.

Experiments

1. Kinetics
Acid catalysed hydrolysis of an ester (Methyl acetate or Ethyl acetate)
2. Molecular Weight
Rast method : Naphthalene, m-dinitrobenzene and diphenyl as solvents.
3. Critical Solution Temperature of Phenol-water system.
4. Effect of impurity on CST (2% NaCl or 2% succinic acid solutions)
5. Phase diagram of a Simple eutectic system: Naphthalene - Biphenyl.
6. Determination of transition temperature of a salt hydrate - Sodium acetate, Sodium Thiosulphate, $\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$ and $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$
7. Conductometry - determination of cell constant and limiting molar conductance of a strong electrolyte (KCl)
8. Conductometry - acid base titration (HCl vs. NaOH).
9. Potentiometry - Redox titration. (FAS vs. KMnO_4)

Demonstration / Group Activity

10. Determination of Optical Purity of Amino acids using polarimetric method.
11. Determination of the optical Activity of *d* & *l* enantiomers and Observation of the racemisation.

ELECTIVE COURSE III : POLYMER CHEMISTRY

Credits : 5

Total Hrs. : 90

General Objectives

1. To learn the types of polymer and their significance
2. To understand the mechanism of polymerization and the processing techniques
3. To understand the classes of industrial polymers based on their properties

Unit I Introduction to Polymer

- 1.1. Monomers, Oligomers, Polymers and their characteristics
- 1.2. Classification of polymers: Natural synthetic, linear, cross linked and network; plastics, elastomers, fibres, Homopolymers and Co-polymers
- 1.3 Bonding in polymers : Primary and secondary bonding forces in polymers ; cohesive energy and decomposition of polymers.
- 1.4 Determination of Molecular mass of polymers: Number Average molecular mass (M_n) and Weight average molecular mass (M_w) of polymers and determination by (i) viscosity (ii) Light scattering method (iii) Gel Permeation Chromatography (iv) Osmometry and ultracentrifuging.

Unit II Kinetics and Mechanism For Polymerization

- 2.1 Chain growth polymerization: Cationic, anionic, free radical polymerization, Stereo regular polymers : Ziegler Natta polymers.
- 2.2 Polycondensation - non-catalysed, acid-catalysed polymerization, molecular weight distribution Step growth polymers

Unit III Techniques of Polymerization and Polymer Degradation

- 3.1 Bulk, Solution, Emulsion, Suspension, Melt polycondensation, solution polycondensation interfacial and gas phase polymerization
- 3.2 Types of Polymer Degradation, Thermal degradation, mechanical degradation, photo degradation, Photo stabilizers.

Unit IV Industrial Polymers

- 4.1 Raw material, preparation, fibre forming polymers, elastomeric material.
- 4.2 Thermoplastics : Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester.

4.3 Thermosetting Plastics: Phenol formaldehyde and epoxide resin.

4.4 Elastomers : Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene. Conducting Polymers : Elementary ideas ; examples : polysulphur nitriles, polyphenylene, poly pyrrole and poly acetylene.

Unit V Introduction to Polymer Processing

5.1 Compounding: Polymer Additives: Fillers, Plasticizers antioxidants and thermal stabilizers fire retardants and colourants.

5.2 Processing Techniques: Calendaring, die casting, compression moulding, injection moulding, blow moulding, extrusion moulding and reinforcing.

Reference Books

1. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995
2. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996
3. F. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971
4. A. Kumar and S. K. Gupta, Fundamentals Polymer Science and Engineering, Tata McGraw-Hill, 1978

ELECTIVE COURSE IV : FORENSIC CHEMISTRY

Credits : 5

Total Hrs. : 90

General Objectives

1. To learn the methods of detection of adulterants and food poisons
2. To understand the principle involved in forensic chemistry
3. To know about the different analytical techniques in crime detection

Unit I Food Adulteration

1.1 Contamination of wheat, rice, dhal, milk, butter, etc. with clay, sand, stone, water and toxic chemicals (e.g. Kasserri dhal with mentanil yellow).

1.2 Food poisons: natural poisons (alkaloids, nephrotoxins), pesticides (DDT, BHC, Follidol), chemical poisons (KCN). First aid and Antidotes for poisoned persons.

1.3 Heavy metal (Hg, Pb, Cd) contamination of Sea food. Use of neutron activation analysis in detecting poisoning (e.g., As in human hair)

Unit II Transportation

2.1 Drunken driving: Breath analyzer for ethanol. Incendiary and timed bombs in road and railway tracks. Defusing live bombs.

2.2 Hit -and-go traffic accidents : Paint analysis by AAS, Soil of toxic and corrosive chemicals (e.g., conc.acids) from tankers.

Unit III Crime Detection

3.1 Accidental explosions during manufacture of matches and fire -works (as in Sivakasi). Human bombs, possible explosives (gelatin sticks, RDX). Metal detector devices and other security measures for VVIP. Composition of bullets and detection of powder burns.

3.2 Scene of crime: finger prints and their matching using computer records. Smell tracks and police dogs. Analysis of blood and other body fluids in rape cases. Identification of blood types. DNA finger printing for tissue identification in dismembered bodies. Blood stains on clothing. Cranial analysis (head and teeth).

Unit IV Forgery and Counterfeiting

4.1 Detecting forgery in bank cheques / drafts and educational records (mark lists, certificates), using UV-light. Alloy analysis using AAS to detect counterfeit coins. Checking silverline wetter mark in currency notes.

4.2 Jewellery : Detection of gold purity in 22 carat ornaments, detecting gold plated jewels, authenticity of diamonds (natural, synthetic, glassy).

Unit V Medical Aspects

5.1 AIDS : Cause and prevention . Misuse of scheduled drugs. Burns and their treatment by plastic surgery.

5.2 Metabolite analysis using mass spectrum - gas chromatography. Detecting steroid consumption among athletes and race horses.

Reference Books

1. P.C. Dikshit, Textbook of Forensic Medicine and Toxicology- 2 edition ,Peepee Publishers and Distributors (P) Ltd, 2013
2. K. S Narayan Reddy - The Essentials of Forensic Medicine and Toxicology-33rd edition, JayPee Brothers, 2014
3. Jay Seigal, Forensic Chemistry: Fundamentals and Applications, John Wiley & Sons 2015

ELECTIVE COURSE V: AGRICULTURAL CHEMISTRY

Credits : 5

Total Hrs. : 90

General Objectives

1. To learn about the chemical composition and physical properties of soil
2. To understand the types of fertilizers and their mechanism of action
3. To know about the different types of chemicals used in pest control.

Unit I Soil Chemistry

1.1 Soil analysis, Composition of soil : Organic and Inorganic constituents ,Soil acidity , buffering capacity of soils. Limiting of soil.

1.2 Absorption of cations and anions , availability of soil nutrients to plants

Unit II Fertilizers and Manures

2.1. Effect of Nitrogen, potassium and phosphorous on plant growth - commercial method of preparation of urea, triple superphosphate. Complex fertilizers and mixed fertilizers - their manufacture and composition. Secondary nutrients - micronutrients and their functions in plants. Use of fertilizers: urea, DAP, Super phosphate, Gypsum, NPK-mixed fertilizers, Optimal addition of Fertilizers to obtain estimated yield.

2.2. Bulky organic manures - Farm yard manure - handling and storage, Oil cakes, Blood meal - fish manures.

Unit III Pesticides and Insecticides

3.1. Pesticides - classification of Insecticides, fungicides, herbicides as organic and inorganic - general methods of application and toxicity, Safety measures when using pesticides.

3.2. Insecticides : Plant products - Nicotine, pyrethrin - Inorganic pesticides - borates, Organic pesticides - D.D.T. and BHC, Plant derivatives : pyrethrin, Nicotine and rotenone, Synthetic organic: carbophos, carbaryl, p-DCB, dimethoate, butachlor, Endrin, Aldrin (Chemical name, Structures and uses).

Unit IV Fungicides and Herbicides

4.1. Fungicides: Inorganic (Bordeaux Mixture) and organic (dithiocarbamate) , Industrial fungicides: creosote fractions.

4.2. Herbicides and weedicides: Selective and non-selective, 2, 4-Dichlorophenoxyacetic acid and 2, 4, 5-Trichlorophenoxyacetic acid (structure and function)

4.3. Integrated pest management, Sex attractants for insect control, Sustainable agriculture.

UNIT V PLANT GROWTH REGULATORS

5.1 3-Indole acetic acid: naphthalene acetic acid: Ethepon (2-chloroethyl phosphoric acid): Alar (succinic acid-2, 2-dimethylhydrazine :) their function.

5.2 Plant hormones: Gibberlin, Cyclocel, Phosphon, dwarfing compound (CCC:2-Chlorethyltrimethyl ammonium chloride). Defoliant

Reference books

1. G.T. Austin ,Shreve's Chemical Process Industries-5th edition, Mc-Graw-Hill, 1984
2. B.A. Yagodin,. Agricultural Chemistry- Volumes I & II, Mir Publishers, Moscow, 1976

ELECTIVE COURSE VI : DAIRY CHEMISTRY

Credits : 5

Total Hrs. : 90

General Objectives

1. To know about the basics of dairy chemistry
2. To understand the physical and chemical properties of milk proteins
3. To learn about the different milk products and their manufacturing methods

Unit I

Milk: General composition of milk, Factors affecting the gross composition of milk, physico-Chemical changes taking place in milk due to processing parameters-boiling - pasteurization- sterilization and homogenization.

Unit II

Milk lipids-terminology and definitions-Milk proteins: Physical properties of milk proteins-Electrical properties and hydration, solubility. Reaction of milk proteins with formaldehyde and ninhydrin.- Milk carbohydrate-Lactose- Estimation of lactose in milk-Milk vitamins-water and soluble vitamins, effect of heat and light on vitamins. Ash and mineral matters in milk.

Unit III

Creams : Definition-composition-chemistry of creaming process- gravitational and centrifugal methods of separation of cream-Factors influencing cream separation (Mention the factors only)-Cream neutralization. Estimation of fat in cream. Butter: Definition- % composition-manufacture-Estimation of fat, acidity, salt and moisture content-Desi butter.

Unit IV

Milk powder : Definition-need for making powder-drying process- spraying, drum drying, jet drying and foam drying-principles involved in each. Manufacture of whole milk powder by spray drying process-keeping quality of milk powder. Ice cream : Definition-percentage composition-types- ingredients needed -manufacture of ice-cream stabilizers-emulsifiers and their role.

Unit V

Dairy Detergents : Definition-characteristics-classification-washing procedure (modern method) sterilization-chloramin-T and hypochlorite solution.

Reference Books

1. Sukumar De , Outlines of Dairy Technology, Oxford Publishers,2001
2. Robert Jenness & S.Patton, Principles of Dairy Chemistry, John Wiley & Sons Inc, 1959
3. K.S. Rangappa and K.T. Achaya ,Indian Dairy products, Asia Publishing House, 1975

UG - Non Major Elective Courses (NMEC)
(Offered to Students of other Disciplines)

Sem	Course	Code	Title	Hrs/ Week	Credit	Marks		
						CIA	ESA	Total
III	NMEC I	U16CH3E1	Food and Nutrition	2	2	25	75	100
IV	NMEC II	U16CH3E2	Principles of Medicinal Chemistry	2	2	25	75	100

NMEC I: FOOD AND NUTRITION

Semester: III
Credits : 2

Code : U16CH3E1
Total Hrs. : 30

General Objectives

1. To know the basic techniques of food processing.
2. To gain basic knowledge about minerals in diet.
3. To appreciate the importance of vitamins in diet
4. To identify adulterants in food

Unit-I Food

Introduction , classification, sources of food - (animal and plant sources), functions and uses of food. Food metabolism: anabolism and catabolism. Basic food groups-proteins- aminoacids -peptides, functions of proteins in the body and deficiency diseases. Carbohydrates - classification, functions and deficiency diseases. Lipids - classification, rancidity of fats - function, storage of fats and deficiency diseases.

Unit-II Vitamins

Introduction, classification of vitamins -Fat soluble vitamins: Vitamin A, D,E &K. Occurrence, functions, requirement, effects of deficiency. Water soluble vitamins: Vitamin B complex (Vit B₁,B₂,B₆,&B₁₂) & Vitamin C. occurrence, functions, requirement, effects of deficiency.

Unit- III Minerals

Classification of minerals, sources, functions, bio-availability and deficiency of the following mineral: Calcium, magnesium, sodium, potassium, iron, fluorine, iodine, chlorine, sulphur, phosphorous, vanadium, cobalt and manganese.

Unit-IV Food Preservation and Processing

Types of food spoilage and deterioration. Methods of food preservation and processing (heating, sterilization, Deep freezing and pasteurization). Objectives of cooking and different modes of cooking fruits and vegetables. Food additives-Artificial sweeteners-saccharin, cyclamate, aspartame. Food flavours-esters, aldehydes and heterocyclic compounds. Taste enhancers - MSG, vinegar.

Unit-V Food Poisoning and Adulteration

Food Poisoning - Reasons, Diagnosis and Treatment. Diseases due to contaminated food stuffs (Acidity, Gastric ulcer, Diarrhoea, Constipation) Adulterants- Common adulterants in different foods-milk and milk products, vegetable oils and fat, spices, cereals, pulses, sweetening agents, and beverages. Contamination with toxic chemicals - pesticides and insecticides. Detection of common food adulterants.

Reference Books

1. Seema Yadav, Food Chemistry, Anmol Publishing (P) Ltd., New Delhi, 1997(**Unit I-III, V**)
2. Sri lakshmi B., Food Processing and Preservation, New age international Pvt.Ltd.Publishers, III ed, 2003 (**Unit- IV**)
3. Carl H, Synder, The Extraordinary chemistry for ordinary things, John Wiley & Sons Inc., New York, 1992
4. Alex .V.Ramani, Food chemistry, MJP Publishers, Chennai.2009
5. Swaminathan M, Text book on Food chemistry, Printing and Publishing Co.,Ltd., Bangalore,1993

NMEC II : PRINCIPLES OF MEDICINAL CHEMISTRY

Semester : IV
Credits : 2

Course Code: U16CH3E2
Total Hrs : 30

General Objectives

1. To know about the basics of drugs.
2. To learn the various modes of actions of drugs.
3. To understand the common diseases and their remedies.

Unit –I Introduction

Common diseases - infective diseases - insect-borne, air-borne and water-borne-hereditary diseases (3 examples for each) -Definition - drug, pharmacology, antimetabolites, and therapeutic index. Receptor and drug action - Receptor concept, Receptor proteins and drug receptor interactions. Mechanism of drug action: agonism and antagonism (Basic concepts only).

Unit –II Drugs

Various sources of drugs, pharmacologically active constituents in plants, Indian medicinal plants - tulsi, neem, keezhanelli, aloe vera - their importance. Manufacture of drugs (e.g. quinine, reserpine, atropine and d - tubocurarine) from Indian medicinal plants. Drug metabolism - Oxidative reactions, Reductive reactions and conjugation reactions. Factors affecting metabolism of drugs (Basic Concepts only).

Unit –III Chemotherapy

Drugs based on physiological action, definition and two examples for Anesthetics - General and local - Analgesics (2 examples) - Narcotic analgesics (only morphine compounds) - Antipyretic analgesics (acetyl salicylic acid, p-aminophenol derivatives). Muscle relaxants. i. Acting at neuromuscular junction (d-tubocurarine chloride). ii. Acting at spinal cord alone (glyceryl guaiacolate, diazepam) and Antibiotics - Penicillin, streptomycin, Antivirals (2 examples). AIDS, Cancer - symptoms, prevention and treatment (structure not required).

Unit –IV Common Body Ailments

Diabetes - Causes, hyper and hypoglycemic drugs - Blood pressure - Systolic & Diastolic Hypertensive drugs - Cardiovascular drugs -nitrates, beta blockers (propranolol and atenolol) and calcium channel blockers. Depressants (special reference to sedatives and hypnotics) - Lipid profile - HDL, LDL, Cholesterol, lipid lowering drugs (structure not required)

Unit –V Health Promoting Drugs

Medicinally important inorganic compounds of Al, P, As, Hg and Fe - examples and applications. Agents for kidney function (Aminohippuric acid) Agents for liver function (Sulfo bromophthalein), antioxidants, treatment of ulcer and skin diseases: Eczema, psoriasis and Acne (structure not required).

Reference Books

1. S. Lakshmi, Pharmaceutical Chemistry, S.Chand & Sons, New Delhi,2004 **(Unit I-V)**
2. V.K. Ahluwalia and Madhu Chopra, Medicinal Chemistry, Ane Books, New Delhi, 2008 **(Unit II-V)**
3. P. Parimoo, A Text Book of Medicinal Chemistry, CBS Publishers, New Delhi, 2006
4. Satoshkar, Medicinal Chemistry, Wiley Eastern Ltd., New Delhi, 1993
5. Romas Nogrady, Medicinal Chemistry, Oxford University Press, **1988**

Allied Chemistry Courses offered to students of Under Graduate Programme in Physics

(For the candidates admitted from the year 2016 onwards)

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
III	III	Allied-IV	U16CHY34	Allied Chemistry-I	4	3	25	75	100
IV	III	Allied-V	U16CHY45	Chemistry for Physicists	4	4	25	75	100
IV	III	Allied Practical-I	U16CHYP1	Volumetric and Organic Analysis	3	3	40	60	100

Allied Chemistry Courses offered to students of Under Graduate Programme in Botany

(For the candidates admitted from the year 2016 onwards)

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
III	III	Allied-III	U16CHY01	Allied Chemistry-I	4	4	25	75	100
IV	III	Allied-IV	U16CHY44	Chemistry for Life Sciences	4	4	25	75	100
IV	III	Allied Practical- II	U16CHYP2	Volumetric and Organic Analysis	6	3	40	60	100

Allied Chemistry Courses offered to students of Under Graduate Programme in Zoology

(For the candidates admitted from the year 2016 onwards)

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
III	III	Allied-III	U16CHY33	Allied Chemistry-I	4	3	25	75	100
IV	III	Allied-IV	U16CHY44	Chemistry for Life Sciences	4	4	25	75	100
IV	III	Allied Practical-II	U16CHYP2	Volumetric and Organic Analysis	6	3	40	60	100

Allied Chemistry Courses offered to students of Under Graduate Programme in Biotechnology
(For the candidates admitted from the year 2016 onwards)

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
III	III	Allied-III	U16CHB33	Basics of Chemistry	4	4	25	75	100
IV	III	Allied-IV	U16CHB43	Chemistry for Biotechnologists	4	3	25	75	100
IV	III	Allied Practical-II	U16CHYP2	Volumetric and Organic Analysis	6	3	40	60	100

**ALLIED III / IV: ALLIED CHEMISTRY – I
(FOR PHYSICS/ BOTANY/ ZOOLOGY)**

Semester: III

**Code : U16CHY33(Zoo)/
U16CHY01(Bot)/
U16CHY34(Phy)**

Credits : 4(Bot),3(Zoo,Phy)

Total Hrs. : 60(Bot,Zoo), 45(Phy)

General Objectives

1. To understand the basics of organic and inorganic chemistry.
2. To be aware of the different parameters involved in bonding and its types.
3. To understand the chemistry of hydrocarbons.

Unit – I Chemical Bonding

1.1 Ionic bond- Nature of Ionic bond - structure of NaCl, KCl & CsCl- Factors influencing the formation of ionic bond.

1.2. Covalent bond- nature of covalent bond -VSEPR theory - shapes of BeCl₂, BF₃, CH₄, PCl₅, IF₇, NH₃ & H₂O.

1.3 Coordinate Bond - Nature of coordinate bond, Werners' theory and structure of some complexes Ni(CO)₄, [Co(NH₃)₆]Cl₃, K₄[Fe(CN)₆]

1.4. Hydrogen bonding-Theory of Hydrogen bonding- one example for inter and intra molecular hydrogen bonding- consequences of hydrogen bonding.

1.5 van der Waals and London Dispersive forces in simple molecules.

Unit- II Chemistry Of Hydrocarbons

2.1 Hydrocarbons: Classification- aliphatic, aromatic, saturated, unsaturated cyclic, acyclic compounds

2.2 Alkanes- nomenclature, isomerism, preparation, properties (halogenation, nitration, sulphonation, oxidation) and uses Alkenes-nomenclature, isomerism, preparation, properties (hydrogenation, halogenation, hydroxylation) and uses. Alkynes - nomenclature-preparation, properties (hydrogenation, halogenation, polymerization) and uses

2.3 Chemistry of benzene: Preparation, properties (nitration, sulphonation, oxidation , Friedel- Crafts alkylation & acylation) and uses any two methods of preparation)

UNIT- III SOLUTIONS (12 hours)

3.1 Mole Concept -Normality – Molarity – parts per million - Simple problems on concentration terms

3.2 Primary and secondary standards and preparation of standard solutions and **simple problems.**

3.3 Acids and bases: Arrhenius, Lowry- Bronsted, Lewis concepts- strong and weak acids and Bases.- pH , pK_a ,pK_b, buffer solutions. Henderson - Hasselbalch equation.

Unit- IV Chemical Kinetics and Catalysis

4.1 Chemical kinetics: rate of reaction, order, molecularity, first order rate law, half life period and derivation of the first order equation

4.2 Catalysis - homogeneous and heterogeneous catalysis, intermediate complex and adsorption theories of catalysis, promoters and poisons, applications.

Unit- V Colloids

5.1 Colloids - Types with examples - classification based on affinity (Lyophilic & Lyophobic)

5.2 Optical and Kinetic properties of colloids - electrophoresis- electroosmosis - peptization - Coagulation

5.3 Applications of colloids

Reference Books

1. B.K. Sharma, Industrial Chemistry, Goel Publishing Co., 1997 **(Unit- III, IV, V)**
2. Puri B.R., Sharma L. R., Kalia K.K, Principles of inorganic Chemistry- (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., 1993 **(Unit- I)**
3. Bahl B. S and Arun Bahl, Organic Chemistry, 12th edition, New Delhi, Sultan Chand and Co., 1997 **(Unit- II)**
4. B.R.Puri, L.R.Sharma and Madan. S. Pathania, Principles of Physical Chemistry-42nd Edition, Vishal Publishing Co., Jalandhar, 2007 **(Unit I-V)**
5. B.S. Bhal G.D. Tuli and Arun Bhal, Essentials of Physical Chemistry, S. Chand & Co., New Delhi, 2004 **(Unit- I, II)**
6. R.T. Morrison & R.N.Boyd, Study Guide to Organic Chemistry, Prentice Hall, New Delhi, 2000
7. R.L. Madan and G.D. Tuli, Inorganic Chemistry, S. Chand Co., Ltd., New Delhi, 2003
8. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, Meerut, 2000

ALLIED III : BASICS OF CHEMISTRY

Semester : III
Credits : 4

Course Code :U16CHB33
Total Hrs 60

General Objectives

1. To understand the basics concepts of bonding in chemical compounds
2. To know about the types and characteristics of reactions in organic chemistry
3. To understand the mole concept and its application to solutions.

Unit –I

Chemical bonding: Ionic bond- Nature of Ionic bond Covalent bond , Coordinate Bond - Nature of coordinate bond, Hydrogen bonding-Theory of Hydrogen bonding- one example for inter and intra molecular hydrogen bonding- consequences of hydrogen bonding. Vander Waals forces of interaction.

Unit- II

Introduction to organic chemistry: types of reactions-addition reactions, substitution and elimination reactions. Aliphatic compounds-inductive effect; aromatic compounds-Resonance effect. Acidic character of phenols; basic character of aniline. Heterocyclic-five membered and six membered ring. Preparation, Structure,acidic and basic character of pyrrole, furan and pyridine.

Unit- III

Solutions: Mole Concept -Normality - Molarity - parts per million - Simple problems on concentration terms Primary and secondary standards and preparation of standard solutions and simple problems. Acids and bases: Arrhenius, Lowry- Bronsted, Lewis concepts- strong and weak acids and Bases.-pH, pKa, pK_b of buffer solutions. Henderson - Hassel Balch equation.

Unit- IV

Chemical kinetics: rate of reaction, order, molecularity, first order rate law, half lifeperiod And derivation of the first order equation - Catalysis - homogeneous and heterogeneous catalysis, promoters and poisons, applications.

Unit- V

Colloids :(Colloids - Types with examples - classification based on affinity (lyophilic & Lyophobic). Optical and Kinetic properties of colloids - electrophoresis- electroosmosis - peptization - Coagulation.Applications of colloids.

Reference Books

1. B.K. Sharma, Industrial Chemistry, Goel Publishing Co, 1997.
2. Puri B.R., Sharma L. R., Kalia K.K, Principles of inorganic Chemistry, (23rdedition), New Delhi, Shoban Lal Nagin Chand & Co, 1993.
3. S. Lakshmi, Pharmaceutical Chemistry, Goel Publishing Co, 1997.

4. Bahl B. S and ArunBahl, Organic Chemistry, 12th edition, New Delhi, Sultan Chand and Co, 1997.
5. United States Pharmacopeia Dispensing Information's, USPDI, Rockvill, Maryland, 1981..
6. The Indian pharmacopoeia 3rd edition, volume2, Quality Specifications, world health Organization 1981.
7. Thiagarajan V, Pharmaceutical chemistry, Chennai, KC S. Desikan and Co, 1986.
8. Jayashree Gosh, Text book of Pharmaceutical Chemistry, New Delhi, S.Chand, 2008.

**ALLIED CHEMISTRY-IV : CHEMISTRY FOR LIFE SCIENCES
(FOR BOTANY/ ZOOLOGY)**

Semester: IV
Credits : 4

Code : U16CHY44
Total Hrs. : 60

General Objectives

1. To understand the chemistry of biomolecules.
2. To learn the elementary concepts of chemical analysis
3. To learn the principles of analytical techniques like chromatography and colorimetry.

Unit- I Chemistry Of Biomolecules

1.1 Classification of carbohydrates, glucose & fructose - preparation -properties - mutarotation, interconversion of glucose and fructose, manufacture of sucrose, test for sugars.

1.2 Amino acids - preparation and properties of glycine and alanine, peptides (elementary treatment) - proteins-classification based on physical properties and biological functions- structure of proteins - primary and secondary -Test for proteins.

1.3 Coordination compounds: biological role of haemoglobin and chlorophyll

Unit-II Chemistry of Water

2.1 Water as a universal solvent - hardness of water- permanent and temporary hardness, disadvantage of hard water- DO, BOD and COD -definition, determination (any one method).

2.2 Water Softening methods - zeolite process, reverse osmosis

2.3 Preparation of Deionised water- Distilled water - Double Distilled water - Packaged drinking water.

Unit-III Basics of Quantitative Analysis

3.1. Error analysis: accuracy, precision, determinate and indeterminate errors, relative error, absolute error,

3.2. Quantitative analysis: Titrimetry- principle, acid-base titrations and redox titrations with examples - End point and equivalence points.

3.3. Theory of Indicators- Types of indicators - Quinonoid theory

Unit-IV Analytical Techniques

4.1 Chromatography-introduction-principle, sampling and applications of paper, thin layer and column chromatography.

4.2 Colorimetry: Beer-Lambert's Law, components of a colorimeter(Block diagram), application (estimation of iron).

Unit- V Types Of Reactions

5.1 Types of chemical reactions -substitution (one example for Nucleophilic and electrophilic with mechanism) - Addition(Addition of HBr on alkenes) - Elimination(Dehalogenation of alkyl halides) - Condensation (formation of ester) - Polymerisation (Formation of Poly vinyl Chloride) - Reduction reaction (Hydrogenation of oil)- Oxidation (KMnO₄ for conversion of benzaldehyde to benzoic acid) .

5.2 Types of intermediates- Electrophiles - nucleophiles - free radicals

Reference Books

1. Tiwari K.S., Melhotra S.N., Vishnoi N.K, A Text book of Organic Chemistry, Vikas Publishing House Pvt. Ltd., New Delhi, 2006 **(Unit-I, V)**
2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand and Sons, New Delhi, 1997**(Unit- IV)**
3. Puri B.R., Sharma L. R., Kalia K.K, Principles of Inorganic Chemistry-23rd edition, New Delhi, Shoban Lal Nagin Chand & Co, 1993**(Unit- I, III)**
4. Puri B.R., Sharma L. R., Kalia K.K, Principles of physical Chemistry, 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co, 1993**(Unit-II)**
5. R.T. Morrison & R.N.Boyd, Study Guide to Organic Chemistry, Prentice Hall, New Delhi, 2000
6. R.L. Madan and G.D.Tuli, Inorganic Chemistry, S. Chand Co., Ltd., New Delhi, 2003
7. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, Meerut, 2000

**ALLIED CHEMISTRY -V
CHEMISTRY FOR PHYSICISTS
(FOR PHYSICS)**

**Semester: IV
Credits: 4**

**Code: U16CHY45
Total Hrs.: 60**

General Objectives

1. To understand the chemistry of electrolytes and solids
2. To learn the principles of techniques like chromatography and colorimetry.

Unit – I Electrochemistry

1.1 Introduction- specific conductance, equivalent conductance, cell constant, Arrhenius theory, Ostwald's dilution law, Determination of equivalent conductance by Kohlrausch law, conductometric titrations (strong acid vs strong base, strong acid vs weak base, weak acid vs strong base, precipitation titration) - Advantages of conductometric titrations

1.2 EMF - Standard reduction potential - electrochemical series- reference electrode - primary (SHE) & secondary electrodes (Calomel) -Nernst equation

1.3 Corrosion and its prevention.

Unit-II Solid State

2.1 Crystalline Vs amorphous Solids - Elements of Symmetry - Unit cell - Bravais lattice - Seven Crystal systems-- Miller Indices

2.2 Lattice energy - Born -Haber Cycle - factors affecting lattice energy.

2.3 Defects in crystals- stoichiometric and non- stoichiometric defects.

2.4 Properties, Importance and uses of materials - Spinels - Inverse Spinels -Pervoskites

Unit-III Basics Of Quantitative Analysis

3.1 Error analysis: accuracy, precision, errors, determinate and indeterminate errors, relative error, absolute error,

3.2.Quantitative analysis: Titrimetry- principle, acid-base titrations and redox titrations with examples- End point and equivalence points. Theory of Indicators- Types of indicators - Quinonoid theory

3.3 Colorimetry: Beer-Lambert's Law, components of a colorimeter (Block diagram), application (estimation of iron).

Unit-IV Phase Equilibria

4.1 Phase - Components -Degrees of Freedom - Gibbs & Reduced Gibbs rule (Expression only) - Phase equilibria of one component system (water) - Two component system- Simple Eutectic (Pb- Ag), Freezing mixture(NaCl -H₂O)

4.2 Mesomorphic State - Liquid Crystals - Types- applications.

Unit- V Types of Reactions

5.1 Types of chemical reactions -substitution (one example for Nucleophilic and electrophilic with mechanism) - Addition(Addition of HBr on alkenes) - Elimination(Dehalogenation of alkyl halides) - Condensation (formation of ester) - Polymerisation (Formation of Poly vinyl Chloride) - Reduction reaction (Hydrogenation of oil)- Oxidation (KMnO₄ for conversion of benzaldehyde to benzoic acid) .

5.2 Types of intermediates- Electrophiles - nucleophiles - free radicals

Reference Books

1. Puri , Sharma & Pathanja , Principles of Physical Chemistry, Vishal publishing Co.,2017 **(Unit V)**
2. Puri B.R., Sharma L. R., Kalia K.K, Principles of Inorganic Chemistry-23rd edition, New Delhi, Shoban Lal Nagin Chand & Co, 1993**(Unit III)**
3. Puri B.R., Sharma L. R., Kalia K.K, Principles of Physical Chemistry - 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co, 1993 **(Unit - I, II, IV)**
4. R.Gopalan , P.S.Subramanian and K.Rengarajan, Elements of Analytical Chemistry, Sultan Chand & Sons, New Delhi, 2003
5. Arun Bahl ,B.S Bahl and G.D Tuli, Essential of Physical Chemistry, S.Chand Publishing, 2010

ALLIED IV : CHEMISTRY FOR BIOTECHNOLOGISTS

Semester : IV
Credits : 3

Course Code : U16CHB44
Total Hrs : 60

General Objectives

1. To understand the concept of chemistry involved in biological system
2. To know the impact of chemical processes and the direction of cellular reactions governed by thermodynamics.
3. To understand the importance of metal ions in biological processes

Unit I

Adjustment of cells to diverse environments: water, salts, acidity, alkalinity, buffers, temperature (heat, cold, freezing) and pressure, radiation - adaptability of prokaryotic and eukaryotic cells.

Unit II

Release of energy to cells: introduction to metabolism- oxidation, and reduction, reactions pathways, group transfer reactions, pathways of oxidoreductions -glycolysis, krebs cycle, pentose shunt pathway, oxidative phosphorylation- Electron transport chain.

Unit III

Direction of cellular reactions: Thermodynamics, free energy, second law of thermodynamics, energy storage, enzymes involved in cellular metabolism (hydrolases, oxidoreductase, NAD, FAD) and exchange role of enzymes.

Unit IV

Kinetics and mechanisms of Transport : glucose transport, ATP -driven active transport(sodium potassium pump), ion- gradient driven active transport (sodium-glucose transport)transport across all membrane- pinocytosis, phagocytosis, Autophagy, permeability of water and salts, salt antagonism.

Unit V

Metals of biological importance :Heme proteins -Binding of Oxygen by Myoglobin, Binding of Oxygen by Hemoglobin Iron - sulfur proteins-Rubredoxin and Ferredoxin. Magnesium in photosynthesis - Magnesium binding to ATP - Cobalt in vitamin B12 - Molybdenum in Nitrogen fixation.

Reference Books

1. Berg, J.M., Tymoczko, J.L., Stryer, L, Biochemistry, 7th Edition. W.H.Freeman, USA, 2010
2. Arthur C.Giese, Cell Physiology - Saunders company 5th edition, 1979
3. Campbell, M.K., Farrell, S.O, Biochemistry, 6th Edition. Brooks ColePublishing Company, USA, 2007
4. Mathews, C. K., Van Holde, K.E., Ahern, K.G, Biochemistry, 3rd Edition.Addison Wesley, USA, 2000.

5. Voet, D., Voet, J.G. and Pratt, C.W, Principles of Biochemistry, 3rd Edition. John Wiley & Sons, USA, 2008
6. Zubay, G.L, Biochemistry, 7th Edition. William C Brown Publishers, New York, 1995
7. Nelson, D.L., Cox, M.M, Lehninger Principles of Biochemistry, 5th Edition. W.H Freeman and Company, USA, 2008.

ALLIED CHEMISTRY PRACTICAL – I / II
VOLUMETRIC AND ORGANIC ANALYSIS
(FOR PHYSICS / BOTANY / ZOOLOGY/ BIOTECHNOLOGY)

Semester: IV

Code: U16CHYP1 (Phy)/
U16CHYP2 (Bot, Zoo, B.Tech)
Total Hrs.: 90

Credits: 3

General Objectives

1. To understand the basic principles and types of volumetric analysis.
2. To gain skills in identifying organic compounds.
3. To appreciate the importance qualitative and quantitative analysis

I. Volumetric Analysis

- a) Acidimetry and Alkalimetry
 - i) Estimation of hydrochloric acid
 - ii) Estimation of sodium hydroxide
- b) Permanganometry
 - iii) Estimation of oxalic acid using KMnO_4
 - iv) Estimation of ferrous sulphate using KMnO_4
- c. **Demonstrative Experiments**
 - i) Estimation of acid content in citrus fruits
 - ii) Determination of total hardness of water
 - iii) Determination of calcium in commercial milk powder by EDTA method
 - iv) Determination of dissolved oxygen in water (Winkler's Method)

II. ORGANIC ANALYSIS

- a) Analysis of organic compounds with the following
 - i) tests for Aromatic/ Aliphatic,
 - ii) saturated/ unsaturated
 - iii) solubility in common solvents, and
 - iv) presence of nitrogen

Test for Functional groups

- i) Carbohydrate
- ii) Diamide
- iii) Aldehyde
- iv) Ketone
- v) Acid
- vi) Amine

b) Demonstration

- i) Preparation of Buffer solution
- ii) Determination of pH using pH meter
- iii) Preparation of standard solution (Molar, ppm & Normal)

Reference Books

1. V.Venkateswaran, R.Veerasingam, A.R. Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, 1997

UG – Skill Based Courses (SBC)

Sem.	Course	Code	Title	Hrs.	Credits	Marks		
						CIA	ESA	TOTAL
IV	SBC-I	U16LFS41	Life Skills	2	1	100	-	100

LIFE SKILLS

Semester IV
Total Hrs : 30

Course code: U16LFS41
Credit : 1

General Objectives

1. To acquire skills and abilities for adaptive and positive behavior that helps to deal effectively with the demands and challenges of everyday life.
2. To develop creative, communicative and critical thinking skills necessary for employability

Unit I Basics of Communication skills & Effective Communication

Features of Communication - Process of Communication Verbal, nonverbal, Body Language - Postures & Etiquette -Listening& speaking Skills- Communication Barriers - Listening & speaking Skills.

Unit II Personal Effectiveness

Maslow's theory - Self-esteem- Role Conflict - Intra & Inter personal Skills - Efficiency Vs effectiveness - Team Building - Emotional Intelligence & Quotient

Unit III Interview Skills

Types of Interviews - Resume Formats & preparation - Cover letters - Simple rules to face interviews - Dos & Don'ts in a an Interview - Telephonic Interview and Etiquette - Group Discussions - Types - Methods - Ingredients and Tips for a Successful Group Discussion.

Unit IV Test of Reasoning & Numerical Ability

- A. Numerical Ability: Problems related to Average - Percentage - Profit /Loss - Simple & Compound Interest- Time & Work - Boats & Streams etc.
- B. Logical reasoning: Logical Detection - Nonverbal reasoning - Problems related to seating arrangements - Relationship model - Assertion & Reasoning etc.
- C. Online Tests: Aptitude - Logical Reasoning - Problem Solving -Time management in Online tests- Online tests on Language skills- Aptitude and technical rounds

Unit V Outbound Learning

Physical, Mental, and emotional exercises

Texts for Reference:

1. Barun.K.Mitra, Personality Development and Soft Skills, 6th edition, Oxford University press Noida 2012.
2. M.Sarada, The complete Guide to Resume Writing, Sterling Publishers Pvt Ltd, New Delhi 2012.
3. Gloria J.Galances& Katherine Adams,Effective Group Disscussions,Theory & practice,12th Edition, Tata McGrawHillpvt Ltd 2012.
4. Francis Soundararaj, Basics of Communication in English, SoftSkills for Listening Speaking, Reading& Writing, Macmillan Publishers India Ltd. 2013.

Scheme of Evaluation

1.	EQ test	10 Marks
2.	Resume	10 Marks
3.	Numerical Ability Test	10 Marks
4.	Online test 1(aptitude)	10 Marks
5.	Group Discussion	10 Marks
6.	Team Work	10 Marks
7.	OBL Observation / Work book	40 Marks
	Total	100 Marks