JJ COLLEGE OF ARTS AND SCIENCE (Autonomous)

NAAC Re-Accredited With Grade 'A'

SIVAPURAM, PUDUKKOTTAI-622422

DEPARTMENT OF CHEMISTRY

UG-PROGRAMME-CHEMISTRY

Course Structure under **Choice Based Credit System**

For the candidates admitted from the academic year **2016-2017**

Sem	Part	Course Code	Course Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
							Int	Ext	
I	I	U1RTL1	Language Course-I	6	3	3	25	75	100
	II	U1REL1	English Language Course – I	6	3	3	25	75	100
	III	U1RCHCC1	General Chemistry-I	6	5	3	25	75	100
			Volumetric Analysis Practical	3	*	*	*	*	*
		U1RMTAC1	Allied Mathematics-I	6	3	3	25	75	100
			Allied Mathematics-II	3	*	*	*	*	*
TOTAL				**30**	**14**	**-**	**-**	**-**	**400**
II	I	U2RTL2	Language Course-II	5	3	3	25	75	100
	II	U2REL2	English Language Course – II	5	3	3	25	75	100
	III	U2RCHCC2P	Volumetric Analysis Practical	3	5	3	40	60	100
		U2RCHCC3	General Chemistry-II	6	5	3	25	75	100
		U2RMTAC2	Allied Mathematics-II	3	3	3	25	75	100
		U2RMTAC3	Allied Mathematics-III	4	3	3	25	75	100
	IV	U2RES	Environmental Studies	2	2	3	25	75	100
		U2RVE	Value Education	2	2	3	25	75	100
TOTAL				**30**	**26**	**-**	**-**	**-**	**800**

Sem	Part	Course Code	Course Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
							Int	Ext	
III	I	U3RTL3	Language Course-III	5	3	3	25	75	100
	II	U3REL3	English Language Course –III	5	3	3	25	75	100
	III	U3RCHCC4	General Chemistry-III	5	5	3	25	75	100
		U3RCHCC5	General Chemistry-IV	5	5	3	25	75	100
			Semimicro Qualitative Inorganic Analysis Practical	3	*	*	*	*	*
		U3RPHAC4	Allied Physics-I (Second Allied course-I)	4	3	3	25	75	100
			Allied Physics-II Practical (Second Allied course-II)	3	*	*	*	*	*
			TOTAL	**30**	**19**	**-**	**-**	**-**	**500**
IV	I	U4RTL4	Language Course-IV	5	3	3	25	75	100
	II	U4REL4	English Language Course –IV	5	3	3	25	75	100
	III	U4RCHCC6P	Semimicro Qualitative Inorganic Analysis Practical	3	5	3	40	60	100
		U4RCHCC7	General Chemistry-V	5	5	3	25	75	100
		U4RPHAC5P	Allied Physics-II Practical	3	3	3	40	60	100
		U4RPHAC6	Allied Physics-III	5	3	3	25	75	100
	IV	U4RCHSBE1	Skill Based Elective Course-I	4	2	3	25	75	100
			TOTAL	**30**	**24**	**-**	**-**	**-**	**700**

Sem	Part	Course Code	Course Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
							Int	Ext	
V	III	U5RCHCC8	Organic Chemistry-I	5	5	3	25	75	100
		U5RCHCC9	Inorganic Chemistry	5	5	3	25	75	100
		U5RCHCC10	Physical Chemistry-I	5	5	3	25	75	100
		U5RCHCC11P	Physical Chemistry Practical	6	5	3	40	60	100
		U5RCHMBE1	Major Based Elective Course –I	5	4	3	25	75	100
	IV	U5RCHSEB2	Skill Based Elective Course-II	2	2	3	25	75	100
		U5RCHIDC1	Inter Disciplinary Course-I	2	2	3	25	75	100
TOTAL				**30**	**28**	**-**	**-**	**-**	**700**
VI	III	U6RCHCC12P	Gravimetric and Organic Analysis Practical	6	5	3	40	60	100
		U6RCHCC13	Organic Chemistry-II	5	5	3	25	75	100
		U6RCHCC14	Physical Chemistry-II	5	5	3	25	75	100
		U6RCHMBE2	Major Based Elective Course –II	5	4	3	25	75	100
		U6RCHMBE3	Major Based Elective Course –III	5	4	3	25	75	100
	IV	U6RCHSBE3	Skill Based Elective Course –III	2	2	3	25	75	100
		U6RCHIDC2	Inter Disciplinary Course-II	2	2	3	25	75	100
	V	U6RGS	Gender Studies	-	1	3	25	75	100
			Extension Activities	-	1	-	-	-	-
TOTAL				**30**	**29**	**-**	**-**	**-**	**800**
GRAND TOTAL					**140**				**3900**

*Carried Over Paper

SEMESTER-I: CORE COURSE-I: GENERAL CHEMISTRY-I

Course Code : U1RCHCC1	**Max. Marks : 100**
Hours/Week : 6	**Internal Marks : 25**
Credit : 5	**External Marks : 75**

Objectives:

- *To understand the principles of quantum numbers and periodicity of elements*
- *To learn the concepts of bonding and shapes of molecules by VSEPR theory*
- *To learnnomenclature of simple aliphatic compounds and types of bonding*
- *To study the preparations, reactions and stability of alkanes, cycloalkanes*
- *To learn the dualism of electron and verify the property through experiments*

Unit - I: Atomic Structure and Basic Quantum Mechanics

Dualism of light–Wave nature of radiation classical theory of electromagnetic, radiation and classical expression for energy in term of amplitude. Particle nature of radiation–black body radiation and Planck's quantum theory, photo electric dualism electric effect and Compton effect of matter – de Broglie hypothesis and Davisson and Germer experiment. Heisenberg's uncertainty principle, Schrödinger wave equation– derivation of Schrödinger wave equation, physical significance of (Ψ) function-properties of function–well–behaved function. Wave picture of electron – Concept of atomic orbitals, Shapes of *s*, *p* and *d* orbitals, Nodal planes and nodal points in atomic orbitals *g* and *u* character of atomic orbitals.

Unit -II: Quantum Number and Periodic Properties

Atomic orbitals, quantum, numbers - Principal, azimuthal, magnetic and spin Quantum numbers and their significance-Principles governing the occupancy of electrons in various quantum levels-Pauli's exclusion principle, Hund's rule, Aufbau Principle,stability of half-filled and fully filled orbitals. **Periodicity:** Periodic law and arrangement of elements in the periodic table,IUPAC nomenclature and group number, horizontal,vertical and diagonal relationship in the periodic table.**General Properties of atom:**Size of atoms and ions-atomic and ionic radii ionisation potential, electron affinity

and electronegativity along periods and groups,electronegtivity –Pauling,Mulliken-Jaffe, Allred-Rochow Methods.

Unit -III: Chemical Bonding

Ionic bond: Properties of ionic compounds-factors affecting formation of ionic compound, Lattice Energy – Born – Haber Cycle – Polarizing power and Polarisability – partial ionic character from electro negativity – Transitions from ionic to covalent character and vice versa–Fajan's rule. **Covalent bond:**Lewis Theory, Octet rule and its exception,electron dot structure formula,Sidgwick-Powel theory,Prediction of molecular shape.**VSEPR Theory:** Shapes of simple inorganic molecules($BeCl_2$, NH_3, H_2O, PCl_3, XeF_4, SF_4, BrF_5). Principles of hybridization – Intermolecular forces – Non-covalent interaction, van der Waals forces and hydrogen bonding.

Unit -IV: Introductory Organic Chemistry

IUPAC nomenclature: Naming of organic compounds (up to 20 carbon systems) – Hydrocarbons – mono and bi-functional compounds–alkanes, cycloalkanes, alkenes, alkynes, halogen compounds, alcohols, ethers, aldehydes, ketones and carboxylic acids. Isomerism-types of isomerism (structural and stereoisomerisms) with appropriate examples. **Hybridization and geometry of molecules:** methane, ethane, ethylene, acetylene; **Electronic effects:** Inductive, resonance, hyperconjugation and steric effect; Cleavage of bonds: Homolytic and heterolytic C-C bond fission. **Reaction intermediatesand stability:** Carbocations, carbanions and free radicals.

Unit -V: Chemistry of Alkanes and Cycloalkanes

Petroleum source of alkanes–Methods of preparing alkanes and cycloalkanes - Chemical properties– Mechanism of free radical substitution in alkanes by halogenations –Uses - Conformational study of ethane and *n*-butane-relative stability of cycloalkanes from cyclopropane upto cyclohexanane–Bayer's Strain theory–limitations.

Text Books

1. B. R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry,23rdEd., New Delhi, Shoban Lal Nagin Chand & Co.(2013).
2. P.L. Soni., text book of Inorganic Chemistry, 20thEd., S Chand &Sons Publications.
3. J. D. Lee, Concise Inorganic Chemistry, UK, Black well science (2006).
4. B. S. Bahland Arun Bahl, Advanced Organic Chemistry,12th Ed., New Delhi, Sultan Chand &Co., (2014).
5. B. R. Puri, L.R. Sharma, M. S. Pathania,Principles of Physical Chemistry,46th Ed.,New Delhi, Shoban Lal Nagin Chand & Co., (2014).
6. S. Glasstone, D. Lewis, Elements of Physical Chemistry, London, Mac Millan & Co. Ltd.
7. B.S.Bahl, Arun Bahl and G.D Tuli,Essentialas of Physical Chemistry, S.chand & Company Pvt.Ltd.(2014).

Reference Books

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry, 5th Ed., Harper Collins, New York, 2003.
2. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3rd Ed., W. H. Freeman and Co, London 1999.
3. R. T. Morrison and R. N. Boyd, Organic Chemistry 7th Ed., New York, Allyn& Bacon Ltd., (2012).
4. S.K.Dogra and S.Dogra, Physical Chemistry Through Problems, New age international, 4thEd. 1996.
5. P.W. Atkins, Physical Chemistry, 7th Ed., Oxford university press, 2001.

SEMESTER-II: CORE COURSE-II: GENERAL CHEMISTRY-II

Course Code : U1RCHCC3	**Max. Marks : 100**
Hours/Week : 6	**Internal Marks : 25**
Credit : 4	**External Marks : 75**

Objectives:

- *To understand the acid, base and Trimetric analyses*
- *To learn the chemistry of s-block elements*
- *To study the preparations and reactions of alkenes, alkynes and dienes*
- *To understand the chemistry of benzene and non-benzenoid compounds*
- *To understand the basic idea of gases*

Unit- I: Principles of Acid–Base Theory and Tritrimetry

Acids and Bases: Arrhenius, Protonic and Lewis Theories of Acids and Bases – Usanovich's generalized definition – Relative strengths of Acids and Bases – Dissociation constant of Acids and Bases – Levelling effect of water, Hard and soft acids and bases (HSAB).**Titrimetry:** Definitions of Molarity normality, Molarity and mole fraction – Primary and Secondary standards – Types of titrimetric reactions – acid-base, redox, precipitation and complex metric titrations – Indicators – Effect of change in *p*H – Neutralization, redox, adsorption and metal ion indicators.

Unit -II: Chemistry of *s*-Block Elements

General characteristics of s-Block elements: Hydrogen in the Periodic Table, atomic hydrogen, nascent hydrogen, occluded hydrogen, uses of hydrogen.**General characteristics of Group IA** – diagonal relationship between Li and Mg – Extraction of Lithium – Physical and Chemical properties of Lithium – Uses – Extraction of Sodium – Physical and Chemical properties – Uses – Preparation of NaOH, Na_2CO_3 (Laboratory) Properties – Uses – Extraction of Potassium – Properties – Uses – Chemistry of KOH, KBr and KI.**General characteristics of Group IIA** – diagonal relationship between Be and Al – Extraction of Beryllium – Physical and Chemical properties of Be – Uses Extraction of Mg – Physical and Chemical properties – Uses –Extraction of Ca – Physical and Chemical properties – Uses.

Unit -III: Chemistry of Alkenes, Alkynes and Dienes

Petroleum source of alkenes and aromatics – General methods of preparation of alkenes – Chemical properties – Elimination mechanisms (E1,E2,E1cB**)**Electrophilic, Free radical additions–Ziegler–Natta catalytic polymerization of ethylene–polymers of alkene derivatives. General methods of preparation of alkynes–physical properties– chemical properties. Types of alkadienes, general methods of preparation of dienes-physical properties– chemical properties, mechanisms of electrophilic and free radical addition reactions.

Unit-IV: Chemistry of Aromatic Compounds

General methods of preparation of benzene – Chemical properties. Electrophillic substitution mechanism–Orientation and reactivity in substituted benzenes. Polynuclear Aromatic compounds - naphthalene from coal tar and petroleum – Laboratory preparation, structure of naphthalene – Aromatic character, Mechanism of aromatic electrophilic substitution–Theory of orientation and reactivity. Anthracene, Phenanthrene from coal tar and petroleum – Laboratory preparation-Molecular Orbital structures– Aromatic Characters–Physical Properties-Chemical properties–Uses– Preparation of biphenyls – Physical and Chemical properties–Uses.

Unit -V: Gaseous State

Maxwell's distribution of Molecular velocities (Derivation not required). Types of Molecular velocities – Mean, Most probable and root mean square velocities. Graphical representation and its significance – Collision diameter, Mean free path and collision number – Transport properties – Thermal conductivity, Viscosity and Diffusion – Law of equipartition of energies – Degree of freedom. Molecular basis of Heat capacity – Real gases – vander Waals equation of states – derivation – significance of critical constants – Virial equations of state – Law of corresponding states – Compressibility factor.

Text Books

1. B. R. Puri,L.R.Sharma, K. K. Kalia, Principles of Inorganic Chemistry, 23rd Ed., New Delhi, Shoban Lal Nagin Chand & Co., (2013).
2. P.L. Soni., Text book of Inorganic Chemistry.20th Ed., S .Chand &Sons Publications.
3. B. S. Bahi and Arun Bahl, Advanced Organic Chemistry, 12thEd., New Delhi, Sultan Chand & Co., (2014).
4. B. R. Puri,L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46thEd., New Delhi, Shoban Lal Nagin Chand & Co., (2014).
5. S.K.Dogra and S.Dogra, Physical Chemistry Through Problems, New age international, 4thEd. 1996.
6. B.S.Bahl, Arun Bahl and G.D Tuli, Essentials of Physical Chemistry, S.Chand & Company Pvt.Ltd.(2014).

Reference Books

1. J. D. Lee, Concise Inorganic Chemistry, UK, Black well science (2006).
2. F. A. Cotton, G. Wilkinson and P. L. Guas, Basic Inorganic Chemistry, 6th Ed.,John Wiley, 2013.
3. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry, 4th Ed., Harper Collins, New York, 2003.
4. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3rdEd., W. H. Freeman and Co, London, 1999.
5. R. T. Morrison and R. N. Boyd, Organic Chemistry 7thEd., New York, Allyn & Bacon Ltd., (2012).
6. P.W. Atkins, Physical Chemistry, 7th Ed., Oxford university press, 2003.
7. S. Glasstone, D. Lewis, Elements of Physical Chemistry, London, Mac Millan & Co. Ltd.

SEMESTER-III: CORE COURSE-IV: GENERAL CHEMISTRY-III

Course Code : U3RCHCC4	**Max. Marks : 100**
Hours/Week : 6	**Internal Marks : 25**
Credit : 4	**External Marks : 75**

Objectives:

- *To learn the concepts of valence bond and molecular orbital theory*
- *To understand the chemistry of boron and carbon group elements*
- *To understand the chemistry of Alcohol, ether and epoxide*
- *To study the chemistry of active methylene compounds*
- *To know the concept of solid states*

Unit-I:VB and MO Theories

Valence bond theory and hybridization, BeF_2, BF_3, CH_4, C_2H_4 and C_2H_2 (*sp*, sp^2, and sp^3 only) resonance and hyperconjucation. MO Theory: Bonding and antibonding orbitals, LCAO method, criteria of orbital overlap, types of molecular orbitals-σ, π- and δ-MOs; combination of atomic orbitals to give σ- and π-MOs and their schematic illustration; Application of MO Theory to H_2,He_2,N_2,O_2, HF and CO–Comparison of VB and MO Theories.Weak bonds: hydrogen bonding-intra- and intermolecular hydrogen bonding.

Unit-II: Chemistry of Boron &Carbon family

General characteristics of p-block elements: general characteristics of elements of Group III A-diagonal relationship between B and Si-extraction of boron – Physical and chemical properties of B- uses – chemistry of some compounds of boron: Boric acid, Borax, Diborane, Boron nitride – Extraction of Al – physical and chemical properties – uses – chemistry of some compounds of Al: Al_2O_3, $AlCl_3$, Alums – Alloys of aluminum. General characteristics of elements of Group IVA: difference of carbon and silicon form the rest of the family- allotropic forms of carbon – chemistry of charcoal – chemistry of oxides of carbon (CO & CO_2) – use of CO_2 in fire extinguishers – fuel gases – preparation of silicon–physical and chemical properties of Si – uses. Manufacture of glass – type of glasses – extraction of lead – physical and chemical properties – uses – lead pigments.

Unit III: Chemistry of Alcohol, Ether and Epoxide

Aliphatic alcohols: Preparation by hydroboration, oxidation, Reduction of carbonyl compounds, epoxidation, and Grignard synthesis. Reactions with reference to C-OH bond cleavage and O-H bond cleavage, iodoform test.**Phenol**-Nomenclature, physical properties, hydrogen bonding. Preparation: Industrial source, preparation from diazonium salts and sulphonic acids. Reactions: acidity, ether formation, ester formation, mechanism of ring substitution, nitration, sulphonation, halogenation, Friedel-Craft's reaction, nitrosation, coupling reactions, Kolbe's reaction and Riemer-Tiemen reaction.**Ethers and Epoxides** (oxiranes): Nomenclature,preparation, properties, uses.

Unit – IV Active-Methylene Compounds

Introduction, Preparation of malonic ester – Physical and Chemical properties – Synthetic applications – Preparation of ethyl acetoacetate – Physical and Chemical properties – Synthetic applications. Introduction to α,β-unsaturated carbonyl compounds– Electrophilic and Nucleophilic addition mechanisms across the –C=C–, Nucleophilic addition mechanism across the –C=O – Michael addition- synthetic uses.

Unit V – Solid States

Classification of solids–Isotropic and anisotropic crystals. Laws of crystallography– representation of planses–Miller indices, space lattice, crystal systems– seven primitive, unit cells, Bravious lattices – X – ray diffraction – derivation of Bragg's equation – determination of structure of NaCl by Debye Scherrer (powder method) and rotating crystal method – determination of Avogadro's number – discussion of structure of KCl & CsCl – defects in crystals – stoichiometric and non stoichiometric – packing of ions in crystals – radius ratio rules and its limitations.**Metallic bond:** crystal structure of metals-*ccp*, *hcp*, metallic properties, band theory of metals.

Text Books

1. J. D. Lee, Concise Inorganic Chemistry, 5th Ed., UK Blackwell Science, London, 2006.

2. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi, 2013.
3. B. S. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.
4. S. Glasstone, D. Lewis, Elements of Physical Chemistry, London, Mac Millan & Co. Ltd.
5. B. R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, 46th Ed, New Delhi, Shoban Lal Nagin Chand & Co., (2014).
6. P.L. Soni., Text book of Inorganic Chemistry. 20th Ed., S .Chand &Sons Publications.
7. B.S.Bahl, Arun Bahl and G.D Tuli,Essentials of Physical Chemistry, S.Chand & Company Pvt.Ltd.(2014).

Reference Books

1. R. T. Morrison And R. N. Boyd, Organic Chemistry, 6thEd, Printice-Hall Of India Limited, New Delhi, 2012.
2. T. W. Graham Solomons, Organic Chemistry, 6th Ed, John Wiley and Sons, 1996.
3. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry, 5th Ed. Harper Collins, 2013.
4. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6thEd., John Wiley, New York, 2013.
5. Jerry March, Advanced Organic Chemistry, 5thEd, John Wiley and Sons, New York, 2000.
6. Francis A. Carey, Organic Chemistry, 3rd Ed, Tata-McGraw Hill Publications, New Delhi, 1999.
7. P.W. Atkins, Physical Chemistry, 7th Ed, Oxford university press, 2003.

SEMESTER-III: CORE COURSE-V: GENERAL CHEMISTRY-IV

Course Code : U3RCHCC5	**Max. Marks : 100**
Hours/Week : 4	**Internal Marks : 25**
Credit : 5	**External Marks : 75**

Objectives:

- *To understand the chemistry of nitrogen group elements*
- *To understand the chemistry of oxygen group elements*
- *To understand the chemistry of heterocyclic compounds.*
- *To learn the nuances of stereochemistry*
- *To know the basic idea of liquid crystals and colloids*

Unit-I: Chemistry of Nitrogen Group

General characteristics of elements of VA Group – the unique features of nitrogen from the rest of the family – preparation of nitrogen – physical and chemical properties of N_2 – uses – industrial preparation of ammonia – physical and chemical properties – uses – chemistry of some compounds of nitrogen: Hydrazine, Hydroxylamine, Nitric acid – nitrogen cycle – artificial fixation of nitrogen – preparation of phosphorous compounds – physical and chemical properties – uses – chemistry of PH_3, PCl_5, P_2O_5 and oxyacids of phosphorus.

Unit-II: Chemistry of Oxygen Group

Anomalous behaviour of oxygen – paramagnetic nature of oxygen, Preparation, properties, structure and uses of oxides of sulphur-SO_2,SO_3:Oxyacids of sulphur-thionic acidseries,peroxoacid series, classification of oxides based on their chemical behaviour – acidic oxide, amphoteric oxide and neutral oxides. Classification of oxides based on oxygen content – normal oxides, peroxides, super oxides, dioxides, sub oxides and mixed oxides. Chemistry of selenium and tellurium.

Unit-III: Chemistry of Heterocyclic Compounds:

Classification: Five membered ring compounds: Preparation of Furan, pyrrole and thiophene. Reactions: electrophilic and nucleophilic substitutions, oxidation and reduction reactions. Six membered rings: Pyridine, Quinoline and isoquinoline:

Preparation by ring closing reactions. Reactions: Mechanism of electrophilic and nucleophilic substitutions, oxidation and reduction reactions.

Unit-IV: Stereo Chemistry

Stereoisomerism-types–optical isomerism– chirality based on symmetry elements (C_n, sigma, i) – idea of asymmetry and dissymmetry – optical activity – measurement of optical activity – concept of enantiomerism, diastereomerism–axial chirality in substituted allenes and spiranes–atropisomerism in substituted biphenyls – R,S and D, L notations to express configurations – erythro, threo conventions – meso and dl – forms of tartaric acid -resolution of racemic mixture using chiral reagent–Walden inversion – asymmetric synthesis – asymmetric induction.Geometrical isomerism-cis-trans and E-Z isomerism-examples(C=C,di substituted cyclohexane)

Unit-V– Liquid Crystals and Colloids

Liquid crystals – types, theories and applications.Colloids-Definitions – types of colloids – sols – preparation, purification and properties – Kinetic, Optical and electrical stability of colloids, gold number, associated colloids, Emulsion – types of emulsions, preparation, properties and application, Gels – types of gels, preparation, properties and applications. Donnan membrance equilibrium –osmosis, reverse osmosis, dialysis and desalination – macromolecules – molecular weight of macro – molecules – determination of molecular weight by osmotic pressure method and light scattering methods.

Text Books

1. J. D. Lee, Concise Inorganic Chemistry, 6th Ed., UK Blackwell Science, London, 2006.
2. P.L. Soni., Text book of Inorganic Chemistry. 20th Ed., S.Chand &Sons Publications.
3. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry,23rd Ed Shoban Lal Nagin Chand and Co., Delhi, 2013.
4. R. T. Morrison And R. N. Boyd, Organic Chemistry, 7th Ed., Printice-Hall Of India Limited, New Delhi, 2012.

5. B. S. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.
6. S. Glasstone, D. Lewis, Elements of Physical Chemistry, London, Mac Millan & Co. Ltd.
7. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46th Ed., New Delhi, Shoban Lal Nagin Chand & Co., (2014)
8. B.S.Bahl, Arun Bahl and G.D Tuli, Essentials of Physical Chemistry, S.Chand & Company Pvt.Ltd.(2014).

Reference Books

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry, 5th Ed., Harper Collins, 2003.
2. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 7th Ed., W. H. Freeman and Co, London, 2003.
3. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6thEd., John Wiley, New York, 2013.
4. Jerry March, Advanced Organic Chemistry, 5th Ed., John Wiley and Sons, New York, 2000.
5. S. H. Pine, Organic Chemistry, 5thEd.,McGraw Hill International Edition, Chemistry Series, New York, 1987.
6. P.W. Atkins, Physical Chemistry, 7th Ed., Oxford university press, 2003.

SEMESTER-IV: CORE COURSE-VII: GENERAL CHEMISTRY-V

Course Code:U4RCHCC7	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 5	**External Marks : 75**

Objectives:

- *To understand the chemistry of halogen and inert gases*
- *To understand the chemistry of d-block elements*
- *To study the chemistry of organometallic compounds*
- *To learn the chemistry of carbohydrates*
- *To understand the principles of radioactivity and nuclear chemistry*

Unit-I: Chemistry of Halogen and Inert Gases:

General characteristics of halogen with reference of electro negativity, electron affinity, oxidation states and oxidizing power. Group 17(halogens):Types:ionic, covalent, bridging halides, Preparation and properties structure of Halogen oxides: oxygen difluoride, dioxygen difluoride, dichlorine monoxide, chlorine dioxide, bleaching powder-estimation of available chlorine; bromine dioxide, iodine pentoxide. Oxoacids of halogens: hypohalous acid HOX, halous acid HXO_2, halic oxide HXO_3, perhalic acid HXO_4, strength of oxoacids. Structure of Interhalogen compounds: ClF_3, BrF_3, IF_3,ClF_5, BrF_5, IF_5.Preparation,properties,and structure of ICl. **Noble gases :** Position in the periodic table – isolation from atmosphere – General characteristics – structure and shape of xenon compounds – XeF_4, SeF_6, XeO_3 and $XeOF_4$ – uses of noble gases

Unit-II:Chemistry of d-Block Elements

Occurrence of transition metals- Concentration of ores – froth floatation, magnetic separation, calcinations, roasting, smelting, flux, aluminothermic process–purification of metals–electrolysis, zone refining, van Arkel de Boer methods. important uses of transition metals and their alloys; differences between the first and the other rows, horizontal comparison with Fe, Co, Ni groups; toxicity of Cd and Hg. Variable oxidation states, lower oxidation states and stabilization, catalytic properties. M-M bonding and

cluster compounds, synthesis and reactivity of vanadates, chromates, dichromate, molybdates, tungstates, tungsten bronzes, manganate, permanganate.

Unit -III: Chemistry of Organometallic Compounds

Introduction to organometallic reagents–Definition,Classification based onnature of metal-carbon bond, Preparation of organometallicreagents with metals like – organolithium Compounds, organomagnesium compounds (magnesium dimethyl, magnesium diphenyl), Organoaluminium compounds, organocopper compounds – physical, chemical properties,structureand their synthetic applications.

Unit-IV: Chemistry of Carbohydrates:

Carbohydrate - classification, properties of mono saccharide (glucose and fructose), structure and configuration of mono saccharide, muta rotation, epimerization - cyclic structure - determination of size of sugar rings.Interconversion-ascending and descending series. **Disaccharide:**sucrose, maltose - structure elucidation. **Polysaccharide:**Structure and properties of starch (elementary treatment).Usesof cellulose derivatives.

Unit - V: The Nuclear Chemistry

Nuclear chemistry: subatomic particles, forces in the nucleus-mesons; stability of nucleus-n/p ratio, binding energy,mass defect,types of nuclear reaction,Fission and fusion –Hydrogen bomb,steller energy-nuclear power station in India. Structure of the nucleus-shell model, liquid drop model. **Radiochemistry:** natural and induced radioactivity; radioactive decay-α-decay, β-decay, γ-decay- unit of radioactivity (Curie); half life period- carbon dating,Geiger-Nuttal rule. Application of radio isotopes(Industry medicine,Agricaltural only)

Text Book

1. B. R. Puri, L. R. Sharma and K. K. Kalia, Principles of Inorganic Chemistry,23rd Ed., Shoban Lal, Nagin Chand & Co., New Delhi, (2013)

2. P.L. Soni., text book of Inorganic Chemistry. 20th Ed., S.Chand &Sons Publications.
3. B. S. Bahl and Arun Bahl, Advanced Organic Chemistry,12th Ed.,Sultan Chand and Co., New Delhi,(2014)
4. B. R. Puri, L. R. Sharma and M. S. Pathania, Principles of Physical Chemistry,46th Ed., Shoban Lal, Nagin Chand & Co., New Delhi, (2014)
5. B.S.Bahl, Arun Bahl and G.D Tuli, Essentials of Physical Chemistry, S.Chand & Company Pvt.Ltd., (2014).

Reference Book

1. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 7th Ed., W. H. Freeman and Co, London, 2003.
2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6th Ed., John Wiley, New York, 2013.
3. J. D. Lee, Concise Inorganic Chemistry, Black well science, UK, (2006).
4. Jerry March, Advanced Organic Chemistry, 5thEd., John Wiley & Sons, New York, 2000.
5. Francis A. Carey, Organic Chemistry, 3rd Ed., Tata-McGraw Hill Publications, New Delhi, 1999.
6. P.W. Atkins, Physical Chemistry, 7th Ed., Oxford university press, 2003.
7. H. J. Arnikar, Essentials of Nuclear Chemistry, 4th Ed., New Age International, New Delhi, 1995.

SEMESTER-V: CORE COURSE-VIII: ORGANIC CHEMISTRY-I

Course Code : U5CHCC8	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 5	**External Marks : 75**

Objectives:

- *To understand the chemistry of aldehydes and ketones*
- *To learn the carboxylic acids and their functional derivatives*
- *To understand the nitrogen containing compounds*
- *To study the chemistry of proteins and vitamins*
- *To know the alkaloids and terpenoids*

Unit- I: Aldehydes and Ketones

Nomenclature and classification. Preparation of aldehydes and ketones. Reactivity of carbonyl groups, acidity of alpha hydrogen. Reactions: Mechanism of enolization reactions, nucleophilic addition,addition reactions with Grignard reagents, cyanide, and bisulphate, preparation of derivatives of ammonia and alcohols. Mechnism of aldol, cannizaro, Perkin, Knoevenagel reactions, Benzoin condensation, Claisen, Wittig, Reformatsky reactions. Mechanism of reduction with $NaBH_4$, $LiAlH_4$. Wolf-kishner Clamension and MPV reduction. Mechanism of haloform and Michael addition

Unit- II: Carboxylic Acids and their Functional Derivatives

Nomenclature and classification of aliphatic and aromatic carboxylic acids. Preparation and reactions. Acidity (effect of substituents on acidity) and salt formation Reactions: Mechanism of reduction, substitution in alkyl or aryl group. Preparation and properties of dicarboxylic acids such as oxalic, malonic, succinic, glutaric, adipic and phthalic acids and unsaturated carboxylic acids such as acrylic, crotonic and cinnamic acids. Preparation and reactions of acid chlorides, acid anhydrides, amides and esters. Acid and alkaline hydrolysis of esters, trans-esterification.

Unit- III: Nitrogen Containing Compounds

Nomenclature and classification. **Nitrocompounds:** aliphatic and aromatic nitro Compounds, classification, general properties, Preparation by nitration. Reactions:

reduction by chemical and electrolytic methods. di- and tri-substitution of aromatic nitro compounds: synthesis of *o*-, *m*-, *p*- dinitrobenzenes and trinitrobenzene. Aromatic amines. Preparation of primary, secondary and tertiary amines, basicity of amines,effect of substituents on basicity of aromatic amines. **Diazoniu salts:** Preparation, diazotisation reactions, replacement reactions (Sandmeyer, Gatterman and Gomberg reactions),coupling reactions, Hinsberg test. Synthetic application of diazomethane.

Unit - IV: Amino Acids,Proteins and Vitamins

Amino acids - classification, general methods of preparation and reactions of amino acids, zwitterion - isoelectric points, action of heat on α, β and ϒ amino acids. **Peptides and proteins:** Peptide linkage - polypeptide -synthesis ofpeptides - Merrifield synthesis. Primary structure - end group analysis - Dangyl chloride, Edman method - secondary structure - denaturation - color reactions of proteins.**Nucleic acids:**Bilogical functions of DNA and RNA(elementary treatment). **Vitamins** (structural elucidation not needed) - classification, biological importance of vitamins A, B_1, B_2, B_6, B_{12} and C.

Unit -V: Alkaloids and Terpenoids

Alkaloids: Definition, occurrence, extraction of alkaloids from plants, general properties, determination of the chemical constitution of the alkaloids, functional group analysis, estimation of groups, degradation and synthesis. Structural elucidation of Coniine, Zingiperine and nicotine. **Terpenoids:** Classification, isoprene rule, isolation and general properties, Occurrence, general structure and physical properties of geraniol, citraland camphor.

Text Books

1. R. T. Morrison, R. N. Boyd,Organic Chemistry, 7th Ed., New York, Allyn & Bacon Ltd., (2012)
2. B.S.Bahl, Arun Bahl Advanced Organic Chemistry, 12th Ed., New Delhi, Sultam Chand and Co., (2014)
3. I. L. Finar, Organic Chemistry, Vol I & II, 6th Ed., England, Addison Wesley Longman Ltd. (1996).

4. Gurdeep Chatwal & Anand, Chemistry of Natural Products, Himalayan Publishing Co, 2001.
5. O. P. Agarwal, Chemistry of Natural Products, Vol-1, 2 ,Goel Publishing House, 1997.

Reference Books

1. S. H. Pine, Organic Chemistry, 4th Ed., New Delhi, McGraw - Hill International Book Company (1986)
2. Seyhan N. Ege., Organic Chemistry, New York, Houthton Mifflin Co., (2004)
3. Francis A.Carey, Organic Chemistry, 3rd Ed., Tata-McGraw Hill Publications, New Delhi, 1999.
4. B. Y. Paula, Organic Chemistry, 3rd Ed., Pearson Education, Inc.(Singapore), New Delhi, 2002.

SEMESTER-V: CORE COURSE-IX: INORGANIC CHEMISTRY

Course Code :U5RCHCC9	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 5	**External Marks : 75**

Objectives:

- *To understand the chemistry of lanthanides and actinides*
- *To study the theory, stability and applications of Coordination compounds*
- *To understand the structure of solids*

Unit - I: Lanthanides and Actinides

Lanthanides: lanthanide series, occurrence, abundanceand natural isotopes, similarity in properties, occurrence, oxidation states, chemical properties of Lanthanide(III) ions, magnetic properties,lanthanide contraction. Separation of lanthanides: solvent extraction, ion exchange method. **Actinides:**actinide series, abundance and natural isotopes, occurrence, preparation of actinides, oxidation states, general properties, the later actinide elements. Uranium-occurrence, metallurgy, chemical properties of hydrides, oxides, and halides.

Unit- II: Coordination Chemistry- I

Types of ligands - IUPAC nomenclature - Isomerisms - theories of coordination compounds – Werner, Sidgewick, valence bond, crystal field theory of octahedral complexes.

Unit- III: Coordination Chemistry- II

Stability of complexes - factors affecting the stability of complexes - unimolecular and bimolecular nucleophilic substitution reactions in octahedral and square planar complexes - *trans* effect - magnetic properties of transition metal complexes.

Unit -IV: Application of Coordination Compounds

Estimation of nickel using DMG and aluminium using oxine - estimation of hardness of water using EDTA - biologically important coordination compounds:chlorophyll,

haemoglobin-their structure and application. **Metal carbonyls**: mono and poly nuclear carbonyls of Ni, Fe, Cr, Co and Mn - synthesis and structure. **Nitrosyl compounds** - classification, structure and uses of nitrosyl chloride and sodium nitroprusside.

Unit - V: Silicates and Silicone

Introduction,types,chlorosilanes,preparation of linear,cyclic,cross linked silicones.Preparation and uses of silicone fluid,polysiloxane gums,silicone rubber, silicone resins.General properties, uses of silicones.**Phosphonitrilic compounds**-introduction-Phosphonitrilic chlorides($PNCl_2$)

Text Books

1. P.L. Soni, Text Book of Inorganic Chemistry, S, Chand & Co, New Delhi (2006).
2. B.R. Puri, L.R. Sharma and Kalia, Principles of Inorganic Chemistry, New Delhi (2002).
3. R.D. Madan, G.D. Juli, and S. M. Malik, Selected Topics in Inorganic Chemistry, S. Chand & Co, New Delhi (2014)
4. J.D. Lee,Concise Inorganic Chemistry, UK Black well science(2006).

Reference Books

1. J.E. Huheey, E.A. Keiter, R. L. Keiter, Inorganic Chemistry, Principles of Structure and Reactivity, 4th Ed., Harper Collins, 2013.
2. D. F. Shriver, P.W. Atkins,Langford, C. H. Inorganic Chemistry, 3rd Ed.,Oxford University Press, 2000.
3. F.A.Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6th Ed., John Wiley, New York, 2013.

SEMESTER-V: CORE COURSE-X: PHYSICAL CHEMISTRY-I

Course Code :U5RCHCC10	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 5	**External Marks : 75**

Objectives:

- *To understand the chemical kinetics and catalysis*
- *To study the basic concept of thermodynamics*
- *To learn the second law of thermodynamics and its importance*
- *To understand the applications of electrolytic conductance*
- *To understand the UV-Visible,IR,Raman spectroscopy*

Unit- I: Chemical Kinetics

Rate of reaction, average and instantaneous rates, rate equation, order of reaction. Rate laws: rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration) – derivation of time for half change with examples. Methods of determination of order of reactions – experimental methods of determination of rate constant of a reaction – volumetry, polarimetry. Effect of temperature on reaction rate – concept of activation energy, energy barrier Arrhenius equation, collision theory – derivation of rate constant of bimolecular gases reaction – failure of collision theory – Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – derivation of rate for a bimolecular reaction.

Unit- II: Thermodynamics - I

System and surrounding – isolated, closed and open systems - state of the system - Intensive and extensive variables. Thermodynamic processes - reversible and irreversible, isothermal and adiabatic processes - state and path functions - exact and inexact differentials. Work of expansion at constant pressure and free expansion. First law of thermodynamics - statement - definition of internal energy (E), enthalpy (H) and heat capactiiy. Relation between Cp and Cv. calculation of w, q, dE and dH for expansion of ideal and real gases under isothermal and adiabatic conditions of reversible and irreversible processes. Definition of joule - thomson coefficient(μ_{JJ}) calculation of (μ_{JJ})for ideal and real gases - Inversion temperature.

Unit -III: Thermodynamics -II

Second law of thermo dynamics - need for the law - different statements of the law - Carnot's cycle and efficiency of heat engine - Carnot's theorem - thermodynamic scale of temperature - concept of entropy - definition and physical significance of entropy - entropy as a function of P, V and T - entropy changes during phase changes - entropy of mixing - entropy criterion for spontaneous and equilibrium processes in isolated system - Gibb's free energy (G) and Helmholtz free energy (A) - variation of A and G with P, V and T- Gibb's - Helmholtz equation and its applications - thermodynamic equation of state - Maxwell's relations ΔA and ΔG as criteria for spontaneity and equilibrium - advantage ΔG over entropy change.

Unit-IV: Electrochemistry

Electrical transport and conductance in metal and in electrolytic solution.- specific conductance and equivalent conductance. Measurement of equivalent conductance-using Kohlraush's bridge. Arrhenius theory of electrolytic dissociation and its limitation. weak and strong electrolyte according to Arrhenius theory. Ostwald's dilution law - applications and limitation. Variation of equivalent conductance with concentration-migration of ion- ionic mobility. Kohlrausch's law and its applications. The elementary treatment of the Debye – Huckel- Onsager equation for strong electrolytes. evidence for ionic atmosphere. The conductance at high fields (Wein effect) and high frequencies (Debye-Falkenhagen effect). Transport number & Hittorfs rule.determination by Hittorf's method and moving boundary method application of conductance measurements - determination of strong electrolytes and acids. Determination of Ka of acids. determination of solubility product of a sparingly soluble salt,common ion effect, conductometric titrations.

Unit-V:Spectroscopy

Electromagnetic spectra - The regions of various types of spectra. **UV-visible spectroscopy:** principle-theory of electronic spectroscopy - types of electronic transitions - Franck - Condon principle – predissociation. **Infrared spectroscopy:** Vibrations of

diatomic molecules - harmonic and anharmonic oscillators, zero point energy, dissociation energy and force constant, selection rules for vibrational transition, fundamental bands, overtones and hot bands, diatomic vibrating rotator - P,Q, R branches. **Raman spectroscopy:** Rayleigh scattering and Raman scattering. Stokes and antistokes lines in Raman spectra, Raman frequency, quantum theory of Raman effect-condition for a molecule to be Raman active Comparison of Raman and IR spectra-structural determination from Raman and IR spectroscopy, rule of mutual exclusion.

Text Books

1. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 23rd Ed., New Delhi, Shoban Lal, Nagin Chand & Co (1993)
2. S.H.Maron and J.B. Lando, Fundamentals of physical chemistry, Macmillan Ltd., New York, 1966.
3. Maron and Prutton, Physical Chemistry, London, Mac Millan.
4. G. V. Castellan, Physical Chemistry, New Delhi, Orient Longmans.
5. K. L. Kapoor, A Textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Ltd, 1994.
6. B.S.Bahl, Arun Bahl and G.D Tuli, Essentials of Physical Chemistry, S.Chand & Company Pvt.Ltd.(2014).
7. J. Rajaram and J.C. Kuriacose, Thermodynamics for Students of Chemistry – Classical, Statistical and Irreversible, Shobhan Lal Nagin, New Delhi, 1981.

Reference Books

1. S.K.Dogra and S.Dogra,Physicalchemistry through problems, New age international, 4th Ed.,1996.
2. Gilbert. W. Castellan, Physical Chemistry, Narosa publishing house, 3rdEd., 1985.
3. P.W. Atkins, Physical chemistry, Oxford university press, 2003.

SEMESTER-VI: CORE COURSE-XIII: ORGANIC CHEMISTRY-II

Course Code:U6RCHCC13	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 5	**External Marks : 75**

Objectives:

- *To understand spectroscopy and its application to organic compounds*
- *To study the organohalogen compounds*
- *To understand the molecular rearrangements*
- *To understand the synthetic dyes*

Unit-I: UV - VIS and IRSpectroscopy

UV - VIS spectroscopy: types of electronic transitions - Factors influencing the absorption – Some terms: Chromophore, Auxochrome, Bathochromic shift, Hypsochromic shift, Hypochromic shift, Hyperchromic shift- solvent effects on λ_{max} - Woodward - Fisher rules - calculation of λ_{max} : dienes and α, β unsaturated carbonyls. **IR spectroscopy :** number and types of fundamental vibrations - modes of vibrations and their energies, position of IR absorption frequencies for functional groups like aldehyde, ketone, alcohol, acid and amide- factors affecting the frequency absorption - conjugation, inductive effect and hydrogen bonding.

Unit-II: NMR and Mass Spectroscopy

NMR spectroscopy: principle - equivalent and non equivalent protons - shielded and deshielded protons, anisotropy, chemical shift - TMS, tau(τ) and delta(δ) scales, integral, splitting of signals - spin -spin coupling, NMR spectrum of EtOH, n - propyl bromide and isopropyl bromide. spin-spin splitting of neighbouring protons in vinyl and allyl systems. Coupling constants and their use. Deuterium-labeling and its use in NMR. **Mass spectroscopy:**Principle of mass spectrometry – simple instrumentation – Parent peak, Base peak and Meta stable peak, Fragmentationpattern – Nitrogen rule – McLafferty rearrangement - Interpreting the mass spectra of n-butane,n-nonane,dodecane organic molecules.

Unit- III: Organohalogen Compounds

Nomenclature – general methods of preparation of haloalkanes – physical and chemical properties – uses – nucleophillic substitution mechanisms (S_N1, S_N2 and S_Ni) – evidences – stereochemical aspects of nucleophillic substitution mechanisms – general methods of preparation of halobenzenes – physical properties – chemical properties – uses. Mechanisms of electrophillic and nucleophillic substitution reactions – theory of orientation and reactivity.

Unit -IV: Molecular Rearrangements

Molecular rearrangements - types of rearrangement (nucleophilic and electrophilic). Classification as anionotropoic, cationotropic, free radical, inter and intramolecular. Mechanism with evidence forPinacol-pinacolone, Beckmann, Hoffmann, Curtius, Benzilic-benzilic acid, Benzidine, Losen rearrangements. Claisenrearrangement (sigmatropic-evidence for inramolecular nature and allylic carbon attachment)-para Claisen, Cope and oxycope rearrangements, and Fries rearrangement. Photochemical reactions of ketones - Norrish type I and II.

Unit -V: Industrial Organic Chemistry

Dyes - theory of color and constitution - chromophore, auxochrome, classification according to application and structure - preparation and uses of nitro dyes - naphthol yellow, nitroso fast green O, azo dyes - methyl orange, triphenyl methane dyes - malachite green, indigo dyes - Indigotin, anthraquinone dyes - alizarin, phthalein dyes - fluorescein - sulphonic acid and derivatives - preparation and properties of benzene sulphonic acid - saccharin, chloramines – T, Pheylene diamine dye-Bismark brown.

Text Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Ed., Printice-Hall Of India Ltd, New Delhi, 1992.
2. William Kemp, Organic Spectroscopy, 3rd Ed., ELBS.
3. B. S. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.

4. F.W.Billmeyer, Jr., A Text Book of Polymer Science, John Wiley and Sons, New York, 1971.
5. V.R.Gowariker, N.V. Viswanathan and Jayadev Sreedhar, Polymer Science, New Age Publishers,New Delhi, 1986.
6. B. S. Bahl, Arun Bahl, Advanced Organic Chemistry, 12th Ed., New Delhi, Sultam Chand and Co., (1986)

Reference Books

1. Jerry March, Advanced Organic Chemistry, 5th Ed., John Wiley And Sons, New York, 2000.
2. S.H, Pine, Organic Chemistry, 5th Ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
3. Francis A.Carey, Organic Chemistry, 3rd Ed.,Tata-McGraw Hill Publications, New Delhi, 1999.
4. I. L. Finar,Organic Chemistry, Vol I&II, 6th Ed., England, Addison Wesley Longman Ltd.(1996).
5. Seyhan N. Ege, Organic Chemistry, New York, Houghton Mifflin Co., (2004)
6. B. Y. Paula, Organic Chemistry, 3rd Ed., Pearson Education, Inc.(Singapore), New Delhi, 2002.
7. B. K. Sharma, Industrial Chemistry (Including Chemical Engineering) –10th Ed.,

SEMESTER-VI: CORE COURSE-XIV:PHYSICAL CHEMISTRY-II

Course Code:U6RCHCC14	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 5	**External Marks : 75**

Objectives:

- *To understand the photochemistry and group theory*
- *To learn the properties of solutions*
- *To understand the electrochemical andelectromotive force*
- *To learn about Gibbs free energy and third law of thermodynamics*
- *To study the phase rule and its applications*

Unit -I: Photo Chemistry and Group Theory

Laws of photo chemistry - Lambert – Beer, Grothus - Draper and Stark – Einstein, quantum efficiency, Photo sensitization and quenching.Cosequences of light absorption-Jablonski diagram-radioactive and non radioactive transition.Photo chemical reactions - rate law - kinetics of H_2-Br_2 reaction. Comparison between thermal and photochemical-Flourescence,Phosphorescence, chemiluminescence. Laser and its uses. **Group theory:** symmetry elements and symmetry operation-Point groups of like HCl,H_2,CO_2,H_2O,NH_3,BCl_3.

Unit-II : Solutions

Ideal and non-ideal soultions,normality, molarity, molality, mole fraction. concept of activity and activity coefficients - completely miscible liquid systems - benzene and toluene. Raoult's law and Henry's law. deviation from Raoult's law and Henry's law. Duhem - Margules equation, theory of fractional distillation. azeotropes - HCl - water and ethanol - water systems - partially miscibe liquid systems - phenol - water, triethanolamine - water and nicotine - water systems. Lower and upper CSTs - effect of impunities on CST - completely immiscible liquids - principle and applications of steam distillation, Nernst distribution law – derivation. Applications –determination of formula of a complex(KI+I_2 = KI_3)solvent extraction-principle and derivation of a general formula of the amount unextracted - dilute solutions: colligative properties, relative

lowering of vapour pressure, osmosis, law of osmotic pressure, abnormal molecular masses, molecular dissociation - degree of dissociation - molecular association.

Unit –III : Electrochemical Cells

Electrolytic and galvanic cells - reversible and irreversible cells. conventional representation of electrochemical cells. Electromotive force of a cell and its measurement- computation of E.M.F- calculation of thermodynamic quantities of cell reactions (ΔG. ΔH, ΔS and K)- application of Gibbs Helmholtz equation. concentration and E.M.F- Nernst equation, Types of reversible electrodes - gas/metal ion - metal/metal ion; metal/insoluble salt/ anion and redox electrodes. electrode reactions - Nernst equation – derivation of cell. E.M.F and single electrode potential- standard hydrogen electrode - reference electrodes - standard electrode potentials - sign convention - electrochemical series and its significance. concentration cell with and without transport-liquid junction potential. application of EMF of concentration cells. Valency of ion-solubility product and activity co-efficient. Potentiometric titrations. Determination of pH using hydrogen and quinhydrone electrodes- determination of pKa of acids by potentiometric method.

Unit-IV: Thermodynamics -III

Equilibrium constant and free energy change - thermodynamic derivation of law of mass action - equilibrium constants in terms of pressure and concentration - NH_3, PCl_5, $CaCO_3$-thermodynamic interpretation of LeChatelier's principle (Concentration, temperature, pressure and addition of inert gases.) systems variable composition - partial molar quantities - chemical potential - variation of chemical potential with T, P and X (mole fraction) - Gibb's Duhem equation. Van't Hoff's reaction isotherm - van't Hoff's isochore - Clapeyron equation and Clausius– Clapeyron equation-applications-third law of thermodynamics –Nernst heat theorem- statement of III law and concept of residual entropy - evaluation of absolute entropy from heat capacity data. Exception to III law (ortho and para hydrogen, CO, N_2O and ice).

Unit -V: Thermodynamics of Phase Changes

Definition of terms in the phase rule - derivation and application to one component systems - water and sulphur - super cooling, sublimation. two component systems - solid liquid equilibria, simple eutectic (lead-silver, Bi-Cd), desilverisation of lead - compound formation with congruent melting point. (Mg-Zn) and incongruent melting point (Na-K). solid solutions - (Ag-Au) - fractional crystallisation. freezing mixtures - $FeCl_3$ - H_2O systems, $CuSO_4$-H_2O system.

Text Books

1. B.R. Puri, L.R. Sharma, M. S. Pathania,Principles of Physical Chemistry, 23rd Ed., New Delhi, Shoban Lal, Nagin Chand & Co., (1993)
2. S.H. Maron and J.B. Lando, Fundamentals of physical chemistry, Macmillan Ltd., New York, 1966.
3. G. V. Castellan, Physical Chemistry, New Delhi, Orient Longmans.
4. Rajaram and Keeriacose, Thermodynamics for students of chemistry.

Reference Books

1. P. W. Atkins, Physical Chemistry, 5th Ed., Oxford Uiversity Press. (1994)
2. Maron and Prutton, Physical Chemistry, London, Mac Millan.
3. Castellan G.V,Physical Chemistry, New Delhi, Orient Longmans.

SEMESTER- I & II: CORE COURSE-II:VOLUMETRIC ANALYSIS PRACTICAL	
Course Code:U2RCHCC2P	**Max. Marks : 100**
Hours/Week : 3	**Internal Marks : 40**
Credit : 5	**External Marks : 60**

Objectives:

- *To know the basic principles of volumetric analysis and learn the techniques*
- *To understand the concepts of indicators and equivalent weight*
- *To know the estimation of total hardness of water*

Titrimetric Quantitative Analysis

Acid-Base Titration

1. Estimation of HCl by NaOH using a standard oxalic acid solution
2. Estimation of Na_2CO_3 by HCl using a standard $Na_2 CO_3$ solution

Permanganometry

3. Estimation of oxalic acid by $KmnO_4$ using a standard oxalic acid solution
4. Estimation of Iron (II) sulphate by $KmnO_4$ using a standard Mohr's salt solution.
5. Estimation of Ca (II) by $KmnO_4$ using a standard oxalic acid solution.

Iodometry

6. Estimation of $KmnO_4$ by thio using a standard $K_2Cr_2O_7$ solution.
7. Estimation of Fe (III) by using $K_2Cr_2O_7$ using a standard Mohr's salt solution using internal and external indicators.
8. Estimation of copper (II) sulphate by $K_2Cr_2O_7$solution

Complexometric titrations:

a. Estimation of calcium.

b. Estimation of magnesium.

Scheme of valuation: Record - 5 marks**,**Procedure writing - 10 marks

Results

1-2% - 45 marks; 2-3% - 35 marks; 3-4% - 25marks;>4% - 15 marks

Reference Books:

1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic principles of Practical Chemistry,2nd Ed.,New Delhi, Sultan Chand & sons (1997).
2. J. Bassett,et al., Vogel's Textbook of Quantitative Inorganic Analysis, 4th Ed., ELBS Longman, (1985).

SEMESTER-IV: CORE COURSE-VI: SEMICICRO QUALITATIVE INORGANIC ANALYSIS – PRACTICAL

Course Code:U4RCHCC6P	**Max. Marks : 100**
Hours/Week : 3	**Internal Marks : 40**
Credit : 5	**External Marks : 60**

Objectives:

- *To learn the types, hazards and handling of chemicals and glassware*
- *To study the applications of solubility product, common ion effect in group separation*
- *To distinguish interfering and non interfering radicals*
- *To learn the techniques of semi micro qualitative analysis of inorganicsalt mixtures*

Semi micro Inorganic Qualitative analysis

Analysis of a mixture containing **two cations** and **two anions** of which one will be an **interfering ion.** Semimicro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations to be analysed: lead, copper, bismuth, cadmium, tin, iron, zinc, manganese, cobalt, nickel, barium,calcium, strontium, magnesium and ammonium.

Anions to be analysed:carbonate, sulphide, sulphate, nitrate, chloride, bromide, fluoride, borate, oxalateand phosphate.

Scheme of valuation

Practical - 55 marks; Record - 5 marks ;Total - 60 marks

4 radicals correct with suitable tests : 55 marks; 3 radicals correct with suitable tests ; 40 marks; 2 radicals correct with suitable tests : 30 marks; 1 radical correct with suitable tests : 15 marks; Spotting : 5 marks

Reference Book:

1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic principles of Practical Chemistry,2nd Ed., New Delhi, Sultan Chand & sons (1997).

SEMESTER-VI: CORE COURSE-XI

PHYSICAL CHEMISTRY-PRACTICAL

CourseCode:U5RCHCC11P	**Max. Marks : 100**
Hours/Week : 3	**Internal Marks : 40**
Credit : 5	**External Marks : 60**

Objectives:

- *To learn the instrumental techniques*
- *To study colligative properties of organic compounds*
- *To understand the concept of chemical equilibrium*
- *To study phase rule and its applications*

List of Experiments:

1. Critical Solution Temperature of Phenol –Water system.
2. Effect of impurity (NaCl) on Critical solution Temperature of Phenol –Water system.
3. Determination of Transition Temperature of a salt hydrate.
4. Determination of molecular weight by Rast´s macro method.
5. Determination of K_f by Rast´s macro method.
6. Phase diagram(Simple eutectic system)
7. Determination of rate constant of acid catalyst hydrolysis of an ester
8. Determination of Partition co-efficient of iodine between water and CCl_4
9. Potentiometric Redox titration
10. Determination of cell constant

Scheme of valuation

Procedure with formula: 10 Marks, Record :5 and Practicals: 45 Marks; Up to 10% - 45 marks; 10-15% - 35 marks; 15-20% - 25 marks; >20% - 15 marks

Reference Books:

1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic principles of Practical Chemistry,2nd Ed.,New Delhi, Sultan Chand & sons (1997).

2. Daniels et al., Experimental Physical Chemistry, 7th Ed., New York, McGraw Hill,(1970).

3. A. Findlay,Practical Physical Chemistry, 7thEd.,London, Longman (1959).

SEMESTER-VI: CORE COURSE-XII

GRAVIMETRIC AND ORGANIC ANALYSIS-PRACTICAL

CourseCode:U6RCHCC12P	**Max. Marks : 100**
Hours/Week : 3	**Internal Marks : 40**
Credit : 5	**External Marks : 60**

Objectives:

- *To learn the techniques of gravimetric analysis*
- *To learn the methods of organic preparations*
- *To learn the techniques of organic qualitative analysis*
- *To learn the determination of physical constants of organic compounds*

Gravimetric Analysis :

1. Estimation of Lead as lead chromate.
2. Estimation of Barium as barium chromate.
3. Estimation of Nickel as Nickel - DMG complex.
4. Estimation of Copper as copper (I) thiocyanate
5. Estimation of Magnesium as magnesium oxalate
6. Estimation Calcium as calcium oxalate monohydrate
7. Estimation of Barium as barium sulphate.
8. Estimation of Iron as Iron (III) oxide.

Organic Qualitative Analysis and Organic Preparation :

Organic Analysis : Analasis of Simple Organic compounds (a) characterization of functional groups (b) confirmation by preparation of solid derivatives / characteristic colour reactions. Note : Mon –functional compounds are given for analysis. In case of bi-functional compounds, students are required to report any one of the functional groups.

Organic Preparation :

Preparation of Organic Compounds involving the following chemical conversions 1. Oxidation 2. Reduction 3. Hydrolysis 4. Nitration 5. Bromination 6. Diazotization 7. Osazone formation

Determination of Physical Constants

Determination of boiling /melting points by semimicro method.

Mark Distribution :

Internal : 40; Ext. Evaluation : 60;

Gravimetry : 30

Org. preparation & org .Analysis : 25

Org. analysis :15

Armatic/ Alphatic –2

Sat/Unsat – 2

Spl. Element –3

functinonal group –5

Derivatives – 3

Org. preparation : 6

Phy Contant : 4

Record :5

References Books

1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic principles of Practical Chemistry,2nd Ed.,New Delhi, Sultan Chand & sons (1997).
2. Sundaram, Krishnan, Raghavan, Practical Chemistry(Part III),S. Viswanathan Co. Pvt., 1996
3. B. S. Furniss, *et al*., Vogel's Textbook of Practical Organic Chemistry,7th Ed,, London, ELBS – Longman, (1984).

MAJOR BASED ELECTIVECOURSE-I: ANALYTICAL CHEMISTRY

CourseCode:	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 4	**External Marks : 75**

Objectives:

- *To develop the habit of accurate manipulation and an attitude of critical thinking*
- *To learn the basic analytical methods and have a sound knowledge of chemistry involved inan analysis*
- *To understand the analyses and handling of chemicals*
- *To understand the chromatographic and titrimetric methods of analyses*
- *To understand the spcetroanalyticaland electroanalytical technique*

Unit-I : Handling Of Chemicals and Analysis

Storage and handling of chemicals, handling of acids, ethers, toxic and poisonous chemicals, antidotes, threshold vapour concentration and first aid procedure. Heating methods, stirring methodsfiltration techniques. Calibration of pipette, standardmeasuring flask and burette.Weighing principle in chemical balance and single pan balance. **Error in chemical analysis:** Accuracy, precision, types of error-absolute and relative error, methods of eliminating or minimizing errors. Methodsof expressing precision: mean, median, deviation, average deviation and coefficient of variation. Significant figures and its application with respect to the glassware used. Normal error curve and its importance.

Unit -II: Chromatography Techniques

Principle of adsorption and partition chromatography.Column chromatography: adsorbents, classification of adsorbents, solvents, preparation of column, adsorption and applications. Thin Layer Chromatography: choice of adsorbent, choice of solvent, preparation of chromatogram, sample, R_f value and its applications. Paper chromatography, solvent used, $R_f$value, factors which affect R_f value. Ion exchange chromatography,resins used, experimental techniques, applications.Gas Chromatography, principle, detector(FID,TCD,ECD),Applications.paper electrophoresis - separation of amino acids and other applications. Ion - exchange chromatography -

principle - types of resins -requirements of a good resin -action of resins - experimental techniques - separation of Na-K, Ca-Mg, Co-Ni and chloride - bromide mixture.

Unit III: Titrimetric Methods of Analysis

Concentration systems: Molarity, molality, normality, wt% ppm, milliequalence and millimoles-problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point. **Acid-base Equilibria**: pH of strong and weak acid solutions. Buffer solutions, Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from K_a and K_b values. Neutralisation-titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange. **Complexometric titrations**: Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics.

Unit IV: Spectro Analytical Techniques

Colorimetry and spectrophotometry - Beer – Lambert's law - principle of colorimetric analysis - visual colorimetry - standard series method - balancing method -estimation of Ni^{+2} and Fe^{+3} colorimetrically - photoelectric photometer method - spectro photometric determination of chromium and manganese in alloy steel. infra red spectroscopy (Instrumentation only)-block diagram- source-monochromator-cell-detectors and recorders-sampling techniques-NMR spectroscopy(instrumentation only)

Unit -V: Thermo and Electro Analytical Techniques

Thermo analytical methods : Principle of thermo gravimetry, differential thermal analysis, differential scanning calorimetry - Instrumentation for TGA, DTA and DSC - Characteristics of TGA and DTA curves - factors affecting TGA and DTA curves. applications - TGA of calcium oxalate monohydrate DTA of calcium acetate monohydrate - determination of purity of pharmaceuticals by DSC. Electro analytical techniques - electro gravimetry -theory of electro gravimetric analysis - determination of copper (by constant current procedure) - electrolytic separation of metals : Principle - separation of copper and nickel, coulometry: principle of coulometric

analysis - coulometry at controlled potential - apparatus and technique - separation of nickel and cobalt.

Text Books

1. B. K. Sharma, Instrumental Methods of Chemical Analysis, coel Publishing House, Merrut, (1997)
2. R. Gopalan, P. S. Subramaniam, and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand and Sons.
3. S. Usharani, Analytical Chemistry, Macmillian.
4. U.N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 1995.
5. R.A. Day Jr. A.L. Underwood, Quantitatives Analysis, 5^{th} Ed., Prentice Hall of India Private Ltd., New Delhi, 1988.

Reference Books

1. D. A.Skoog and D. M. West, F.J. Holler,Fundamentals of Analytical Chemistry, 7^{th} Ed.,Harcourt College Publishers.
2. J. Mendham, R. C. Denney, J. D .Barnes, M. Thomas, Vogel's Text book of Quantitative Chemical analysis 6^{th} Ed., Pearson education.
3. D.A. Skoog, D.M. West and F.J. Holler, Analytical Chemistry: An Introduction, 5^{th} Ed., Saunders college publishing, Philadelphia, 1990.
4. U.N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 1995.

MAJOR BASED ELECTIVECOURSE-II: POLYMER CHEMISTRY

CourseCode:	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 4	**External Marks : 75**

Objectives:

- *To understand about the polymer*
- *To study the reaction of polymer*
- *To understand the polymerization technique*
- *To know about commercial polymer*
- *To know the application of polymer*

Unit -I: Introduction to Polymers

Importance of polymer: basic concept-monomers and polymers-definition.Classification of polymers on the basis of microstructures, macrostructures and applications (thermosetting and thermoplastics) Distinction among plastics, elastomers and fibers. Homo and heteropolymers. Copolymers.Chemistry of polymerization- chain polymerization, free radical, ionic, coordination step polymerization, Polyaddition and polycondensation- miscellaneous ring-opening & group transfer polymerization.

Unit –II: Physical Properties and Reactions of Polymers

Properties: Glass transition temperature (Tg) – Definition – Factors affecting $T_g$relationships between T_g and molecular weight and melting point. Importance of T_g.Molecular weight of polymers: number average, weight average, sedimentation and viscosity average molecular weights. Molecular weights and degree of polymerization. Reactions: hydrolysis - hydrogenation – addition – substitutions, cross-linking vulcanization and cyclisations reaction. Polymer degradation, Basic idea of thermal, photo and oxidative degradation of polymers.

Unit-III: Polymerization Techniques and Processing

Polymerisation techniques : Bulk, solution, suspension, emulsion, melt condensation and interfacial polycondensation polymerizations. Polymer processing: Calendering –die casting, rotational casting –compression, injection moulding.

Unit-IV: Chemistry of Commercial Polymers

General methods of preparation, properties and uses of the following Polymers: Teflon, polymethylmethacrylate, Polyethylene,polystyrene, rubber –styreneand neoprene rubbers, Phenol – formaldehydes and urea-formaldehyde resins.

Unit-V: Advances in Polymers

Biopolymers-biomaterials. Polymers in medical field. High temperature and fireresistant polymers. Silicones. Conducting polymers-carbon Fibers. (basic idea only).

Text Book :

1. F. W. Billmeyer , Text book of polymer science, Jr. John Wiley and Sons, 1984.

ReferenceBooks :

1. V. R. Gowariker, V. N. Viswanathan, and Jayader Sreedhar, Polymer Science,Wiley Eastern Ltd., New Delhi, 1978.
2. B.K.Sharma, Polymer Chemistry, Goel Publishing House, Meerut, 1989.
3. M. G. Arora, M. Singh and M. S.Yadav, Polymer Chemistry, 2nd Revised Ed.,anmol Publications Private Ltd., New Delhi, 1989.

MAJOR BASED ELECTIVECOURSE-III: GREEN CHEMISTRY

Course Code:	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 4	**External Marks : 75**

Objectives:

- *To understand the green chemistry and green reagents*
- *To understand microwave green synthesis*
- *To understand the synthetic application of catalysis*
- *To know the application of biocatalysis*

Unit-I: Introduction to Green Chemistry

Green chemistry- General introduction – need of green chemistry – principles of green chemistry – planning a green synthesis in chemistry lab – choice of starting material, reagents, catalysts and solvents – green chemistry in day today life – dry cleaning of clothes, versatile bleaching agents – environmental pollution.

Unit- II: Green Reagents and Catalysts

Green reagents: Dimethyl carbonate, Polymer supported reagents – Polymer supported chromic acid, Poly N-Bromo succinamide, Polystyrene Wittig reagent, Polystyrene anhydride Green catalyst : Acid catalyst , Base catalyst, Oxidation catalyst, Polymer supported catalyst- Polystyrene Aluminium chloride, Polymeric super acid catalyst.

Unit-III : Microwave induced Green Synthesis

Microwave method- General introduction,Microwave assisted reaction in water : Hydrolysis, Oxidation of alcohol, sopanification reaction.Microwave assisted reaction in organic solvents : Esterification, Diels-Alder reaction, Claisen rearrangement.Microwave assisted solvent free reaction(Solid state): Deacetylation, Saponification of ester, reductions, synthesis of heterocyclic compounds.

Unit-IV : Phase Transfer Catalysis in Green Chemistry

Introduction, Application of PTC in organic synthesis – Elimination reactions,N-Alkylation, C-Alkylation, Wittg reaction, Darzen reaction. Crown ethers: Esterification, Aromatic substitution reaction, Alkylation reactions, Elimination reactions, Displacement reactions.

Unit-V : Bio Catalysis in Organic Chemistry

Introduction, Biochemical oxidation, Reduction Enzyme catalysed hydrolytic process – Enantio selective hydrolysis of meso, di ester, hydrolysis of N-acyl amino acids ,Green chemistry in pharmaceuticals – Synthesis of Ibuprofen, Paracetamol, Benzimidazole.

Text Books :

1. V.K.Ahluwalia, Green chemistry, Anees Books India, New Delhi, 2008.
2. V.K.Ahluwalia, M.Kidwai, New Trends in Green chemistry, 2nd Ed., Anamaya Publication, New Delhi, 2008.
3. Dr.K.R.Desai, Green Chemistry-Microwave synthesis, Himalaya publication House, Mumbai

MAJOR BASED ELECTIVECOURSE-IV: INDUSTRIAL CHEMISTRY

Course Code :	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 4	**External Marks : 75**

Objectives:

- *To impart knowledge on glass, refractories, paints and varnishes and pigments*
- *To know the cement, paper, pulp*
- *To understand the corrosion and batteries*
- *To have knowledge on applied the chemistry in daily life*

Unit – I:Glass, Ceramics and Refractories

Glass and Ceramics: Glass – General properties of glass – types of glasses – manufactureof glass – Ceramics – classification – clay products – white wares – chemical store wares – plasticity of clay – manufacture of white pottery, glazing, Earthen wares. **Refractories :** Definition – classification, properties of refractories – manufacture ofrefractories, fire clay bricks manufacture, uses of fire clay refractories – High aluminarefractories – uses – silicon carbide refractories – properties and uses

Unit –II:Paints, Varnishes,Pigments:

Paints and Varnishes: Paint – definition – classification of paints based on their applications– constituents – Requisites of a good paint – emulsion paints. Varnishes - Definition –constituents of varnish – characteristics of a good varnish – uses – Japans varnish. Enamel– definition – Types – Ingredients and uses.**Pigments:** Definition – composition, characteristics and uses of white lead, Zinc oxide,Lithopone and TiO_2 – Blue pigments – Ultra marine blue – characteristics – uses. Redpigments – red lead – characteristics and uses. Green pigments – chrome green, Guigwet'sgreen and chromium oxide – characteristics and their uses.

Unit –III: Cement,Pulp and Paper

Portland Cement: Introduction – types of cements – High alumina cement, Portland cement- manufacture and quantitative requirements, Setting of Cement anduses.**Pulp and**

Paper: Introduction – manufacture of pulp – mechanical process – chemicalprocess – sulphate, sulphite,soda, rag pulp. Beating, Refining, filling, sizing and colouring,manufacture of paper, types of paper and uses.

Unit –IV:Corrosion and Batteries

Corrosion: Introduction – Dry and Wet Corrosion – Electrochemical theory of Corrosion-Mechanism – Galvanic corrosion, Concentration cell, corrosion Waterline Attack – Pitting –passivity – stress corrosion - Corrosion control methods.**Batteries:** Fundamentals of Batteries – Classification of Batteries – Sizes of Batteries –Primary Batteries – Le'clanche dry cell – Magnesium dry cell – Secondary batteries –Lead-acid battery – Alkaline Storage Batteries.

Unit –V: Fertilizers and Fuels

Fertilizers – Requisites of fertilizers,Organic and Inorganic fertilizers, Preparation and uses.Fuels – Energy resources - Industrial gases, Water gas, Producer gas, Oil gas, natural gas, coal gas, Gobar gas, Indane gas, Petroleum products and coal products.

Text Books:

1. B.K. Sharma "Industrial Chemistry", 1st Ed., Goel Publishing House– Meerut.,1984.
2. P.L. Soni, H.M. Chawla "Text Book of Organic Chemistry", Sultan Chand and Sons,New Delhi, 1994.
3. Arun Bahl and B.S. Bahl "Text Book of Organic Chemistry", 11th and 18th Ed., S.Chand, New Delhi, 2006.

MAJOR BASED ELECTIVECOURSE-V

MATERIAL CHEMISTRY AND NANOTECHNOLOGY

Course Code :	**Max. Marks : 100**
Hours/Week : 5	**Internal Marks : 25**
Credit : 4	**External Marks : 75**

Objectives:

- *To understand the solid electrolytes*
- *To understand magnetic material*
- *To know modern engineering material*
- *To understand nanophase material*
- *To understand nanotechnology*

Unit-I: Ionic Conductivity and Solid Electrolytes

Types of ionic crystals – alkali halides – silver chloride-alkali earth fluovider –simple stoichiometric oxides. Types of ionic conductors – halide ion conductors – oxide ion conductors – solid electrolytes – applications of solid electrolytes. Electrochemical cell – principles – batteries, sensors and fuel cells – crystal defects in solids – line and plane defects – point defects - schottky and frenkel defects. Electronic properties and band theory; metals, semiconductors – Inorganic solids – colour, magnetic and optical properties, luminescence

Unit II: Magnetic Materials

Introduction – types of magnetic materials – diamagnetism – paramagnetism, ferromagnetism. Ferrites : Preparation and their applications in microwave –floppy disk – magnetic bibble memory and applications. Insulating Materials: Classification on the basis of temperature – Blymer insulating materials and ceramic insulating materials. Ferro electric materials: examples – applications of ferroelectries.

Unit III: Modern Engineering Materials

Metallic glasses – introduction –composition, properties and applications. Shape memory alloys: introduction – examples – application of SMA – advantages and disadvantages.

Biomaterials: Introduction –metals and alloys in biomaterials –ceramic biomaterials, composite biomaterials-polymer biomaterials.

Unit IV : Nanophase Materials

Introduction – techniques for synthesis of nanophase materials –sol-gel synthsis-electrodeposition –inert gas condensation-mechanical alloying –properties of nanophase materials –applications of nanophase materials, composite materials: Introduction –types.

Unit V: Nano Technology

Introduction –importance –various stages of nanotechnology –nanotube technology – nanoparticles –fullerenes-nanodendrimers –nanopore channels, fibres and scaffolds – CVD dismond technology –FCVA technology and its applications – nanoimaging techniques.

Reference Book:

1. A. R. West, Solidstate chemistry and its applications, john wiley and sons (1989).
2. V. R. Raghavan, Materials Science and Engineering, Printice Hall (India) Ltd., (2001).
3. K. J. Klabunde, Nanoscale materials in chemistry, A. John Wiley and Sons Inc. Publication.

SKILLBASED ELECTIVECOURSE-I
FOOD CHEMISTRY ANDTECHNOLOGY

Course Code:	**Max. Marks : 100**
Hours/Week : 2	**Internal Marks : 25**
Credit : 2	**External Marks : 75**

Objectives:

- *To learn basic knowledge in Food Chemistry*
- *To know the nutritional values of food*
- *To get awareness on the food spoilage, adulteration and sanitation*
- *To know the food beverages and edible oil*

Unit -I: Food Adulteration

Food adulteration: Definition, classification – Common adulteration in food, Sources of food, types, advantages and disadvantages. Food adulteration – contamination of Wheat, Rice, Alial, Milk, Butter etc. with clay stones, water and toxic chemicals – Common adulterants - Ghee adulterants and their detection. Practical rules for good sanitation of food:Food laws and standards – Bureau of Indian Standards, AGMARK – Consumer Protection act.

Unit-II: Food Poison

Food poisons – natural poisons (alkaloids – nephrotoxing) – pesticides. (DDT, BHC, Malathion) – Chemical poisons – first aid for poison consumed victims. Food Spoilage – Causes of food spoilage – Fermentation, rancidity,autolysis and putrefaction – food poisoning.**Food Preservation**: principle and importance-method of freezing, canning, pickling, salting,smoking, bottling, sterilization, refrigeration, dehydration, heating, radiation and preservative agents.

Unit-III: Food Additives

Food additives –artificial sweetners – saccharin – cyclomate and aspartate. Food flavours –esters, aldehydes and heterocyclic compound. Food colours – nestricte use spurious colours – Emulsifying agents – preservatives learning agents. Baking powder yeast – taste makers – MSG vinegar.

Unit-IV: Beverages

Beverages – Soft drinks – soda – fruit juices – alcoholic beverages examples. Carbonation – addiction to alcohol – cirrhosis of liver and social problems.

Unit-V: Edible Oils

Fats, Oils, - Sources of oils – production of refined vegetable oils – preservation. Saturated and unsaturated fatty acids – iodine value – role of MUFA and PUFA in preventing heart diseases – determination of iodine value and R_M value, saponification values and their significance. Estimation of iodine and R_M values in edible oils.

Reference Books:

1. M. Swaminathan., Text book on food chemistry,printing and publishing CO., Ltd.,Bangalore,1993.
2. Jayashree Ghosh, Fundamental concepts of appliced chemistry, S. Chand & Co. Publishers.
3. Thanlamma Jacob, text books of applied chemistry for home science and allied science, Macmillan.
4. M. Swaminathan M. Advanced Text Book on Food and Nutrition , volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.
5. N.N. Potter, Food science, CBS publishers and distributors, New Delhi. 1994.
6. Lillian Hoagoland Meyer, Food Chemistry, CBS publishers and distributors, New Delhi. 1994.
7. O.R. Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.
8. B. Srilakshmi, Food Science, New Age International Pvt. Ltd. Publishers, 3rd Ed., 2003.

SKILL BASED ELECTIVECOURSE-II: CHEMISTRY OF EVERY DAY LIFE

Course Code:	**Max. Marks : 100**
Hours/Week : 2	**Internal Marks : 25**
Credit : 2	**External Marks : 75**

Objectives:

- *To acquire knowledge on chemistry applied in day to day activities*
- *To get knowledge about the preparation and uses of several commodities in daily life*
- *To understand the importance of fuels and fire protection*

Unit-I:Essential oils, Perfumes and Flavours

Essential oils – definition – occurrences – methods of production plants – steam distillationand expression method.**Perfumes:** Formulations, Requirements of a good perfume, composition of perfumes,classification of perfumery materials – animals - synthetic – formulations Manufacturingand Packaging processes of Perfumes.**Flavours:** Definition of flavours – classification, chemical composition, commoncharacteristics, formulation, uses and hazards.

Unit-II:Cosmetics

Cosmetics: Face cream, sun screen lotion, shaving cream-composition-formulation - uses and theirhazard. Sprayer, hand lotion, nail lacquers, nail bleaches, hair oil, hair dyes – Composition, formulation-uses and their hazards.

Unit-III: Soaps

Saponification of oils and fats. Manufacture of soaps. Formulation of toilet soaps. Different ingredients used and their functions. Medicated soaps, Herbal soaps. Mechanism of action of soap. Soft soaps. Shaving soaps and creams. ISI specifications. Testing procedures/limits.

Unit-IV: Detergents

Anionic Detergents: Manufacture of LAB (linear alkyl benzene). Sulphonation of LAB – preparation of acid slurry. Different ingredients in the formulation of detergent powders

and soaps. Liquid detergents. Foam boosters. AOS (alpha olefin sulphonates. **Cationic detergents**: examples. Manufacture and applications. **Non-ionic detergents**: examples. Manufacture of ethylene oxide condensater.**Mechanism of action of detergents**. Comparison of soaps and detergents. Biodegradation – environmental effects. ISI specifications / limits.

Unit-V:Fuels for Home and Fire Protection

Fuels: Definition, classification-solid, liquid and gaseous fuels, requirements of a good fuel-Composition and uses of LPG, gobar gas and water gas. **Fire Protection**: Causes of fire accidents in homes, firefighting in homes – methods ofextinguishing fire, chemical fire extinguishers - merits and demerits. Automatic firedetection cum control, causes and fire fighting.

Text Books:

1. Thangammal Jacob, A textbook of applied chemistry, Mcmillan Company Ind. Ltd, 1979.
2. K.Bagavathi Sundari, Applied Chemistry, MJP publishers Chennai, 1st Ed., 2006.

Reference Books:

1. B.K.Sharma, Industrial Chemistry, Goel Publishing House, 1995.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 1st Ed.,S.Chand Company Ltd – New Delhi, 2006.

SKILLBASED ELECTIVECOURSE-III
SOIL,DAIRY AND LEATHER CHEMISTRY

Course Code:	**Max. Marks : 100**
Hours/Week : 2	**Internal Marks : 25**
Credit : 2	**External Marks : 75**

Objectives:

- *To impart knowledge on soil and fertilizers.*
- *To impart knowledge on water, leather and dairy.*
- *To understand the applications of chemistry in industrial processes*

Unit – I:Soil Chemistry

Soil Chemistry: Introduction - soil classification, physical and chemical properties of soil,soil water, soil air, soil temperature, soil minerals, soil colloids, soil reaction and buffering – soilpH, soil acidity, soil salinity and alkalinity, soil fertility and soil formation.

Unit– II:Fertilizers

Fertilizers: Organic Manures - Farmyard Manure - compost - oil cakes - bone meal – meatmeal - fish meal - blood meal and green manures - Fertilizers - classification of fertilizers -requisites of a good fertilizers – preparation properties and uses of nitrogenous fertilizers, urea,CAN - phosphatic fertilizers - super phosphate of lime - triple super phosphate - NPK fertilizers – ill effects of fertilizers -Micronutrients – definition - role of micronutrients in plants .

Unit – III: Water Chemistry

Water Chemistry: Water – types of water – soft and hard water – hardness, degree of hardness, temporary and permanent hardness, removal of hardness - Reverse osmosis and ionexchange methods – principle and techniques. Water analysis - Determination of TDS, Totalhardness by EDTA, BOD and COD.

Unit – IV:Leather Chemistry

Leather Chemistry: Introduction, chief process used in leather manufacture, structure ofhide and skin, leather processing-process before tannage - tanning process- vegetable tanning and chrome tanning, Tannery effluent and by product problems and treatment .

Unit – V:Dairy Chemistry

Dairy Chemistry: Milk - Definition, physicochemical properties of milk, constituents ofmilk, chemical change taking place in milk - boiling, pasteurization, sterilization andhomogenization. Definition and composition of creams, butter, ghee and ice creams. Milk powder, definition,need for making powder. Principles involved in drying process - spray drying and drum drying.

Reference Books:

1. B.K.Sharma, Industrial Chemistry, 13th Ed., Goel Publishing House, Reprint 2008.
2. Dilip Kumar Das, Introductory Soil Science, 1st Ed., Kalyani Publishers, Reprint 2002.
3. Gurdeep Chatwal, Organic Chemistry of Natural Products, Vol. 2, Himalaya Publishing House,Reprint, 2000
4. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 1stEd., S.Chand & Co Ltd.
5. Clarence Henry Eckles, Willes Barnes Combs, Harold Macy, Milk and Milk Products, 4th Ed., Tata McGraw Hill Publishing Company Ltd, Reprint 2002.
6. G.R. Agarwal, Kiran Agarwal and O.P. Agarwal, Agarwal's Text Book of Biochemistry, 11th Ed., Goel Publishing House, 2000.
7. M. Satake, Y. Mido, Chemistry of colour, 1st Ed., Discovery Publishing House, Reprint2003.

SKILLBASED ELECTIVECOURSE-IV: MEDICINAL CHEMISTRY

Course Code :	**Max. Marks : 100**
Hours/Week : 2	**Internal Marks : 25**
Credit : 2	**External Marks : 75**

Objectives:

- *To impart the knowledge in the basic concept of drugs*
- *To create the awareness about the diseases and their causes*
- *To know antibiotics and sulpha drugs*
- *To know anesthetics and antiseptics*
- *To know diabetes andanticonvulsant agents*

Unit –I

Drugs: source of drugs - important terminologies - molecular pharmacology,pharmacodynamics, pharmacophore, metabolites, virus, antimetabolites, bacteria, fungi -actinomycetes.**Indian medicinal plants and trees** –Adathoda, tulsi, thoothuvalai, neem, mango, and kizhanelli.**Causes and symptoms of common diseases**: Tuberculosis, asthma, jaundice, leprosy,typhoid, malaria, cholera and filaria.

Unit – II

Antibiotics: Definition, structure - uses of chloramphenicol, ampicillin, streptomycin, tetracycline, Rifamycin – Erythromycin – Properties, uses.**Sulpha drugs**: Definition and drug action of sulpha drugs.Preparation and uses ofsulphadiazine, sulphapyridine, sulpha thiazole and sulpha furazole.

Unit – III

Antiseptics and Disinfectants: Definition - standardization – use of phenols – dyes – chloramines – organo mercurials – formaldehyde - cationic surface active agents - uses. **Anasthetics:** Definition – classification – general volatile anaesthetics – ethers, nitrousoxide, chloroform, trichloro ethane, storage – advantages – disadvantages – intravenousanaesthetics – thiopental sodium, methohexitone – local anaesthetics – cocaine, procaine,benzocaine – uses – advantage – disadvantages.

Unit– IV

Antipyretic Analgesics: Salicylic acid derivatives, aminophenol derivatives, mechanism of action – uses. Anti-Inflammatory Drugs: Indolyl derivatives – indomethacin – ibubrufen – properties and uses.**Blood:** Composition of blood, blood graphics – Rh factor, Blood clotting, Mechanism. **Haematological agents:** Coagulants and anticoagulants, definition-examples.Qualitative test for urea, bile, ketone, Protein in urine sample and urea, glucose in blood sample.

Unit-V

Psychopharmacology, antipsychotic drugs, anti anxiety drugs, anti depressant drugs,sedatives and hypnotics – definition – examples.**Diabetes and Hypoglycemic Drugs:** Types-causes- symptoms – control methods insulin - oral hypoglycemic agents - sulphonyl urea – adverse effects.**Anticonvulsant agents:** Definition, types, barbiturates, hydantoins, succinimides – acetyle urea derivatives -uses.

Text Books:

1. Mathew George and Lincy joseph,Text book of pharmaceutical chemistry, 2009.
2. Jayashree Ghose, Text book of Pharmaceutical chemistry, 2nd Ed., 2003.
3. S. Lakshmi, Pharmaceutical Chemistry, 3rd Ed., Sulthan Chand and Sons, New Delhi,2004.

Reference Books:

1. Aleg gringaur, Introduction to Medicinal Chemistry, Sharma Printers Delhi, 2011.
2. D.Sriram and P.Yogeshwari, Medicinal Chemistry, 2nd Ed.,-2008.
3. Ashutoshkar, Medicinal chemistry, revised and expanded Ed.,, InternationalPublishers, 2010.
4. V.N.Rajasekaran, Vol.I and Vol.II, Pharmaceutical Chemistry, Sun publicationsChennai. 4th Ed., 2003.
5. V.K.Ahluwalia and Madhu Chopra, Medicinal chemistry, Ane books private Ltd.,New Delhi, 1st Ed., 2008.
6. Marlin Herbert, Pharmacology, Ashton Nany Darkson, Jones and Bartlett India Pvt.Ltd,11th Ed.,, 2010.

SKILLBASED ELECTIVECOURSE-V: AGRICALTURAL CHEMISTRY

Course Code :	**Max. Marks : 100**
Hours/Week : 2	**Internal Marks : 25**
Credit : 2	**External Marks : 75**

Objectives:

- *To understand the origin of soil*
- *To know the chemical composition of soil*
- *To understand the plant nutrients*
- *To learn fertilizer, pesticides and fungicides*

Unit –I: Origin of Soil

Origin of soils, their properties, acid, alkali and saline soils- diagnosis – remediation of acid and salt affected soils – methods of reclamation and after care.

Unit – II: Chemistry Aspects of Soil

Soil testing – concept, objectives and basis – soil sampling, tooks, collection processing, despatch of soil samples – soil organic matter – its decomposition and effect on soil fertility.

Unit – III: Plant Nutrients

Plant nutrients – macro and micro nutrients – their role in plant growth – sources - forms of nutrient absorbed by plants – factors affecting nutrient absorption - deficiency symptoms in plants – corrective measures – chemicals used for correcting nutritional deficiencies – nutrient requirement of crops – their availability fixation and release of nutrients.

Unit – IV: Fertilizers

Fertilizers – classification of NPK fertilizers – sources - natural and synthetic – straight – complex – liquid fertilizers, their properties, use and relative efficiency secondary and micronutrient fertilizers – mixed fertilizers.

Unit – V: Pesticides and Fungicides

Pesticides: definition – Classification – organic and inorganic pesticides – mechanism of action – characteristics safe handling of pesticides – impact of pesticides on soil, plants and environment. **Fungicides:** Definition – Classification – mechanism of action – sulphur, copper, mercury compounds, dithanes, dithiocarbamate.

Reference Books

1. T. D. Biswasand S. K. Mukherjee, Text book of soil science 1987.
2. J .Daji, A text book of soil science, Asia publishing House, Madras – 1970.
3. S. L. Tisdale, W.L. Nelsonand J. D. Beaton, Soil fertility and fertilizers, Macmillon Pub Co New York 1990.
4. P. R. Hesse, A text book of soil chemical analysis John Murray, NewYork, 1971.
5. K. H. Buchel,Chemistry of Pesticides, John Wiley & Sons New York 1983.
6. V. S. Sree Ramulu, Chemistry of Insecticides and Fungicides, Oxford and IBH Publishing Co., New Delhi 1979.

INTER DISCIPLINARY COURSE-I
BASIC CONCEPT IN BIO- CHEMISTRY

Course Code:	**Max. Marks : 100**
Hours/Week : 2	**Internal Marks : 25**
Credit : 2	**External Marks : 75**

Objectives:

- *To make the students about the importance of an amino acids and proteins*
- *To know enzymes and lipids*
- *To understand carbohydrates and nucleic acids*

Unit -I: **Amino Acids and Proteins**

Amino acids – classification – Synthesis of amino acids and their identification, peptide bond.**Proteins** –Introduction-occurrence and function-general properties of protein, classification –simple protein and derived proteins. Hydrolysis of proteins: denaturation, precipitation and coagulation.

Unit –II:Enzymes

Introduction, classification and properties- factors influencing enzyme action. Mechanism of enzyme action – Lock and Key model and induced fit models.Coenzymes –mechanism of coenzyme Micelis Mentens,enzymes of clinical interest

Unit -III:Lipids

Classification –simple, complex and derived lipids, biological function of lipids-difference between oil and fats-extraction of fats-physical and chemical properties of lipids-analysis of oil and fats;Acid value,saponification value,iodine value and Recihert – Meissel value.

Unit -IV:Carbohydrates

Classification:Monosaccharides.Glucose-Straight chain and ring structure for glucose-Mutarotation-Frutose,Galactose and Glycosides.Disaccharides-Maltose,Lactose and sucrose,proertis and reaction of sugars.Polysaccharides-Starch-structure of Amylose and Amlopectin,hydrolysis of starch,glycogee,Dextrin,Cellulose,Dextran and Inulin.

Unit -V:Nucleic Acids

Classification-Nucleoside and nucleodites,purin and pyrimidine bases-isolation,component and constitution of nucleic acids-sequence of nucleic acids Difference between DNA and RNA. Structure of DNA and RNA,types of RNA

Text Books:

1. Ambikashanmugam,fundamentals of Biochemistry for Medical students,7th Ed.,Reprint 2004
2. Gurdeep Chatwal, Organic Chemistry of Natural Products, Vol.1 and 2, Himalaya Publishing House, Reprint, 2000
3. T.N.Pattabiraman,Text book of biochemistry,2nd Ed.,All India puplishers and Distributor 2002
4. S.P.Butani,Chemistry of Biomolecules,Ane Books Pvt.Ltd.,2009.

INTER DISCIPLINARY COURSE-II
COMPUTER APPLICATION IN CHEMISTRY

Course Code:	**Max. Marks : 100**
Hours/Week : 2	**Internal Marks : 25**
Credit : 2	**External Marks : 75**

Objectives:

- *To enable the students to learn computer basics and operating system*
- *To know the fundamentals of networks and C programming*
- *At the end of this course the students will be in a position to get an idea of solvechemistry formulae in C programming.*

Unit-I:Introduction to computer

Characteristics of computers – organization of a computer –secondary storage devices – computer languages – low level, assembly and high level languages –software – system and application software – application of computer – algorithms and flow charts.

Unit-II: Operating system

MS-DOS, simple DOS commands – MS-Windows - Components ofWindows – desktop, My Computer, Recycle Bin, Taskbar, My briefcase and NetworkNeighborhood – Windows Accessories – Calculator, games, Windows media player, Notepad andImaging – Windows Explorer. Power point – creating a presentation – slide preparation – popularwebsites for data collection in chemistry.

Unit-III: Fundamentals of Computer Networks

Importance – Mode of Connections – Protocol –Network Topologies – Bus, Ring and Star topologies – Network Architecture – Networkcomponents – Hubs , cables, repeaters, routers and bridges,**Internet and its application:** Internet – meaning – importance – WWW– Browsing the internet –Browsing software – URL addresses, search engines, exploring websites and downloadingmaterials from websites, E-mail – sending, receiving and storing mail and chatting.

Unit-IV:Fundamentals of C

Character set – identifiers – keywords – data types – Constants –Variables – symbolic constants – operators – expressions – evaluation of expressions. Input andOutput functions - get char – put char – scanf – Printf – gets and puts functions.

Unit – V:Applications of C-Programming:

- Basic Structure of C-Programming
- Conversion of temperature from Kelvin to Celsius
- Determination of molecular weight by Rast - Macro method
- Calculation of rate constant using first order rate equation
- Calculation of root mean square, average and most probable velocities of molecules
- Calculation of Bohr radius
- pH determination using Henderson equation
- Determination of half life and average life of a radioactive nucleus
- Determination of van der Waals constants
- Determination of lattice energy of a Crystal using Born-Lande equation

Text Books:

1. E. Balagurusamy "Programming in ANSI C" 3rd Ed., Tata McGraw-Hill-NewDelhi.
2. Pundir Ansu Bansal "Computers for Chemists" 9th Ed., Pragati PrakashanPublication, 2011.

Reference Books:

1. Kishor Arora "Computer Application In Chemistry" 1stEd.,Anmol PublicationsPvt. Ltd.
2. Andrews Tenenbaum "Computer Networks" 4th Ed., Prentice-Hall of India Pvt.Ltd. New Delhi -110 001.
3. Ramesh Kumari, "Computer and Their Applications to Chemsirty"Narosa PublishingHouse, New Delhi.

SEM-III:ALLIED COURSE-I: ALLIED CHEMISTRY-I

Course Code : U3RPHAC4	**Max. Marks : 100**
Hours/Week : 4	**Internal Marks : 25**
Credit : 3	**External Marks : 75**

Objectives:

- *To understand the concept of periodic properties and molecular orbital theory*
- *To know the chemistry of biomolecules*
- *To study the concept of polymer and stereochemistry*
- *To learn the principles of separation techniques*
- *To understand the electrochemistry and corrosion*

Unit – I

Periodic properties - Ionization potential, electron affinity and electro negativityvariation in the periodic table. **Molecular Orbital Theory:** Some important basic concepts of molecular orbital theory - LCAO. Bonding, anti-bonding orbital and bond order – application of MO theory to H_2, He_2, N_2, O_2, and F_2 molecules. **Industrial Chemistry:** Fuel gases – Water gas, Producer gas, L.P.G. Gobar gas and Natural gas. Fertilizers – N.P.K and mixed fertilizers. Soap and detergents – An elementary idea of soap and detergent. Cleansing action of soap and detergents.

Unit – II

Carbohydrates: Classification – Glucose and fructose – Preparation and properties – Sucrose –Manufacture and properties – Starch and cellulose – Properties and uses. **Amino Acids and Proteins:** Amino acids – Classification, preparation and properties. Peptides (Elementary treatment) – Proteins – Classification based on physical properties and biological functions. **Nucleic acid:** DNA and RNA – functions - Structure of DNA and RNA.

Unit – III

Synthetic polymers – Teflon, Alkyl and Epoxy resins, Polyesters – definitions anduses Types of polymerization – Thermosetting and thermoplastics.**Heterocyclic compounds** – Furan, thiophene, and pyridine – Preparation and properties. **Stereoisomerism:** Optical isomerism – lactic and tartaric acid – Racemic mixture andresolution – Geometrical isomerism –maleic and fumaric acid.

Unit – IV

Chromatography – principles of column, paper and thin layer chromatography. **Photochemistry:** Photochemical reaction – Lambert's law, Beer's law – Absorbtion, Extinction Coefficient – The law of Photochemical equivalence, Quantum efficiency, Some of Photochemical and their quantum yield. **Phase Rule:**Phase, Component, Degree of freedom, Phase Rule – Definition. One component system –Water system.

Unit – V

Electrochemistry: Specific and equivalent conductance – their determination – Effect of dilution on conductivities – An elementary idea about ionic theory – Ostwald'sDilution Law, Kohlrausch Law, Conductometric titrations. **pH and Buffer:** Importance of pH and buffers in the living systems. pH determination by colorimetric and electrometric methods. **Corrosion:** Types of corrosion, Prevention.

Text books

1. R.D. Madan, J.S. Tiwari and G.L. Mudhara A Textbook of First Year B.Sc. Chemistry,S.Chand and Co.
2. P.L. Soni "Text book of Inorganic Chemistry. S. Chand & Co., New Delhi (1999).
3. P.L. Soni and H.M. Chawla "Text Book of Organic Chemistry" 28th Ed., (1999) - Sulthan and Chand company, New Delhi.
4. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", VishalPublications, Jalandhar, 2002.

References Books

1. Bahl and Arun Bahl – "Advanced Organic Chemistry" 19th Ed., (2005) Sulthan AndChand company, New Delhi.

2. M.K. Jain – "Organic Chemistry" – 12th Ed., (2003) Sulthan and Chand Company, NewDelhi.
3. R.L. Madan, G.D. Tuli, "Simplified Course in Physical Chemistry", 5th revised and enlargedEd., S.Chand & Co., New Delhi, 2009.

SEM-IV:ALLIED COURSE-II: ALLIED CHEMISTRY-II

Course Code : U4RPHAC6	**Max. Marks : 100**
Hours/Week : 4	**Internal Marks : 25**
Credit : 3	**External Marks : 75**

Objectives:

- *To understand the types of chemical bonding and the importance of coordinationcompound*
- *To have knowledge of types for organic reaction and aromaticity*
- *To study the importance of solids and colloids*
- *To know the concept of chemical equilibrium and catalysis*

Unit – I

Coordination Chemistry: Nomenclature of mononuclear complexes – Werner, Sidgwick and Pauling'sTheory.Biological role of Haemoglobin and Chlorophyll. Application of complexesin qualitative and quantitative analysis. **Metallic Bond:**Electron gas, Pauling and Band Theories. Semiconductors - Intrinsic, n andp-type.**Compounds of Sulphur**: Peracids of sulphur and sodium thiosulphate.

Unit – II

Electron Displacement Effects- Inductive effect – Relative strength of aliphaticacid and alkyl amines. Resonance – Condition for resonance - Consequences ofresonance - Hyper conjugation – definition and examples- steric effect. **Aromaticity** – Conditions – Huckel's rule - aromaticity of benzene.**Substitution reactions**- Nitration, halogenation, sulfonation and alkynation of benzene.

Unit –III

Halogen containing compounds: Preparation and uses of Dichloromethane,Chloroform, Carbon tetrachloride, DDT, and BHC. **Chemotherapy:** Structure and uses of Sulpha drugs – Sulpha pyridine,Sulpha thiazole and sulpha diazine –Antibiotics - Struture and uses of penicillin –Gand Chloromycetin.**Name reactions:** Benzoin, Perkin, Cannizaro, Claisen, Haloform, Carbylaminereactions – Biuret reaction.

Unit – IV

Solid State: Typical crystal lattice – Unit cell. Elements of symmetry. Bragg's equation, Weiss indices, Miller indices, Simple, Body centered and face centered cubes.**Colloids:**Types of colloidal systems — Classification of colloidal systems, Lyophilic andLyophobic Sols — properties of colloidal system – Dialysis – Electro-dialysis, Ultrafiltration. Emulsion –types- preparation- emulsifier- Deemulsification-Gelstypes.

Unit – V

Chemical Equilibrium: Criteria of homogeneous and heterogeneous equilibria.Decomposition of HI and PCl_5.**Chemical Kinetics:**Order, Rate, Molecularity of the reaction and rate constant, Determination of orderof the reaction – Activation energy, Effect of temperature on reaction rate. **Catalysis**– Types-Importance of catalysis, types of catalysis - Homogeneous andheterogeneous catalysis (Industrial catalyst – catalyst carrier, catalyst promoter,catalyst inhibitor, catalytic poison, activity of catalyst). Theory of catalysis -Intermediate complex theory – concept of acid-base and enzyme catalysis.

Text books:

1. P.L. Soni "Text book of Inorganic Chemistry. S. Chand & Co., New Delhi (1999).
2. P.L. Soni and H.M. Chawla "Text Book of Organic Chemistry" 28thEd., (1999)Sulthan and Chand company, New Delhi.
3. B.R. Puri, L.R. Sharma and S. Pathania – Principles of Physical Chemistry: Shoban LalNagin Chand and Co., New Delhi
4. A.K. Srivastava "Organic Chemistry" 1stEd.,(2002) New Age InternationalPublishers, New Delhi.

References Books:

1. R.D Madan – "Modern Inorganic Chemistry" (1987), S. Chand & Co Pvt Ltd.
2. B.R. Puri and L.R. Sharma – Principles of Inorganic Chemistry: Shoban Lal Nagin Chand andCo., New Delhi (2000).

3. R.L. Madan, G.D. Tuli, "Simplified Course in Physical Chemistry", 5th revised and enlargededition, S.Chand & Co., New Delhi, 2009.

SEM:IV:ALLIED COURSE-II: ALLIED CHEMISTRY PRACTICAL

Course Code:U4RPHAC5P	**Max. Marks : 100**
Hours/Week : 3	**Internal Marks : 40**
Credit : 3	**External Marks : 60**

I. Volumetric Analysis

1. Estimation of HCl by NaOH using a standard oxalic acid solution
2. Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution
3. Estimation of oxalic acid bu $KMnO_4$ using a standard oxalic acid solution
4. Estimation of Iron (II) sulphate by $KmnO_4$ using a standard Mohr's salt solution.
5. Estimation of Ca (II) by $KmnO_4$ using a standard oxalic acid solution.
6. Estimation of $KmnO_4$ by thio using a standard $K_2Cr_2O_7$ solution.
7. Estimation of Fe (III) by using $K_2Cr_2O_7$ using a standard Mohr's salt solution using internal and external indicators.
8. Estimation of copper (II) sulphate by $K_2Cr_2O_7$ solution
9. Estimation of Mg (II) by EDTA solution
10. Estimation of Ca (II) by EDTA solution

II .Organic Analysis:

a) Identification of acidic, basic, phenolic and neutral organic substances
b) Detection of N, S and halogens
c) Test for aliphatic and aromatic nature of substances.
d) Test for saturation and unsaturation.
e) Identification of functional groups

i. Carboxylic acid
ii. Phenols
iii. Aldehydes
iv. Ketones
v. Esters
vi. Carbohydrates
vii. Primary amines
viii. Amides

Reference Books :

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. N.S. Gnanapragasam and G. Ramamurthy, Organic chemistry – Lab manual, S. Viswanathan, Co. Pvt. Ltd., 1998.
3. J.N. Gurtu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.