

St.Mary's College

(Autonomous)

Re-accredited with 'A' Grade by NAAC



Syllabus

(From June 2015-2018)

ST.MARY'S COLLEGE (AUTONOMOUS), THOOTHUKUDI

Bachelor of Science (Chemistry)

Course structure (w.e.f 2015)

Part	Subject	Subject code	Title of the paper	Contact	Credits	Max. marks		
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Semester -I

Part	Subject	Subject code	Title of the paper	Contact Hours/ week	Credits	Max. marks		
						CIA	ESE	Total
I	Tamil/ French	15ULTA11		6	3	50	50	100
II	English	15ULEA11 15ULEB11 15ULEC11		6	3	50	50	100
III	Core – I	15UCHC11	Fundamentals of Chemistry	4	4	50	50	100
	Core – II	15UCHC12	General chemistry	4	4	50	50	100
	Allied I	15UMAA11 / 15UBOA11	Allied Mathematics I/ Angiosperms Taxonomy and Medicinal Botany	6 / 4	5/4	50	50	100
	Core Practical	15UCHCR1	Inorganic quantitative Analysis	2				
	Allied Practical	15UBOAR1	(Volumetric Method) Allied Botany Practicals	2				
IV	Foundation course	15UFPD11	Personality Development	2	2	50	50	100
				30	20	300	300	600

Semester -II

						CIA	ESE	Total
I	Tamil/ French	15ULTA21 15ULFR21		6	3	50	50	100
II	English	15UGEA21 15UGEB21 15UGEC11		6	3	50	50	100
III	Core – III	15UCHC21	Inorganic chemistry-I	4	4	50	50	100
	Core – IV	15UCHC22	Organic chemistry-I	4	4	50	50	100
	Allied –I	15UMAA21/ 15UBOA21	Allied Mathematics-II/ Plant Biotechnology	6 /4	4	50	50	100
IV	Core Practical	15UCHCR1	Inorganic quantitative Analysis (Volumetric Method)	2	2	50	50	100
	Allied Practical	15UBOAR1	Allied Botany Practicals	2	2	50	50	100
	Foundation course	15UFVE21	Value Education	2	2	50	50	100
	NCC/NSS/ Sports				1			
				30	25	400	400	800

Semester -III

Part	Subject	Subject code	Title of the paper	Contact Hours/	Credits	Max. marks		
						CIA	ESE	Total

				week				
I	Tamil/ French	15ULTA31 15ULFR31		6	3	50	50	100
II	English	15UGEA31 15UGEB31 15UGEC31		6	3	50	50	100
III	Core – V	15UCHC31	Physical chemistry-I	4	4	50	50	100
	Allied II	15UPHA31	Allied Physics-I	4	4	50	50	100
	Core practical Allied practical	15UCHCR2	Inorganic Qualitative Analysis	2				
		15UPHAR1		2				
	SBE	15UCHS31	Basic Computer Techniques in chemistry	2	2	50	50	100
NME	15UCHN31	Chemistry of consumer products	2	2	50	50	100	
IV	Foundation course	15UFYM31	EVS	2	2	50	50	100
	Self study course	15UCHSS2	Day to day chemistry		+1			100
				30	20+1	350	350	700+ 100

Semester -IV

Part	Subject	Subject code	Title of the paper	Contact Hours/we	Cred its	Max. marks		
						CIA	ESE	Total

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I	Tamil/ French	15ULTA41 15ULFR41		6	3	50	50	100
II	English	15UGEA41 15UGEB41 15UGEC41		6	3	50	50	100
III	Core – VI	15UCHC41	Organic chemistry-II	4	4	50	50	100
	Allied II	15UCHA41	Allied Physics-II	4	4	50	50	100
	SBE	15UCHS41	Pharmaceutical Chemistry	2	2	50	50	100
	NME	15UCHN41	Industrial Chemistry	2	2	50	50	100
IV	Foundatio n course	15UFES41	Yoga & meditation (last 2 hours)	2	2	50	50	100
	Core practical Allied practical	15UCHCR2	Inorganic Qualitative Analysis	2	2	50	50	100
		15UPHAR1		2	2	50	50	100
	Self study Course	15UCHSS3	History of Scientific Inventors		+1			100
	Extention activity				+1			
				30	24+2	450	450	900+100

Semester -V

Subject	Subject code	Title of the paper	Contact	Credits	Max. marks
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			Hours/ week		CIA	ESE	Total
Core VII	15UCHC51	Organic chemistry –III	5	5	50	50	100
Core VIII	15UCHC52	Physical chemistry-II	5	5	50	50	100
Core Elective I	15UCHE51	Co-ordination and Bio-inorganic chemistry	4	4	50	50	100
Core Elective II	15UCHE52	polymer Chemistry	4	4	50	50	100
SBE	15UCHS51	Applied Chemistry	4	4	50	50	100
Self study course	15UCHSS1	Chemistry for Competitive Examination	-	+1	-	100	100
Core Practicals	15UCHCR3	Gravimetry and Inorganic preparation	5	3	50	50	100
	15UCHCR4	Organic Analysis and Organic preparations	3				
			30	25 +1	300	400	700

Semester -VI

Subject	Subject code	Title of the paper	Contact Hours/ week	Credits	Max. marks		
					CIA	ESE	Total
Core IX	15UCHC61	Inorganic chemistry -II	6	5	50	50	100
Core X	15UCHC62	Organic chemistry-IV	6	5	50	50	100
Core XI	15UCHC63	Physical chemistry-III	5	5	50	50	100
Core Elective III	15UCHE61	Analytical Chemistry	5	5	50	50	100
Core Practicals	15UCHCR4	Organic Analysis and Organic preparations	3	3			
	15UCHCR5	Physical chemistry Experiments	5	3			
			30	26			600

SEMESTER- I			
Part III	Core I	Fundamentals of Chemistry	
Code :15UCHC11	Hrs./Week:4	Hrs/ Sem: 60	Credits:4

OBJECTIVES:

- To know the various methods of purification of organic compounds.
- To understand the basic mechanism involved in Organic reactions.
- To apply VSEPR theory to inorganic molecules.
- To appreciate the phenomenon of catalysis in industry and biological systems.

UNIT I NOMENCLATURE AND PURIFICATION OF ORGANIC COMPOUNDS

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

Purification of Organic compounds – crystallization-selection of solvent, preparing the solution, filtering, crystallizing, separation and drying of crystals – sublimation – Extraction with the solvent – fractional distillation

UNIT II MECHANISM OF ORGANIC REACTIONS IN ALIPHATIC COMPOUNDS

Nucleophiles and electrophiles –definition – classification – nucleophilic substitution reaction – S_N^1 , S_N^2 , $S_N^{1'}$ and $S_N^{2'}$ and S_N^i reactions with examples. Elimination reactions – E^1 , E^2 reactions with examples – Hofmann's rule and Saytzeff's rule – their applications.

Addition reactions – electrophilic and nucleophilic addition – addition reaction at C=C system. Addition to symmetrical and unsymmetrical alkenes. Markovnikov's rule – Kharash Peroxide Effect.

UNIT III CHEMICAL BONDING I

Ionic bond, factors influencing the formation of ionic bond- covalent bond – overlapping of atomic orbital – σ bond and π bond – coordinate covalent bond – Fajan's rule – valence bond theory – limitations – molecular orbital theory – bonding and anti bonding molecular orbital – energy level – bond order – molecular orbital diagram of homo nuclear

diatomic molecules H_2 , H_2^+ , N_2 , O_2 , F_2 – molecular orbital diagram of hetero nuclear molecules CO and HF – comparison of VB and MO theory.

UNIT IV CHEMICAL BONDING II

Hybridization of sp^3d , sp^3d^2 , sp^3 , sp^2 and sp with example – salient features of concept of hybridization – VSEPR Theory – postulates – VSEPR theory as applied to molecules of regular geometry ($BeCl_2$, BF_3 , CCl_4 , PCl_5 , SF_6 and IF_7) and irregular geometry (NH_3 , H_2O , and SF_4) – geometry of ions (CO_3^{2-} and ClO_4^-).

Intermolecular forces: dipole – dipole interaction, dipole – induced dipole interaction, induced dipole – induced dipole interaction. Hydrogen bonding – nature, type and its influence on the physical properties of organic and inorganic molecules.

UNIT V CATALYSIS

General characteristics of catalytic reactions- acid-base catalysis and enzyme catalysis – Fischer Lock and key theory – characteristics of enzyme catalysis. Mechanism of enzyme catalysed reaction (Michaelis-Menton equation – derivation not required). Activation energy and catalysis – theories of homogeneous and heterogeneous catalysis – mechanism of the hydrogenation of ethylene on nickel surface – acid base catalysis – mechanism – promoters – promotion action. examples of catalytic poisoning – negative catalysis. Mechanisms of negative catalysis and autocatalysis.

BOOKS FOR REFERENCE

1. Arun Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand and Company Ltd., Reprint 2005.
2. B.R.Puri, L.R.Sharma, K.C.Kalia, Principles of Inorganic Chemistry, Milestone publishers and distributors, Delhi, 2010.
3. Arun Bahl, B.S.Bahl, G.D.Tuli, Essentials of Physical Chemistry, S.Chand & Company Ltd., New Delhi, 2008.
4. Jerry March, Advanced Organic Chemistry, Reactions Mechanisms and Structure, 4th Edition. 2013
5. K.S.Tewari, N.K.Vishnoi, S.N.Mehrotra, A Text Book of Organic Chemistry, 2nd Revised Edition, 1998.

SEMESTER- I

6. B
.R.

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

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

Part III	Core II	General Chemistry	
Code :15UCHC12	Hrs./Week:4	Hrs/ Sem: 60	Credits:4

OBJECTIVES:

- To understand the quantum mechanical concept of electron.
- To know the importance of periodic table and to understand the periodic properties.
- To appreciate polar effects and formation of reaction intermediates.
- To be familiar with nuclear reaction and their impacts.
- To have an insight into the theory of practicals.

UNIT ATOMIC STRUCTURE

Bohr's model of the atom –postulates-derivation of Bohr's radius and energy of the electron – spectrum of hydrogen atom – Ritz combination principle – limitations of Bohr's theory Sommerfeld theory – dual character of electron – Davison and Germer experiment- de-Broglie's equation – derivation and its significance — photoelectric effect. Heisenberg's uncertainty principle -.shapes of orbitals – nodal planes – g and u character. Quantum numbers – rules for filling up of orbitals — Hund's rule – Pauli's exclusion principle Aufbau's principle. Electronic configuration of elements.

UNIT II PERIODIC TABLE AND ATOMIC PROPERTIES

Defects of Mendeleev's table – periodic classification of elements – Modern periodic law- long form of periodic table – periodic properties – trends in ionic and covalent radii , ionization energy, electron affinity and electro negativity –factors affecting ionization energy, electron affinity and electro negativity- scales of electro negativity – Alred-Rochow's scale – Pauling scale – Mulliken approach – applications of electro negativity— Slater's rule – calculation of effective nuclear charge.

UNIT III BASIC CONCEPTS OF ORGANIC CHEMISTRY

Empirical and molecular formula – calculation (including problems) – Determination of molecular weight -Victor meyer's method, chemical method, silver salt method, chloroplatinic salt method.

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

Bond fission – homolytic and heterolytic fission. Reaction intermediates – carbocation, carbanion, free radicals and carbenes – their generation, shapes and stability.

Types of reactions – Substitution – elimination – addition – definition and examples.

UNIT IV: NUCLEAR CHEMISTRY

Fundamental particles of an atom-Isotopes –isobars-isotones - group displacement law – radioactive disintegration series— half life – average life. Rate of radioactive decay-units of radioactivity. Radioactive equilibrium. artificial radio activity – radioactive dating(rock dating and carbon dating)- nuclear isomers. Nuclear stability - mass defect – nuclear binding energy – packing fraction – neutron / proton ratio – magic numbers. – nuclear reactions - nuclear fission-applications (atom bomb, nuclear reactors – fast breeder reactor) nuclear fusion–applications (hydrogen bomb and stellar energy).

UNIT V: THEORY OF PRACTICALS I

Titrimetry – terminology—basic requirements of a titration reaction. Primary and secondary standard. Preparation and requisites of a primary standard solution. Methods of expressing the strength of the solution – percentage, normality, molarity, molality and formality, volumetric principle – calculation of strength of solution.

Types of titrations –definition - principle and examples. Acid-base titrations-choice of indicators, -theory of acid-base indicators-benzenoid and quinonoid theory. Redox titrations involving self, internal and external indicators. Complexometric titrations - role of EDTA in complexometric titrations – indicators for EDTA titrations.

BOOKS FOR REFERENCE

1. Arun Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, S.Chand and Company Ltd., New Delhi-Revised edition-2008
2. B.R. Puri, L.R. Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers and distributors, Delhi, 2010.

3. Arun Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand and Company Ltd., Reprint 2005.
4. Vogel's text book of quantitative chemical analysis., ELBS/Longman England, 7th edition 1994.
5. B.S.Giri, D.N.Bajpai and O.P.Pandey, Practical Chemistry, S.Chand and Company Ltd., New Delhi, 6th Edition.

Semester –I			
Part III		Allied Mathematics I for I B.Sc. Chemistry	
Code :15UMAA11	Hrs/week :6	Hrs/Sem :90	Credits :5

Objectives

1. To introduce basics in Mathematics
2. To familiarize the learners of Mathematics to Algebra and Calculus

Unit I

Theory of equations-Transformation of equations - Approximate solutions of equations - Horner's method and Newton's method

Unit II

Matrices Consistency and solution of equations - Characteristic equation of a matrix, Eigen values and Eigen vectors – Cayley - Hamilton theorem and simple problems

Unit III

Curvature and Radius of Curvature –Cartesian and polar co - ordination - Centre of Curvature - Evolutes

Unit IV

Vector Differentiation - Gradient - Curl - Divergence

Unit V

First order differential equations of higher degree - Equations solvable for p,x,y - Clairauts form - Linear equations of second and higher order with constant and variable co - efficients - particular integrals of the form x^n , $e^{ax}f(x)$

Text Book

S.Arumugam&Issac, Allied Mathematics, New Gamma Publishing House, Palayamkottai

Reference Books

1. Narayanan S., Kandaswamy P., Hanumantha Rao R., Manicavachagom Pillay T.K., **Ancillary Mathematics Volume – I**, S.Viswanathan (Printers & Publishers), PVT., LTD., 2010
2. Narayanan S., Kandaswamy P., Hanumantha Rao R., Manicavachagom Pillay T.K., **Ancillary Mathematics Volume – II**, S.Viswanathan (Printers & Publishers), PVT., LTD., 2010

Semester-I	
Allied Paper 1: Angiosperm Taxonomy and Medicinal Botany(15UBOA11)	
4 Hrs / week	Credit 4

Objectives:

- To study the floral characters with an aim to identify the taxa.
- To know the importance of medicinal plant diversity.

Unit I:

Modification of plant parts: root (tap root), stem, leaf. Inflorescence-types, Fruits-simple- fleshy and dry (dry dehiscent and dry indehiscent fruit)-aggregate.

Unit II:

Concept of classification – Natural system- Bentham and Hooker. Vegetative , floral characters and economic importance of : Annonaceae, Rutaceae, Caesalpiniaceae.

Unit III:

Rubiaceae , Asclepiadaceae, Euphorbiaceae, Poaceae.

Unit IV:

Study of the following plants with reference to the morphology of the useful parts and their importance: *Aloe vera*, *Zingiber officinale*, *Piper nigrum*, *Gymnema sylvestre*.

Unit V:

Extraction methods and medicinal uses of *Eucalyptus*, Castor and Lemon grass oil
Conservation of medicinal plants-*in-situ* and *ex-situ* methods.

Reference Books:

1. John Jothi Prakash, E. 2001. Medicinal and Aromatic Plants, JPR Publications, Vallioor.
2. John Jothi Prakash, E., K. Venkataraman, 2001. The science of Medicinal Botany, JPR Publications, Vallioor.
3. Kokate C.F., A. P. Purohit & S.R. Gokhale, 2004. Pharmacognosy. Nirali Prakashan.
4. Pandey, B.P. 2000. Economic Botany, S. Chand & Co., New Delhi.
5. Shukla P. and Misra, S.P. 1997. An introduction to Taxonomy of angiosperms, Vikas Pub. House Ltd., New Delhi.
6. Vashista, P.C. 1985. Taxonomy of Angiosperms. S. Chand & Co., New Delhi.
7. Wallis, T. E. 2000. Test book of Pharmacognosy. CBS Publishers.

Practicals:

2Hrs/week

To make dissections and drawing of the floral parts of typical genus belonging to the families prescribed in the syllabus to bring out the salient features (Floral diagram and floral formula are expected).

To assign the given plant to its family giving reasons.

To identify and to record the medicinal value and morphology of the useful parts of the plant prescribed in the syllabus.

To maintain a record note book

SEMESTER II			
Part III	Core III		Inorganic Chemistry- I
Code :15UCHC21	Hrs./Week:4	Hrs/ Sem :60	Credits:4

OBJECTIVES:

- To know the importance of metallurgy.
- To study the chemistry of hydrogen and oxygen compounds.
- To understand theory of acids, bases and non-aqueous solvents.
- To acquire the knowledge of theory behind practicals.

UNIT I GENERAL PRINCIPLES OF EXTRACTION OF METALS

Minerals, ores and gangue -different steps of metallurgy – crushing and grinding of the ore – concentration of the ore – electromagnetic separation – gravity separation (Hydraulic Washing)– leaching process (Hydrometallurgy)– froth flotation process – calcination – roasting –difference between calcination and roasting – Pyrometallurgy (smelting) –Gold Schmidt’s aluminothermic process –Kroll’s process – flux and slag.Refining of impure metals – thermal refining-distillation, liquation –vapour phase refining- Van Arkel process, carbonyl process-electrolytic process- zone refining process. Extraction of manganese and nickel

UNIT II HYDROGEN AND OXYGEN COMPOUNDS

Hydrides: Definition, Classification, Preparation, Properties and Structure.

Hydrogen peroxide:Preparation -Manufacture(auto oxidation and electrolytic) –Methods of concentration- reactions and uses – expression of concentration of hydrogen peroxide - volume strength and related simple problems -- constitution of H₂O₂.

Ozone- Occurrence –laboratory preparation – Siemen’s ozoniser –Brodies commercial preparation – properties —uses.

UNIT III ACIDS AND BASES

Arrhenius concept – limitations – Bronsted - Lowry concept – proticity (Basicity) of an acid – hydroxity (Acidity) of a base –levelling concept, Lux Flood concept,Cady-Elsey concept, Lewis concept – relative acidity of Hy molecules. Pearson’s principle of hard and soft acids and bases (HSAB). Theories of hardness and softness – applications of HSAB theory(relative

stabilities of compounds-occurrence of minerals-course of reactions-poisoning of metal catalysts-rate of chemical reactions).

UNIT IV REACTIONS IN NON-AQUEOUS SOLVENTS

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

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

Liquid SO_2 as non aqueous solvent – reason. Reactions- precipitation, neutralization, solvolysis, complex formation and redox reactions. Advantages and disadvantages of liquid SO_2 as a solvent.

UNIT V THEORY OF PRACTICALS II

Inorganic qualitative analysis - basic ideaTypes of radicals - simple and interfering radicals Common ion effect and solubility product -definition - applications in inorganic qualitative analysis.

Analysis of anions: Tests with equations –sulphide, sulphate, nitrate (brown ring test), bromide and iodide (silver nitrate test), chloride and chromate (chromyl chloride test), oxalate and fluoride (calcium chloride test), borate (ethyl borate test), phosphate (ammonium molybdate test).

Need for eliminating interfering radicals –methods of elimination of various radicals.

Analysis of Cations : Tests with equations – lead, copper, cadmium, antimony, bismuth, cobalt, nickel, manganese, zinc, barium, strontium, calcium, magnesium and ammonium.

BOOKS FOR REFERENCE

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

4. Sathyaprakash and R.D.Madan, Advanced Inorganic Chemistry Volume I, S.Chand and Company, New Delhi. 2005,
5. S.Giri, D.N.Bajpai and O.P.Pandey, Practical chemistry, S.Chand and Company Ltd., New Delhi. 6th Edition.

SEMESTER- II			
Part III	Core IV		Organic Chemistry I
Code :15UCHC22	Hrs./Week:4	Hrs/ Sem: 60	Credits:4

OBJECTIVES:

- To know the importance of halogen and hydroxy compounds.
- To study the mechanism of specific reactions.
- To understand the properties of carbonyl, carboxyl and nitrogen compounds.

UNIT: I ALKENES AND ALKYNES

Alkenes- Oxidation reactions of alkenes- hydroxylation-oxidative degradation –epoxidation – ozonolysis – polymerisation reaction. Dienes: classification with examples. 1,3 butadiene- preparation – properties-mechanism of addition reactions – polymerisation – Diels-Alder reaction.

Alkynes : Terminal and non terminal alkynes. Acidic nature of acetylenic hydrogen atom – alkylation-oxidation reaction polymerization – Isomerisation.

UNIT II ALIPHATIC HALIDES

General methods of preparation and properties of monohalogen derivatives – preparation and properties of chloroform, bromoform, iodoform, vinyl and allyl chlorides and their comparative reactivity – preparation and uses of westron, westrosol, freon and chloroprene. Role of chlorofluorocarbon in environmental degradation.

UNIT III ALIPHATIC ALCOHOLS AND ETHERS

General methods of preparation and properties of mono hydric alcohols – distinction between primary, secondary and tertiary alcohols – (Lucas test, catalytic dehydrogenation, oxidation, Victor - Meyer's test). Interconversion of primary, secondary and tertiary alcohols. Ascent and descent in the series of alcohols.

Preparation and properties of di and trihydric alcohols (ethylene glycol and glycerol) – derivatives of glycerol – nitroglycerine, blasting gelatin, cordite and dynamite. Unsaturated alcohols – preparation and properties of allyl and crotyl alcohols.

Ethers of industrial importance – Preparation properties and uses of oxirane, and dioxane– Estimation of the number of methoxy groups in a compound (zeisel's method)

UNIT IV - ALIPHATIC CARBONYL AND CARBOXYL COMPOUNDS

Carbonyl compounds: Reactivity of carbonyl group-relative reactivities of aldehydes and ketones-Mechanism of nucleophilic addition reactions (HCN,NaHSO₃, Grignard reagent)-mechanism of aldol condensation, cross aldol condensation, Cannizaro reaction and crossed Cannizaro reaction-oppenauer oxidation-clemmenson reduction-Wolff-Kishner reduction.

Carboxylic acids– stability of carboxylate ion – relative strength of monocarboxylic acid – effect of substituents on acidity– Hell-Volhard-Zelinsky reaction. Unsaturated acid – preparation and properties of acrylic acid, crotonic acid. Dicarboxylic acid – formation of anhydrides and cyclic ketones – Blanc's rule.

UNIT V ALIPHATIC NITROGEN COMPOUNDS

Aliphatic nitrogen compounds – alkyl nitriles and isonitriles – preparation and reactions of aliphatic nitriles and aliphatic isonitriles – distinction between nitroalkanes and alkyl nitrites-preparation and reactions of aliphatic cyanates— reduction reaction of nitroalkanes – Nef reaction.

Aliphatic amines – separation of mixture of amines (Hofmann and Hinsberg method) – comparison of 1°, 2° and 3° amines – Hofmann mustard oil reaction – Mannich reaction – ascending and descending of amines.

BOOKS FOR REFERENCE

1. I.L. Finar, Organic Chemistry, Volume 1, The Fundamental Principles, 6th Edition, 1973.
2. M.K.Jain and S.C. Sharma, Modern Organic Chemistry, Vishal Publishing Company, 2008.
3. Arun Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand and Company Ltd., Reprint 2005.
4. K.S. Tewari, N.K.Vishnoi, S.N. Mehrotra, A Text Book of Organic Chemistry, 2nd Revised Editions, 1998.

Semester –II			
Part III Allied Mathematics II for I B.Sc. Chemistry			
Code :15UMAA21	Hrs/week :6	Hrs/Sem :90	Credits :5

Objectives

1. To introduce the students to Differential Equations
2. To familiarize the learners of Mathematics to Integration and Vector Integration

Unit I

Partial differential equation –first order formation - types of solutions - four standard forms - Lagrange’s form

Unit II

Laplace transforms - inverse Laplace transform - application to solution of differential equations (except simultaneous equations)

Unit III

Jacobian- Vector integration – line integral

Unit IV

Verification of Green’s , Stoke’s and Gauss Divergence theorems (simple problems only).

Unit V

Evaluation of integrals using Beta and Gamma functions

Text Book

S.Arumugam and Issac, Allied Mathematics, New Gamma Publishing House, Palayamkottai

Reference Books

1. Narayanan S., Kandaswamy P., Hanumantha Rao R., Manicavachagom Pillay T.K., **Ancillary Mathematics Volume – I**, S.Viswanathan (Printers & Publishers), PVT., LTD., 2010
2. Narayanan S., Kandaswamy P., Hanumantha Rao R., Manicavachagom Pillay T.K., **Ancillary Mathematics Volume – II**, S.Viswanathan (Printers & Publishers), PVT., LTD., 2010

Semester-II	
Allied: Plant Biotechnology (15UBOA21)	
4 Hrs / week	Credit 4

Objectives:

- To provide an opportunity in acquiring knowledge in plant biotechnology.
- To motivate the students to be self-employed.

Unit I:

Plant Biotechnology - definition and scope . External morphology, mass cultivation and utilization of *Nostoc* as biofertilizer. Single cell protein. - *Spirulina* Structure , mass cultivation and uses. Yeast as SCP- Production of Baker's yeast

Unit II:

Morphology of commercially cultivated mushrooms *Agaricus bisporous* and *Volvariella volvacea* –Nutritional and medicinal values of mushrooms- Mushroom culture media- PDA, MGYP media- Sterilization techniques- maintenance and storage of cultures. Cultivation methods. Storage and importance of mushrooms .

Unit III:

Genetic engineering – isolation of specific genes from cell DNA and mRNA, restriction endonucleases Type II, exonuclease and ligases, cloning vectors- P^{BR} 322, Ti- plasmid –Structure - *Agrobacterium* mediated gene transfer in plants.

Unit IV

Fermentation – Structure and mode of operation of stirred tank bioreactor. – Industrial production of ethanol and penicillin-Biogas production - KVIC biogas plant-uses.

Unit V:

Plant tissue culture – Introduction, totipotency, differentiation – dedifferentiation and redifferentiation. Explants – selection and sterilization, inoculation, incubation, subculture, regeneration of plants from callus, organogenesis, embryogenesis, hardening (general)

Reference Books:

1. Dubey, R.C. 2004. Textbook of Biotechnology, S. Chand & Company, New Delhi.
2. Gupta, P.K. 1988. Elements of Biotechnology, Rastogi publications, Meerut.
3. Islam, A.S. 1996. Plant tissue culture, Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi.
4. Kalia Kumar De, 1992. Plant Tissue culture, New central book agency, Calcutta.
5. Kumar, H.D. 1993. Molecular Biology and Biotechnology, Vikas Publishers, New Delhi.
6. Kumaresan, V. 2005. Biotechnology, Saras Publication, Nagercoil.
7. Mitra, S. 1996. Genetic engineering, Macmillan India Ltd., Delhi.
8. Razdan, M.K. 1993. An Introduction Plant tissue Culture, Oxford & IBH Publishing Colours, New Delhi.
9. Reinert J., M. Yeomen 1983. Plant cell and tissue culture, Narosa publishing house, New Delhi.
10. Singh, B. D. 1998. Biotechnology, Kalyani publishers, Ludhiana.

Practicals:

2Hrs/week

Demonstration only

1. Mass production of *Nostoc*
2. Mass production of *Spirulina*
3. Structure of White button mushroom- *Agaricus bisporous*
4. Cultivation of White button mushroom- *Agaricus bisporous*
5. Plasmid - pBR 322
6. Ti - Plasmid (octopine)
7. Agrobacterium mediated gene transfer in plants
8. Structure of KVIC Biogas plant
9. Stirred tank fermentor
10. Cleaning and sterilization of glasswares.
11. Callus culture

SEMESTER I & II			
Major Practical I			
Code : 15UCHPR1	Hrs/Week : 2	Hrs/ Sem : 30	Credits : 2

INORGANIC QUANTITATIVE ANALYSIS (VOLUMETRIC METHODS)

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

TITRIMETRIC QUANTITATIVE ANALYSIS:

	Substance to be estimated	Primary Standard
I Acidimetry and alkalimetry.	1. NaOH/ Na ₂ CO ₃	Na ₂ CO ₃
	2. HCl/H ₂ SO ₄	Oxalic acid
II Permanganometry	3. Na ₂ C ₂ O ₄	Oxalic acid
	4. Fe ²⁺	Mohr's Salt
III Dichrometry - External indicator method	5. Fe ²⁺	Mohr's Salt
	6. CuSO ₄	K ₂ Cr ₂ O ₇
IV Iodometry	7. Zn ²⁺	ZnSO ₄ .7H ₂ O
V Complexometry	8. Mg ²⁺	MgSO ₄ .7H ₂ O
	9. Mn ²⁺	MnSO ₄ .H ₂ O
	10. Ni ²⁺	ZnSO ₄ .7H ₂ O

VI Course work (Not for external examination)

1. Estimation of acetic acid in vinegar samples.
2. Estimation of oxalate content in vegetables and fruits such as tomato, guava, grapes, etc.

BOOKS FOR REFERENCE

1. Vogel's text book of quantitative chemical analysis. 7th edition, ELBS/Longman England, 1994.
2. S.Giri, D.N.Bajpai and O.P.Pandey, Practical chemistry, 6th Edition, S.Chand and Company Ltd., New Delhi.
3. J. N. Gurtu and R. Kapoor, Advanced Experimental Chemistry Volume II, S.Chand & Company Ltd.
4. Thomas A. O., Practical Chemistry for B Sc. Main students, Scientific Book centre, Cannanore.

SEMESTER- III			
Part III	Core V	Physical Chemistry- I	
Code :15UCHC31	Hrs./Week:4	Hrs/ Sem 60	Credits:4

OBJECTIVES:

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

UNIT I GASEOUS STATE

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

UNIT II SOLID STATE

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

UNIT III COLLOIDS

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

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

UNIT IV COLLIGATIVE PROPERTIES

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

UNIT V PHASE RULE

Mathematical statement – definition of terms used – thermodynamic derivation – application of phase rule to one component system – water, CO₂, sulphur – two component systems – condensed system and reduced phase rule – simple eutectic – Ag-Pb system – Pattinson's process of desilverisation of lead. Freezing mixture -definition– principle of formation of freezing mixture using KI-H₂O system.

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

Solid – Vapour equilibria – CuSO₄.H₂O system – explanation of deliquescence and efflorescence on the basis of vapour pressure.

BOOKS FOR REFERENCE

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

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

Part III - ALLIED PHYSICS – PAPER I - 15UPHA31

Hrs/Week:4	Credits:4
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Objectives:

- To study about elasticity and bending moment
- To know about surface tension and viscosity and to study Bernoulli's theorem
- To study mean free path and transport phenomena
- To determine thermal conductivity of the bad conductor and specific heat capacity of liquid
- To have a knowledge about physical optics

Unit I: Elasticity

Elastic moduli – Work done in shearing strain – Relation between elastic constants – Twisting couple on a cylindrical wire – Expression for couple per unit twist – Torsion pendulum – Experiment to determine the rigidity modulus of a wire using Torsion pendulum.

Unit II: Bending moment

Bending of beams – Expression for bending moment - Theory of uniform bending – Expression for elevation in uniform bending – Experiment to find young's modulus using microscope – Non- uniform bending – Expression for depression – Experiment to find young's modulus using scale and telescope.

Unit III: Surface tension & Viscosity

Surface tension – Excess of pressure over a curved surface –Coefficient of viscosity and its dimension –Experiment to determine the coefficient of viscosity of a highly viscous liquid (Stoke's) – Rate of flow of liquid through a capillary tube by dimension method and by Poiseuille's method – Analogy between current flow and liquid flow.

Unit IV: Thermal Physics

Mean free path – expression for mean free path – Transport phenomena – Expression for viscosity, thermal conductivity and diffusion – Thermal conductivity - Lee's disc experiment to determine the thermal conductivity of a bad conductor – Newton's law of cooling – Determination of specific heat capacity of a liquid.

Unit V: Interference and diffraction

Young's double slit experiment – Condition for interference –Additional phase difference due to dissimilar reflections – Colour of thin film – Air wedge –Thickness of a wire –

Fresnel and Fraunhofer diffraction – Plane transmission grating - Experiment to find wavelength by normal incidence method – Distinction between interference and diffraction bands.

Book for study:

1. Allied Physics – A. Ubald Raj & G. Jose Robin

Books for reference:

1. A text book of Optics – Brijlal & Subramanian (S. Chand & Co)
2. Properties of matter – D. S. Mathur 1992 Shyamalal charitable trust, Ram nagar
3. Properties of matter – R. Murugesan, Revised edition 2008, S. Chand & Co. Ltd.
4. Fundamentals of Physics - David Halliday & Roberresnik & Jeul Walker, John Wiley & sons Inc.

SEMESTER III			
Part IV	Skill Based Elective	Basic Computer Techniques in Chemistry	
Code :15UCHS31	Hrs./Week:2	Hrs/ Sem 30	Credits:2

OBJECTIVES

- To impart computer knowledge to chemistry students.

UNIT I MS WORD

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

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

UNIT II MS EXCEL

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

UNIT III MS POWERPOINT

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

UNIT IV E-MAIL AND INTERNET

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

UNIT V CHEMISTRY RELATED WEBSITES

A brief study of Websites and softwares related to chemistry.

Drawing simple chemical structures using Chemdraw and Chem finder

REFERENCES

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

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

OBJECTIVES:

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

UNIT I ALICYCLIC COMPOUNDS AND CONFORMATIONAL ANALYSIS

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

UNIT II TAUTOMERISM AND MOLECULAR REARRANGEMENT

Resonance – definition – resonance energy – resonance theory.

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

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

UNIT III CARBOHYDRATES

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

UNIT IV ORGANOMETALLIC COMPOUNDS AND REAGENTS OF SYNTHETIC IMPORTANCE

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

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

UNIT V REACTIVE METHYLENE COMPOUNDS AND DYES

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

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

BOOKS FOR REFERENCE

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

SEMESTER IV

Part III - ALLIED PHYSICS – PAPER II - 15UPHA41

Hrs/Week:4	Credits:4
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Objectives:

- To study about Coulomb's law & Gauss law and its applications
- To determine self inductance using Ballistic Galvanometer
- To derive Schrodinger's equation and to know uncertainty principle
- To understand logic gates as universal building blocks
- To study about solar energy and its applications

Unit I: Electrostatics

Coulomb's law – Electric field and field intensity – Electric field due to point charge – Electric dipole – Electric flux – Gauss law – Applications – Electric field due to a charged conducting sphere (point inside and point outside) – Uniformly charged cylinder (line charge) – Electric potential – Potential difference – Relation connecting electric field and electric potential at a point – Equipotential surface .

Unit II: Electromagnetism

Faraday's laws of induction – Induced current and charge – Self induction – Self inductance of torroidal solenoid - Determination of self inductance using Rayleigh method – Mutual inductance – Coefficient of coupling – Determination of mutual inductance using B.G.

Unit III: Relativity and Wave mechanics

Frame of reference – Galilean transformation – Postulates – Lorentz transformation –De Broglie's theory of matter waves – De Broglie wavelength – Wave function –Postulates of quantum mechanics – Schrodinger wave equation – Time dependent form.

Unit IV: Digital electronics

Binary numbers – Conversion of decimal number into binary number – Binary to decimal – Binary addition – Multiplication –Subtraction by 2's complement – Basic logic gates - OR , AND, NOT, NOR, NAND gates – De Morgan's laws – Boolean equations and logic circuit from truth table – NOR and NAND gates as universal building blocks –Binary adder – Half adder.

Unit V: Energy Physics

World's reserve of commercial energy source and their availability – Various forms of energy – Conventional and non conventional energy sources – Solar energy – Photo voltaic effect – Photo voltaic cells – Conversion of solar energy into electricity – Solar cells – Solar heaters – Wind energy – Power of wind – Wind mill – Wind farms – Energy crisis and possible solutions – Global warming.

Books for study:

1. Allied Physics – A. Ubald Raj & G. Jose Robin
2. Modern Physics – R. Murugesan

Books for reference:

1. Solar energy Utilization - G. D. Rai, Khanna Publishers, V edition, 7th reprint 2008.
2. Electricity & Magnetism – Brijlal N. Subramanian, Published by Ratan Prakashan Mandir, 14th revised edition, (1985).
3. Electricity and magnetism – K. K. Tewari, Published by Sultan chand & Co, Reprint-2nd edition-1994.
4. Integrated Electronics - Milman and Taub, International student edition, (TMH)

ALLIED PHYSICS - PRACTICALS - 15UPHAR1

Any 12 experiments

1. Young's modulus – Uniform bending – Pin and microscope
2. Young's modulus – Non-uniform bending – Scale and telescope
3. Rigidity modulus – Torsion pendulum
4. Specific heat capacity of liquid – Newton's law of cooling
5. A. C. frequency – Sonometer
6. Spectrometer – Dispersive power of the prism
7. Spectrometer – Grating – Oblique incidence
8. Air wedge – Thickness of a wire
9. Potentiometer – Calibration of voltmeter by standardization method
10. Potentiometer – Calibration of Ammeter
11. Characteristics of Zener diode
12. Basic logic gates – OR, AND and NOT
13. Series resonance circuits
14. Parallel resonance circuits
15. Co-efficient of viscosity – Stoke's method
16. Surface tension – Capillary rise method.
17. Compound pendulum - g

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

OBJECTIVES

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

UNIT I CLASSIFICATION AND METABOLISM OF DRUGS

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

UNIT II CAUSES OF COMMON DISEASES AND THEIR TREATMENT BY DRUGS

Common diseases and their treatment:

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

Important Indian medicinal plants and trees and their uses:

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

UNIT III CLINICAL CHEMISTRY

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

UNIT IV BLOOD PRESSURE AND CARDIO VASCULAR DRUGS

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

UNIT V DIABETES AND SOME COMMON DRUGS

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

Books for References

- I. Text Book of pharmaceutical chemistry Jayashree Ghosh —S.Chand and company
New Delhi , 2003
2. Pharmaceutical chemistry-Dr.S. Lakshmi, Sultan Chand & Sons, NewDelhi, Edition 2004
3. Medicinal chemistry- Ashutosh Kar New age International (P) Limited, Publishers,
New Delhi , 1997
4. General Organic & Biochemistry — Bettelheim Brown, Campbell and Farrell, Books/cole
Cengage Learning, Publishers India Edition.
- 5.Fundamental Concepts of Applied chemistry Jayashree Ghosh , S.Chand and Company,
New Delhi. 2006

SEMESTER III & IV			
Core Practical II		Inorganic Qualitative Analysis	
Code :15UCHCR2	Hrs/Week : 2	Hrs/ Sem : 30	Credits : 1

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

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

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

Anions:

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

Cations :

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

BOOKS FOR REFERENCE

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

SEMESTER V			
Part III	Core VII	Organic Chemistry III	
Code :15UCHC51	Hrs/Week : 5	Hrs/ Sem : 75	Credits : 5

OBJECTIVES:

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

UNIT I STEREOISOMERISM

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

UNIT II AROMATICITY AND AROMATIC SUBSTITUTION:

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

UNIT-III HYDROXY AND NITROGEN COMPOUNDS

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

Nitro compounds – preparation of o-, and p-dinitrobenzene, trinitrobenzene (TNB), m-nitrotoluene, trinitrotoluene (TNT) amines – effect of substituents (-NH₂, -CH₃, -NO₂, -SO₃H, -COOH and -X,) on the basicity of aromatic amines. Preparation and properties of o-, p- and m-phenylene diamines. Diphenyl amines and triphenyl amines. Diazonium compounds – preparation of benzene diazonium chloride and its synthetic applications.

UNIT IV AROMATIC CARBONYL COMPOUNDS AND CARBOXYLIC ACIDS

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

UNIT V GREEN CHEMISTRY

Introduction – need for green chemistry – twelve principles of green chemistry – green chemistry in day-to-day life – dry cleaning, versatile bleaching agent – atom economy – green solvents – supercritical fluid CO₂, ionic liquids and water

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

BOOKS FOR REFERENCE :

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

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

SEMESTER V			
Part III	Core VIII	Physical Chemistry II	
Code :15UCHC52	Hrs/Week : 5	Hrs/ Sem : 75	Credits : 5

OBJECTIVES:

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

UNIT I THERMODYNAMICS I

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

UNIT II THERMODYNAMICS II

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

UNIT III THERMODYNAMICS III

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

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

UNIT IV CHEMICAL KINETICS

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

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

UNIT V NANOCHEMISTRY

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

BOOKS FOR REFERENCE

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

SEMESTER V			
Part III		Core Elective I Co-ordination and Bio-Inorganic Chemistry	
Code :15UCHE51	Hrs/Week : 4	Hrs/ Sem : 60	Credits: 4

OBJECTIVES:

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

UNIT I CO-ORDINATION COMPOUNDS I

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

UNIT II CO-ORDINATION COMPOUNDS II

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

UNIT III REACTION MECHANISM IN CO-ORDINATION COMPOUNDS

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

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

UNIT IV METAL CARBONYLS

Definition – low oxidation state of metal ion in metal carbonyls – classification of carbonyls- based on the number of metal atoms present in carbonyl- based on the structure of carbonyls -General methods of preparation, properties of transition metal carbonyls. Nature of M-CO bonding in metal carbonyls. Evidence for back bonding. Structure of carbonyls on the basis of VB theory. Structure and bonding in metal carbonyls of mono, bi nuclear and poly nuclear carbonyls of Ni, V, Cr, Fe, Co and Mn [(Ni(CO)₄), V(CO)₆, Fe(CO)₅, Cr(CO)₆, Co₂(CO)₈, Fe₂(CO)₉, Mn₂(CO)₁₀, and Fe₃(CO)₁₂] .

UNIT V BIO-INORGANIC CHEMISTRY

Role of metal ion in living systems (excess and deficiency of trace metals) – metallo-proteins, metallo-enzymes – characteristics of metallo-enzymes – characteristics of metal activated enzymes – functions of metal in enzymes – elementary idea of metallo-porphyrins. Structure and function of haemoglobin, chlorophyll and vitamin B₁₂ . Function of Na/K pump. Applications of co-ordination compounds in medicine, industry, biological systems and analytical chemistry.

BOOKS FOR REFERENCE

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

SEMESTER V			
Part III	Core Elective II		Polymer Chemistry
Code :15UCHE52	Hrs/Week : 4	Hrs/ Sem : 60	Credits : 4

Objectives :

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

UNIT I INTRODUCTION TO POLYMERS

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

UNIT II PROPERTIES OF POLYMERS

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

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

UNIT III POLYMERIZATION AND POLYMERIZATION TECHNIQUES

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

UNIT IV POLYMER REACTIONS

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

UNIT V SOME IMPORTANT SYNTHETIC RESINS AND POLYMERS

Outline of synthesis and their uses of the following

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

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

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

Biomedical Applications of polymers.

Books For Reference

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

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

OBJECTIVES

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

UNIT I PETRO CHEMICALS

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

UNIT II CORROSION AND PROTECTIVE COATING

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

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

UNIT III RUBBER INDUSTRY AND FIBRES

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

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

UNIT IV FATS, OILS AND WAXES:

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

Waxes – definition, manufacture and classification.

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

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

UNIT V FOOD INDUSTRY

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

BOOKS FOR REFERENCE

1. Jayashree Ghosh, Fundamental concepts of Applied chemistry Edition 2006, S. Chand & company Ltd New Delhi
2. Harish Kumar Chopra, Anupama Parmar, Engineering Chemistry Narosa Publishing House New Delhi.
3. K.Bagavathi Sundari Applied Chemistry Mjp publishers, Tamil Nadu Book House Chennai
4. B.S.Bahl, Arun Bahl, Advanced Organic chemistry –S.Chand & company.
5. Siva sankar B., Food processing and preservation Prentice–hall of India Pvt., ltd New Delhi 2002.

SEMESTER V	
Part IV Self study	Chemistry For Competitive Examination
Code :15UCHSS1	Credits : 1

Objective: To train students for competitive examinations

UNIT I MATTER

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

UNIT II STRUCTURE OF ATOMS

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

UNIT III CLASSIFICATION OF ELEMENTS AND PERIODICITY OF PROPERTIES

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

UNIT IV CHEMICAL BONDING AND NON - METALS

Need for the Chemical bond formation - introduction to ionic bond, covalent bond, coordinate bond and metallic bond - ionic bond formation - definition, and explanation using

NaCl, - covalent bond - definition and explanation using H₂, O₂, N₂, CH₄, Properties of ionic and covalent compounds Noble gases and their applications - Halogens and their applications preparation and uses of hydrogen, phosphorus and sulphur, Differences between diamond and graphite.- Fullerenes.

UNIT V AIR AND WATER

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

SEMESTER V	
Major Practical III	Gravimetry And Inorganic Preparation
Code : 15UCHCR3	Credits : 3

OBJECTIVE:

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

a) Gravimetric Analysis

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

b) Inorganic Preparations

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

Course work

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

BOOKS FOR REFERENCE

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

2. Vogel's text book of quantitative chemical analysis. 7th edition, ELBS/Longman England, 1994.

3. Arthur I. Vogel, A text book of quantitative inorganic analysis including elementary instrumental analysis, Longman Group Ltd. ELBS edition, 1975

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

OBJECTIVE:

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

UNIT I ZERO GROUP ELEMENTS

Position of zero group in the periodic table – Ramsay- Rayleigh’s method – Fisher-Ringe’s method – separation of noble gases from liquid air –compounds of xenon – preparation, properties and structure (valence bond approach) of XeF₂, XeF₄, XeF₆, XeO₂F₂, XeO₃, XeO₄, XeOF₄, clathrates- type of clathrates –preparation, stability and structure of clathrates. Wrap around complexes (supra molecules).

UNIT II s and p- BLOCK ELEMENTS

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

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

UNIT III d- BLOCK ELEMENTS I

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

UNIT IV d- BLOCK ELEMENTS II

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

Iron - Preparation and uses of Ferric chloride, Potassium ferro and ferricyanides

Cobalt - Extraction, properties and uses – Preparation and uses of sodium cobaltinitrite

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

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

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

.UNIT V f- BLOCK ELEMENTS

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

BOOKS FOR REFERENCE

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

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

OBJECTIVES:

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

UNIT I ORGANIC PHOTOCHEMISTRY

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

UNIT II POLY NUCLEAR HYDROCARBONS

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

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

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

UNIT III HETEROCYCLIC COMPOUNDS

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

UNIT IV - ALKALOIDS AND TERPENOIDS

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

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

UNIT V ORGANIC SPECTROSCOPY

UV Spectroscopy – Chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic and hypochromic effect – instrumentation- types of electronic transitions – forbidden and allowed transitions. Woodward-Fieser rule for calculation of absorption maxima of dienes and α, β unsaturated ketones .

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

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

BOOKS FOR REFERENCE

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

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

OBJECTIVES

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

UNIT I GROUP THEORY

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

UNIT II ELECTROCHEMISTRY - I

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

UNIT III ELECTROCHEMISTRY - II

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

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

UNIT IV CHEMICAL REACTIONS UNDER LIGHT AND SOUND

Photochemistry – Beer-Lambert law(derivation)– photochemical rate law – Grotthus – Draper law, Stark – Einsteins law of photochemical equivalence – quantum yield – validity of Einstein's law – reason for low and high quantum yield – determination of quantum yield using actinometer – flash photolysis.. Kinetics of decomposition of HI – combination of H_2 and Cl_2 reaction. Photophysical processes – explanation of fluorescence and phosphorescence using Jablonski diagrams. Luminescence – chemiluminescence – thermoluminescence – bioluminescence. **Sonochemistry** – Definition , principle-cavitation-sonoluminescence and applications.

UNIT V SOLUTION

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

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

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

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

BOOKS FOR REFERENCE

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

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

OBJECTIVES

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

UNIT I SEPARATION AND PURIFICATION TECHNIQUES

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

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

UNIT II COLORIMETRY AND SPECTROPHOTOMETRY

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

UNIT III SPECTROSCOPY

Types of molecular spectra. Micro wave (rotational) spectra – theory – instrumentation and applications in the determination of bond distances in diatomic molecules –microwave oven. Vibrational (IR) spectra – theory – modes of vibrations – instrumentation – applications in the

determination of bond strength. Raman spectra – theory – instrumentation and Mutual exclusion principle – applications to CO₂ and HCN molecules. NMR spectra – theory – instrumentation – Magnetic Resonance Imaging. Types of NMR spectra .Atomic Absorption Spectra – basic principle only.

UNIT III THERMO ANALYTIC METHOD

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

UNIT V ANALYTICAL TREATMENT OF EXPERIMENTAL DATA

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

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

BOOKS FOR REFERENCE

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

SEMESTER VI			
Major Practical IV Organic Analysis And Organic Preparations			
Code : 15UCHCR4	Hrs/Week : 3	Hrs/ Sem : 45	Credits : 3

OBJECTIVE:

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

1. Organic Analysis:

Analysis of simple organic compounds

- Nature of the compound- Aromatic / Aliphatic
- Test for saturation/ unsaturation.
- Detection of element present/ absent
- Characterization of functional groups (Acids, amide, amines, phenol, aldehyde, ketone, anilide, ester, carbohydrates , nitro compounds), Confirmation by preparation of a solid derivative.

2. Preparation of Organic compounds involving the following chemical conversions

- Oxidation
- Hydrolysis
- Nitration
- Bromination
- Diazotization
- Benzoylation
- Osazone formation

3.Course work

Organic Estimation and separation

- Estimation of Phenol/Aniline
- Determination of physical constants

BOOKS FOR REFERENCE

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

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

OBJECTIVE:

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

LIST OF EXPERIMENTS:

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

BOOKS FOR REFERENCE

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