DEPARTMENT OF CHEMISTRY

B.Sc. Chemistry

U.G. PROGRAMME

SYLLABUS

Effective from the Academic Year 2012-2013

Loyola College (Autonomous)

Chennai- 600 034

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI - 600 034.

SEMESTER	Course	2012-2013	Title of the Paper	h/Cr	Page
I	MC	CH-1505	Analytical Chemistry	3/3	1
		CH-1506	Basic Concepts in Inorg.Chemistry	3/3	3
		CH-1507	**Vol Anal &Inorg. Prep Practicals**	**3/3**	**5**
	AR-1 To Chem Dept	MT-1102	Maths for Chemistry	6/4	7
	AR-1 To other Depts*	CH-1100	Chemistry for Biologists-I	4/3	8
		CH-1101	**Chemistry for Biologist practicals-I**	**2/1**	**10**
II	MC	CH-2506	Chemistry of hydrocarbons	3/3	11
		CH-2507	Thermodynamics	3/3	13
		CH-2508	**Organic qualitative analysis**	**3/3**	**16**
	AR-2 To Chem Dept	PH-2105	Physics for Chemistry	4/3	17
		PH-2106	**Physics for Chemistry practicals**	**2/1**	**18**
	AR-2 To other Depts*	CH-2104	General Chem for Maths& Physics	4/3	19
		CH-2105	**General Chem for Maths& Physics Practicals**	**2/1**	**21**
III	MC	CH-3506	Organic functional groups	3/3	22
		CH-3507	Main group elements & Solid state chemistry	3/3	25
		CH-3508	**Inorganic qualitative analysis**	**3/3**	**28**
	AO-1 To other Depts*	CH-3204	Chemistry for biologists-II	4/3	20
		CH-3205	**Chemistry practical for biologists-II**	**2/1**	**30**
	EG-1 To other Depts*	CH-3301	Chemistry in everyday life	3/1	31
IV	MC	CH-4504	Electrochemistry	3/3	33
		CH-4505	**Physical chemistry practicals**	**3/3**	**35**
		CH-4506	Computer applications for chemistry	3/3	36
	AO-2 To Other Depts	CH-4206	Gen Chemistry for Maths&Phys-II	4/3	38
		CH-4207	**Gen Chemistry Lab for Maths&Phys-II**	**2/1**	**40**
	EG-2 To other Depts*	CH-4302	Basic clinical & pharmaceutical chemistry	3/1	41
V	MC	CH-5510	Organo-Nitrogen compounds & stereochemistry	5/5	44
		CH-5511	Trans elem& nuclear chemistry	5/5	47
		CH-5512	Phase equilibria& kinetics	5/5	49
		CH-5513	Fundamentals of spectroscopy	5/5	52
		CH-5514	**Grav. Anal & Org. preparations**	**4/4**	**53**
	ES (Any two)	CH-5402	Polymer chemistry (or)	3/2	54
		CH-5403	Forensic chemistry		56
		CH-5404	Biochemistry (or)	3/2	57
		CH-5405	Agricultural chemistry		60
VI	**MS** Package-A or B	CH-6612	Molecular dynamics	4/5	62
		CH-6613	Coordination chemistry	4/5	64
		CH-6614	Chemistry of materials (Pack-A)	3/4	67
		CH-6615	Synthetic organic chemistry (Pack-A)	4/6	69
		CH-6616	Chemistry of Natural products (Pack-B)	3/4	71
		CH-6617	Industrial chemistry (Pack-B)	4/6	73
	SK CH-6650 or CH-6651 and CH-6652	CH-6650	Food chemistry + Food Chem.practical + Industrial exposure	13/13	75
		CH-6651	Chem. of consumer products + Chem of consumer products practicals + Industrial exposure	13/13	80
		CH-6652	Gen trends in Industrial Chem (Seminar & Report)	2/2	85
			TOTAL h/Cr (To ChemDept)	120/131	
			TOTAL h/Cr (To other Dept*)	24/14	

Dept of Chem., B.Sc (Chemistry)-Re Str. Syllabus effective from 2012-2013-**CONTENTS**

LOYOLA COLLEGE (AUTONOMOUS)
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Subject	Sem-I h/c	Sem-II h/c	Sem-III h/c	Sem-IV h/c	Sem-V
Allied required **AR** **1.5h = 1 Cr**	MT-1102 : Math.forChem 6/4	PH-2105: Phys for Chem4 /3 **PH-2106: Phys for Chem (Pract) 2/1**			
Allied optional **AO** **1.5hrs = 1 Cr**			**#** One AO from other Dept.(AO-1) 6/4 {Maths, PB or Zoo)	**#**One AO from other Dept.(AO-2)6/4 {Phys, PB or Zoo)	
Elective Subject **ES** (Two) **1.5h = 1 Cr**					**CH-5402 Polym** **CH-5403 Foren** **CH-5404 Bioch** **e** **CH-5405 Agri.C**
Major Core **MC** **1 h = 1 Cr**	CH-1505: Anal Chem. 3/3 CH-1506: Concepts in Inorg. Chem. 3/3 **CH-1507: Vol. Anal. Inorg. Prepn.- Pract3/3**	CH-2506: Hydrocarbons 3/3 CH-2507 : Thermodynamics 3/3 **CH-2508 :Org.Qual. Analysis** **3/3**	CH-3506: Organic Fn. Gp3/3 CH-3507: Main Gp& Solid State Chem. 3/3 **CH-3508 :Inorg. Qual.** **Anal** **3/3**	CH-4504: Electro chem. 3/3 **CH-4505:Phy.Chem** **Pract3/3** CH-4506: Comp. Appl. for Chem3/3	CH-5510:OrgNit &Stereo5/5 CH-5511:TransE Nucl. Chem5/5 CH-5512: Phase and Kinetics 5/5 CH-5513: Fund. **CH-5514:Gra.A** **Org.Preps4/4**
*Major Special **MS** **Package-A or B**					

1.5 h = 2 Cr					
*Skill Based **SK** **1 h = 1 Cr**					
Total	15/13	15/13	15/13	15/13	30/2

#Courses offered to other Departments:

AR-1:CH-1100,1101:Chem for biologists – I (Sem- I) **AO-1**: CH-3204, 3205:Biochem for Biologists – II (Sem-III)**EG-1**:CH-3301:Chem in Everyday Life (Sem-III) 3h/1c

AR-2:CH-2104,2105: Gen chem for Maths& Physics – I (Sem- II)**AO-2**: CH-4206,4207:General chem for Maths and Physics – II (Sem-IV) **EG-2**: CH-4302:Basic Cl&Pharm.Chem (Sem-IV) 3h/1c

Department of Chemistry

RESTRUCTURED SYLLABUS

B.Sc. (Chemistry)

(Effective from 2012-2013)

I-SEMESTER

CH-1505: ANALYTICAL CHEMISTRY

Semester – I No. of credits: 3

Course: Major Core (**MC**) No. of hours:3 h/wk

Objectives:

1. *To enable the student to develop the habit of handling analytical data.*
2. *To learn the principles of basic analytical methods and their applications.*

Unit-1: Handling of Chemicals and Data analysis (10 h)

1.1. *Safety and hygiene in the Chemistry Lab*

Storage and handling of chemicals, Handling of acids, ethers, toxic and poisonous chemicals.Antidotes, threshold vapour concentration and first aid procedure. MSDS, COSHH.

1.2. *Error in chemical analysis*

Accuracy and precision, Absolute and relative errors.Methods of eliminating or minimizing errors. Precision: mean, median, average deviation and coefficient of variation. Significant figure and its relevance.Normal error curve and its importance.

Unit-2: Separation and Purification Techniques (10 h)

2.1. *Chromatographic techniques and applications*

Principles of adsorption and partition chromatography: Column and Paper chromotography. TLC, ion-exchange chromatography - technique and applications.Gas chromatography, principle, detector and applications.

2.2. *General purification techniques*

Purification of solid organic compounds: recrystallisation, sublimation. Use of miscible solvents.Use of drying agents and their properties.Purification of liquids.Techniques of distillation.Chemical methods of purification and test of purity.

Unit-3: Titrimetric Methods of Analysis (10 h)

3.1. *General Principle*

Methods of expressing concentration of solutions.Types of titrations.Requirements for titrimetric analysis.Primary and secondary standards.Limitation of volumetric analysis.

3.2. *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 and choice of indicators.

3.3. *Complexometric titrations*

Stability of complexes.Titration involving EDTA. Metal ion indicators and their characteristics.

Unit-4: Solubility Equillibria (10 h)

4.1. *Precipitation titrations*

Concept of sparingly soluble salts.Relation between solubility and solubility products.Argentometric titrations, indicators for precipitation titrations involving silver nitrate.Determination of chloride by Volhard's method.Adsorption indicators.

4.2. *Gravimetric methods of analysis:*

Separation by precipitation.Factors affecting solubility, gravimetric factor.Purity of precipitates, von Weiman ratio. Co-precipitation and post precipitation. Precipitation from homogeneous solution.

Unit-5: Thermal Analysis (5 h)

5.1. Principle of thermogravimetric analysis (TGA). Differential thermal analysis (DTA): Instrumentation and applications.

5.2. Factors affecting TGA and DTA curves. TGA of $AgNO_3$, $CaC_2O_4.H_2O$ and DTA of sulphur.

Text Books :

1. R.A. Day and A.L. Underwood, *Quantitative Analysis*, 5th ed., Prentice Hall of India Private Ltd., New Delhi, 1988.
2. U. N. Dash, *Analytical Chemistry: Theory and Practice*, Sultan Chand and sons Educational Publishers, New Delhi, 2011.
3. B. R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 33rd ed., 1992.
4. R. Gopalan, P. S. Subramanian and K. Rengarajan, *Elements of Analytical Chemistry*, Sultan Chand, New Delhi, 2007.
5. S. Usharani, *Analytical Chemistry*, McMillan Publisher, 2000.

References :

1. D. A. Skoog, D. M. West and F. J. Holler, *Analytical Chemistry: An Introduction*, 5th ed., Saunders college publishing, Philadelphia, 1998.

2. H. Kaur *Instrumental Methods of Chemical Analysis* Pragati Prakashan, Meerut, 2010.
3. V.K. Srivastava, K.K. Srivastava, *Introduction to Chromatography: Theory and Practice*, S. Chand and Company, New Delhi, 1987.
4. A.K. Srivastava, P.C. Jain, *Chemical Analysis: An Instrumental Approach* for B.Sc. Hons. and M.Sc. Classes, S. Chand and Company Ltd., Ram Nagar, New Delhi, 2010.

CH-1506: BASIC CONCEPTS IN INORGANIC CHEMISTRY

Semester-I | No. of credits: 3

Course: Major Core (**MC**) | No. of hours: 3h/wk

Objectives :

1. *To know the arrangement of elements in the periodic table and the periodic properties.*
2. *To understand the different kinds of chemical forces in molecules.*
3. *To identify the nature of chemical bond in a given inorganic compound.*

Unit 1: Atomic Structure and Periodic Table (10 h)

1.1 *Electronic configuration*: Bohr theory, duel nature of electrons, Heisenberg uncertainty principle, Pauli's exclusion principle, Hund's rule, sequence of energy levels (Aufbau principle).

1.2 *Periodicity*: Periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number. Horizontal, vertical and diagonal relationships in the periodic table.

1.3 *Properties ofatoms*: Size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity-Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect. Atomic, molecular and equivalent weights; Avagadro's principle and mass-volume relationship.

Unit 2: Ionic bond (10 h)

2.1 Properties of ionic compounds, factors favoring the formation of ionic compounds-ionization potential, electron affinity, and electronegativity.

2.2 *Lattice energy(U_o)* : Born-Lande equation (derivation not required). Factors affecting lattice energy. Born-Haber cycle-enthalpy of formation (ΔH_f) of ionic compounds.Stability and solubility of ionic compounds of alkali- and alkaline earth metals on the basis of ΔH_f and U_o. Enthalpy of salvation and enthalpy of solution.

2.3 Covalent character of ionic compounds-Fajan's rules; effects of polarization-solubility, melting points, and thermal stability of typical ionic compounds.

Unit 3: Covalent Bond (12 h)

3.1 Lewis theory-Octet rule and its exception, electron dot structural formula; Sidgwick-Powell theory-prediction of molecular shapes; Valance Bond theory-arrangement of electrons in molecules. Hybridization and geometry of molecules.

3.2 VSEPR model-Effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity. Illustration of structures by VESPR model-NH_3, SF_4, ICl_4^-, ICl_2^-, XeF_4, XeF_6.

3.3 MO theory: 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; qualitative MO energy level diagram of homodiatomic molecules-H_2 to Ne_2 and their magnetic properties, bond order and stability of molecules.

Unit 4: Metallic and Weak Bonds (5 h)

4.1 *Metallic bond*: Metallic properties, band theory of metals; semiconductors: *n*- and *p*-type semiconductors.

4.2 *Weak bonds*: Hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O, and F compounds; crystalline hydrates and clathrates; van der waals forces, ion dipole-dipole interactions.

Self-study: *Properties of molecules exhibiting inter- and intramolecular hydrogen bonding. Compounds formed by London dispersive forces and van der Waals forces.*

Unit 5: Acids and Bases (8 h)

5.1 *Types of chemical reactions*: Acid-base, oxidation-reduction, electron transfer and double decomposition reactions. Balancing chemical reactions by oxidation number and ion-electron method.

5.2 *Theories of acids and bases*: Arrhenius theory of acids and bases in protic solvents. Bronsted-Lowry theory, Lewis theory, the solvent system.Lux-Flood definition and Usanovich definition.

5.3 *Nonaqueous solvents*: Classification-protonic and aprotic solvents. Liquid ammonia as solvent-solutions of alkali and alkaline earth metals in ammonia.

Self-study: *Common protic and aprotic nonaqueous solvents.Identification of acids and bases according to different definitions.*

Text Books:

1. J. D. Lee, *Concise Inorganic Chemistry*, 5th ed., Blackwell Science, London, 1996.
2. F. A. Cotton, G. Wilkinson and P. L. Guas, *Basic Inorganic Chemistry*, 3rd ed., John Wiley, 1994.
3. B. Douglas, D. McDaniel and J. Alexander, *Concepts and Models of Inorganic Chemistry*, 3rd ed., John Wiley, 1994.
4. B. R. Puri, L. R. Sharma, K. C. Kalia, *Principles of Inorganic Chemistry*, Shoban Lal Nagin Chand and Co., 1996.

References*:*

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, *Inorganic Chemistry*, 4th ed., Harper Collins, New York, 1993.
2. D. F. Shriver and P. W. Atkins, *Inorganic Chemistry*, 3rd ed., W. H. Freeman and Co, London, 1999.
3. T. Moeller, *Inorganic Chemistry: A Modern Introduction*, Wiley, New York, 1990.

CH-1507: **VOLUMETRIC ANALYSIS AND INORGANIC PREPARATIONS**

Semester – I | No. of credits: 3

Course: Major Core (**MC**) | No. of hours : 3h/wk

Objective

To enable the students to acquire the quantitative skills in volumetric analysis.

A. Volumetric Practicals

1. Calibration of volumetric apparatus: Burette, pipette and standard flasks.
2. Acid – base titrations:
   a. Estimation of HCl.
   b. Estimation of oxalic acid.
3. Redox titrations:
   a. Estimation of Ferrous ammonium sulphates (Permanganometry).
   b. Estimation of calcium (Permanganometry).
   c. Estimation of $KMnO_4$ (Iodometry).

d. Estimation of copper (Iodometry).

e. Estimation of Fe^{2+}-Fe^{3+} mixture using diphenyl amine (Dichrometry)

3. Complexometric titrations:

a. Estimation of calcium.

b. Estimation of magnesium.

B. Inorganic preparations

a. Preparation of Ferrous ammonium sulphate.

b. Preparation of tetraamminecopper(II) sulphate.

c. Preparation of potassium trioxalatoaluminate.

d. Preparation of potassium trioxalatochromate

Text books:

1. S. Sundaram and K. Raghavan, *Practical Chemistry* , S. Viswanathan Co. Pvt., 1996.
2. N. S. Ganapragasam and G. Ramamurthy, *Organic Chemistry – Lab manual*, S. Viswanathan Co. Pvt., 2002.

Reference:

1. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, *Vogel's Text Book of Practical Organic Chemistry*.5th ed., Pearson Education, 2005.

MT 1102: **MATHEMATICS FOR CHEMISTRY -I**	
Semester – I	No. of credits: 4
Course: Allied Required (**AR-1**)	No. of hours : 6h/wk

Objective:

To familiarize the applications of mathematics to chemistry.

Unit-1: Differentiation of standard functions-hyperbolic and inverse hyperbolic functions differentiation of one function with respect to another-slope-tangent and normal-maxima and minima-angle of intersection of curves in cartesian and polar coordinates

Unit-2: Methods of integration-integration by parts-Bernoulli's formula-properties of definite integrals-differential equations-second order differential equations with constant coefficients.

Unit-3: Application of binomial, exponential and logarithmic series to summation-eigenvalues and eigenvectors (differential calculus approach)-partial differential equations-all types.

Unit-4: Complex numbers- DeMoivre's theorem and applications-expansions of sin nθ, cos nθ, $\sin^n\theta$, $\cos^n\theta$, sinθ, cosθ-hyperbolic functions-Fourier series.

Unit-5: Probability-mean-standard deviation-Binomial, Poisson and normal distributions.

Text Books:

1. S.Narayanan, and T.K.Manickavachagam Pillai, *Calculus, Vol.I* and Vol. II, S.Viswanathan Printers & Publishers, 1996.
2. T.K.Manickavachagam Pillai, T.Natarajan. andK.S. Ganapathy, *Algebra*, *Vol* I, S.Viswanathan Printers & Publishers,1994.
3. S.Narayanan, *Trigonometry*, S.Viswanathan Printers & Publishers, 1995.
4. S.P. Gupta, *Elements of Statistics*, S.Chand & Co, 1986.
5. M.K.Venkataraman, *Engineering Mathematics*, *III-A*, The National Publishing Co.,1995.

References:

1. N.Shanthi ,*Differential Calculus*, S.Chand & Co., 1964.
2. P.R.Vittal,.*Trigonometry*, Margham Publications,1988.
3. P.Duraipandian, *Vector Analysis*, Emerald Publishers, 1984.

CH-1100: CHEMISTRY FOR BIOLOGISTS-I

(Offered to B.Sc. Zoology and Plant Biology)

Semester – I | No. of credits: 3

Course: Allied Required (**AR-1**) | No. of hours:4h/wk

Objective:

To enable the students to understand the concepts of chemistry.

Unit 1: Handling of chemicals and Data analysis (15 h)

1.1 *Storage and handling of chemicals*: Handling of acids, ethers, toxic and poisonous chemicals. Antidotes, threshold vapour concentration and first aid procedure.

1.2 *Errors in chemical analysis:* Accuracy, precision. Types of error-absolute and relative errors. Methods of eliminating and minimizing errors.

1.3 *Separation techniques*–Solvent extraction. Principle of adsorption and partition chromatography, column chromatography, thin layer chromatography (TLC), paper chromatography and their applications.

Unit 2: Chemical bonding (15 h)

2.1 *Ionic Bond*: Nature of Ionic bond. Structure of NaCl, KCl and CsCl. Factors influencing the formation of ionic bond.

2.2 *Covalent Bond*: Nature of covalent bond. Structure of CH_4, NH_3, H_2O based on hybridisation.

2.3 *Coordinate Bond*: Nature of coordinate bond. Coordination complexes.Werner's theory.Geometrical and optical isomerism in square planar and octahedral complexes. Mention of structure and functions of chlorophyll and hemoglobin

2.4 *Hydrogen Bond*: Theory and importance of hydrogen bonding. Types of hydrogen bonding.Hydrogen bonding in carboxylic acids, alcohol, amides, polyamides, DNA and RNA.

2.5 *van der Waal's forces*: Dipole – dipole and dipole - induced dipole interactions.

Unit 3: Volumetric analysis (10 h)

3.1 *Methods of expressing concentration*: normality, molarity, molality, ppm.

3.2 *Primary and secondary standards*: preparation of standard solutions

3.3 *Principle of volumetric analysis*: end point and equivalence points.

3.4 *Strong and weak acids and bases* - Ionic product of water , pH, pK_a, pK_b. Buffer solutions - pH of buffer solutions. Mention of Henderson equation & its significance.

Unit 4: Kinetics (10 h)

4.1 *Chemical Kinetics:* Rate, rate law, order and molecularity. Derivation of rate expressions for I and II order reactions.

4.2 *Catalysis*-Homogeneous and heterogeneous catalysis. Enzyme catalysis, enzymes in biological system and in industry.

Unit 5: Chemistry of biomolecules (10 h)

5.1 *Fats* – Occurrence and composition. Hydrolysis of fats.

5.2 *Vitamins* – Source, provitamin, properties and classification. Structure and function of vitamin A, C, D, K and E

5.3 *Hormones* – Thyroxin, adrenaline and sex hormones (structure and functions only)

Text Books:

1. R. Gopalan, S. Sundaram, *Allied Chemistry*, Sultan Chand and Sons, 1995.

2.U. Sathyanarayana, *Biochemistry*, Books and allied (p) Ltd, 1999.

3.B.R.Puri and L.R.Sharma, *Principles of physical chemistry*, Shoban Lal Nagin Chand and Co. 33rd ed., 1992.

References:

1.D.A. Skoog, D.M. West and F.J. Holler, *Analytical Chemistry: An Introduction*, 5th ed., Saunders college publishing, Philadelphia, 1990.

2.G.C. Hill, J.S. Holman, *Chemistry in Context*, ELBS, 1998

3.W.R. Kneen, M.J.W. Rogers, P. Simpson, *Chemistry – Facts, patterns and principles*, ELBS, 1999.

CH-1101: CHEMISTRY PRACTICAL FOR BIOLOGISTS-I

(Offered to B.Sc. Zoology and Plant Biology)

Semester – I | Credit: 1

Course: Allied Required(**AR-1**) | No. of hours :2h/wk

Objective:

To enable the students to understand the concept of organic analysis.

Organic Analysis:

a) Detection of N, S and halogens

b) Test for aliphatic and aromatic nature.

c) Test for saturation and unsaturation.

d) Nature and identification of the following functional groups

i) Carboxylic acid

ii) Phenols

iii) Aldehydes

iv) Ketones

v) Carbohydrates

vi) Primary amines

vii) Amides

Text Books:

1. N.S. Gnanapragasam and G. Ramamurthy, *Organic chemistry* – Lab manual, S. Viswanathan Co. Pvt. Ltd., 2002.

2. J.N. Gurtu and R. Kapoor, *Advanced Experimental Chemistry (Organic),* S. Chand and Co., 1987.

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II-SEMESTER

CH-2506: CHEMISTRY OF HYDROCARBONS

Semester – II | No. of credits: 3

Course: Major Core (**MC**) | No. of hours : 3h/wk

Objectives:

1. *To know the method of naming organic compounds*
2. *To learn various methods of preparation of hydrocarbons*
3. *To understand the mechanism of reactions of hydrocarbons.*

Unit 1: Nomenclature, Classification and Basic Properties (10 h)

1.1 Trivial and IUPAC nomenclature. Classification, Geometry of hydrcarbons.Hybridization.

1.2 *Cleavage of bonds*: Homolytic and heterolytic cleavages, bond energy, bond length and bond angle.

1.3 *Aromaticity and resonance*: Huckel's rule, Antiaromaticity, Mobius model.

1.4 *Electron displacement effects*: Inductive, inductomeric, electromeric, mesomeric, resonance, hyperconjugation and steric effects.

1.5 *Tautomerism:* Keto-enoltautomerism-Identification, acid and base catalysed inter conversion mechanism.Amido-imidol and nitro acinitro forms.

1.6 Stability of reaction intermediates, carbocation, carbanion, and free radicals.

Self-Study: *Comparison of stability of reaction intermediates*

Unit 2: Alkanes and Cycloalkanes (10 h)

2.1 *Alkanes*: Preparation by Wurtz reaction, reduction or hydrogenation of alkenes, Corey-House method, petroleum refining

Reactions: Mechanism of halogenation, free radical substitution, sulphonation, nitration, oxidation, cracking and aromatisation.

2.2 *Cycloalkanes*: Preparation using Wurtz reaction, Dieckmann's ring closure and reduction of aromatic hydrocarbons.

Reactions: Mechanism of substitution and ring-opening reactions. Baeyer's strain theory and theory of strain less rings.

Self Study: *Properties of alkanes and cycloalkanes, comparison of stability of ring compounds*

Unit 3: Alkenes (10 h)

3.1 *Alkenes*: General methods of preparation by dehydrogenation, dehydrohalogenation, dehydration, Hoffmann and Saytzeff rules, cis and trans eliminations.

Reactions: Mechanism of electrophilic and free radical addition, addition of hydrogen, halogen, hydrogen halide (Markownikoff's rule), hydrogen bromide (peroxide effect), sulphuric acid, water, hydroboration, ozonolysis, dihydroxylation with $KMnO_4$, allylic bromination by NBS.

3.2 Stability of alkenes and dienes (conjugated, isolated and cumulative dienes).

3.3 General methods of preparation, mechanism of dehydrohalogenation of dienes. *Reactions*: Mechanism of 1,2- and 1,4-additions, Diels-Alder reactions. Polymerization: addition polymerization, Ziegler Natta catalysed polymerization.

Unit 4: Alkynes (8 h)

4.1 *Preparation*: Mechanism of dehydrohalogenation and dehydrogenation.

4.2 *Reactions*: Acidity of alkynes, formation of acetylides, Mechanism of addition of water, hydrogen halides and halogens, oxidation, ozonolysis and hydroboration/oxidation.

Self-study: *Preparation and properties of higher order alkenes, dienes and alkynes. Examples ofpolymerization reactions*

Unit 5: Homocyclic Aromatic Hydrocarbons (7h)

5.1 *Benzene*: Extraction, industrial and laboratory preparations, purification.

Properties: Electrophilic substitution reactions, Nitration, sulphonation, halogenation, Friedel Crafts alkylation and acylation with mechanisms.

5.2 Di substitution reactions of aromatic compounds, orientation and reactivity.

5.3 *Polynuclear aromatic hydrocarbons*: Preparation and properties of naphthalene, anthracene and phenanthrene. Synthetic applications.

Self-study: *Preparation of disubstituted benzenes. Extraction of poly nuclear aromatic hydrocarbons*

Text books:

1. R. T. Morrison and R. N. Boyd, *Organic Chemistry*, 6th ed., Printice-Hall of India Limited, New Delhi, 1992.
2. B. Y. Paula, *Organic Chemistry*, 3rd ed., Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

3. T. W. Graham Solomons, *Organic Chemistry*, 6th ed., John Wiley and sons, 1996.

References:

1. J. March and M Smith, *Advanced Organic Chemistry*, 5th ed., John-Wiley and sons, 2001.
2. S. H. Pine, *Organic Chemistry*, 5th ed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
3. S. N. Ege, *Organic Chemistry, Structure and Reactivity*, 3rded., A.I.T.B.S., New Delhi, 1998.
4. H. Cram and Hammond, *Organic Chemistry*,3rd ed., McGraw-Hill, Kogakusha, Limited, 1970.
5. F. A. Carey, *Organic Chemistry*, 3rd ed., Tata-McGraw Hill Publications, New Delhi, 1999.
6. I. L. Finar, *Organic Chemistry, Vol-1,* 6th ed., Pearson Education Asia. 2004

CH -2507: **THERMODYNAMICS**

Semester – II | No. of credits: 3

Course: Major Core (**MC**) | No. of hours : 3h/wk

***Objective*:**

a) To understand the concepts of thermodynamics

b) To apply it to physical and chemical systems.

Unit-1: First law of thermodynamics and its applications (10 h)

1.1 *First law of thermodynamics*: Statement and the concept of internal energy & enthalpy- Exact & inexact differentials, state & path functions. Concept of ideal gas: Gas laws, Kinetic theory of gases – postulates and derivation of the equation PV = 1/3 mnc^2. Deviation from ideal behavior, van der Waals equation of state – Derivation, Virial equation of state

1.2 *Applications first law of thermodynamics to ideal gases*: Heat capacity, relation between C_P and C_V. Isothermal process: Change in internal energy, work done, $W_{(rev)}$ and $W_{(irrev)}$. Adiabatic process: work done, and entropy changes.

1.3 *Application of the laws of thermodynamics to real (van der Waals) gases*: Isothermal process- Work done, change in internal energy, heat absorbed. Adiabatic process: Work

one - Joule - Thomson effect- Joule- Thomson coefficient and its significance, inversion temperatures. Variation of enthalpy change of reaction with temperature (Kirchoff's equation).

Self-study: *Derivation of critical constants in terms of van der waals constants*

Unit-2: Thermochemistry (10 h)

2.1 Measurements of thermal changes. Heats of reaction. Calculation of change in internal energyfrom the enthalpy change, standard states and standard heats of formation;

2.2 Integral heat of solution and dilution, heat of neutralization, heat of hydration; heat of transition.

2.3 Bond energy, heat of combustion and heat of reaction.

Self-study: *Determination of calorific value using Bomb calorimeter*

Unit-3: Second Law of Thermodynamics (10 h)

3.1 Limitations of first law and the need for the second law. Formulation of second law of thermodynamics on the basis of Carnot cycle. Thermodynamic principle of working of refrigerator.

3.2 Criteria of spontaneity. Changes in S, G and A as criteria for spontaneous process, dS, dG and dA. Evaluation of ΔG and ΔS for the mixing, Maxwell's equations and thermodynamic equation of state. Gibbs-Helmholtz equation.

Self-study: *Trouton's rule and its significance.*

Unit - 4: Thermodynamics of reversible processes (10 h)

4.1 *Law of mass action*: Various forms of equilibrium constants. Relationships between K_P and K_C; significance of equilibrium constants.Vant Hoff isotherm.Derivation of thermodynamic equilibrium constant, and its relationship with change in standard free energy.vant Hoff isochore.

4.2 Le-Chatelier-Braun principle: Formation of ammonia. Application of law of mass action and Le-Chatelier-Braun principle to homogeneous gaseous reactions: dissociation of nitrogen tetroxide and ammonia.

Self-study: *Formation of HI, dissociation of* PCl_5.

Unit- 5: Third law of thermodynamics (5 h)

5.1 Nernst heat theorem- Planck and Lewis Randall formulation of third law.

5.2 Absolute entropy of solids, liquids and gases. Evaluation of the standard entropy of oxygen, on the basis of heat capacity. Exceptions to third law of thermodynamics.

Text Books:

1. S.H. Maron and J.B. Lando, *Fundamentals of Physical Chemistry*, Macmillan limited, New York, 1966.
2. B.R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 33rd ed.,1992.
3. P.W. Atkins, *Physical Chemistry*, 7th ed.,Oxford university press, 2001.
4. S.K. Dogra and S. Dogra, *Physical Chemistry Through Problems*, New age international, 4th ed, 1996.

References:

1. G. W. Castellan, *Physical Chemistry*, Narosa publishing house, 3rded.,1985.
2. I. M. Klotz and R. M. Rosenberg, *Chemical Thermodynamics*, John Wiley and sons, Inc. 1994.
3. J. Rajaram and J.C. Kuriacose, *Thermodynamics*, Shoban Lal Nagin Chand and Co. 1986.

CH -2508: ORGANIC QUALITATIVE ANALYSIS

Semester – II | No. of credits: 3

Course: Major Core (**MC**) | No. of hours : 3 h/wk

Objective:

To develop analytical skills in organic qualitative analysis and preparations.

Practicals

1. Determination of melting and boiling points of organic substances.
2. 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 acids	ii) Phenols	iii) Aldehydes	iv) Ketones
v) Esters	vi) Carbohydrates	vii) Amines	viii)Amides
ix) Anilides	x) Nitro	ix) Halogen compounds	

   f. Preparation of derivatives for the functional groups.

Text Book:

1. N.S. Gnanapragasam and G. Ramamurthy, *Organic Chemistry – Lab manual*, S. Viswanathan Co. Pvt., 2002.

References:

1. J.N. Gurthu and R. Kapoor, *Advanced Experimental Chemistry* (Organic), S. Chand and Co., 1987.
2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, *Vogel's Text Book of Practical Organic Chemistry*. 5th ed., Pearson Education, 2005.

PH-2105: PHYSICS FOR CHEMISTRY -I	
Semester – II	No. of credits: 3
Course: Allied Required (**AR-2**)	No. of hours : 4h/wk

Objective: *While the chemical properties are learnt in the major, the study of physical properties will complement their studies.*

Unit – 1: Classical mechanics

a) Particle dynamics: Displacement, velocity and acceleration- distance –time graph- velocity – time graph – projectile motion – uniform circular motion – tangential acceleration in circular motion – relative velocity and acceleration

b) **Lagrangian formulation :**Generalised coordinates – holonomic and non-holonomic constraints – Lagrange's equations – simple applications- Atwood's machine – simple pendulum

Unit 2: Gravitation

a) **Classical theory of gravitation :** Kepler's laws, Newton's law of gravitation – G and measurement – Earth –moon system – weightlessness – earth satellites – parking orbit – earth density – mass of the Sun – gravitational potential – velocity of escape – satellite potential and kinetic energy.

b) **Einstein's theory of gravitation:** Introduction – the principle of equivalence – experimental tests of general theory of relativity – gravitational red shift – bending of light – preihelion of mercury.

Unit –3: Properties of matter

a) **Elastic properties: Elastic** limit – Hooke's law – moduli of elasticity – poission ratio – relation between q,n,k – force in a bar due to contraction or expansion – energy stored in a wire – rigidity modulus –torsion in a wire – static torsion and torsional oscillations method**.**

b) **Viscosity and surface tension :** Newton's formula – Stoke's formula – Poiseuille's flow – molecular theory of surface tension – excess pressure over curved surface – spherical and cylindrical drops – surface energy – capillary rise – Quincke's method for mercury.

Unit – 4: Optics

a) **Diffraction:** Fresnel and Fraunhofer diffractions – Fraunhofer diffraction at single slit- diffraction at multiple slits- plane diffraction grating–determination of wavelength of a special line.

b) **Polarisation:** Double refraction of crystals– geometry of Nicol prism – Huygen's theory – Polaroid – circular and elliptical polarization – quarter and half wave plates – production and analysis of polarized beams – optical activity.

Unit – 5 : Crystal Physics

a) **Crystal structures:** Introduction – periodic array of atoms – crystal lattice – unit cell – basis – symmetry considerations – classification of crystals – Bravais lattices in three dimensions – crystal planes and Miller indices – simple crystal structures.

b) **Crystal diffraction:** Bragg's law – experimental X-ray diffraction methods: - Laue method – rotating crystal method – powder method – neutron diffraction.

Text Books:

1. M.Narayanamurthy and N.Nagarathnam Dynamics ,The national publishers.
3. D.S.Mathur, properties of matter, S.Chand and Co., New Delhi
4. S.Subrahmanyam and S.Brijlal, A text book of optics, S.Chand and Co., 22nd ed.,.
5. C.Kittel , Introduction to solid state physics – Wiley eastern 5th ed., .

Reference:

1. D.Halliday and R.Resnick , Physics, Part-1, Wiley eastern

PH-2106: PHYSICS FOR CHEMISTRY - PRACTICAL-I

Semester – II | No. of credits: 1

Course: Allied Required (**AR-2**) | No. of hours: 2h/wk

LIST OF EXPERIMENTS

1. Young's modulus by stretching -vernier microscope
2. Rigidity modulus -torsional pendulum
3. Surface tension and interfacial tension - method of drops
4. Surface tension - capillary rise
5. Viscosity - capillary flow
6. Specific heat of liquid - method of mixtures (approximate radiation correction)
7. Specific heat of liquid - electrical heating
8. Sonometer -verification of laws
9. Compound bar pendulum - determination of 'g'and radius of gyration

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI - 600 034.

CH-2104: GENERAL CHEMISTRY FOR MATHS AND PHYSICS

Semester – II | No. of credits: 3
Course: Allied Required (**AR-2**) | No. of hours : 4h/wk

Objectives:

1. *To get a good exposure to the basic concepts of chemistry*
2. *To enable them to apply concepts related to chemistry in their careers.*

Unit 1: Coordination Compounds (11 h)

1.1 Double salts and coordination compounds. Basic concepts of coordination compounds.

1.2 Types of ligands. IUPAC nomenclature of mononuclear complexes.

1.3 Theories: Werner's, Sidgwick's and Pauling's theories. Explanation of shapes and magnetic nature.

1.4 Mention of biologically important coordination compounds: Haemoglobin and Chlorophyll.

Unit 2: Basic concepts in Organic Chemistry (13h)

2.1 Electronic displacement effects: Inductive, resonance and steric effects.

2.2 *Organic reactions and their basic mechanisms*: Addition – ionic, free radical, electrophilic, nucleophilic. Substitution – S_N1 and S_N2 reaction of alkyl halides. Elimination - E1 and E2 reactions. Rearrangement – inter and intramolecular.

2.3 *Isomerism*:

Geometrical isomerism: methods of differentiating cis and trans isomers on the basis of boiling point, melting point, dipole moment and chemical reaction. Optical isomerism with special reference to lactic and tartaric acids.Conformational isomerism of ethane, n-butane.

Unit 3: Electrochemistry and Kinetics (15 h)

3.1 *Electrochemistry*:

Strong and weak electrolytes.Ionic product of water, pH, pK_a, pK_b, buffer solutions, solubility, solubility product of sparingly soluble salts, electrode potential, standard hydrogen electrode and calomel electrode, cell potential -standard western cell,electrochemical cell – galvanic and electrolytic cell. Derivation of Nernst equation, calculation of EMF of the cell. Corrosion – causes and prevention.

3.2 *Kinetics and catalysis*:

Order and molecularity.Derivation of rate expression for first and second order reaction. Methods of determining order of a reaction.Catalysis - homogeneous and heterogeneous. Energy of activation and Arrhenius equation.

Unit 4: Photochemistry (10 h)

4.1 Comparison between thermal and photochemical reactions, Grotthus-Drapper'slaw, Einstein's law, quantum yield, photosensitization, Beer-Lambert's law.

Unit 5: Industrial chemistry (11h)

5.1 *Water treatment*

Sources of water.Hardness of water, disadvantages of hard water. Estimation of hardness by EDTA method.Purification process – ion exchange, reverse osmosis, activated charcoal treatment. Disinfection – ozone, UV, chlorination, specification of drinking water.

5.2 *Pollution and its control*

Air pollution, effect of air pollution- acid rain and greenhouse effect, ozonedepletion.Water pollution – significance of BOD and COD values.

Text Books:

1. R. Gopalan, S. Sundaram, *Allied Chemistry*, Sultan Chand and Sons 1995.
2. P. C. Jain and M. Jain, *Engineering Chemistry*, 10th ed.; Dhanpatrai and sons: Delhi, 1993.
3. C.N.R. Rao, *University General Chemistry*, Macmillan Co., India Ltd, 1973.
4. M.J. Sienko and R.A. Plane, *Chemistry-Principles and Properties*, international Student ed., 1995.

References:

1. G.C. Hill, J.S. Holman, *Chemistry in Context*, ELBS, 1998.
2. W.R. Kneen, M.J.W. Rogers, P. Simpson, *Chemistry – Facts, patterns and principles*, ELBS, 1999.
3. Bruce H. Mahan, *University Chemistry*, 3rd ed., Addition-Wesley Publishing Company, 1977.

CH-2105: GEN.CHEM.LAB FOR MATHS AND PHYSICS

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI - 600 034.

Semester – II | No of credit: 1

Course: Allied Required (**AR-2**) | No. of hours : 2h/wk

Objectives:

1. *To enable the students to understand the concepts of organic analysis*
2. *To apply such analysis in their scientific area of interests.*

Organic Analysis:

a) Detection of N, S and halogens

b) Test for aliphatic and aromatic nature of substances.

c) Test for saturation and unsaturation.

d) Nature and identification of the following functional groups

- i) Carboxylic acid
- ii) Phenols
- iii) Aldehydes
- iv) Ketones
- v) Carbohydrates
- vi) Primary amines
- vii) Amides

Text Books:

1. N.S. Gnanapragasam and G. Ramamurthy, *Organic chemistry – Lab manual*, S. Viswanathan Co. Pvt. Ltd., 2002.
2. J.N. Gurtu and R. Kapoor, *Advanced Experimental Chemistry (Organic),* S. Chand and Co., 1987.

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III-SEMESTER

CH -3506: ORGANIC FUNCTIONAL GROUPS

Semester: III | No. of credits: 3
Course: Major core (**MC**) | No. of hours:3h/wk

Objectives

1. *To explore the chemistry of functional groups of organic compounds.*
2. *To learn the preparation of organic compounds of halide and oxygen based functional groups.*
3. *To understand the physical and chemical properties of functionalized organic compounds.*

Unit- 1: Aliphatic and aromatic halides (10 h)

1.1 Nomenclature and classification

1.2 Preparation of aliphatic and aromatic halides: Free radical mechanism, addition and Substitution reactions.

1.3 Reactions: Nucleophilic substitutions, S_N1, S_N2 and S_NAr mechanisms, stereochemistry and reactivity, effects of structure, substrate, solvent, nucleophile and leaving groups.

1.4 Eliminations: E1 and E2 mechanisms, evidences, orientations and stereochemistry.

Self-study: *Competition between elimination and substitution reactions, application of Hoffmann and Saytzeff rules*

Unit- 2: Hydroxy derivatives (10 h)

2.1 Aliphatic alcohols: Preparation by hydroboration, oxidation, Reduction of carbonyl compounds, epoxidation, Grignard synthesis and haloform reaction.

2.2 Reactions with reference to C-OH bond cleavage and O-H bond cleavage.

2.3 Phenols: Nomenclature, physical properties, hydrogen bonding.

2.4 Preparation: Industrial source, preparation from diazonium salts and sulphonic acids.

2.5 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.

Self study: *Classification and nomenclature, hydrolysis of alkyl halides, reduction of carbonyl compounds and hydroxylation of alkenes, preparation and properties of catechol, resorcinol and phloroglucinol*

Unit- 3: Ethers and Epoxides (oxiranes) (5 h)

3.1 Nomenclature and classification.

3.2 Preparation by Williamson's synthesis and alkoxymercuration-demercuration methods.

3.3 Reactions: cleavage by acids.

3.4 Preparation and reactions of epoxides.

Self-Study: *Properties of simple and mixed ethers*

Unit- 4: Aldehydes and Ketones (10 h)

4.1 Nomenclature and classification

4.2 Preparation of aldehydes and ketones.

4.3 Reactivity of carbonyl groups, acidity of alpha hydrogen.

4.4 Physical and chemical properties of carbonyl compounds.

4.5 Mechnism of aldol, Perkin, Knoevenagel reactions and benzoin condensation, Claisen, Wittig, Cannizarro and Reformatsky reactions.

4.6 Mechanisms of reduction with $NaBH_4$, $LiAlH_4$, Wolf-kishner and MPV reduction. Mechanism of haloform and Michael addition.

4.7 Photochemical reactions of carbonyl compounds: Norrish type I and II reactions.

Self-Study: *Electrophilic substitution reactions of aromatic aldehydes and ketones*

Unit- 5: Carboxylic acids and their Functional Derivatives. (10 h)

5.1 Nomenclature and classification of aliphatic and aromatic carboxylic acids.

5.2 Preparation and reactions. Acidity (effect of substituents on acidity) and salt formation

5.3 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

5.4 Reactions: Action of heat on hydroxy and amino acids, and saturated dicarboxylic acids, stereospecific addition to maleic and fumaric acids.

5.6 Preparation and reactions of acid chlorides, acid anhydrides, amides and esters-acid and alkaline hydrolysis of esters, trans-esterification.

Self-study: *Physical properties, industrial source, Acetic acid,phthalic acid, Halogenated acids, cyano acids, lactic, pyruvic and tartaric acids*

Text Books

1. R. T. Morrison and R. N. Boyd, *Organic Chemistry*, 6th ed., Printice-Hall of India Limited, New Delhi, 1992.
2. T. W. Graham Solomons, *Organic Chemistry*, 6th ed., John Wiley and Sons, 1996.
3. B. Y. Paula, *Organic Chemistry*, 3rded., Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.
4. Bahl and ArunBahl, *Organic Chemistry*, S. Chand and Sons, New Delhi, 2005.

References

1. J.March*Advanced Organic Chemistry*, 4th ed., John Wiley and Sons, New York, 2001.
2. S. H. Pine, *Organic Chemistry*, 5thed., McGraw Hill International Edition, Chemistry Series, New York, 1987.
3. Sehan. N. Ege, *Organic Chemistry, Structure and Reactivity*, 3rd ed., A.I.T.B.S., New Delhi, 1998.
4. J. B. Hendrickson, D. J. Cram andG. S. Hammond, *Organic Chemistry,* 3rded., McGraw-Hill Kogakusha, Ltd, 1970.
5. Francis A. Carey, *Organic Chemistry*, 3rd ed., Tata-McGraw Hill Publications, New Delhi, 1999.

CH-3507: **MAIN GROUP ELEMENTS AND SOLID STATE CHEMISTRY**

Semester–III | No. of credits: 3

Course: Major core (**MC**) | No. of hours: 3h/wk

Objectives

1. *To know the nature of compounds formed by s- and p-block elements.*
2. *To know the various reagents of main group elements and their use in synthetic chemistry.*
3. *To know the reactivity of halogens and the formation of interhalogen compounds.*
4. *To understand the crystal structures of ionic compounds.*

Unit-1: *s*-Block Elements (10 h)

1.1 Chemical properties of the metals: reaction with water, air, nitrogen; uses of *s*-block metals and their compounds.

1.2 Compounds of *s*-block metals: oxides, hydroxides, peroxides, superoxides-preparation and properties; oxo salts-carbonates, bicarbonates, nitrates; halides and polyhalides; anomalous behavior of Li and Be, extraction of beryllium.

1.3 Complexes of *s*-block metals: complexes with crown ethers, biological importance of sodium and potassium, organometallic compounds of Li and Be.

Self-study: *The factors favoring the formation of ionic compounds by s-block elements. Uses of s-block metals.*

Unit-2: Boron and Carbon Group Elements (10 h)

2.1 Group 13 (boron group): extraction of B and Si; types of compounds; reaction of B with other elements, water, air, acids, and alkali.

2.2 Compounds of boron with oxygen: boron sesquioxide, borates, and borax.

2.3 Boronhydrides-reaction with ammonia, hydroboration, structure of boranes; borohydrides and their uses.

2.4 Aluminium-amphoteric behavior, aluminates.

2.5 Group 14 (carbon group): catenation and heterocatenation, allotropy of carbon-graphite, diamond, fullerenes and carbon nanotubes (structural features and uses); carbides-salt-like carbides, interstitial carbides, covalent carbides.

2.6 Silicates-ortho-, pyro-, cyclic-, chain-, sheet-, three dimensional silicates and their properties and structures; silicates in technology-alkali silicates, ceramics, glass.

Self-study:*Differences between boron and other members of the group. Important borides and carbides and their uses.*

Unit- 3: Nitrogen and Oxygen Group Elements (10 h)

3.1 Group-15 (nitrogen group): metallic and nonmetallic character of group 15 elements; hydrides and halides of group 15 elements-hydrazine, hydroxylamine, phosphines;

ammonium nitrate, sodium bismuthate-properties and uses; sulphides of phosphorus (P_4S_3 and P_4S_{10}).

3.2 Oxides of N and P: oxides of nitrogen-dinitrogen tetroxide, dinitrogenpentoxide; oxides of phosphorus, arsenic, and bismuth-trioxides, pentoxides.

3.3 Oxoacids of nitrogen and phosphorus: nitrous acid, nitric acid, hyponitrous acid, hydrazoic acid, pernitric acid,orthophosphorous acid, metaphosphorous acid, hypophosphorous acid; orthophosphoric acid, di-, tri-, and tetrapolyphosphoric acids; salts of phosphorus acids-dihydrogen- and monohydrogenphosphites, hypophosphites; salts of phosphoric acids-dihydrogen- and monohydrogen phosphates, normal phosphates, polyphosphates, metaphosphates; properties and uses of phosphites and phosphates; phosphate fertilizers.

3.4 Group-16(oxygen group): structure and allotropy of elements, ozone, oxides-normal oxides, peroxides, suboxides, basic oxides, amphoteric oxides, acidic oxides, neutral oxides.

3.5 Oxides of sulphur-S_2O, SO_3; oxoacids of sulphur-thionic acid series, peroxoacid series, oxohalides-thionyl compounds, sulfuryl compounds (methods of preparation and properties).

Self-study: *Structures of oxoacids of sulfur and phosphorus. Uses of the salts of oxoacids of sulfur.*

Unit-4: Halogens (5h)

4.1 Group-17 (halogens): group discussion, anomalous behavior of F, ionic-, covalent-, bridging halides, reactivity of halogens, reduction of halogens by thiosulfate and application to iodo/iodimetry.

4.2 Halogen oxides: oxygen difluoride, dioxygendifluoride, dichlorine monoxide, chlorine dioxide, dichlorinehexoxide, dichlorineheptoxide; bleaching powder-estimation of available chlorine; bromine dioxide, iodine pentoxide.

4.3 Oxoacids of halogens: hypohalous acid HOX, halous acid HXO_2, halic oxide HXO_3, perhalic acid HXO_4, strength of oxoacids.

4.4 Interhalogen compounds: ClF, ICl; ClF_3, BrF_3, IF_3;ClF_5, BrF_5, IF_5; poly halides; structure-VSEPR Model.

4.5 Psuedohalogens:cyanide, thiocyanate, and azide-structure and properties.

Self-study: *Structures of interhalogen compounds with the help of VSEPR model. Uses of interhalogen compounds.*

Unit- 5: Structure of Solids (10 h)

5.1 Classification: amorphous and crystalline solids; types of solids-metals, ionic crystals, van der Waals crystals, covalent crystals.

5.2 Weiss and Miller indices-drawing various planes in a cubic lattice.

5.3 Crystal systems and Bravais lattices.

5.4 X-ray diffraction: Bragg's equation (derivation), principle of X-ray diffraction.

5.5 Structure of ionic solids: packing of ions in solids, radius ratio, coordination number in ionic crystals, crystal structures-sodium chloride, zinc blende, wurtzite, rutile, cesium chloride, fluorite, antifluorite (unit cell diagrams); identification of simple cubic, *bcc*, *fcc* lattices and indexing of X-ray lines.

5.6 Crystal defects: Schottky and Frenkel defects, *F*-center.

Self-study: *Coordination numbers of cations and anions in ionic crystals from radius ratio. Unit cell diagrams of crystal structures.*

Text Books

1. J. D. Lee, *Concise Inorganic Chemistry*, 5th Ed., Blackwell Science, London, 1996.
2. D. F. Shriver and P. W. Atkins, *Inorganic Chemistry*, 3rd Ed., W. H. Freeman and Co, London, 1999.
3. B. R. Puri, L. R. Sharma and K. C. Kalia, *Principles of Inorganic Chemistry,* Chand and Co., Delhi, 1996.
4. A. R. West, *Solid State Chemistry and its applications*, John-Wiley and sons,1987

References

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, *Inorganic Chemistry*, 4th ed., Harper Collins, 1993.
2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, *Advanced Inorganic Chemistry*, 6th ed., John Wiley, New York, 1999.
3. T. Moeller, *Inorganic Chemistry: A Modern Introduction*, Wiley, New York, 1990.

CH-3508: INORGANIC QUALITATIVE ANALYSIS

Semester-III No. of credits: 3

Course: Major core(**MC**) No. of hours:3h/wk

Objectives

1. *To develop analytical skills in inorganic qualitative analysis.*

2. *To appreciate the various chemical reactions of metal ions.*

Semi micro qualitative analysis:

1. Training sessions for three classes:

   Mixture of anions containing an interfering anion and its elimination technique.

   Mixture of cations of simple radicals to familiarize with the inter group separation techniques.

2. Semi micro qualitative analysis of inorganic salt mixtures containing one interfering acid radical.

3. Simple anions:

   Carbonate, nitrate, sulphate, sulphide, sulphite, chloride and bromide.

4. Interfering anions:

   Borate, fluoride, oxalate, phosphate, arsenite and chromate.

5. Cations:

Group I cations:	Lead, silver, mercurous.
Group II cations:	Mercuric, copper, cadmium, bismuth, antimony, tin.
Group III cations:	Aluminium, ferrous, ferric, chromium.
Group IV cations:	Cobalt, nickel, manganese, zinc.
Group V cations:	Barium, strontium, calcium
Group VI cations:	Magnesium, ammonium.

References

1. V.V. Ramanujam, *Inorganic Semi Micro Qualitative Analysis*, 3rd ed., The National Publishing Company, Chennai, 1974.

2. *Vogel's Text Book of Inorganic Qualitative Analysis*, 4th ed., ELBS, London, 1974.

CH - 3204: CHEMISTRY FOR BIOLOGISTS-II
(Offered to B.Sc. Zoology and Plant Biology)

Semester – III — No. of credits: 3
Course : Allied Optional(**AO-1**) — No. of hours: 4h/wk

Objective

To understand the concepts of chemistry of bio-molecules.

Unit 1: Proteins and Enzymes (10 h)

1.1 Amino acids: Classification, preparation and properties, zwitter ions, isoelectric point,peptide synthesis.

1.2 Proteins: Classification based on structure and functions, primary and secondary structure, N-terminal andC-terminal analysis, denaturation.

1.3 Enzymes: Classification, factors affecting enzyme activity, mechanism of enzyme action, kinetics of enzyme reaction, Micheles-Menton equation, enzyme inhibition.

Unit 2: Lipids (10h)

2.1 Types and functions of lipids (fatty acids, glycerides, complex lipids and nonglycerides),fats and oils (rancidity,saponification, hydrogenation of oils), waxes, phospholipids (lecithins, cephalins, plasmalogens)

2.2 Steroids: structure, functions and biosynthesis of cholesterol, types and functions of plasma lipoproteins. Bile salts, steroid hormones.

Unit 3: Nucleic Acids (10 h)

3.1 Components of nucleic acids, structure of purine and pyrimidine bases,Structure of DNA and RNA.

3.2 Hydrogen bonding in nitrogeneous bases in DNA, properties and types of DNA and RNA,differences between DNA and RNA.

3.3 Replication, transmission and transcription of DNA, regulatory metabolism, mutation, genetic engineering.

Unit 4: Carbohydrates (10h)

4.1 Classification and functions of carbohydrates. Structure of glucose and fructose, interconversions, mutarotation. Differences between reducing and non-reducing sugars.

4.2 Structure of sucrose, inversion of Cane Sugar.

4.3 Glycolysis, TCA cycle, relationship between glycolysis and respiration, photosynthesis.

Unit 5:Natural Products and Agricultural Chemistry (20h)

5.1 Alkaloids: Classification, isolation,and biological importance (mention of papaverine, nicotine, coniine).

5.2 Terpenes: Classification, extraction and biological importance (mention of Camphor, Citral, and α-Pinene).

5.3 Flavones and flavonoids:structure, isolation and importance.

5.4 Types of soil, soil analysis, fertilizers– role of macro and micro nutrients, N, P, K fertilizers, Urea, Superphosphate of lime and Potassium nitrate.

5.5 Insecticides (DDT, BHC), herbicides (2,4-D and 2,4,5-T), fungicides (Bordeaux mixture, lime-sulphur).

Text books

1. G.P. Talwar, L.M. Srivatsava, K.D. Moudgil, *Text book of Biochemistry and Human Biology*, Printice-Hall of India Pvt. Ltd. New Delhi, 1989.
2. A.V.S.S. Rama Rao, *Text Book of Biochemistry*, 5th ed., L.K.S. Publishers, 1989.
3. Gurudeep R. Chatwall, *Organic chemistry of natural products*, volume-I & II, Himalaya publishing House Pvt.Ltd, Mumai, 1980.

References

1. Keshav Trehan, *Biochemistry*, Wiley Eastern Ltd, 1987.
2. E.J. Wood and W.R. Piekering, *Introducing Biochemistry*, ELBS, 1984.
3. Luberty Stryer, *Biochemistry*, Freeman and Co, 1975.
4. David L.Nelson, Michael M.Cox, Lehninger, *Principles of Biochemistry*, 3rd ed.,Worth Publishers, New York, 2000.

CH - 3205: CHEMISTRY PRACTICAL FOR BIOLOGISTS-II
(Offered to B.Sc. Zoology and Plant Biology)

Semester – III | No. of credits: 1
Course : Allied Optional(**AO-1**) | No. of hours : 2h/wk

Objectives:

1. *To understand the concepts of organic analysis*
2. *To appreciate the estimation techniques in the analysis of biologically importantorganic compounds.*

Experiments:

1. Estimation of Ascorbic acid.
2. Estimation of Glucose.
3. Estimation of acetic acid in vinegar.
4. Estimation of Glycine.
5. Determination of iodine value of Oil.
6. Determination of saponification value of Oil.
7. Determination of pH of soil, water.

Demonstration Experiments:

1. Column Chromatography of plant extract.

2. TLC – Separation of triglycerides.
3. Paper Chromatography – Separation of amino acids.

Text Books

1. N.S. Gnanapragasam and G. Ramamurthy, *Organic chemistry–Lab manual*, S. ViswanathanCo. Pvt. Ltd., 2002.
2. J.N. Gurtu and R. Kapoor,*Advanced Experimental Chemistry*, S. Chand and Co.,1987.

CH-3301: **CHEMISTRY IN EVERYDAY LIFE**
B.Sc. (For students other than Chemistry)

Semester – III | No. of credits: 2
Course :Elective General (**EG**) | No. of hours :3h/wk

Objectives

1. *To make non-chemistry students to get exposed to day to day chemistry related materials and science.*
2. *To learn the terms and definitions in general chemistry and use of popularly used chemicals.*

Unit-1: Chemistry of fuels (10 h)

1.1 Energy-renewable and non-renewable sources.

1.2 Classification of fuels, solid, liquid and gaseous fuels- coal, petroleum, biogas. Nuclear fuels.

1.3 Calorific value of fuels and its determination.

1.4 Alternate fuels- bio diesel, bio alcohols, fuel cells

Unit-2: Agricultural Chemistry (10 h)

2.1 Fertilizers: Fertilizers- natural, synthetic, mixed, NPK fertilizers. Excessive use of fertilizers and its impact on the environment. Bio-fertilizers.

2.2. Plant nutrients: micro and macronutrients and their role.

2.2 Pesticides: Classifications- herbicides, insecticides, fungicides- repellants – fumigants, defoliants

Unit -3: Food Science (8 h)

3.1 Food additives: Artificial sweeteners, Functional food additives, adulteration, food laws. Food colours - permitted and non – permitted- Toxicology. Flavours – natural and

synthetic- Toxicology .Other functional additives- Soft drinks- formulation Health drinks, preservatives

3.2 Food adulteration: Common adulterants used in different foods, analysis of detection and prevention

3.3 Water quality parameters - Total dissolved solids - hardness - dissolved oxygen – water treatment - sterilization - Chlorination - Ozonisation

Unit-4: Consumer Products (9 h)

4.1 Soaps – Introduction, detergent action of soap. Toilet soap, bathing bars, washing soaps, liquid soap manufacture- additives, fillers and flavors. Significance of acidity and alkalinity

4.2. Detergents-Introduction, detergent action, Common detergent chemicals-additives, excipients, colors and flavours. Enzymes used in commercial detergents. Environmental hazards

4.3. Cosmetics- Introduction, classification – bathing oils, face creams, toilet powder, skin products, dental cosmetics, hair dyes, shaving cream, shampoo, general formulation of each type. Toxicology of cosmetics

Unit-5: Articles used in daily life (8 h)

5.1 Polymers:Thermoplastic and thermosetting plastics. Use of PET, HDPE, PVC, PVA, PU.Recycling of plastics.Biodegradable plastics. Environmental hazards of plastics

5.2 Glass: composition, types and uses

5.3 Cement: composition and setting of cement

5.4 Dyes: classification based on application

5.5 Pharmaceuticals: Chemotherapy- types of drugs- analgesics, antipyretics, antihistamines, antacids, tranquilizers, sedatives, antibiotics - Misuse of drugs

Text Books

1. A.K.Biswas, *Frontiers in Applied Chemistry*, Narosa publishing house, 1989
2. B.K. Sharma,*Industrial Chemistry*, 13th ed. , Krishnaprakash Media Pvt Ltd Meerut, 2002.

References

1. O.P.Vermain and A.CNarula., *Applied chemistry*, New age international Chennai,1995.
2. V.T .Thiagarajan, *Pharmaceutical chemistry*, K.S.C. Desikan & Co, Chennai,1995.

IV-SEMESTER

LOYOLA COLLEGE (AUTONOMOUS)
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CH -4504: **ELECTROCHEMISTRY**

Semester – IV | No. of credits:3

Course : Major core(**MC**) | No. of hours: 3h/wk

Objectives: The students should be able to

1. *Understand the inter conversion of chemical and electrical energy and to link thermodynamics with electrochemistry.*
2. *Understand the concepts of non-equilibrium electrochemistry (conductance, transport number, overvoltage).*

Unit 1: Equilibrium Electrochemistry (10 h)

1.1 **Electrode potential**

Single and standard electrode potentials. Reference electrodes: (i) Primary reference electrode: Standard hydrogen electrode (ii) Secondary reference electrode: Saturated calomel electrode. Determination of standard electrode potentials of zinc and copper electrodes.Measurement of EMF using potentiometer.Construction and working of Weston saturated and unsaturated standard cells. Conventions regarding sign of EMF. Electromotive series and its significance.

1.2 **Different types of electrodes**

(i) Metal-Metal ion electrodes (ii) Amalgam electrodes (iii) Gas electrodes (iv) Metal insoluble salt electrodes (v) Oxidation –reduction electrodes (definition and derivation of EMF for each electrode).

Self-study: *Different electrode system.Derivation of EMF for different types of electrodes.*

Unit-2: Electrochemical Reactions (10 h)

2.1 **Thermodynamics of electrochemical reactions**

Derivation of Nernst equation and its use in calculating EMF of cells at different activities of the individual electrodes.Relationship between EMF and changes in G, H and S in electrochemical reactions.Equilibrium constants for electrochemical reactions.

2.2 **Classification of electrochemical cells**

Chemical cells and concentration cells with and without transference.Definition and derivation of EMF for each cell-liquid junction potential.

2.3 **Applications of EMF**

Determination of (i)valency of ions (ii)free energy, enthalpy and entropy changes in electrochemical reactions, (iii)solubility product and (iv) pH (hydrogen, quinhydrone and glass electrodes) Potentiometric acid-base, redox and precipitation titrations.

Self-study: *Commercial cells: Dry cell, lead storage, alkali (Na-S) and H_2-O_2 fuel cells*

Unit 3: Non-Equilibrium Electrochemistry (10 h)

3.1 Faraday's laws of electrolysis. Factors affecting the products of electrolysis

3.2 Properties of electrolytes**:** Ionic strength of solutions. vant Hoff factor.

3.3 Electrolytic conductance: Determination – variation of conductance with concentration. Equivalent conductance at infinite dilution.Kohlraush's Law and its application

3.4 Transference and transference numbers: Absolute velocity of ions and ionic mobilities. Hittorf's rule, determination of transference numbers – Hittorf's method and moving boundary method.

Self-study: *Arrhenius theory of electrolytic dissociation.Evidences in favour of the theory. Limitations.Conductometric titrations*

Unit-4: Ionics (8 h)

4.1 **Activities and activity coefficients of strong electrolytes**

Definiton of activity and activity coefficients.Debye-Huckel theory of activity coefficients (no derivation expected).

4.2 Mention of Debye-Huckel-Onsager equation. Effect of concentration, solvent dielectric constant and temperature on conductance.

Unit-5:Over voltage and polarisation (7 h)

5.1 **Over-voltage**

Decomposition potential, Hydrogen over-voltage, anodic process.Metal deposition, electrolytic separation of metals.Simultaneous deposition.

5.2 **Polarization**

Concentration polarization of electrodes.Principle of polarography-diffusion current, half wave potential-mention of Ilkovic equation.

Self-study: *Electrochemical theory of corrosion.*

Text Books

1. S.H. Maron and J.B. Lando, *Fundamentals of physical chemistry*, Macmillan limited, New York, 1966.

2. B.R. Puri and L.R. Sharma, *Principles of physical chemistry*, ShobanLalNagin Chand and Co. 33rd ed., 1992.

References

1. S.K. Dogra and S. Dogra, *Physical chemistry 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, 2008.
4. K. L. Kapoor, *A textbook of Physical chemistry*, (volume-2 and 3) Macmillan, India Ltd, 2006.
5. R. A. Alberty and R.J. Silbey, *Physical Chemistry 2nd ed.*, Wiley Eastern Ltd., New York 1997.

CH 4505: **PHYSICAL CHEMISTRY PRACTICALS**

Semester – IV | No. of credits: 3

Course: Major Core (**MC**) | No. of hours: 3h/wk

Objectives: The students should be able to

1. *Acquire analytical skills for quantitative analysis.*
2. *apply the concepts of physical chemistry to various experiments*

Experiments

1. Determination of partition coefficient of iodine between water and carbon tetrachloride
2. Determination of equilibrium constant for the formation of potassium triiodide from iodine and KI.
3. Phase diagram of a simple eutectic system and determination of unknown composition.
4. Phenol – water system: Phase diagram, CST, and effect of impurities on CST.
5. Transition temperature of a salt hydrate – determination of molecular weight.
6. Kinetics of acid catalyzed hydrolysis of methyl acetate and comparison of rate constants.
7. Kinetics of persulphate - iodide reaction: Determination of pseudo first order rate constant.
8. Determination of strength of a strong acid by conductometric titration (HCl*vs* NaOH).
8. Determination of limiting molar conductance of a strong electrolyte (KCl) by conductometry.
9. Determination of solubility product of a sparingly soluble substance by potentiometry.

10. Determination of the strength of Fe (II) by potentiometric redox titration.

References

01. J.N. Gurthu and R. Kapoor,*Advanced Experimental Chemistry*, S. Chand and Co., 1987.

02. Sundaram, Krishnan, Raghavan, *Practical Chemistry* (Part II), S. Viswanathan Co. Pvt., 1996.

03. David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, *Experiments in Physical Chemistry*, 5th Edn., McGraw- Hill Book company, 1989.

CH -4506: COMPUTER APPLICATIONS FOR CHEMISTRY

Semester – IV | No. of credits:3

Course : Major core(**MC**) | No. of hours:3h/wk

Objectives

1. *To learn the application of software that is easily available in the market and apply it to solve problems in quantitative chemical analysis and present the results graphically.*
2. *To take a given set of data and enter into a standard program and carry out either a calculation-routine, plot it as a graph or chart and if needed print it out to get a hard copy of the results.*

01. General Introduction to Microsoft 2000 and Excel 2000 (10 h)

1.1 Starting, Getting Help and Quitting.

1.2 Excell Environment: rows, columns, cell, workbook, worksheet, toolbar, menubar, formula bar, etc.

1.3 Details about standard toolbar and formatting toolbar buttons.

02. Building Worksheets (10 h)

2.1 Entering, copying, importing and editing data.

2.2 Saving and opening files.

03. Calculations (9 h)

3.1 Simple calculations, use of standard mathematical functions.

3.2 Complex calculations involving user-made functions and statistical function.

04. Plotting DATA (10 h)

4.1 Standard and customized charts and graphs.

4.2 Editing and annotating and pasting.

05. Printing and Transfer (6 h)

5.1 Previewing and printing spreadsheet data and graph

5.2 Transferring data and graphs interactively.

Note: All examples and problems for illustration as well as for assignments will be taken from the areas of chemistry, which the students are familiar with.

Text Book

K.V. Raman, *Computers in Chemistry*, Tata McGraw-Hill Ltd., New Delhi, 1993.

References

1. Gini Courter and Annette Marquis, *Microsoft Office 2000*, BPB Publications, New Delhi, 1999.
2. Julia Kelly, *Using Microsoft Excel 2000*, Prentice-Hall of India, New Delhi, 1999.
3. Robert de Lavie, *A spreadsheet workbook for Quantitative chemical analysis*, McGraw-Hill, Inc. New Delhi, 1997.

CH -4206:GENERALCHEMISTRY FOR MATHS AND PHYSICS - II

(Offered to B.Sc. Physics and Mathematics)

Semester – IV No. of credits: 3

Course: Allied Optional (**AO-2**) No. of hours : 4h/wk

Objectives:

1. To get a exposure to the basic concepts of chemistry

2. To apply concepts related to chemistry in their careers.

Unit-1: Inorganic Chemistry (10 h)

1.1 *Solid state chemistry*–Classification, amorphous and crystalline solids; types of crystalline-ionic crystals, van der Waals crystals, covalent crystals.

1.2 Structure of ionic solids: radius ratio, coordination number in ionic crystals, crystal structures-sodium chloride, zinc blende, cesium chloride.

1.3 Born-Haber cycle, lattice energy, solubility of ionic compounds.

Unit-2: Organic Chemistry (15 h)

2.1 *Hydrogen bond*:

a) Detection, molecular weight of acetic acid in benzene, boiling point of water

b) Strength of hydrogen bonds: Effect of temperature (ice and water), inter and intra molecular hydrogen bonding, separation of o- and p-nitrophenols by steam distillation, solubility of polar organic compounds in water(ethanol and phenol).Theory of hydrogen bonding.

2.2 *Dyes*:

a) Colour and constitution: chromophores and auxochromes

b) Classification based on structure and mode of dyeing, uses of mordents.

c) Preparation of congo-red and malachite green

2.3 *Drugs*:

a) Classification of drugs.

b) Sulpha drugs: synthesis of sulphanilimide, structure and uses of sulphadiazine and sulphamethoxazole.

c) Antibiotics: Structure of penicillin, broad spectrum antibiotics and their uses(structural elucidation is not required).

d) Antipyretics: synthesis and uses of aspirin.

Unit-3: Physical Chemistry (10 h)

3.1 *Energetics*:

a) First law of thermodynamics: Concepts of internal energy and enthalpy.

b) Hess's law, heat of formation, combustion, neutralization, bond energy, bond dissociation energy, Kirchoff's equation

3.2 *Electrochemistry*:

a) Faraday's law, electrolysis of aqueous NaCl and $CuSO_4$ solutions using corresponding metal or inert electrodes.

b) Electrolytic conductance: Determination, variation of conductance with concentration.

c) Equivalent conductanceat infinite dilution: Determination, Kohlrausch's law, determination of K_a and K_{sp}. Conductometric titrations.

Unit-4: Bio-Organic Chemistry (10 h)

4.1 *Carbohydrates:*

Classification, functions, structure of glucose, fructose, and sucrose

4.2 *Proteins:*

a) Formation of amino acids and polypeptides

b) Sequence determination: N-terminal and C-terminal amino acid analysis

c) Primary and secondary structures.

4.3 *Enzymes:*

a) Classification, characteristics and properties.

b) Lock and key mechanism, factors affecting enzyme reaction.

c) Types of inhibition.

Unit-5: Industrial Chemistry (15 h)

5.1 *Energy resources and applications*:

a) Sources of energy: renewable(solar, wind, tidal) and non-renewable(coal, lignite, petroleum and natural gas).

b) Liquid fuels: fractional distillation of petroleum, thermal and catalytic cracking, octane number.

c) Nuclear energy: principle of fission and fusion reaction, uses of radio isotopes(medicinal, agriculture and industry).

5.2 *Agrochemicals*:

a) Types of soils, role of humus, importance of manures

b) Fertilizers: manufacture of urea, ammonium sulphate, superphosphate of lime and triple superphosphate, mixed fertilizers, role of macro and micronutrients.

c) Pesticides: DDT, BHC.

d) Herbicides: 2,4-D and 2,4,5-T.

e) Fungicides: Bordeaux mixture.

Text books

1. C.N.R. Rao, *University General Chemistry*, Macmillan Co. India, Ltd, 1973.
2. M.J.Sienko and R.A.Plane, *Chemistry: Principles and properties*, International Student Edition, 1995.
3. R.Goplalan, S.Sundaram, *Allied Chemistry*, Sultan Chand and sons, 1995.

References

1. B. R. Puri, L. R. Sharma, K. C. Kalia, *Principles of Inorganic Chemistry,* Shoban Lal Nagin Chand and Co., Delhi, 1996.

2. W.R. Kneen, M.J.W.Rogers and P.Simpson, *Chemistry: Facts, patterns and Principles*, ELBS, 1999.

3. Bruce H.Mahan, *University Chemistry*, 3rd ed., Addition-Wesley Publishing company, 1977.

4. Darrell D. Ebbing and Steven D. Gammo, *Fundamentals of Chemistry*, Houghton Mifflin College, 2010.

CH-4207: GENERAL CHEMISTRY LAB FOR MATHS AND PHYSICS

(Offered to B.Sc. Physics and Mathematics)

Semester – IV | No. of credits:1

Course : Allied Optional(**AO-2**) | No. of hours:2h/wk

Objectives:

To understand the concepts of organic analysis &apply such analysis in their scientific area of interests.

Experiments:

1. Estimation of Oxalic acid.
2. Estimation of HCl.
3. Estimation of $KMnO_4$ using standard ferrous sulphate.
4. Estimation of $KMnO_4$ using standard dichromate.
5. Estimation of $FeSO_4$ using standard dichromate.
6. Estimation of ascorbic acid.
7. Determination of pH of soil, water, ...
8. Demonstration experiments:
   a) Column Chromatography of food dyes.
   b) TLC - Separation of triglycerides.
   c) Paper chromatography - separation of amino acids.

References

1. J.N. Gurtu and R. Kapoor, *Experimental Chemistry*,S.Chand and Co, 1987.

2. N.S. Gnanapragasam and G. Ramamurthy, *Organic chemistry – Lab manual*, S. Viswanathan Co. Pvt. Ltd., 2002.

CH-4302: **BASIC CLINICAL AND PHARMACEUTICAL CHEMISTRY**

Semester – IV | No. of credits: 2

Course: Elective General(**EG**) | No. of hours: 3h/wk

Objectives:

The student is expected to learn about

1. *Disinfectants and antiseptics.*
2. *Important drugs and the mode of actions.*
3. *Enzymes& Body fluids*

Unit-1: Clinical Hygiene and Biochemical Analysis (10 h)

1.1 Definition of health. Role of WHO.

1.2 Sterilization of surgical instruments. Disinfectants, antiseptics, sanitation.

1.3 Biochemical analysis of urine, serum and fecal matter.

1.4 Treatment for specific poisons-acids, alkalis, arsenic and mercury compounds.

Self-study: *Different types of chemical poisons in society*

Unit-2: Common Drugs (15 h)

2.1 Manufacture of drugs (e.g. quinine, reserpine, atopside and d – tubocurarine) from indian medicinal plants.

2.2 Testing of drugs: biological variation, screening and toxicity. Use of pharmacoepia and therpeutic index.

2.3 Types of drugs and their modes of action:

Depressant drugs (special reference to sedatives and hypnotics).

Anticonvulsant drugs (sodium valproate, hydantoins).

Narcotic analgesics (only morphine compds).

Antipyretic analgesics (acetyl salicyclic acid, p – amino – phenol derivatives).

Muscle relaxants.

i. Acting at neuromuscular junction (d – tubocurarine chloride).
ii. Acting at spinal cord alone (glycerylguaiacolate, diazepam).

Antibiotics (pencillin, streptomycin, tetracyclin, chloramphenicol)

Cardiovascular drugs-nitrates, beta blockers(propranalol and atinelol) and calcium channel blockers.

2.4 Nuclear medicine (Radiation therapy)

Self-study:*Knowing names of medicines used for the above diseases*

Unit-3: Enzymes (6 h)

3.1 Classification, specificity. Coenzymes, Cofactor, ATP.

3.2 Mechanism of enzyme action and immobilisation of enzymes.

Self-study: *Specific action of enzymes, factors affecting enzyme activity*

Unit-4: Body Fluid (6h)

4.1 Blood volume, blood groups, coagulation of blood.Plasma lipoprotiens.Blood pressure. Arteriosclerosis, diseases affecting red cells: Hyperchromic and hypochromic anaemia.

4.2 Blood tranfusion.Blood sugar and diabetes.

Self study: *Knowledge of measuring blood pressure, influence of blood pressure, blood sugar control levels and medicine used to control blood pressure and blood sugars*

Unit-5: Biotechnology (8 h)

5.1 Heredity, recombinant DNA, Genetic engineering and its possible hazards, Gene splicing,

5.2 Manufacture of interferon and human insulin (Humulin), Drug manufacture based on fermentation (only antibiotics)

Visits: One full day visit to a medical research laboratory and to pharmaceutical industry.(5 h)

Text Books

1. J.Ghosh, *A text book of Pharmaceutical Chemistry*, S.Chand and Co. Ltd, 1999.
2. S.C. Rastogi, *Biochemistry*, Tata McGraw Hill Publishing Co., 1993
3. AshutoshKaur, *Medicinal Chemistry*, Wiley Eastern Limited, New Delhi, 1993.

References

1. O.Le Roy, Natural and synthetic organic medicinal compounds, Ealemi., 1976.
2. O. Kleiner and J. Martin, Bio-Chemistry, Prentice-Hall of India (P) Ltd, New Delhi, 1974.

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V-SEMESTER

CH-5510: ORGANO-NITROGEN COMPOUNDS AND STEREOCHEMISTRY

Semester – V | No. of credits: 5

Course: Major core (**MC**) | No. of hours :5h/wk

Objectives

1. *To learn and understand the chemistry of nitro and amine compounds.*
2. *Toappreciatethe basicprinciples of heterocyclic compounds and natural products.*
3. *To understand the stereochemistry of organic compounds on conformation, geometric and optical isomerism.*
4. *To learn and practice the molecular rearrangements and the reaction mechanisms.*

Unit-1: Nitro and Amine Compounds (15 h)

1.1 Nomenclature and classification.

1.2 Nitrocompounds: aliphatic and aromatic nitro compounds, classification, general properties,

1.3 Preparation by nitration, oxidation of amines

1.4 Reactions: reduction by chemical and electrolytic methods.

1.5 Di- and tri-substitution of aromatic nitro compounds: synthesis of o-, m-, p-dinitrobenzenes and trinitrobenzene.

1.6 Aromatic amines. Preparation of primary, secondary and tertiary amines.

1.7 Reactions: basicity of amines, effect of substituents on basicity of aromatic amines. Some sulpha drugs.

1.8 Diazonium salts: Preparation, diazotisation reactions, replacement reactions (Sandmeyer, Gatterman and Gomberg reactions), coupling reactions.

Self-study: *Hinsberg test, separation of primary, secondary and tertiary amines*.

Unit -2: Heterocyclic compounds and Natural Products (15 h)

2.**1** 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.

2.2 Alkaloids: Definition, occurrence, extraction of alkaloids from plants, general properties, General method of determining structure, degradation. Sturucture and functions of Coniine, Piperine and nicotine.

2.3 Terpenoids: Classification, isoprene rule, isolation and general properties, Occurrence, general method of elucidation of terpenoids. Structure and functions of geraniol, citral, menthol, α-pinene and camphor.

Self-study:*Extraction, resonance structures of heterocyclic compounds, applications. Exercises on application of isoprene rule,*

Unit -3: Stereochemistry-I (15 h)

3.1 Geometrical isomerism: Cis-trans, syn-anti and E-Z notations, methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration, cyclisation and heat of hydrogenation.

3.2 Conformational isomerism: Conformers, dihedral angle, torsional strain.

3.3 Conformational analysis of ethane and n-butane, conformers of cyclohexane (Chair, boat and skew boat forms), axial-equatorial positions and their interconversions, conformers of mono and disubstitutedcyclohexanes, 1,2 and 1,3 interactions.

Self-study: *Examples of geometrical isomerism and mono, di-substituted cyclohexanes*

Unit-4: Stereochemistry-II (15 h)

4.1 Optical isomerism, optical activity, optical and specific rotations, conditions for optical activity, asymmetric center, chirality, achiral molecules, meaning of (+) and (-) and D and L notations, elements of symmetry, racemization, methods of racemization (by substitution and tautomerism), methods of resolution (mechanical, seeding, biochemical and conversion to diasteromers), asymmetric synthesis (partial and absolute synthesis), Walden inversion.

4.2 Projection Formula, Fischer, flying wedge, sawhorse and Newmann projection formulae – notation of optical isomers - Cahn-Ingold-Prelog rules, R and S notations for optical isomers with one and two asymmetric carbon atoms, erythro and threo representations.

4.3 Optical activity in compounds not containing asymmetric carbon atoms namely biphenyls, allenes and spiranes.

Self-study: *Examples on optically active compounds having various functional groups, resolution of optically active compounds.*

Unit -5: Molecular Rearrangements (15 h)

5.1 Classification as anionotropoic, cationotropic, free radical, inter and intramolecular.

5.2 Mechanism and Stereochemical aspects of Pinacol-pinacolone rearrangement, Beckmann, Hoffmann, Curtius and Benzilic acid rearrangements.

5.3 Claisen rearrangement (sigmatropic-evidence for intramolecular nature and allylic carbon attachment)-paraClaisen, Cope and oxycope rearrangements, and Fries rearrangement.

Self-study: *Specific examples applying the rearrangement reactions*.

Text books

1. R. T. Morrison and R. N. Boyd, *Organic Chemistry*, 6th ed., Printice-Hall Of India Limited., New Delhi, 1992.
2. B. Y. Paula, *Organic Chemistry*, 3rded., Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.
3. Bahl and Arun Bahl, *Organic Chemistry*, S. Chand and Sons, New Delhi, 2005.
4. O. P. Agarwal, *Chemistry of Organic Natural Products,* Vol 1 and 2, Goel Pub. House, 2002.
5. GurdeepChatwal, *Chemistry of Organic Natural Products,* Vol 1 and 2, Goel Pub. House, 2002.
6. P. S. Kalsi, *Stereochemistry: Conformation and Mechanism*, 2nd ed., Wiley Eastern Ltd, 1993.
7. V. K. Ahluwalia, *Organic Reaction Mechanism*, Ane Books Pvt. Ltd, 2007.

References

1. J.March,*Advanced Organic Chemistry*, 4th ed., John Wiley and Sons, New York, 1992.
2. S. H. Pine, *Organic Chemistry*, 5thed., Mcgraw Hill International Edition, Chemistry Series, New York, 1987.
3. Sehan. N. Ege, *Organic Chemistry, Structure and Reactivity*, 3rded., AITBS, New Delhi, 1998.
4. J. B. Hendrickson, D. J. Cram and G. S. Hammond, *Organic Chemistry*,3rded., McGraw-Hill, Kogakusha, Limited, 1970.
5. I. L. Finar, *Organic Chemistry*, *Vol 2*, 6th ed., ELBS, 1990.
6. E. L. Eliel and S. H. Wilers, *Stereochemistry of Organic Compounds*, John Wiley and Sons, New York, 2004.

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CH-5511: **TRANSITION ELEMENTS AND NUCLEAR CHEMISTRY**

Semester-V | No. of credits: 5

Course : Major core (**MC**) | No. of hours: 5h/wk

Objectives

1. *To know the tendency of transition metals to exhibit variable valency.*
2. *To know the catalytic properties of transition metals and industrial applications of their compounds.*
3. *To understand the occurrence of metals in nature and the methods of their extraction.*
4. *To* know the importance of nuclear reactions in the modern world.

Unit-1: Transition Elements (15 h)

1.1 Magnetic property; reactivity and passive behavior-reactivity toward oxygen, water, halogens; standard reduction potentials; 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.

1.2 Variable oxidation states, lower oxidation states and stabilization, catalytic properties.

1.3 M-M bonding and cluster compounds; oxides, mixed oxides, halides, and oxohalides of transition metals; synthesis and reactivity of vanadates, chromates, dichromate, molybdates, tungstates, tungsten bronzes, manganate, permanganate; polycations.

1.4 Interstitial compounds: nitrides, carbides, hydrides, borides of Ti, V, Cr, W, and their industrial uses.

Unit -2: Metallurgy (15 h)

2.1 Overview of the abundance and occurrence of transition metals; mineral benefication-pretreatment, dense medium separation, flotation process, solution methods, magnetic separation, electrostatic precipitation;

2.2 Factors influencing the choice of extraction process, thermal decomposition methods; displacement of one metal by another; high temperature chemical reduction methods-reduction by carbon, reduction by metal, self-reduction, reduction of oxides with hydrogen; electrolytic reduction-in aqueous solution, in nonaqueous solvents, in fused melts; thermodynamics of reduction processes-the Ellingham diagram.

2.3 Metallurgy of Ti, V, W, and Cr.

Self-study

(a) The natural occurrence and ores of transition metals.

(b) The common and stable oxidation states of transition metals.

(c) Metallurgy of Cu and Zn.

Unit -3: Lanthanides and Actinides (15 h)

3.1 Lanthanides: lanthanide series, abundance and natural isotopes, lanthanide contraction, similarity in properties, occurrence, oxidation states, chemical properties of lanthanide(III) cations,electronic spectra of lanthanide compounds.

3.2 Separation of lanthanides: solvent extraction, ion exchange, chemical properties of Ln(III) metal ions.

3.3 Actinides: actinide series, abundance and natural isotopes, occurrence, separation of actinides, oxidation states, general properties, the later actinide elements.

3.4 Uranium-occurrence, metallurgy; chemical properties of hydrides, oxides, and halides.

Self-study

(a) The minerals of lanthanides and actinides and their occurrence in India.

(b) The electronic configurations of lanthanides and their positions in the periodic table.

Unit-4: Nucleus and Radiochemistry (15 h)

4.1 The nucleus: subatomic particles, structure of the nucleus-forces in the nucleus-mesons; stability of nucleus-n/p ratio, binding energy; radioactive elements. Factors affecting stability of nucleus-binding energy per nucleon, *n/p* ratio, magic number, odd-even rule.

4.2 Radiochemistry: Natural and induced radioactivity; radioactive decay; neutron emission, positron emission, electron capture; unit of radioactivity (Curie); half life period; Geiger-Nuttal rule, radioactive displacement law, radioactive series.

4.3 Measurement of radioactivity: ionization chamber, Geiger counters, scintillation counters.

Self-study

(a) Nature of subatomic particles.

(b) Radioactive isotopes.

Unit-5: Nuclear Reactions (15 h)

5.1 Nuclear reactions: types of nuclear reactions, nuclear cross section, spallation, nuclear fission-theory of nuclear fission; chain reaction, critical mass; nuclear reactors-fast breeder reactors, fuels used in nuclear reactors, separation of isotopes, moderators, coolants; nuclear fusion; nuclear reactors in India.

5.2 Applications: energy tapping, dating of objects, neutron activation analysis, isotopic labeling studies, nuclear medicine-^{99m}Tc radiopharmaceuticals.

Self-study

(a) Isotopes used in nuclear fission reactions.

(b) Radioisotopes used in noninvasive imaging techniques in nuclear medicine.

Text Books

1. J. D. Lee, *Concise Inorganic Chemistry*, 5th ed., Blackwell Science, London, 1996.
2. D. F. Shriver and P. W. Atkins, *Inorganic Chemistry*, 3rd ed., W. H. Freeman and Co, London, 1999.
3. H. J. Arnikar, *Essentials of Nuclear Chemistry*, 4th ed., New Age International, New Delhi, 1995.
4. B. R. Puri, L. R. Sharma, K. C. Kalia, *Principles of Inorganic Chemistry*, Shoban Lal Nagin Chand and Co., Delhi, 1996.

References

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, *Inorganic Chemistry*, 4th ed., Harper Collins, New York, 1993.
2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, *Advanced Inorganic Chemistry*, 6th ed., John Wiley, New York, 1999.
3. T. Moeller, *Inorganic Chemistry: A Modern Introduction*, Wiley, New York, 1990.

CH -5512: **PHASE EQUILIBRIA AND KINETICS**

Semester – V | No. of credits: 5

Course: Major core (**MC**) | No. of hours: 5h/wk

Objectives: The students should be able to

1. *Apply phase rule to different systems.*
2. *Understand the significance of colligative properties.*
3. *Study the rate and rate constants of various reactions.*

Unit-1: Phase Equilibria (15 h)

1.1 Phase Rule: Concepts of phase, component and degrees of freedom, with examples. Gibb's phase rule – derivation.Clapeyron and Clausius-Clapeyron equations and their applications to equilibria in phase transitions.

1.2 **Phase diagram and application of phase rule**: *One-component system*- Water and sulphur systems.

Two component system: (i) Simple eutectic: Lead-silver system. (ii) Formation of compound with congruent melting point: Ferric chloride – water system. Three component systems: General account of graphical representation of three component systems, examples of three component systems having one, two partially miscible pairs.

Self-study: *Formation of compound with incongruent melting point.*

Unit-2: Colligative Properties of solutions (15 h)

2.1 Ideal solutions: Vapour pressure- Composition diagrams of solutions. Raoults law, positive and negative deviations from the law.

2.2 Principle of fractional distillation: Binary systems. Vapour diagram and azeotropic distillation, Partially miscible binary systems (CST-UCST, LCST, and both UCST and LCST). Effect of addition of solute on CST.Steam distillation.Solubility of gases in liquids; Henry's law, its relationship with Raoults law.

2.3 Lowering of vapour pressure: Thermodynamics derivation for elevation of boiling point and depression of freezing point. Relationship between osmotic pressure and vapour pressure.vant Hoff's theory of dilute solutions.

2.4 Distribution law: Thermodynamic derivation; limitation of the law, application in studying association, dissociation and solvation. Study of formation of complex ions.Extraction with solvents; efficiency of extraction.

Self-study: *Determination of molecular weight by Cottrell's, Beckmann's and Berkeley and Hartley method.*

Unit-3: Chemical kinetics- kinetic parameters (10 h)

3.1 Rate, order, rate law, rate constants. Simple reactions involving zero, first, second and third – order reactions. Derivation of rate equations for zero, first and second order reactions. Pseudo-first – order reactions.

3.2 Determinations of rate, rate constant and order by different methods. Simple mechanisms and molecularity of reactions (S_N1 and S_N2).

Self-study: *Study of kinetics of pseudo-first-order reactions – acid and base catalyzed hydrolysis of ester and inversion of cane sugar.*

Unit-4: Types and theories of chemical reaction rates (15 h)

4.1 Reversible or opposing, consecutive and parallel reactions (no derivation expected).

Thermal chain reactions.(i) H_2 and Br_2 reaction (ii) Dissociation of acetaldehyde. Steps involved only (no kinetic expressions needed).

4.2 Factors affecting chemical reactions – nature of reactants, concentration, catalyst, solvent polarity and ionic strength (only qualitative ideas). Arrehenius equation.Collision theory of bimolecular and unimolecular reactions.Lindemann hypothesis. Transition state or absolute reaction rate theory (ARRT) (no derivation expected).

Self-study: *Comparison of thermal and photochemical chain reactions.*

Unit-5: Catalysis (20 h)

5.1 **Homogeneous catalysis**

Reactions in gases and in solutions (Acid, base and Wilkinson's catalysts). Kinetics of enzyme catalysis :Michaelis-Menton equation. Factors affecting enzyme catalysis.

5.2 **Heterogeneous catalysis**

Langmuir adsorption isotherm.Its application to slightly, strongly, and moderately adsorbed systems.Mechanisms of uni and bi molecular surface reactions.

Self-study*: Enzyme catalysis in biological systems.*

Text Books

1. S.H. Maron and J.B. Lando, *Fundamentals of physical chemistry*, Macmillan limited, New York, 1966.
2. B.R. Puri and L.R. Sharma, *Principles of physical chemistry*, ShobanLalNagin Chand and Co. 33rd ed., 1992.

References

1. S.K. Dogra and S. Dogra, *Physical chemistry through problems*, New age international, 4th ed., 1996.
2. Gilbert. W. Castellan, *Physical chemistry*, Narosa publishing house, 3rd ed., 1985.
3. P.W. Atkins, *Physical chemistry*, Oxford university press, 1978.
4. K. L. Kapoor, *A textbook of Physical chemistry*, (volume-2 and 3) Macmillan, India Ltd, 1994.
5. R. A. Alberty & R.J. Silbey *Physical Chemistry 2nd ed.,* Wiley Eastern Ltd., New York 1997.

CH-5513:**FUNDAMENTALS OF SPECTROSCOPY**

Semester – V No. of credits: 5

Course: Major core (**MC**) No. of hours : 5h/wk

Objectives

To learn the basic analytical methods of various spectral analysis and their significance.

Unit-1: Introduction to Spectroscopy (15 h)

1.1 Interaction of radiation with matter: Electromagnetic spectrum, quantisation of energy, Electronic, vibrational and rotational energy levels, and transitions in atoms and molecules.Absorption and emission spectra.

1.2 Boltzman distribution (formula only). Relative population of translational, rotational, vibrational and electronic energy levels at different temperatures,transition probabilities

1.3 Selection rules, line widths, resolution and signal to noise ratio.

Unit-2: Electronic Spectroscopy (15 h)

2.1 Absorption laws, calculations involving Beer – Lambert's law, verification and its limitations.

2.2 Instrumentation of photocolorimeter and spectrophotometer, types of electronic transitions, chromophores and auxochromes, absorption bands and intensity, factors governing absorption maximum and intensity.

2.3 Atomic absorption spectroscopy and Flame photometry – principles and applications

Unit-3: Infrared Spectroscopy (15 h)

3.1 Principle, types of stretching and bending vibrations, vibrational frequencies, instrumentation, block diagram, source, monochromator, cell sampling techniques, detector and recorders, identification of organic molecules from characteristic absorption bands.

3.2 Raman spectroscopy, Raleigh and Raman scattering, stoke's and antistoke's line, instrumentation, block diagram, differences between IR and Raman spectroscopy, mutual exclusion principle, applications, structural diagnosis.

Unit-4: NMR Spectroscopy (15 h)

4.1 Principle of nuclear magnetic resonance, basic instrumentation, shielding mechanism, chemical shift, multiplicity, spin-spin coupling and coupling constants, splitting of signals, deuterium labeling.

4.2 Applications of NMR to simple organic compounds.

Unit-5: Mass spectrometry (15 h)

5.1 Basic principles of mass spectrum, molecular ion peak, base peak, isotopic peak, metastable peak and their uses, fragmentation – nitrogen rule.

5.2 Instrumentation, determination of molecular formulae with example, mass spectrum of simple organic compounds, identification – alcohols, aldehydes, aromatic hydrocarbons

5.3 Combined application in identifying organic compounds.

Text Books

1. D.A. Skoog, D.M. West and F.J. Holler, *Analytical Chemistry: An Introduction*, 5th ed., Saunders college publishing, Philadelphia, 1990.
2. U.N. Dash, *Analytical Chemistry: Theory and Practice*, Sultan Chand and sons Educational Publishers, New Delhi, 1995.
3. R.A. Day Jr. A.L. Underwood, *Quantitative analysis*, 5th ed., Prentice Hall of India Private Ltd., New Delhi, 1988.

References

4. V.K. Srivastava and K.K. Srivastava, *Introduction to Chromatography: Theory and Practice*, S. Chand and company, New Delhi, 1987.
5. S. M. Khopkar, *Basic concept of Analytical Chemistry*, 2nd ed., New Age International Publishers, New Delhi, 1998.

CH -5514: GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATIONS

Semester – V | No. of credits: 4

Course: Major core(**MC**) | No. of hours : 4h/wk

Objectives

1. *To acquire the quantitative skills in gravimetric analysis and in inorganic preparations.*
2. *To plan experimental projects and execute them.*

1. Gravimetric analysis

Estimation of sulphate as barium sulphate.

Estimation of barium as barium chromate.

Estimation of copper as copper as copper thiocyanate.

Estimation of nickel as Ni-DMG.

Estimation of lead as lead chromate

Estimation of magnesium as magnesium pyrophosphate.

Estimation of calcium as calcium oxalate.

Estimation of copper in an alloy.

2. Organic preparations

Single stage organic preparations involving bromination, hydrolysis, nitration, oxidation, and benzoylation.

References

1. Sundaram, Krishnan, Raghavan, *Practical Chemistry* (Part III), S. Viswanathan Co. Pvt., 1996.
2. Vogel's *Text Book of Quantitative Chemical Analysis*. 5th Edi., ELBS/Longman England, 1989.
3. N.S. Gnanapragasam and G. Ramamurthy, *Organic chemistry – Lab manual*, S. Viswanathan Co. Pvt. Ltd., 2002.

CH -5402:POLYMER CHEMISTRY

Semester – V | No. of credits:2

Course:Elective Subject (**ES**) | No. of hours: 3h/wk

Objectives:*The students should be able to*

1. *Understand the importance of industrial polymers and their classification*
2. *Learn the various mechanisms and techniques of polymerization*.

Unit -1: Introduction to Polymers (10 h)

1.1 Monomers, Oligomers, Polymers and their characteristics

1.2 Classification of polymers: Natural, synthetic, linear, cross linked and network; Plastics, elastomers, fibres, Homopolymers and Co-polymers

1.3 Bonding in polymers: Primary and secondary bond forces in polymers ; cohesive energy.

1.4 Determination of Molecular mass of polymers: Number Average molecular mass (M_n) and Weight average molecular mass (M_w) of polymers.

Self study:*Molecular weight determination of high polymers by different methods*.

Unit -2: Mechanism of Polymerization (10h)

2.1 Chain growth polymerization: Cationic, anionic, free radical polymerization, Stereo regular polymers: Ziegler Natta polymerisation

2.2 Step growth polymerisation.

Self-study:*Degree of polymerization*

Unit -3: Techniques of Polymerization and Polymer Degradation (10h)

3.1 Bulk, Solution, Emulsion, Suspension, interfacial and gas phase polymerization

3.2 Types of Polymer Degradation, Thermal degradation, mechanical degradation, photodegradation, Photo stabilizers.

Self study:*Solid and gas phase polymerization*

Unit -4: Industrial Polymers (10 h)

4.1 Preparation of fibre forming polymers, elastomeric material.

4.2 Thermoplastics: Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester.

4.3 Thermosetting Plastics : Phenol formaldehyde and expoxide resin.

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

Self-study:*Poly methylmethacrylate, polyimides, polyamides, polyurethanes, polyureas, polyethylene and polypropylene glycols*

Unit-5: Introduction to Polymer Processing (5 h)

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

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

Self-study: *Film casting,Thermofoaming, Foaming*.

Text Books

1. V.R. Gowariker, *Polymer Science*, Wiley Eastern, 1995.
2. G.S. Misra, *Introductory Polymer Chemistry*, New Age International (Pvt) Limited, 1996.

References

1. F. N. Billmeyer, *Textbook of Polymer Science*, Wiley Interscience, 1971.
2. A. Kumar and S. K. Gupta, *Fundamentals and Polymer Science and Engineering*, Tata McGraw-Hill, 1978.

CH -5403: **FORENSIC SCIENCE**

Semester – V | No. of credits: 2

Course :Elective Subject (**ES**) | No. of hours :3h/wk

Objectives:

To understand the importance of chemistry in the field of crime detection.

Unit -1:Food Adulteration (10 h)

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

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

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

Unit -2:Transportation (10 h)

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

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

Unit -3:Crime Detection (10 h)

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

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

Unit -4: Forgery and Counterfeiting (10h)

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

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

Unit -5: Medical Aspects (5h)

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

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

Text book:

1. K. S. Narayan Reddy, *The Essentials of Forensic Medicine and Toxicology*, 12th ed., Sri Lakshmi Art Printers, Hyderabad, 1990.

CH -5404: **BIOCHEMISTRY**

Semester – V | No. of credits: 2

Course :Elective Subject (**ES**) | No. of hours : 3h/wk)

Objectives:

1. *To develop a sound knowledge of fundamental concepts in biochemistry.*
2. *To enumerate the molecular motif of a living cell, structural and functional hierarchy of biomolecules.*
3. *To emphasis the various aspects of metabolism and interrelationship of metabolic events.*

Unit -1:Amino acids and Proteins (9 h)

1.1 **Living Cell** – Plant and Animal cell. Cell membrane – organelles – functions of major sub-cellular components – Anabolism and catabolism and their relation to metabolism.

1.2 **Amino acids** – classification –Synthesis of α-amino acids and their identification.

1.3 Peptide bond- stereochemistry, synthesis of peptides by solution and solid phase techniques.

1.4 Proteins– classification – properties-3D structure-determination of amino acid sequence – denaturation and renaturation of protein molecules.

1.5 Separation and purification of proteins – dialysis – gel filtration - electrophoresis.

1.6 Catabolism of amino acids: Transamination, oxidative deamination, decarboxylation. The urea cycle and other possibilities of detoxification of ammonia.

Self-study: *Rare amino acids of proteins, tertiary structure of globular proteins. Plasma proteins*.

Unit -2: Enzymes (9 h)

2.1 Nomenclature, classification and properties-specificity, factors influencing enzyme action.

2.2 Mechanism of enzyme action – Lock and Key model and induced fit models.Coenzymes – cofactors – prosthetic groups of enzymes (TPP, NAD, NADP, FAD, ATP). Their importance in enzyme action.

2.3 Mechanism of inhibition (competitive, non- and uncompetitive and allosteric). Immobilization of enzymes. Enzyme specificity,

Self-study: *Kinetics of mono and disubstrate enzyme catalyzed reactions. Serum enzymes and isoenzymes-their diagnostic value*.

Unit -3:Lipids (10 h)

3.1 Classification - neutral lipids, Phospho lipids (lecithines, cephalins, plasmalogens) and glycolipids – importance, synthesis and degradation.

3.2 Fatty acids – saturated, unsaturated fatty acids, EFA. Properties – Hydrolysis-acid number, saponification number. Auto-oxidation (Rancidity), addition reactions-Iodine value, Polenske number, Reichert-Meissl number, acetyl number. Hydrogenation

3.3 Cholesterol – biosynthesis. Bile salts derived from cholesterol.

3.4 Metabolism: Oxidation of glycerol – β-oxidation of fatty acids; biosynthesis of lipids – synthesis of fatty acids and synthesis of triglycerides.

Self-study: *Reaction of lipases on triacylglycerols in aqueous and organic solvents. Steroid hormones, vitamin D, lipoproteins*.

Unit-4: Carbohydrates (10 h)

4.1 Classification – reducing and non-reducing sugars. Glucose: structure-conformation – stability

4.2 Carbohydrates of the cell membrane – starch, cellulose and glycogen. (Structure and utility)

4.3 Metabolism: Glycolysis and its reversal; TCA cycle. Relation between glycolysis and respiration.Principles of bioenergetics, electron transport chain and oxidative phosphorylation.

Self-study:*Gluconeogenesis, pentose phosphate pathway*.

Unit -5: Nucleic Acids (7 h)

5.1 Nucleosides and nucleotides – purine and pyrimidine bases. Nucleic acids Difference between DNA and RNA. Classification of RNA.

5.2 Biosynthesis of DNA: Replication. Biosynthesis of mRNA: Transcription.

5.3 Genetic code – mutations and mutants. DNA repair.Biosynthesis of proteins.

5.4 DNA sequencing and PCR, recombinant DNA technology, DNA polymorphism.

Self-Study:*Strategies for screening DNA libraries. Blood composition.Blood coagulation.Haemoglobin - its role in chemistry of respiration*.

Text books

1. Lehninger, *Principles of Biochemistry*, 4th ed., by David L. Nelson and Michael M. Cox, Worth Publishers, New York, 2005.
2. L. Veerakumari, *Biochemistry,* MJP publishers, Chennai, 2004.
3. Lubert Stryer, *Biochemistry*, W. H. Freeman and company, New York, 1975.

References

1. J. L. Jain, *Biochemistry*, Sultan Chand and Co.1999
3. A. Mazur and B. Harrow, *Text book of biochemistry*, 10th ed., W.B. Saunders Co., Philadelphia, 1971.
4. Paula Yurkanis Bruice, *Organic chemistry*, 3rd ed., Pearson Education, Inc. (Singapore), New Delhi, reprint, 2002.
5. P. W. Kuchel and G. B. Ralston, Shaum Series, *Theory and Problems of Biochemistry*, McGraw-Hill Book Company, New York, 1988.

CH - 5405: AGRICULTURAL CHEMISTRY

Semester – V	No. of Credits : 2
Course: Elective Subject (**ES**)	No. of hours: 3h/wk

Objectives:

To understand the importance of chemistry related to soil. To analyze suitable methodsfor the cultivationand promotion of agriculture.

Unit-1: Soil Genesis **(10h)**

1.1 Soil geology - Geomorphology & Geochemistry - origin of earth - Geological formationof India-Soilforming rocks and minerals and their classification –

1.2 Weathering of rocks and minerals and their classification - weathering of rocks and minerals weathering stability, sequences – agencies and weathering indices - factors of soil formation soil forming process .

Unit- 2: Analysis and Dynamics of Nutrients in Soils **(10h)**

2.1 Soilanalysis.Composition of soil : Organic and Inorganic constituents. Types of soils, Soil

acidity : buffering capacity of soils. Limiting of soil.

2.2 Nitrogen cycle - sources - Nitrogen fixation - Transformation in flooded and upland soils immobilisation -mineralisation - Nitrogen in relation to atmospheric pollution.

2.3 Phosphorus cycle - sources inorganic and organic fractions of soils - Fixation and transformation - availability - phosphate potential - intensity and quantity factors.Phosphate buffering capacity.

Unit- 3: Fertilizers (8h)

3.1 Peat and organic manures (composts).Role of humus.Effluent from gobar gas plants.

3.2 Use of fertilizers : urea, DAP, Super phosphate, Gypsum, NPK-mixed fertiizers, Optimal addition of Fertilizers to obtain estimated yields.

Unit- 4: Pesticides (12h)

4.1 Insecticides: stomach and contact poisons. Plant derivatives : pyrethrine, Nicotine and rotenone

4.2 Synthetic organic: carbophos, carbaryl, p-DCB, dimethoate, butachlor, Endrin, Aldrin (Chemical name and uses).Rodenticdes.

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

4.4 Herbicides and weedicides : Selective and non-selective, 2, 4-D and 2, 4, 5-t (structure and function)

4.5 Intenerated pest management.Sex attractants for insect control.Sustainable agriculture.

Unit- 5: Plant Growth Regulators (5 h)

5.1 3-Indole acetic acid, Napthalane acetic acid, Ethepon (2-chloroethyl phosphoric acid), Alar (succinin acid-2, 2-dimethyhydrzine) - functions.

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

Text book

1. G.T. Austin ,*Shreve's Chemical Process Industries*, 5th ed.,TataMc-Graw-Hill, 1984.

Reference

2. B.A. Yagodin ,*Agricultural Chemistry*, Mir Publishers (Moscow), 1976.

LOYOLA COLLEGE (AUTONOMOUS)
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VI-SEMESTER

CH -6612: MOLECULAR DYNAMICS

Semester – VI | No. of credits:5

Course : Major Special(**MS**) | No. of hours: 4h/wk

Objectives

The student should be able to

1. *Understand the difference between classical mechanics and quantum mechanics, the modern concept of atomic structure and the applications of quantum mechanics to conjugatedpolyenes.*
2. *Know the basic concepts in statistical thermodynamics.*
3. *Understand the photochemical activation and deactivations of molecules.*

Unit-1: Transition from Classical mechanics to Quantum mechanics (10h)

1.1 Classical mechanics: Concepts – failures. Photoelectric effect.Energy distribution inblack body radiation.

1.2 Bohr's theory of atom – derivation for energy of an electron in hydrogen like species. Emission spectrum of hydrogen atom – Zeemann effect.

Self-study:*Concept of orbitals and quantum numbers – Pauli's exclusion principle*.

Unit–2:Principles of Quantum chemistry (10 h)

2.1 Postulates of quantum mechanics. Concepts of operators, Eigen functions, Eigen values. Schrodinger equation.

2.2 Particle in one-dimensional box - derivation for energy. Application to linear conjugated polyenes (ethylene and butadiene).

Unit–3:Basic principles of statistical thermodynamics (10 h)

3.1 Thermodynamic probability – macro and microstates, most probable distribution. Maxwell–Boltzmann statistics. Partition function – relation between partition function and energy. Separation of partition function – partition function for translation.

3.2 Entropy and probability. Translational entropy: Sackur-Tetrode equation (no derivation) . Residual entropy.

Unit–4: Photo physical processes in electronically excited molecules (15 h)

4.1 Laws of photochemistry. Jablonski energy level diagram – primary and secondaryphotochemical processes. Radiationless transition – internal conversion and inter system crossing. Radiative transitions – fluorescence - relation to structure. Phosphorescence – conditions for phosphorescence emission (spin-orbit coupling). Chemiluminescence.

4.2 Experimental techniques of photochemical reactions – chemical actinometers–quantum yield. Mechanism of photosynthesis

Unit–5:Photochemical kinetics (15 h)

5.1 Kinetics of photochemical reactions between hydrogen & chlorine, hydrogen &bromine – rate law, comparison with thermal reactions.

5.2 Bimolecular quenching – Stern-Volmer equation – photosensitization.

5.3 Kinetics of fast reactions –principle of relaxation methods - flash photolysis.

Text books

1. R.K. Prasad,*Quantum chemistry*, New age international(P) Ltd., 1997.
2. B.R.Puri and L.R. Sharma,*Principles of physical Chemistry* ,ShobanLal Nagin Chand and Co., 36th ed., 1996.
3. K.K.Rohatgi Mukherjee, *Fundamentals of photochemistry (Revised edition)*, Wiley Eastern Ltd., 1996.

References

1. D.A.McQuarrie and J. D.Simon, *Physical Chemistry-A Molecular Approach,* Viva Books (P) Ltd., 1999.
2. R. A. Alberty and R.J. Silbey ,*Physical Chemistry,*2nd ed.,Wiley Eastern Ltd., New York 1997.
3. S.H.Maron and J.B.Lando, *Fundamentals of Physical Chemistry*, Macmillan Ltd., New york,1996.
4. P.W. Atkins, *Physical Chemistry*,OxfordUniversity Press, 1978.
5. K.L.Kapoor, *A Textbook of Physical Chemistry*, Vol.4,Macmillan India Ltd., 1992.

LOYOLA COLLEGE (AUTONOMOUS)
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CH-6613: COORDINATION CHEMISTRY

Semester–VI | No. of credits: 5

Course: Major Special (**MS**) | No. of hours : 4h/wk

Objectives

1. *To understand the nature of bonding in coordination compounds.*
2. *To understand the nature of metal-ligand bonding in organometallic compounds and their reactivity.*
3. *To know the method of synthesizing coordination compounds.*
4. *To understand the importance and application of coordination compounds in catalysis and in industry.*
5. *To know the role of transition metal ions in primary bioinorganic systems and the importance of coordination compounds in medicine.*

Unit-1: Theory of Coordination Compounds (15 h)

1.1 Introduction: ligands-monodentate, bidentate, and polydentate ligands; coordination sphere; coordination number; nomenclature of mononuclear complexes; chelate effect; thermodynamics of formation of coordination compounds.

1.2 Isomerism: linkage-, ionization-, hydrate-, coordination-, coordination position isomerism, geometrical- (*cis*-/*trans*- and *fac*-/*mer*-), and optical isomerism.

1.3 Theories: Sidgwick theory-EAN and stability, formation of metal-metal bond in dimmers, limitations of Sidgwick theory; valence bond theory-hybridization, formation of tetrahedral and octahedral complexes, geometry-magnetic property relationship, drawbacks of VBT.

1.4 Crystal field theory: assumptions of crystal field theory, crystal field splitting in octahedral and tetrahedral geometries-qualitative crystal field splitting diagrams, high-spin and low-spin complexes, CFSP and factors affecting it, computation of CFSE, evidences of crystal field splitting,spectrochemical series.

1.5 Jahn Teller theorem, crystal field splitting in tetragonally distorted octahedral geometry, and in square planar geometry.

1.6 Covalency in transition metal complexes: evidences for covalency-intensity of d-d transitions, nephelauxetic effect, spin-spin splitting, hyperfine splitting, adjusted crystal field theory

1.7 MO Theory: Metal orbitals and LGOs suitable for σ- and π-bonding in octahedral geometry, construction of qualitative MO energy level diagram for σ-bonding in octahedral geometry.

Self-study

(a) Survey of common monodentate and bidentate ligands.

(b) Illustration of the failure of EAN rule and the limitations of VB theory with examples.

Unit-2: Reaction Mechanisms of Coordination compounds (15h)

2.1 Substitution reactions in octahedral complexes: dissociative and associative and interchange mechanisms.

2.2 Electron transfer reactions: inner-sphere and outer-sphere mechanisms, noncomplementary electron transfer reactions.

2.3 Inorganic photochemistry: principles, photosubstitution, photoisomerization, and photoredox reactions.

2.4 Substitution reactions in square complexes: dissociative and associative mechanisms.

2.5 Vaska's complexes: structure and reactivity, oxidative addition and reductive elimination reactions.

Unit-3: Organometallic Compounds and Catalysis (10 h)

3.1 Nomenclature of organometallic compounds, 16- and 18-electron rule.

3.2 Structure and bonding in transition metal carbonyls: polynuclear carbonyls, bridging and terminal carbonyls

3.3 Organometallic compounds of Ti, Fe, Co, Zn, Hg: alkyls, aryls, and their synthetic uses.

3.4 Transition metal alkyls, carbenes, and carbynes, and metallocenes-synthesis and structures.

3.5 Wilkinson's catalyst and alkene hydrogenation, hydroformylation, Monsanto acetic acid process, Ziegler-Natta catalyst and polymerization of olefins.

Unit-4: Synthesis of Coordination Compounds (10 h)

4.1 *Cis*- and *trans*-effects in synthesis of square planar and octahedral complexes.

4.2 Metal template synthesis-metal phthalocyanins and Schiff bases.

Unit-5: Inorganic Biochemistry (10 h)

5.1 Biological roles of transition metal ions containing proteins and enzymes: apoenzymes and coenzymes; heme proteins-hemoglobin and myoglobin: general structures features and mechanism of oxygen transport.

5.2 Biological role of cytochromes, carboxypeptidase A, superoxide dismutase; in vivo and in vitro nitrogen fixation.

5.3 Inorganic medicinal chemistry: radiopharmaceuticals, chelate therapy, and contrast agents in MRI.

Self-Study

(a) Synthesis and properties of metal carbonyls, bridging and terminal carbonyls, and metal alkyls.

(b) Essential and trace elements in biological systems.

Text books

1 J. E. Huheey, E. A. Keiter andR. L. Keiter, *Inorganic Chemistry, Principles of Structure and Reactivity*, 4th ed., Harper Collins, 1993.

2. F.A. Cotton,G.Wilkinson,C. A. Murillo andM.Bochmann, *Advanced Inorganic Chemistry*, 6th ed., John Wiley, 1999.

3. D. F.Shriver,;P. W Atkins,.; C. H. Langford, *Inorganic Chemistry*, 3rded., Oxford University Press, 2000.

References

1. M. L Tobe,;J.Burgess,. *Inorganic Reaction Mechanisms*, Addison Wesley Longman, 1999.

2. S.Arunachalam, *Inorganic Photochemistry*, Kala Publications, Trichirapalli, 2002.

CH -6614: CHEMISTRY OF MATERIALS

Semester – VI | No. of credits: 4

Course: Major-Special (**MS**)(Package-A) | No. of hours : 3h/wk

Objective

To introduce area of solid state chemistry and material science.

Unit-1: Structures of solids (10 h)

1.1 Introduction to solids – crystalline and amorphous. Unit cell, Bravais lattices and X-ray structure determination (NaCl and KCl only) – powder and single crystal- methods and applications-identification of the cubic lattice and indexing of the X-ray diffraction lines.

1.2 Radius ratio rules – coordination number. Packing arrangement -different structure types in solids – rock salt, zinc blende, wurtzite, fluorite and antifluorite, spinel and inverse-spinel and perovskite structures.

Unit-2:Preparative methods and characterization (10 h)

2.1 Solid state reactions – ceramic method, sol-gel, hydrothermal, high pressure, zone refining, CVD, Czochralski and Bridgman and Stockbarger methods.

2.2 Physical methods – thermogravimetric and differential thermal analysis and scanning electron microscopy (only introduction and application).

Unit-3:Electrical and optical properties (10 h)

3.1 Defects in solid state – point defects – Frenkel and Schottky defects and non-stoichiometric defects.

3.2 Conductors – variation of conductivity with temperature – semiconductors – p and n types, pn- junction, photoconduction, photo voltaic cell and photogalvanic cell – solar energy conversion, organic semiconductors.

3.3 Piezoelectric, pyro-electric and ferroelectrics (introduction and application). Photoluminescence.

Unit-4:Magnetic properties (7h)

4.1 Magnetic properties – classification - diamagnetic, paramagnetic, antiferromagnetic, ferro and ferri magnetic — magnetic susceptibility.

4.2 Variation with temperature – Curie-Wiess law, Curie temperature and Neel temperature. Permanent and temporary magnets.

Unit-5:Special materials (8 h)

5.1 Superconductivity – introduction, Meissner effect – mention of Bardeen, Cooper and Schrieffer theory and Cooper pairs – examples of superconducting oxides, Chevrel phases – applications of superconducting materials.

5.2 Ionic conductors – sodium-β alumina, sodium-sulphur battery. Intercalation – layered compounds – graphitic compounds. Special applications of solid state materials.High energy battery, lithium cells.

5.3 Liquid crystals: nematic, cholesteric and smectic types and applications.

Text books

1. L.Smart and E. Moore, *Solid State Chemistry-An Introduction*, Chapman Hall, London, 1992.
2. M. G. Arora,*Solid State Chemistry*, Anmol Publications, New Delhi, 2001.
3. P. K. Palanisamy, *Materials Science*, SciTech Publications, Chennai, 2003.

References

1. W. L. Jolly, *Modern Inorganic Chemistry*, McGraw Hill Book Company 2nd ed., 2007.
2. D. F. Shriver and P. W. Atkins, *Inorganic Chemistry* Longford, Oxforduniversity press, 1990.
3. H. P. Meyers, *Introductory Solid State Physics* Viva Books Private Limited, 1998.
4. A. R. West, *Solid State Chemistry and its applications*, John-Wiley and sons,1987.
5. H. J. Emelius and A. G. Sharpe,*Modern aspects of Inorganic Chemistry* Universal Book stall, 1989.

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CH -6615: SYNTHETIC ORGANIC CHEMISTRY

Semester – VI | No. of credits: 5

Course : Major-Special(**MS**)(Package-A) | No. of hours : 4h/wk

Objectives

The course should prepare the students for

1. *Looking at the molecular complexity of carbon skeletons and the presence of functional groups and their relative positions.*
2. *Applying disconnection approach and identifying suitable synthons.*
3 *Identifying suitable reaction sequences to achieve the synthesis of target molecules.*
4. *Studying various synthetically important reactions with a view to appreciate their scope, limitations and potential use in synthetic sequences.*

Unit-1: Planning an Organic Synthesis and Control elements (15 h)

1.1 Preliminary Planning – knowns and unknowns of the synthetic system studied.

1.2 Analysis of the complex and interrelated carbon framework into simple rational precursors.

1.3 Retrosynthetic analysis, alternate synthetic routes. Key intermediates that would be formed, available starting materials and resulting yield of alternative methods.

1.4 Linear Vs convergent synthesis.Synthesis based on umpolung concepts of Seeback.

1.5 Regiospecific control elements. Use of protective groups, activating groups and bridging elements.

1.6 Synthesis of simple compounds.

Self-Study: *Examples on retrosynthetic approach, calculation of yield, advantages of connvergent synthesis, synthesis of stereochemistry controlled products.*

Unit-2: Organic Reactions of Importance in Synthesis (10 h)

2.1 Catalytic hydrogenation and dehydrogenation

2.2 Reductions with LAH, $NaBH_4$ and DIBAL.

2.3 Hydroboration and oxidation.

2.4 Birch, Clemmenson and Wolf-Kishner reduction

2.5 Oxidation with Cr(VI) and Mn(VII) reagents

2.6 Oxidation by peracids and DMSO with oxalyl chloride

Self-Study: *Mechanism for each reactions, synthesis of organometallic compounds and reactions.*

Unit –3: Introduction to Pericyclic Reactions (15h)

3.1 Cycloaddition reactions: Diels alder reactions.

3.2 Electrocyclization reaction.

3.3 Sigmatropic rearrangements: (3,3), (5,5)-sigmatropic rearrangements.

3.4 Group transfer reactions.

3.5 Thermal and photochemical FMO approach.

Self Study: *Crossed aldol condensation, reactions involving active methylene groups, Diels Alder reactions under heat or light.*

Unit-4: Synthesis involving Active Methylene Group (10 h)

4.1 Malonic and acetoacetic esters: Characteristic reactions of active methylene group, synthetic uses of malonic, acetoacetic and cynaoacetic ester.

4.2 Diazomethane and diazoacetic ester: Preparation, structure and synthetic applications.

4.3 Aldol, crossed aldol condensation and Cannizaro reactions.

Self-Study: *Specific examples on preparation of synthetically important compounds from diazomethane and diazoacetic esters.*

Unit-5: Introduction to Green Chemistry (10 h)

5.1 Importance and experimental conditions required.

5.2 Microwave assisted reactions, solid state synthesis and ionic liquid reactions.

5.3 Synthesis of simple compounds.

Text books

1.M.B. Smith, *Organic Synthesis*, McGraw Hill International Edition 1994.

2.Ian Fleming, *Pericyclic Reactions*, Oxford Science Publications, Cambridge, 1999

3.V. K. Ahluwalia and Renu Aggarwal, *Organic Synthesis; Special Techniques*, Narosa Publishing House, New Delhi, 2001.

4. Rashmi Sanghi, M.M. Srivastava, *Green chemistry*, *Environment Friendly Alternatives*, Narosa Publishing House, 2007.

References

1. R. E. Ireland,*Organic synthesis*, Prentice Hall India, Goel publishing house, 1990
2. R. T. Morrison and R. N. Boyd, *Organic Chemistry*, Prentice Hall Inc., 6th ed., 1992.
3. Kiochi Tanaka, *Solvent Free Organic Synthesis*, Wiley VCH, Weinheim, 2003.
4. V. K. Ahluwalia, *Organic Reaction Mechanism*, Ane Books Pvt. Ltd, 2007.

CH-6616: CHEMISTRY OF NATURAL PRODUCTS

Semester – VI | No. of credits: 4
Course : Major Special course[**MS**](Package-B) | No. of hours : 3h/wk

Objectives

This course should prepare the students for

1) *An introduction to chemistry of natural products like alkaloids, terpenoids, etc.*
2) *Understanding of the methods of isolation, purification and structural elucidation of natural products.*
3) *an introduction to synthesis of important natural products.*
4) *an appreciation of bio-activity of natural products*

Unit-1: Alkaloids (10 h)

1.1 Introduction and functions of alkaloids.

1.2 Classification, general methods of structural elucidation

1.3 Structure and biological properties of coniine, piperine, nicotine and papaverine.

Self-Study: *Occurrence, classification and isolation*

Unit-2: Terpenoids and Carotenoids (10 h)

2.1 *Terpenoids*: Introduction, Isoprene rule, classification

2.2 General methods of determining structure

2.3 Structure, functions and synthesis of citral, menthol, Geraniol and camphor.

2.4 *Carotenoids*: Introduction, geometrical isomerism

2.5 Structure, functions and synthesis of β-carotene and vitamin-A

Self-study: *Classification, Occurrence and isolation of terpenes*

Unit-3: Anthocyanines and flavones (10 h)

3.1 *Anthocyanines*: Introduction to anthocyanines.

3.2 Structure and general methods of synthesis of anthocyanines.

3.3 Cyanidine chloride: structure and determination.

3.4 *Flavones*: Structure and determination of flavone and flavonoids.

3.5 Quercetin: Structure determination and importance.

Self-study: *General nature of anthocyanins, introduction and biological importance of flavones.*

Unit-4: Purines and Steroids (10 h)

4.1 *Purines*: Introduction, biological importance

4.2 Structure and synthesis of Uric acid, Caffeine

4.3 *Steroids*: Introduction, stereochemistry and nomenclature.

4.4 Bio-synthesis of cholesterol.

Self study: *Occurrence and isolation of purines.Classification and spectral properties of steroids.*

Unit -5: Natural Dyes (5 h)

5.1 Occurrence, colour and constitution

5.2 Structural determination and synthesis of indigoitin and alizarin.

Self-study: *Classification, isolation, purification and properties.*

Text books

1. O. P. Agarwal, *Chemistry of Natural Products, Vol-1& 2*, Goel Publishing House, 1997.
2. GurdeepChatwal and Anand, *Chemistry of Natural Products Vol 1 & 2*, Himalayan Publishing Co, 2001

Reference

1. I. L. Finar, *Organic Chemistry, Vol.2*, 5th ed., Pearson education, London, 1975.

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CH-6617: INDUSTRIAL CHEMISTRY

Semester – VI | No. of credits: 6

Course : Major Special course[**MS**](Package-B) | No. of hours : 4h/wk

Objectives :

To enable a student to understand

(i) The generation of energy from various types of fuels.

(ii) Use of chemicals in improvement of agricultural crops

(iii) Methods employed for purification of water for industry and home

(iv) Pollution occurring from various sources and resulting toxic effects

Unit-1 : Industrial fuels (10 h)

1.1 **Energy**

Sources: non-renewable, classification of fuels: solid, liquid and gaseous. Calorific value of fuels and its determination.

1.2 **Solid fuels**

Coal: types – properties and uses – lignite, sub-bituminous coal, bituminous coal and anthracite. Coking and non-coking coal.

1.3 **Liquid fuels**

Refining of crude petroleum and uses of fractions.Hydrodesulphurisation. Cracking: thermal and catalytic (fixed bed and fluidised bed cataylsis). Octane number. Production and uses of tetraethyl lead, ETBE and MTBE.

1.4 **Gaseous fuels**

Natural gas and gobar gas: production, composition and uses, Gobar electric cell.

Unit-2 : Chemistry and agriculture (15 h)

2.1 **Fertilizers**

NPK, representation,superphosphate, triple superphosphate, uses of mixed fertilizers. Micronutrients and their role, biofertilizers, plant growth harmones.

2.2 **Pesticides**

Classification of pesticides with examples.Insectides; stomach poisons, contact insecticides, fumigants. Manufacture and uses of insecticides. DDT, BHC (gammaxane: Conformation of gamma isomer) pyrethrin. Mention of aldrin, dieldrin,endrin and pentachlorophenel (and its Na salts) and Biopesticides.

Herbicides: Manufacture of 2,4-D and 2,4,5-T

Fungicides: Preparation of Bordeaux mixture. Mention of lime-sulphur, creosote oil and formula.

2.3 **Sugar industry**

Double sulphitation process. Refining and grading of sugar. Saccharin: synthesis and use as a sugar substitute - aspartame. Ethanol: manufacture from molasses by fermentation.

Unit-3 : Water treatment (15 h)

3.1 **Introduction**

Sources of water. Hardness of water-temporary or carbonate hardness, permanent hardness or non-carbonate hardness. Units of hardness, disadvantages of hard water – In domestic, in industry and in steam generation in boilers.Effect of iron and manganese in water.Estimation of hardness – EDTA method – Estimation of total hardness – O. Hehner's method or alkali titration method.

3.2 **Water softening methods**

Industrial purposeLime – soda process, Zeolite process; Ion-exchange - Demineralisation - deionisation process. Mixed – bed deionisation. Domestic purpose

Removal of suspended impurities. Removal of microorganism – Chlorination .Break point chlorination. Reverse osmosis. Desalination.Waste water treatment

Unit-4 : **Pollution and chemical toxicology** (10 h)

4.1 **Pollution:** Air pollution - Acid rain. Green house effect (global warming), ozone layer depletion - photochemical oxidants. Control of air pollution.Water pollution – organic pollutants, Chemical oxygen demand (COD), Biological oxygen demand (BOD), total organic carbon. International standards for water and air quality and regulations

4.2 **Chemical toxicology:** Effect of toxic chemicals on enzymes. Lead, mercury and cyanide pollution and their biochemical effects. Carbon monoxide, sulfur dioxide, oxides of nitrogen, ozone – biochemical effects.

4.3 **Quality control:**BIS specification. Patent: Purpose and procedures

Unit-5 : Materials and Industries (10 h)

Glass, Cement, Dyes, Paints, Special paints, Lubricants and greases, Refractories, Abrasives, Plastics, Perfumes and flavoring industries, Fermentation industries, Explosives, Pulp and paper industries, Rubber industries, Pharmaceutical

industries, Food and food products industries, Photographic product industries, Ceramic industries, Petrochemicals.

Text books

1. R. Norris shreve, and A.Joseph Brink, *Chemical process industries*, 4th ed.; Mcgraw – hill Kogakusha, ltd: 1977.
2. George T. Austin. *Shreve's Chemical Process Industries*, 5th ed.; McGraw – Hill: 1984.
3. N. S. Subbarao, *Biofertilizers in agriculture*; Oxford and IBH publishing Co.: New Delhi, 1982.

References

1. P. Kamaraj,R. Jeyalakshmi, andV. Narayanan, *Chemistry in engineering and technology*; sudhandhira publications: Chennai, 2001.
2. J. C. Kuriakose, and J. Rajaram, *Chemistry in engineering and technology. Vol.2.;* Tata Mc graw hill: New Delhi, 1988.
3. A.K. De, *Environmental chemistry* 2nd ed.; Wiley eastern Ltd., 1987.
4. Jugal, Kishore, Agrawal, *Practicals in Engineering Chemistry*; Oxford and IBH Publishing Co., New Delhi, 1976.

CH-6650: FOOD CHEMISTRY *{Theory, Practical & Industrial Exposure}*

Semester – VI | No. of credits: 13

Course: Skill Based course(**SK**) | No. of hours : (8h/wk)

Objectives

This course provides

1) Students the basic knowledge in Food Chemistry and modern trends in the industry.

2) Training in analysis of food products.

3) Practical training to industrial process.

Unit -1: Introduction (10 h)

1.1 **Food:** source, functions of food – food groups – food guide – basic five food groups, usage of the food guide – food in relation to health – objectives of cooking..

1.2 **Water:** Purification processes – Ion exchangers, reverse osmosis, activated charcoal treatment. Use of chlorination, ozone, and UV light disinfection.Specification of drinking water.Water borne diseases – microbiological examination. Sources and detection.

1.3 **Milk**: Composition and effectiveness as a diet. Fat content in milk, whole and skimmed.Effect of cooking and heat processing of milk – pasteurization.Preservation of

milk.Deep freeze preservation, dairy products – cheese, butter, ghee and kova. Spray drying technique – milk powder, infant food preparation. Lactose intolerance Milk substitutes – vegetable milk. Toned milk.

Self-study: *Different mode of cooking, and objectives of cooking*.

Unit-2: Constituents of foods (40 h)

2.1 **Proteins:** amino acids – peptides – proteins, modification of food products through heat processing.Effect of cooking – steaming or cooking under pressure of legumes. Detoxication. Analysis of proteins – principles in the determination of moisture content, ash content, nitrogen content – Kjeldahl's method.Separation of amino acids by paper chromatography, separation of proteins by electro phoresis.

2.2 **Enzymes**: Nomenclature, classification – Apo, holo and coenzymes. Enzymes used in food processing.Enzymic browning – mode of action, secondary reaction of o-quinones, prevention of enzymic browning – thermal inactivation, pH, antioxidants Non-enzymic browning-Maillard reaction, prevention of non-enzymic browning. Measurement of enzyme activity- principles, estimation of the activity of catalase in Chow-chow and radish (Titrimetry) – principles..

2.3 **Carbohydrates:** Classification, structure and reactions of monosaccharides, glucose, fructose, structure of sucrose, maltose, lactose and starch.Artificial sweetening agents.Effect of cooking on the nutritive value of rice and of baking of wheat – bread and biscuit, processing and storage of carbohydrates. Principles involved in the analysis of carbohydrates – analysis of glucose, starch, Benedict method, Anthrone method, Neilson–Somoyogi method, analysis of crude fibers – estimation of carbohydrates in wheat floor

2.4 **Lipids:** Nomenclature and classification.Emulsions and emulsifiers, rancidity of fats – chemistry of fat and oil processing – function and storage of fats.Heat treatment on the nutritive value of oilseeds, nuts and oil-seedmeals. Role of MUFA and PUFA in preventing heart diseases. Analysis of oils and fats – analysis of crude fats and determination of iodine number, R_M value, acid number and saponification values – principles.

2.5 **Minerals and vitamins**: Sources, functions, bioavailability and deficiency of the following minerals (calcium, iron, iodine, fluorine, sodium and potassium (elementary treatment). Vitamins - classification, sources, functions and deficiencies of fat- soluble vitamins – A, D, E and K, water-soluble vitamins – C, thiamin, niacine, riboflavin, B-complex, - B_6,

Folic acid and B_{12}.Fortification with vitamins and minerals.Effect of cooking on vitamins and minerals – different methods of cooking of vegetables, fruits – dehydrated fruits, canned fruit, canned fruit juices. Estimation of thiamine and riboflavin (fluorimetry), Estimation of metals in tea dust – principles.

Self-study*: Classification of amino acids, proteins, lipids and vitamins.*

Unit -3: Food Additives and morden foods (40h)

3.1 **Food additives**: Artificial sweeteners – saccharin, cyclomate, asparatame – food flavours – esters, aldehydes and heterocyclic compounds. Antioxidants. Food colours – changes in cooking..Restricted use.Spurious colours.Emulsifying agents, preservatives – leavening agents.Baking powder –Yeast. Taste enhancers – MSG-vinegar

3.2 **Modern food**: Mushroom cultivation and types, spirulina composition. Snack foods. Production of bread, bun and biscuits. Raw materials, methods and machinery required. Candy manufacturing.Caramellisation.Fast foods.Instant foods.Dehydrated foods.Oleoresin of spices.Condiments.

3.3 **Beverages:** Soft drinks, soda, fruit juices and alcoholic beverages (Types and content of alcohol).Examples, Carbonation. Addiction to alcohol.Cirrhosis of liver.Social problems.Composition of soft drinks.Excessive use leading to urinary bladder stones.Preservation of tetrapak.Nitrogen preservation and packing of fruit juices.Coconut water.

Self-study*: Functions and uses of food additives.*

Unit -4: Nutrition and Balanced Diet (15 h)

4.1 **Nutrition** – calorific value of food stuff – RQ of food (Respiratory quotient of food) – basal metabolic rate – factors influencing BMR, specific dynamic action (SDA) of food.

4.2 **Thermogenic effect** – energy requirements of individuals – diet and its components – the protein requirements – biological value of proteins, supplementary value of proteins. Diseases associated with protein malnutrition.

Nutritional value of carbohydrates. – Fibers in the diet, dietary sugars – nutritional aspects of lipids.

4.3 Fermentation and technology- types of food fermentation-effect on food.

Self-study*: Low cost nutrient supplements and bio-fortification.*

Unit-5: Food Adulteration And Hygiene (15 h)

5.1 **Adulterants:** Common adulterants in different foods – milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses, sweetening agents and beverages. Contamination with toxic chemicals – pesticides and insecticides. Principles involved in the analysis of detection and prevention of food adulteration.

5.2 **Microbial growth:** growth curve of bacteria. Effect of environmental factors on growth of microorganisms.pH, water activity, oxygen availability temperature – beneficial effect of micro organisms Food borne illness – bacteria, virus, moulds and parasites. (Any two illness each)-Enzyme production from micro organisms. Application of enzymes in food processing.

5.3 **Food preservation and processing :**Food deterioration, methods of preservation and processing.

5.4 **Quality control:** Specifications and standards: PFA, FPO, FDA, drug license, WHO standards, BIS specifications**,** packing and label requirements, essential commodities act, consumer protection act. AGMARK.

Self-study*: Packaging of foods – classification of package, materials used for packing, laws related to packaging and nutrition labelling.*

Text books

1. M. Swaminathan *Advanced Text Book on Food and Nutrition* ,V*ol.I & II Printing and Publishing Co.,* Ltd., Bangalore. 1993.
2. M.Swaminathan *Text Book on Food chemistry,Printing and Publishing Co., Ltd., Bangalore.* 1993.
3. N. Norman Potter, Food *science*, *CBS publishers and distributors, New Delhi.* 1994.
4. L.H. Meyer, *Food Chemistry*, *CBS publishers and distributors, New Delhi.* 1994.

References

1. Owen R Fennema, *Food Chemistry*, Marcel Decker Inc., New York. 1996.
2. B. Srilakshmi,*Food Science*, *New age International Pvt. Ltd. Publishers,* 3rd ed. 2003.
3. BSiva Sankar, *Food Processing and Preservation. Prentice – Hall of India Pvt. Ltd., New Delhi.*2002.
4. S.,Ramakrishnan,K.G.Prasannam and R.Rajan, *Text book of medical biochemistry. Orient Longman* Ltd. 2nd ed. 2001.

5. N. Shakuntala Manay and M. Shadaksharaswamy, FOODS: Facts and Principles. *New age International Pvt. Ltd. Publishers,* 2nd ed. 2002.

Food Chemistry Practicals No. of hours: 5 h/wk)

01. Estimation of Nitrogen (protein) by Kjeldhal method.
02. Estimation of iodine value, acid value and RM value of edible oil.
03. Estimation of food colours (by colorimetric method).
04. Estimation of available carbondioxide in baking powder.
05. Isolation of caesein and lactose from milk.
06. Preparation of oleoresin of ginger and the essential oil.
07. Steam distillation of mint.
08. Estimation of glycine.
09. Isolation of natural food colours – Soxhelet extraction of chlorophyll.
10. Flavour analysis – GC/ HPLC demonstration.
11. Isolation of caffeine from tea dust.
12. Detection of adulterants in food stuffs.
13. Estimation of hardness of water and iron.
14. Estimation of ascorbic acid.
15. Estimation of glucose.
16. Visit to food industry.

Reference

N. S. Gnanapragasam and G. Ramamurthy, *Organic Chemistry Lab Manual*, S.Viswanathan printers and publishers LTD., 2002.

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CH-6651: CHEMISTRY OF CONSUMER PRODUCTS *{Theory, Practical & Industrial Exposure}*

Semester – VI No. of credits : 13

Course: Skill based course (**SK**) No. of hours: 8h/wk

Objectives

This skill based course provides

1) *Basic knowledge inchemical consumer products.*
2) *Training in consumer product analysis.*
3) *Practical training to industrial process.*

Unit -1: Soaps and Detergents (15 h)

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

1.2 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.

1.3 Mechanism of action of detergents. Comparison of soaps and detergents. Biodegradation – environmental effects. ISI specifications/limits.

Unit-2:Cosmetics (20h)

2.1 Shampoos - Manufacture of SLS and SLES. Ingredients.Functions.Different kinds of shampoos – anti-dandruff, anti-lice, herbal and baby shampoos.

2.2 Hair dye. Manufacture of conditioners. Coco betaines or coco di-ethanolamides– BIS specifications.Testing procedures and limits.

2.3 Skin lightening materials: face and skin powders. Ingredients, functions.Different types. Snows and face creams. Chemical ingredients used. Anti perspirants. Sun screen preparations. UV absorbers.Skin bleaching agents.Depilatories.Turmeric and Neem preparations.Vitamin oil.

2.4 Nail polishes: nail polish preparation, nail polish removers. Article removers.Lipsticks, roughes, eyebrow pencils.Ingredients and functions – hazards.BIS specifications.

Unit-3: Agrochemicals (35 h)

3.1 Chemical fertilizers: requisite of a good fertilizer, classification of fertilizers, straightfertilizers, complexfertilizers, effect of excess fertilization and manuring, Eutrophication.

3.2 Pesticides:insecticides,herbicides,fungicides,bactericides,rodenticides,nematicides. Insecticides-naturallyoccurringinsecticides,organochlorineinsecticides (DDT,BHC,Chlordane,Aldrine),Organo phosphorus insecticides(malathion,parathion),Carbamate insecticides(Carbaryl),Fumigants(methyl bromide, ethylenedibromide), Acaricides (azobenzene),insect repellents, Nematicides – furaden Rodenticides - sodium fluoroacetate.

3.3 Herbicides -ferric sulphate,coppersulphate,sodium borate,2,4-D.Bactericides-streptomycin in bacterial infection of maize, apples and tobacco.

3.4 Analytical techniques of fertilizers and pesticides principles involved in the analysis of fertilizers- Determination of moisture content-Karl Fischer method. Determination of total nitrogen in nitrate free sample and nitrogen containing samples.Determination of phosphates, potassium and pH.Priniciples involved in the analysis of pesticides-Multi residue gas chromatographic method for determination of organo chlorine and pyrethroid pesticides in milk, fish and egg. HPLC method for the determination of pesticides residue in food commodities.

Unit-4: Paper and Fuels (20 h)

4.1 Pulp and paper industry- raw materials, pulping process- various methods (sulphate or craft pulping , acid –sulphide pulping , semi chemical pulping process).Paper making.

4.2 Paint and varnishesProtective coating- metallic coating ,electro plating ,methods of electro plating of gold, eletroless plating of nickel, organic coating, paints.

4.3 Fuels and combustion-introduction, classification of fuels, calorific value, characteristics of a good fuel, comparison of solid, liquid and gaseous fuel. Petroleum, cracking, knocking, producer gas, water gas, CNG fuel, LPG, synthetic petrol combustion (cracking-knocking, octane number and acetane number) synthetic petrol –Fischer Tropsch and Berguisprocesses, gaseous fuels.

Unit -5:Chemicals in Food & Medicine (30 h)

5.1 Food additives:Artificial sweeteners- saccharin, cyclamate, asparatame. Food flavors- esters, aldehydes and heterocyclic compounds. Foodcolours- changes in cooking, restricted use, spurious colour.Emulsifying agents, and preservatives- leavening agents. Baking powder, yeast. Taste enhancers – MSG-vinegar.

5.2 Anti- oxidants in food and mechanism of anti- oxidants activity- mechanism of anti oxidation(oxidative rancidity in food)-reaction of 12-hydroperoxide from α-lenolenic acid to 9-hydroperoxyendoperoxide,metal catalysed lipid oxidation- pathway of lipooxygenasecatalysed oxidation-types of lipid oxidation and inhibited lipid auto oxidation reaction, types of inhibitors-synergism –synthetic anti oxidants-BHA(4-methoxy-2-tert-butyl phenol),BHT(2,6-ditertiarybutyl hydroxy toluene) natural anti oxidants(tocopherols),key influences on anti oxidant activities- physical factors, substrate factors, physiochemical state, methods of producing stable foods without adding anti-oxidants)

5.3 Pharmaceuticals: Sulpha drugs- synthesis of various sulphadrugs ,sulphonamides,sulpha pyridine, sulphadiazine. Antibiotics- classification-Stertomycin, Chloramphenical- synthesis-mode of action of antibiotics.Anti malarial drugs (4-amino quinolinederivatives,chloroquine-synthesis, pharmacological properties, and mode of action. Antipyretics and analgesics – aspirin, paracetamol(synthesis and application), narcotics – morphine, codeine (structure). Tranquilizers, hypnotics, anesthetics – procaine.

5.4 Consumer education and specification.Leading firms, brand names, choosing the right product.Packing regulations.Marketing.Licensing – drug license – legal aspects.GMP – ISO 9000,12000 – consumer education.Evaluation of the product – advertisements.

Text books

1. S. GobalaRao, *Outlines of chemical technology*, Affiliated East West press,1998
2. Kafaro, *Wasteless chemical processing*, Mir publishers, 1995.
3. W. Sawyer, *Experimental cosmetics*,Dover publishers, New york, 2000.

References

4. K.Bagavathisundari,*Applied chemistry*, MJP Publishers, 2006.
5. V.K.Ahluwalia,*Organic chemistry*, Narosa publishing house,3rd ed.,2010
6. J. Ghosh, A*Text book of Pharmaceuticalchemistry*, S.Chand Publishing, 2010.

Chemistry of Consumer Products- Practicals ;No. of hours :5h/wk

01. Determination of active content (SLS, SLES, LABS) in a detergent.
02. Estimation of iodine and saponification values of an oil.
03. Estimation of hardness of water:Estimation of iron (III) by colorimetric method'.
04. Detection of adulteration in food/ milk / petrol / diesel.
05. Estimation of ascorbic acid by iodimetric method.
06. Determination of nitrogen by Kjeldhal method.
07. Analysis of essential oils by gas chromatographic method.
08. Estimation of glucose by Benedict's method. Estimation of sugar by refractometric method.
09. Estimation of purity of soda ash.
10. Estimation of phenol by Winkler's method.
11. Isolation of lactose from milk.Caffeine from tea leaves, Ginger oleoresin from Ginger.
12. Visit to the analytical laboratories / BIS / FPO / Government laboratories
13. Detection of alkaloids, terpenes, flavanoids, anthocyanins, proteins, amino acids and hydrocarbons in the natural product extracts. (a herbal extraction will be carried out.)

INDUSTRIAL EXPOSURE

Semester – VI Time : One month

Course : Skill based (**SK**)

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI - 600 034.

(A) **Assessment** (Industrial level)

Student name: _____ D. No. _____

Industry : _____

Industrial Person-in-charge: _____

Staff-in-charge: _____

(1) Attendance Max mark: 20

Excellent	Good	Satisfactory	Not-satisfactory	

(2) Work Skill Max mark: 40

Excellent	Good	Satisfactory	Not-satisfactory	

(3) Interpersonal relationship Max mark: 15

Excellent	Good	Satisfactory	Not-satisfactory	

Total marks awarded [Out of 75] : ……

Any other remarks: ……

(B) **Assessment** (Dept level)

Report & Viva-Voce Max marks: 25

CH-6652:**GENERAL TRENDS IN INDUSTRIAL CHEMISTRY (Seminar and Report)**

Semester – VI No. of Credits : 2

Course : Skill based (**SK**) No. of hours per week : 2

Objectives:

To make the student understand publications in journals and present a researchtopic, under the guidance of a professor, in the subject related to his skill based course viz., Food Chemistry or Industrial Chemistry in the class room.

Testing:

Each studentwill give a one hour seminar on a **Title**of recent trends in Food or Industrial chemistry taken from current publications in reputed journals.

The student will be tested both in subject matter and mode of presentation of the seminar as follows:

Subject matter-50 Marks

Standard of subject and plan

Preparation and mastery

Originality and logical development

Answers to questions

Summary and references

Mode of presentation-50 Marks

Economy of time

Voice as a tool of communication

Blackboard use and teaching aids

Language and diction

Relating to the audience

The student will submit a report of his seminar and attend such similar seminars given by others in the class and to keep a record of all. The report and the record maintained will also form a part of the evaluation.