MANONMANIAM SUNDARANAR UNIVERSITY

DEPARTMENT OF CHEMISTRY

M.Sc. CHEMISTRY Integrated program (CBCS) (3 + 2 = 5 years)

For the academic year 2019-2020

Preamble

M.Sc. Integrated program has 10 semesters system. In the first 6 semesters, the students will learn about the concept of organic, Inorganic and physical chemistry as equal to B.Sc. Program. After the successful completion of six semesters, students are allowed to continue in the next 4 semesters as equal to M.Sc. Program. The purpose of this integrated program is to acquire a basic appreciation and experience of chemistry. This program has the laboratory session along with theory that goes deals with the basics of chemical analysis and separation of components. The main aim of M.Sc. Integrated chemistry program is to equip the young students to continue their studies in Research and to get industrial and teaching positions in various institutions. The emerging Chemical Technologies are highly science based. A Chemist cannot isolate himself from other disciplines. The practice of Chemistry over a span of more than a century has created unavoidable impacts of human environment. The adverse effects were particularly noted during last few decades. The concept of sustainable development is now well accepted. The integrated program principles and applications of Chemistry should be learnt on this background.

Necessity

The purpose of post-graduate education in Science is to create highly skilled manpower in specific areas, which will lead to generation of new knowledge and creation of wealth for the country. Chemistry is a fundamental science and has contributed immensely to the improvement of the life of human beings by providing many of human requirements and essentialities.

Importance

Chemistry is an important subject to the world economy as well. The developments in Chemistry during last few decades are phenomenal. It is also seen that these developments are crossing the traditional vertical boundaries of scientific disciplines; the more inclination is seen towards biological sciences. New branches of chemistry are emerging and gaining importance, such as bioorganic chemistry, materials chemistry, computational

chemistry, etc. The practice of Chemistry at industrial scale also is undergoing radical changes and is more or more based on deep understanding the chemical phenomena.

Objectives

i. To impart theoretical and practical skills that underpins the various branches of the science of Chemistry
ii. To enable the students to have a thorough understanding and knowledge of different branches of Chemistry
iii. To make the students to develop the ability to think analytically and solve problems.
iv. To apply the skills and knowledge gained through the subject to real life situations and face competitive examinations with confidence.

Outcome

After completing the M.Sc. program the students will be able to

i. Pursue research program
ii. Qualify as Chemist/Scientist in various industries and research institutions
iii. Appear qualifying examination for teaching position.

Eligibility for Admission

The minimum eligibility conditions for admission to the M**.Sc., INTEGRATED COURSE in Chemistry** program are given below.

The candidates for admission into the first semester of this course will be required to have qualified the Higher Secondary Examination with 60 % marks (5 % relaxation for SC, ST and physically challenged candidates) conducted by the Board of Higher Secondary Education, Government of Tamil Nadu in the following Science subject groups:

1. Mathematics, Physics, Chemistry + any other subject
2. Physics, Chemistry, Botany/Zoology + any other subject

or any other Examination as equivalent there to in Science subject. In addition, the candidate has to qualify the Entrance test conducted for admission in to this course.

Admission will be based on (i) the total marks obtained in the entrance test (50%) and the qualifying Higher Secondary examination (Chemistry paper only 50%) and (ii) by following the govt. norms of reservation.

Duration of the Course

The students shall undergo the prescribed course of study for a period not less than **five** academic years (Ten semesters) consisting of 6 semesters (I – VI) for studying fundamentals of Chemistry (similar to Undergraduate Chemistry) and 4 semesters (VII – X) for studying advanced Chemistry (similar to Post-graduate Chemistry). Each semester contains 90 working days.

Scheme of Examination and question pattern

Time: 3 hours Max. marks:75

Part A	:	10 questions full of Objective type WITHOUT multiple choice. Two questions from each unit of a paper. Each question carries one mark	10 x 1=10 marks
Part B	:	5 descriptive questions, of either a or b type (internal choice). One question is from each unit. Each question carries 5 marks	5 x 5 = 25 marks
Part C	:	5 descriptive questions of either a or b type (internal choice). One question is from each unit. Each question carries 8 marks.	5 x 8 = 40 marks

Course Weight:

In each of the courses, credits will be assigned on the basis of the lectures, tutorials / lab work and other forms of learning in a 15 week schedule.

1. One credit for each lecture hr. per week
2. One credit for each tutorial hr. per week
3. One credit for every two hrs. of Lab or Practical Work per week

Internal /External Distribution of Marks

For all theory papers, the Internal / External distribution of Mark will be 25: 75 (Total = 100).

The 25 marks for the Internal component has been divided as follows:

3 compulsory tests, out of which average of the best two tests	= 20 marks
Assignment	= 5 marks
Total	=25 marks

For all Practical papers the examination time shall be 6 hours and the Internal / External distribution of Marks will be 50: 50 (Total = 100) respectively.

Internal component of 50 marks is divided as follows:

For the regular class periodical assessment		= 25 marks
2 Compulsory Internal test,		
Out of which Average of two internal test		= 25 marks
	Total	=50 marks

External Examination:

Record		= 10 marks
Practical Examination		= 40 marks
	Total	=50 marks

There is no internal passing minimum. There is a passing minimum of 50% for external and overall components.

MINI PROJECT

Mini Project for VI semester shall be an GROUP project. Project evaluation will be done by Guide and another faculty member of the department. Viva voce Examination for the project students will be conducted jointly by the same examiners who evaluated the project report.

Course Structure of M.Sc Integrated Chemistry Program

The credit and teaching norms of the program is distributed as under.

Program Structure (For I - VI Semesters)

SEM	Sub No.	Subject Status		Subject Title	T. Hrs/Week	P Hrs./Week	Credits
I	1	Language	F1TL11	Tamil / other Language	4	-	4
	2	Language	F2EN11	English	4	-	4
	3	Core	FCHC11	Inorganic chemistry I	4	-	4
	4	Core	FCHC12	Organic Chemistry I	4	-	4
	5	Major Practical -I	FCHL11	Inorganic practical I	-	4	2
	6	Allied – I	FMAA11 / FZOA11		3	-	3
	7	Allied Practical - I	FMAAL1 / FZOAL1		-	4	2
	8	Common	FEVS11	Environmental Studies	2	-	2
				Subtotal	**29**		**25**
II	9	Language	F1TL21	Tamil / other Language	4	-	4
	10	Language	F2EN21	English	4	-	4
	11	Core	FCHC21	Inorganic Chemistry II	4	-	4
	12	Core	FCHC22	Physical Chemistry I	4	-	4
	13	Major Practical -II	FCHL21	Inorganic practical II	-	4	2
	14	Allied – II	FMAA21 / FZOA21		3	-	3

	15	Allied Practical - II	FMAAL2 / FZOAL2		-	4	2
	16	Common	FVBE21	Value Based Education/Social Harmony	2	-	2
				Subtotal	**29**		**25**
III	17	Language	F1TL31	Tamil / other Language	4	-	4
	18	Language	F2EN31	English	4	-	4
	19	Core	FCHC31	Physical Chemistry II	4	-	4
	20	Major Practical -I	FCHL31	Organic practical I	4	-	4
	21	Allied – I	FPHA31		-	4	2
	22	Allied Practical - I	FPHAL1		3	-	3
	23	Non Major Elective	FCHNE1 / FCHNE2	Food chemistry/Water manangement	-	4	2
	24	Common	FYOG31	Yoga	2	-	2
				Subtotal	**29**		**25**
IV	25	Language	F1TL41	Tamil / other Language	4	-	4
	26	Language	F2EN41	English	4	-	4
	27	Core	FCHC41	Organic Chemistry II	4	-	4
	28	Major Practical -II	FCHL41	Organic Practical II	4	-	4
	29	Allied – II	FPHA41		-	4	2
	30	Allied Practical - II	FPHAL2		3	-	3
	31	Non Major Elective	FCHNE3 / FCHNE4	Applied Chemistry/Clinical Chemistry	-	4	2
	32	Common	FCDE41	Computer for Digital Era	2	-	2

	33	Extension Activity	FEXA41	NCC, NSS, YRC, YWF	2	-	1
				Subtotal	**30**		**25**
V	34	Core	FCHC51	Inorganic III	4	-	4
	35	Core	FCHC52	Physical III	4	-	4
	36	Core	FCHC53	Organic III	4	-	4
	37	Skill Based Core - I	FCHSC1/FCHSC2	Food Chemistry/Agro Chemistry	4	-	4
	38	Major Elective –I	FCHEA /FCHEB	Analytical/Pharmaceutical Chemistry	4	-	4
	39	Major Practical - V	FCHL51	Physical practical I	-	4	2
	40	Major Practical - V	FCHL52	Physical practical II		4	2
	41	Skill Based Common	FSBC51	Personality Development/Effective Communication/Youth Leadership	2	-	2
				Subtotal	**28**		**26**
VI	42	Major Elective – II	FCHEC /FCHED	Polymer/Industrial Chemistry (online mode)	4	-	4
	43	Skill Based Core - II	FCHSC3 / FCHSC4	Chromatography/ Dairy Chemistry (online mode)	4	-	4
	44	Internship	FCHI61	Internship	-		27
				Subtotal	**8**		**35**
				Grand Total	**173**		**160**

For Semesters VII to X, the Structure of Program and syllabus shall be the one followed for TWO YEAR M.Sc Chemistry program CBCS offered in Department of Chemistry.

SEMESTER I

INORGANIC CHEMISTRY PAPER – I

L (hrs)	Credits
60	4

Objectives

i. To study the atomic structure from wave mechanical concept
ii. To know the arrangement of elements in the periodic table and the periodic properties.
iii. To understand the different kinds of chemical forces in molecules.
iv. To know the nature of compounds formed by s- and p-block elements.

Unit I Atomic structure (12hrs.)

Dual nature of matter – de Broglie equation (verification not required) - Schrodinger wave equation and its applications (no derivation)- Eigen value and eigen function-significance of Ψ and Ψ^2 –quantum numbers and their significance-principles governing the occupancy of electrons in various quantum levels-Pauli's exclusion principle-Hund's rule, Aufbau principle- probability distribution of electron around the nucleus –radial probability distribution

Unit II Periodic properties (10hrs.)

Long form of periodic table- classification as s, p, d and f block elements - periodicity in properties- variation of atomic and ionic radii, electron affinity, ionization energy and electronegativity along periods and groups – various scales of electronegativity – Pauling, Mullikan and Allred Rochow's scale of electronegativity – factors affecting the magnitude of electronegativity – applications of electronegativity

Unit III Chemical bonding-I (14 hrs)

Properties of ionic compounds- Lattice energy- definition- Born-Lande equation (derivation not required), factors affecting lattice energy, Born-Haber cycle-enthalpy of formation of ionic compound and stability. Covalent character in ionic compounds-polarization and Fajan'srule.

Unit IV Chemical bonding-II (10hrs.)

Valence bond theory – hybridization of atomic orbitals and geometry of molecules –sp, sp^2, sp^3, sp^3d and sp^3d^2hybridization with examples. VSEPR theory- shapes of simple inorganic

molecules – MO theory- applications of MOT to O_2, F_2, HF and CO- comparison of VBT and MOT.

Unit V S-block elements (14hrs.)

Hydride (classification, general methods of preparation and salient features), hydration energies, solvation and complexation tendencies of alkali and alkaline-earth metals- Chemistry of Li and Be, their anomalous behavior and diagonal relationship - alkyls and aryls- roles of Li and Be in biology.

References

1. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi, 1996.
2. P. L. Soni, Text Book of Inorganic Chemistry, 20th edition, 2001.
3. R. D Madan, Modern Inorganic Chemistry, S. Chand and company, 13th edition, 2005.
4. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
5. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, Wiley India, 6th edition, 2008.

ORGANIC CHEMISTRY PAPER – I

L (hrs)	Credits
60	4

Objectives

1. To study about polar effects and reaction intermediates
2. To learn the mechanism of substitution and elimination reactions.
3. To study the conformations of hydrocarbons.
4. To learn the chemistry of halide and oxygen based functional organic compounds.
5. To learn the preparation and uses of organometallic compounds.

Unit I Principles of reaction (12hrs.)

Polar effects-inductive, resonance and steric effects and their influence on acidity and basicity of organic compounds – pπ-dπ bonds, Heterolytic and homolytic cleavage, nucleophiles and electrophiles-reaction intermediates – preparation, properties and structures of carbonium ions, carbanions and free radicals -type of reactions - substitution, addition, elimination and polymerisation reactions.

Unit II Hydrocarbons (12hrs.)

Classification of alkadienes, stability of conjugate dienes- Mechanism of 1,2 and 1,4-addition- Diels-Alder reaction. Acidity of alkynes and formation of metal acetylides.
Addition to unsymmetrical olefins (Markownikoff's rule and peroxide effect), hydroboration, ozonolysis, dihydroxylation with $KMnO_4$, OsO_4& allylic bromination by NBS (mechanisms not required) Brominating reagents – Br_2, $NaBrO_3$.

Unit III Halogen derivatives (12hrs.)

S_N1 and S_N2 mechanisms - E_1 and E_2 mechanisms- Hoffmann's and Saytzeffs rule-preparation, properties and uses of chloroform, carbon tetrachloride, vinyl chloride and allyl chloride- preparation and uses of westron, westrosol, freon and chloroprene.

Unit IV Alcohols and ethers (12hrs.)

Distinction between primary, secondary and tertiary alcohols – nitroglycerol, dynamite- estimation of hydroxyl groups- mechanism of dehydration of alcohols-preparation and properties of allyl and crotyl alcohol.

Preparation and uses of oxirane and dioxan –Estimation of number of methoxy groups-Zeisel's method.Distinction between ethers and alcohols.

Unit V Organometallic compounds and organosulphur compounds (12hrs.)

Preparation, structure and synthetic uses of Grignard reagent-preparation and reactions of methyl lithium, diethyl zinc, tetraethyl lead and tetramethyltin-Reformatsky reaction - Preparation and properties of thioalcohols and thioethers – sulphonal-mustard gas and sulphones.

References

1. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry, Vikas Publishing House Pvt Ltd, 2006.
2. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons, 2012.
3. M.K. Jain and S. C. Sharma, Modern Organic Chemistry, Visal Publishing Co, 2015.
4. N. Tewari, Advanced Organic Reaction Mechanism, Third Edition 2011, Books & Allied (P) Ltd.
5. L. Finar, Organic Chemistry Volume I, ELBS, Longmans,2011.

INORGANIC PRACTICAL - I

Volumetric Analysis

L (hrs)	Credits
60	2

Objective

1. To enable the students to acquire the quantitative skills in volumetric analysis and qualitative inorganic salt analysis

Acidimetry and alkalimetry

1. Estimation of oxalic acid – Std. oxalic acid
2. Estimation of Na_2CO_3 – Std. Na_2CO_3

Permanganometry

3. Estimation of sodium oxalate – Std. oxalic acid
4. Estimation of ferrous ammonium sulphate – Std. ferrous ammonium sulphate

Iodometry

5. Estimation of copper – Std. copper sulphate

Dichrometry

6. Estimation of ferrous iron – Std. ferrous ammonium sulphate
7. Estimation of $K_2Cr_2O_7$ – Std $K_2Cr_2O_7$

Complexometry

8. Estimation of Zn – Std ZnSO4
9. Estimation of Pb – Std ZnSO4
10. Estimation of Mg – Std ZnSO4
11. Estimation of Cu – Std ZnSO4
12. Estimation of Ni – Std ZnSO4
13. Total hardness of water

Semi micro qualitative analysis

Inorganic salt mixtures containing two acid radicals (one should be an interfering radical) and two basic radicals

Anions	Simple anions	Carbonate, nitrate, sulphate, chloride and bromide
	Interfering anions	Borate, fluoride, oxalate, phosphate and chromate
Cations	Group I	Lead
	Group II	Copper, Cadmium, Bismuth, Antimony
	Group III	Aluminium, Ferrous iron
	Group IV	Cobalt, Nickel, Manganese, Zinc

	Group V	Barium, Strontium, Calcium
	Group VI	Magnesium, Ammonium.

References

1. G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denny 'Vogel's Text book of Quantitative Chemical Analaysis5th Edition,1978, ELBS.
2. I.M.Kolthoff and E.A.Sanderson, Quantitative Chemical Analysis, S Chand, O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II &III BSc, 1989.
3. Students. S.Chand & Company Ltd reprint 2009.
4. V.K.Ahluwalia, Sunitha Dhingra, Adarsh GulateCollege Practical Chemistry, Universities Press (India) Pvt. Ltd 2008 (reprint).

SEMESTER II

INORGANIC CHEMISTRY- II

L (hrs)	Credits
60	4

Objectives

1. To know the basic principles of metallurgy and the chemistry of d- Block elements
2. To learn the chemistry of f- Block elements
3. To learn the acid base concepts and the reactions in Non-aqueous solvents
4. To understand the basic concepts of coordination chemistry and early theory
5. To learn the basic analytical methods

Unit I p-block elements (12hrs.)

Comparative study (group-wise) of group 13 & 14 elements with respect to periodic properties. Compounds such as hydrides, halides, oxides and oxyacids- diagonal relationship-

preparation, properties, bonding and structure of diborane, borazine and alkali metal borohydrides. Preparation, properties and technical applications of carbides and fluorocarbons.Silicones and structure of silicates.

Unit II Metallurgy (12hrs.)

Occurrence of metals – concentration of ores – froth floatation, magnetic separation, calcinations, roasting and smelting. Purification of metals – electrolysis, zone refining, van Arkel de Boer methods.

Unit III d-Block elements (12hrs.)

General characteristics of d- Block elements – Group study of Titanium, Iron, Coinage and Zinc group metals. Important compounds of transition metals: Ziegler – Natta catalyst. Prussian blue, Sodium nitroprusside, Turnbull's blue, Nickel DMG complex, Wilkinson's Catalyst- $KMnO_4$ and $K_2Cr_2O_7$.

UNIT IV Coordination Chemistry-I (12hrs.)

Introduction: ligands- monodentate, bidentate, and polydentate ligands; coordination sphere; Coordination number; nomenclature of mononuclear and dinuclear complexes. Structural and stereoisomerism in tetrahedral, square planar and octahedral complexes.

Valance Bond theory – applications of valance bond theory to tetrahedral, square planar and octahedral complexes- Merits and limitations of VB theory

Unit V Acids, Bases and Non-aqueous solvents (12hrs.)

Acids and Bases: Arrhenius theory, acids and bases in protic solvents, Bronsted-Lowry theory, Lewis theory, the solvent system, Lux-Flood definition, Usanovich definition; hard and soft acids and bases-HSAB principle.

Non-aqueous solvents: physical properties of a solvent, types of solvents and their general characteristics. Reactions in non - aqueous solvents with reference to liq. NH_3 and liq SO_2- Comparison.

References

1. Puri B.R., Sharma L.R., Kalia K.K., Principls of Inorganic Chemistry, 28th edition, Vallabh Publication, 2004, New Delhi.
2. R.D. Madan, Advanced Inorganic Chemistry, 2nd edition.S. Chand & Company, 2005, New Delhi.
3. Concise coordination chemistry – R. Gopalan, V. Ramalingam, Vikas publishing House, Pvt. Ltd, 2001, New Delhi.
4. J.D.Lee, Concise Inorganic Chemistry, 5th edition , Oxford University Press, New Delhi 2008.
5. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denny, Vogel's Text book of Quantitative Chemical Analysis, 5th Edn., ELBS, 1989.
6. D.A.Skoog and D.M.West, Fundamentals of Analytical Chemistry, Holler Saunders College publishing, USA.VI Ed., 1998.

PHYSICAL CHEMISTRY-I

L (hrs)	Credits
60	4

Objectives

1. To study the behavior of molecules in gaseous states
2. To learn the various properties of crystalline solids
3. To understand the various phenomena on the surface of solids
4. To study the nuclear stability and nuclear reactions
5. To understand the basic concepts and first law of thermodynamics

Unit I Gaseous state (12hrs.)

Types of molecular velocities and their inter relations - mean, rms, most probable velocities - Calculation of most probable velocity, average velocity and root mean square velocity Maxwell's distribution of molecular velocities, statement of equation and explanation (no derivation) – graphic representation - effect of temperature on velocity distribution. Collision diameter - collision number - collision freqeuency - mean free path – Degrees of freedom of gaseous molecules - principle of equipartition of energy - heat capacity and molecular basis. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity

Unit II Solid state (12hrs.)

Difference between crystalline and amorphous solids - isotropy and anisotropy - crystal lattices - laws of crystallography - elements of symmetry of crystals - crystal systems - unit cell - space lattice - Bravais lattices - Miller indices - cubic and hexagonal packing – radius ratio rule – tetrahedral and octahedral voids

Bragg's equation, derivation and applications - determination of structure of crystals by X-ray diffraction methods - rotating crystal and powder method, structure of NaCl, KCl and ZnS. Imperfections in a crystal - Schottky defects, Frenkel defects, Nonstoichiometric defects - use of crystallographic data for the determination of Avogadro number and molecular mass

Unit III Surface chemistry (12hrs.)

Adsorption - physisorption and chemisorptions - adsorption of gases by solids - adsorption isotherms - Freundlich adsorption isotherm - derivation of Langmuir

adsorption isotherm, statement and explanation of BET isotherm - applications of adsorption - determination of surface area – adsorption indicators.

General characteristics of catalytic reactions – phase transfer catalysis - acid base catalysis - enzyme catalysis - mechanism and kinetics of enzyme catalyzed reactions – Michaelis-Menten equation

Unit IV Nuclear chemistry (12hrs.)

Natural radioactivity - detection and measurement of radioactivity – Geiger Nuttal rule - rate of disintegration and half life period - average life period - nuclear stability, n/p ratio, magic number, mass defect and binding energy - liquid drop model - shell model - isotopes, isobars, isotones and isomers. Artificial radioactivity - nuclear fission and nuclear fusion – mechanisms – applications - differences – Stellar energy - nuclear reactors - hazards of radiations - fertile and fissile isotopes. Applications of radioisotopes – C^{14} dating, rock dating, neutron activation analysis and isotope as tracers - study of reaction mechanism

Unit V Chemical kinetics (12 hrs.)

Rate of reaction-Measuring rates of reaction-expressing reaction rates- factors influencing rate-rate constant-Rate laws, Stoichiometry, order and molecularity of reactions- Setting up and solving simple differential equation for first order, second order, third order and zero order reactions. Experimental techniques involved in following kinetics of reaction-Volumetry, manometry and colorimetry. Effect of temperature on rate constant. The activation energy - determination of Arrhenius frequency factor and energy of activation-The collision theory of reaction rates and its limitation. Lindemann theory of unimolecular reactions-The theory of Absolute reaction rates.Comparison of the collision theory with the Absolute reaction rate theory.

Reference:

1. Principles of physical chemistry - Puri, Sharma and Pathania, Millennium Edition, Vishal Publishing Co, 2003.
2. Text Book of physical chemistry - P.L. Soni - Sultan Chand, 1983.
3. Atkins' Physical chemistry, 9th Edition, Oxford University Press, 2010.
4. Advanced Physical Chemistry - Gurdeep Raj, Goel Publishing House,2008.
5. Physical Chemistry, G.M.Barrow, Tata McGraw Hill, 2006.

INORGANIC PRACTICAL – II

Inorganic Qualitative Analysis

L (hrs)	Credits
60	2

Objective

1. To enable the students to understand various inorganic salt preparation and their quantitative estimation.

Gravimetric Estimation

2. Estimation of lead as lead chromate
3. Estimation of barium as barium chromate
4. Estimation of nickel as nickel dimethylglyoximate
5. Estimation of zinc as zinc oxinate
6. Estimation of copper as copper thiocyanate

Inorganic preparations

1. Preparation of Potash alum
2. Preparation of Chrome alum
3. Preparation of Prussian blue
4. Preparation of Sodium ferrioxalate
5. Preparation of Tetramminecopper(II) sulphate
6. Preparation of Tristhiourea copper(I)chloridedihydrate
7. Preparation of Potassium trisoxalatoferrate(III)
8. Preparation of Hexathiourealead(II) nitrate

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. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
4. V.K.Ahluwalia, Sunitha Dhingra, Adarsh GulateCollege Practical Chemistry, Universities Press (India) Pvt Ltd 2008 (reprint)
5. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai, 1974.
6. Vogel's Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London, 1974.

SEMESTER III

PHYSICAL CHEMISTRY II

L (hrs)	Credits
60	4

Objectives

1. To study about the thermo chemistry
2. To understand the concept of chemical equilibrium
3. To learn about the chemistry of solutions

Unit I Chemical equilibrium (12hrs.)

Reversible and irreversible reactions-nature of chemical equilibrium-Law of mass action-equilibrium constants- K_p, K_c and K_x Thermodynamic derivations -Relations between K_p, K_c and K_x- Temperature dependence of equilibrium constant- Van't Hoff isochore-Pressure dependence of equilibrium constant- Heterogenous equilibrium-Le-Chatelier principle-application of Le-Chatelier principle to homogenous equilibrium and physical equilibrium.

Unit II Solutions (12hrs.)

Kinds of solutions - methods for expressing concentration - Molarity, molality, mole fraction, normality, mass fraction, parts per million -solutions of gases in liquid -Solubility of gases in liquids - Henry's law – statement and limitations.

Solutions of liquid in liquid– Binary liquid mixture - Ideal and non ideal solutions - Raoult's law. - deviation from ideal behavior - pressure - composition and temperature - Composition diagrams for completely miscible binary solutions - Fractional distillation - Azeotropic distillation - nature of azeotropic mixtures - partially miscible liquids - consolute temperature- critical solution temperature-system with upper CST, lower CST and upper and lower CST - Crismer test - Completely immiscible systems-steam distillation.

Unit III Dilute solutions (12hrs.)

Colligative properties of dilute solutions: relative lowering of vapour pressure, elevation of boiling point, depression of freezing point and osmotic pressure, Ebullioscopic constant-Cryoscopic constant- Relation between colligative properties and Molecular mass –Osmosis-osmotic pressure-.laws of osmotic pressure -osmotic pressure and concentration of solute- Experimental methods for determining various colligative properties, degree of dissociation and association of solutes Abnormal molecular mass – Van't Hoff factor.

Unit IV Ionic equilibria (12 hrs.)

The Ostwald's dilution law-experimental verification – limitations-acids and bases-Lewis concept-dissociation of weak acids and weak bases-dissociation of water-pH scale-common ion effect- its applications-buffer solution-different types-calculation of pH value of buffer solution. Hydrolysis of salts - salts of weak acids & strong base, salts of weak base and strong acids, salts of weak acid and weak base - determination of degree of hydrolysis. Acid-base indicators- acid-base titration and use of indicators.Solubility product-Application of solubility product principle.

Unit V Phase equilibria (12 hrs.)

Phase rule - phase, component, degree of freedom - thermodynamic derivation of phase rule, One-component system: Phase diagrams of Water and sulphur systems.

Two component system: (i) Simple eutectic: Lead-silver system and potassium iodide-water system. (ii) Formation of compound with congruent melting point: Magnesium- zinc system and ferric chloride - water system. Distribution Law-Statement and thermodynamic derivation-association of the solute in one of the solvents- dissociation of the solute in one of the solvents-applications of the distribution law-solvent extraction.

References

1. Principles of Physical chemistry-Puri,Sharma and Pathania 2004,Vishal Publishing Co., NewDelhi.
2. Text book of Physical Chemistry, P.L.Soni, O.P. Dharmarha& U.N. Dash, , 22ndEdn.,Sultan Chand & Sons, New Delhi,1993.
3. Essentials of Physical Chemistry - B.S.Bahl, Arun Bahl, G.D.Tuli,Reprint 2006,S.Chand & Company Ltd., New Delhi-110055.
4. Atkin's Physical Chemistry, 9th Ed, Peter Atkins & Julio de Paula, 2010.
5. A Text book of Physical Chemistry-A.S.Negi S.C Anand 2nd Edition-2007.

NON-MAJOR ELECTIVE- FOOD CHEMISTRY

Objectives:

1. To acquire the basic knowledge of food chemistry

L (hrs)	Credits
45	2

Unit I Introduction (9 hrs.)

Food : sources and classification – food as a source of energy - functions and biological importance of carbohydrates, protein, fat, vitamins and minerals - calorific value of food – energy requirements of individuals - balanced diet.

Unit II Food additives (9 hrs.)

Definition, food colourants : natural and artificial - antioxidants, stabilizers, flavours, bleaching and maturing agents – leavening agents.

Unit III Food preservatives (9 hrs.)

Definition - classification - methods of food preservation and processing by heat, cold, radiation, drying and deep freezing.

Unit IV Food adulteration (9 hrs.)

Definition – types – detection and analysis of adulterants in foods: milk, chilli powder, coffee powder, turmeric powder, ghee, oil and pulses.

Unit V Quality standards (9 hrs.)

Quality control - specification and standards - FA, WHO standards – packing and labeling of foods, Essential Commodities Act - Consumer Protection Act - AGMARK.

References

1. Sivasankar B, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
2. Swaminathan M. Textbook on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore 1993.
3. Food Science – III Edition – Sri Lakshmi B, New Age International Publisher, 2005.
4. Fundamentals of Foods and Nutrition – Mudambi. R. Sumathi, and Rajagopal, M.V. - Willey Eastern Ltd, Madras, 1982.

NON-MAJOR ELECTIVE- WATER MANAGEMENT

Objectives:

1. To realize the importance of quality water in day to day life

L (hrs)	Credits
45	2

Unit I Water pollution (9 hrs.)

Definition-sources of water pollution-types of water pollutants: sewage and domestic wastes, industrial effluents, agricultural discharges, detergents, disease causing agents and radioactive materials. Eutrophication and its effects.

Unit II Water quality parameters (9 hrs.)

Physical, chemical and biological water quality parameters-water quality standards for drinking water - BIS and WHO. Determination of pH, Total hardness, DO, BOD and COD.

Unit III Water purification (9 hrs.)

Purification of water for drinking purposes: Sedimentation, filtration and disinfection- Desalination: reverse osmosis-Purification of water for industrial purposes: water softening-permutit process and ion-exchange process.

Unit IV Waste water treatment (9 hrs.)

Elementary ideas of waste water treatment: pre-treatment-primary treatment-secondary treatment: aerobic and anaerobic processes - tertiary treatment: evaporation adsorption - chemical precipitation.

Unit V Restoration and management (9 hrs.)

Importance of lakes and rivers-stresses on the Indian rivers and their effects - A restoration case study: Ganga Action Plan: objectives implementation and drawbacks. Rain water harvesting - Nwater recycling- The water Prevention and control of Pollution Act 1974.

References

1. A. K. De, Environmental Chemistry, Wiley Eastern Ltd., New Delhi, 1994.
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut, 1997.
3. R. K. Trivedy and P. K. Goel, Chemical and biological methods for water pollution studies, Environmental Publications, Karad, India,1986.

4. BIS 1991, Specification for drinking water, Bureau of Indian Standards, New Delhi
5. WHO 1992, International standards for drinking water, World Health Organisation, Geneva.

ORGANIC PRACTICAL - I

ORGANIC ANALYSIS

Objective

1. To analyze and identify the organic compounds

L (hrs)	Credits
60	2

Practicals

Qualitative analysis of the given organic compound

a. Test for aliphatic and aromatic nature of substances
b. Test for saturation and unsaturation
c. Identification of functional groups (carboxylic acids, phenols, aldehydes, ketones, esters, amines, amides, anilides, nitrocompounds and carbohydrates)
d. Preparation of solid derivative to confirm the presence of functional group

References

1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.
3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.
4. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
5. P.R.Singh, D.C.Gupta, K.S.BajpalExperimental Organic Chemistry Vol.I and II, 1980.

SEMESTER IV

ORGANIC CHEMISTRY - II

L (hrs)	Credits
60	4

Objectives

1. To study about aldehydes and ketones
2. To understand the reactivity of carboxylic acids & acid derivatives
3. To learn about the aliphatic nitrogen compounds
4. To study about the reactivity of methylene compounds & tautomerism
5. To know about alicyclic compounds and its properties

Unit I Aldehydes and ketones (12 hrs.)

Structure and reactivity of carbonyl group – relative reactivities of aldehydes and ketones – mechanism of nucleophilic addition reaction (HCN, $NaHSO_3$, Grignard reagent) – mechanism of aldol condensation, crossed aldol condensation, Knoevenagal reaction, Reformatsky reaction.

Study of the following reactions – Wolff-Kishner reduction, Wittig reaction, MeerweinPonndorfVerley reduction.

Preparation, properties and uses of chloral, acrolein, crotonaldehyde and succinaldehyde.

Unit II Carboxylic acids & acid derivatives (12 hrs.)

Structure of carboxylic acid and carboxylate anion - relative strengths of monocarboxylic acids - effect of substituents on acidity - Hell - Volhard - Zelinsky reaction - action of heat on hydroxy acids - preparation, properties and uses of lactic acid and citric acid–dicarboxylic acids: action of heat on dicarboxylic acids - preparation, properties and uses of oxalic acid and succinic acid. Acid anhydrides - Amides - Preparation, properties and structure of urea - Esters- mechanism of esterification and ester hydrolysis.

Unit III Aliphatic nitrogen compounds (12 hrs.)

General methods of preparation of primary, secondary and tertiary amines - General Properties - Isomerism - Stereochemistry - basic character of amines - Distinction between primary, Secondary and tertiary amines. Preparation and properties of quartenary ammonium compounds.Preparation and reactions of diazo methane and diazoacetic ester

Unit IV Reactive methylene compounds & tautomerism (12 hrs.)

Reactivity of methylene groups - preparation and synthetic uses of diethyl malonate, ethyl acetoacetate and ethyl cyanoacetate.

Tautomerism - definition - various types, keto - enol, amido - imido, nitro - acinitro and oxime - nitroso tautomerism.

Unit V Alicyclic compounds (12 hrs.)

Nomenclature - general methods of preparation - spectroscopic properties – chemical properties - relative stabilities of cyclo alkanes - Baeyer's strain theory –Sachse-Mohr theory - Coulson and Moffit's concept - conformations of cyclohexane and monosubstituted cyclohexanes - largering compounds - synthesis and structure of civetone and muscone (structure elucidation not necessary).

References:

1. K.S. Tewari, N.K. Vishil, S.N. Mehotra – A text book of org. chem – 1st edition,
2. Vikas Publishing House Pvt. Ltd., 2001, New Delhi.
3. P.L. Soni, Text Book of Organic chemistry, Sultans chand, 1991, New Delhi,
4. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.
5. M.K. Jain and S. C. Sharma, Modern Organic Chemistry, 2017.
6. Organic Chemistry - R.T.Morrison and Boyd - Prentice Hall, 2002.
7. Advanced General Organic Chemistry - SachinK.Ghosh - Books and Allied (P) Ltd
8. Organic Chemistry – Bhupinder Mehta and Manju Mehta - PHI Learning Pvt. Ltd, 2008.

NON-MAJOR ELECTIVE - APPLIED CHEMISTRY

Objectives:

1. To acquire knowledge about the chemicals used in day to day life

L (hrs)	Credits
45	2

Unit I Soaps and detergents (9 hrs.)

a. Soaps: Definition-classification-raw materials used in the manufacture of soap – manufacture of toilet soap.
b. Detergents: Definition –various types with examples- advantages of detergents over soaps –cleansing action of soap.

Unit II Fertilizers (9 hrs.)

Definition-characteristics of a good fertilizer- role of nitrogen, potassium and phosphorous in plant growth – natural fertilizers- chemical fertilizers: urea, muriate of potash and triple superphosphate - mixed fertilizers - biofertilizers – advantages of biofertilizers.

Unit III Polymers (9 hrs.)

a. Fibers: Classification - uses of terylene, nylon and orlon.
b. Resins: Natural resins - synthetic resins-type-uses of fevicol, quick fix, araldite, glyptaland Bakelite.
c. Plastics: classification- differences between thermoplasts and thermosets. Advantages of plastics-uses of polythene, PVC, polystyrene, Teflon and thermocole.
d. Rubber: Types-defects in natural rubber-vulcanization - synthetic rubbers- uses of neoprene, thiocol, butyl rubber, silicone rubber and foam rubber.

Unit IV Chemicals in pharmacy (9 hrs.)

Definition and therapeutic uses of the following (an elementary study only)

a. Antiseptics: alum, boric acid
b. Mouth washes: Hydrogen peroxide
c. Antacids: Aluminium hydroxide
d. Analgesics: Aspirin, paracetamol
e. Antibiotics: Penicillins, tetracyclines

f. Haematinics: Ferrous fumerate, ferrous gluconate
g. Laxatives: Epsom salt, milk of magnesia
h. Sedatives: Diazepam

Unit V Chemicals in day-to-day life (9 hrs.)

An outline of the preparation and uses of the following articles.Tooth powder, tooth paste, writing inks, gum paste, boot polish, talcum powder, chalk crayons, agar battis, phenyl and moth balls.

References

1. B. K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut, 2000.
2. Jeyashree Gosh, A text book of Pharmaceutical Chemistry, S. Chand and Company, NewDelhi, 2014.
3. B. N. Chakrabarty, Industrial Chemistry, Oxford and IBH Publishing Co. Pvt. Ltd., Calcutta, 2005.

NON-MAJOR ELECTIVE - CLINICAL CHEMISTRY

Objectives

1. To know about the safety in laboratory
2. To know basic first aids
3. To acquire skill in biochemical analysis

L (hrs)	Credits
45	2

Unit I Lab Safety Precautions (9 hrs.)

Safety in laboratory-importance-safety equipments-personal protection-dangers to avoid chemical hazards-corrosive, irritants, toxic, flammability and explosive hazards Physical hazards - fire, pressure and radiation Biological hazards-micro organisms and animal body fluids Spillage and waste disposal.

Unit II Lab First Aid (9 hrs.)

First aids for accidents-important rules of first aid, First aid for cuts and abrasions, First aid for bleeding and fractures,First aid for burns, fainting and poisonous bites, First aid box.

Unit III Analysis of Blood sample I (9 hrs.)

Blood: Definition-functions and composition-collection of blood through vein puncture and finger prick-Haemolysis agents-precautions.Anti coagulants - definition, types and quantity used for tests. Haemotopoiesis -erythropoiesis, leucopoiesis and thrombopoiesis.

Unit IV Analysis of Blood sample II (9 hrs.)

Blood hemoglobin-methods and procedure for hemoglobin test. Total RBC count-RBC indices-retculocyte count-normal values-increased and decreased conditions.

Classification of leucocytes-functions-total WBC count-morphology types of WBC-total eosnophil count-normal values- increased and decreased conditions.

Functions of platelet - total platelet count-normal values- increased and decreased conditions.

Unit V Blood donor screening (9 hrs.)

Blood group system-blood groups-importance, types, antigen and agglutination antigen-antibodies in different groups. Blood transfusion: detailed blood donor screening

procedure-blood collection-anticoagulants in blood bank-storage of donor blood. Procedures for estimating blood glucose and blood urea.

References

1. Text Book of Medical Lab Technology – Praful B. GodkarandDarshar P. Godkar, Bhaiani Publishing House, 2006
2. Clinical Laboratory Methods – Jolm D. Bener, Mosby, 2012.
3. Clinical Chemistry in Diagnosis and Treatment – Ziwa I. F. P. Peter, Mayne P. D., Year Book Medical Publishers, 1994.
4. Medical Lab Technology – RamnikSood, JPB, 1999.
5. Practical Clinical Biochemistry – W. H. Heinemann, Verley Publications, 1969.

ORGANIC PRACTICAL - II

ORGANIC PREPARATION & DETERMINATION OF PHYSICAL CONSTANTS

L (hrs)	Credits
60	2

Objectives

1. To provide training on organic preparation
2. To provide experimental skill and training to determination of boiling point/ melting point

Practicals

1. Organic preparation

a. Preparation of salicylic acid from methyl salicylate/ benzoic acid from ethylbenzoate
b. Preparation of benzoic acid from benzamide
c. Preparation of acetyl salicylic acid from salicylic acid/ acetanilide from aniline
d. Preparation of benzoic acid from benzaldehyde
e. Preparation of p-bromoacetanilide from acetanilide
f. Preparation of 2-naphthyl benzoate from 2-naphthol
g. Preparation of picric acid from phenol
h. Preparation of methyl orange from sulphanilic acid

2. Determination of boiling point/ melting point of the given organic compound

References

1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.
3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.
4. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
5. P.R.Singh, D.C.Gupta, K.S.BajpalExperimental Organic Chemistry Vol.I and II, 1980.

SEMESTER – V

INORGANIC CHEMISTRY - III

Objectives

L (hrs)	Credits
60	4

1. To study the chemistry of noble gases
2. To study the theories in coordination chemistry
3. To study the chemistry of metal carbonyls
4. To understand the role of metal ions in biological systems
5. To study the basic principles of photoinorganic chemistry

Unit I Chemistry of f- Block elements (12 hrs.)

General characteristics of f-block elements – comparative account of lanthanides and actinides – occurrence, oxidation states, magnetic properties, colour and spectra – separation by ion exchange and solvent extraction methods – lanthanide contraction – chemistry of thorium and uranium – occurrence, ores, extraction and uses – preparation, properties and uses of ceric ammonium sulphate, thorium dioxide, thorium nitrate, uranium hexafluoride, uranylacetate

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Unit II Noble gases (12 hrs.)

Occurrence - isolation of noble gases from the atmoshphere - separation of the gases from one another - general physical properties - special properties of helium - isotopes of helium - uses of noble gases - importance of inert gases in theoritical chemistry - chemical properties - xenon chemistry preparation and properties of fluorides, oxides and oxofluorides of xenon - xenates and perxenates - xenon fluoride complexes - structure and bonding in xenon compounds. Fluorides of kripton and radon - hydrates and clathrates of noble gases - uses of clathrate compunds

Unit III Co-ordination chemistry II (12 hrs.)

Crystal field theory - splitting of d-orbitals in octahedral and tetrahedral complexes - factors affecting the magnitude of crystal field splitting - effects of crystal field splitting - spectrochemical series - applications of CFT - magnetic properties and spectra of transition metal complexes - crystal field stabilization energy and their uses - limitations of CFT - effective atomic number rule - stability of complexes - step-wise and overall stability constants - factors affecting the stability of complexes - determination of stability constants.

Unit IV Co-ordination chemistry III (12 hrs.)

Labile and inert complexes - ligand substitution reactions in octahadral complexes aquation, base hydrolysis and anation reactions - substitution reactions in square planner complexes - trans effect - theories of trans effect - mechanism of substitution reactions - redox reactions : inner-sphere and outer-sphere electron transfer reactions - metal carbonyls : 18 electron rule as applied to metal carbonyls - preparation, properties and structure of mono, di and polynucluer carbonyls of Cr, Mn, Fe, Co and Ni - nature of M-L bond in metal carbonyls - metal nitrosyls.

Unit V Bioinorganic chemistry (12 hrs.)

Role of alkali and alkaline earth metals in biological systems and their transport across the membranes - the effect of excess and deficiency of essential trace metals (Cu, Fe, Co and Zn) - metalloporphyrins - myoglobin and hemoglobin - dioxygen binding - co-operativity in hemoglobin - the Bohr effect - chlorophyl - vitamin B_{12}. Metal complexes of copper, gold and platinum as therapeutic agents - chelation therapy in metal poisoning.

References :

1. J.D. Lee, Concise Inorganic Chemistry 5th Ed., Blackwell Science Ltd.,
2. James E. Huheey, Elien A. Keiter and Richard L. Keiter, Inorganic Chemistry : Principles Structure and Reactivity, 4th Ed., Harper College Publisher.
3. F. Albert Cotton, Geoffrey Wilkinson, Carlos A. Marilo and Manfred Bochman, Advanced Inorganic Chemistry, 6th Ed., Wiley Interscience Publication.
4. Fred Basolo and Ralph G. Pearson, Mechanisms of Inorganic Reactions : A study of metal complexes in solution, 2nd Ed., John wiley and sons, Inc.,
5. David E. Fenton, Biocoordination Chemistry, Ist Ed., Oxford Science Publications.
6. IvanoBertini, Harry B Gray, Stephen J Lippard, Joan Selverstone Valentine, Bioinorganic Chemistry, 1st Ed., Viva Books Pvt. Ltd.,
7. J.K. Rohatgi - Mukherjee, Fundamentals of Photochemistry - Wiley Eastern Revised Ed.,
8. Journal of Chemical Education, Vol.60, No.10, October 1983.
9. A.W. Adamson and P.D. Fleischauer, (Editors) Concepts of Inorganic photochemistry, John wiley and sons, New York, 1975.

PHYSICAL CHEMISTRY – III

L (hrs)	Credits
60	4

Objectives

1. To understand the kinetics of reactions
2. To understand the concepts of thermodynamics
3. To study the principles of electrochemistry and the types of electrochemical cells
4. To know the terms in phase rule and its application to various systems

Unit I Thermodynamics-I (12hrs.)

Basic concepts - system, surroundings - types of systems - extensive and intensive properties - state functions and path functions - types of processes - . Exact and inexact differentials -Zeroth law of thermodynamics. Statements of first law - definition of internal energy and enthalpy - heat capacities at constant volume (C_v) and at constant pressure (C_p), relationship between C_p and C_v - calculation of work, heat, internal energy change and enthalpy change for the expansion of an ideal gas under reversible isothermal and adiabatic conditions. Joule-Thomson effect – Joule-Thomson coefficient and its significance - derivation of the expression for Joule-Thomson coefficient - inversion temperature.Kirchoff's equation and its applications - numerical problems.

Unit II Thermodynamics-II (12hrs.)

Introduction to second law of thermodynamics - spontaneous processes - statement of second law of thermodynamics.

Entropy: Definition –entropy a state function - Trouton's rule -entropy change in reversible and irreversible processes- Clausius inequality- entropy as function of T and V - entropy as a function of T and P - entropy change in isothermal transformation - entropy change accompanying change of phase - entropy of mixing of ideal gases - physical significance of entropy.

Free energy: Work and free energy functions – definition-general conditions of equilibrium and spontaneity -physical significance of dA and dG. Temperature and pressure dependence of G - variation of G during isothermal change -Gibbs Helmholtz equation.

Unit III Thermodynamics-III (12hrs.)

Van't Hoff isotherm and isochore - Clapeyron equation-Clapeyron-Clausius equation-Applications of Clapeyron-Clausius equation.

Third law of thermodynamics: Nernst heat theorem- statement of III law and its applications. Exception to third law- experimental verification of the law-residual entropy- Evaluation of absolute entropy from heat capacity measurements.

Partial molar properties: Partial molar free energy. The concept of chemical potential - variation of chemical potential with T and P- Gibbs Duhem equation- concept of fugacity and activity- activity coefficient - standard states.

Unit IV Electrochemistry- I (12 hrs.)

Metallic and electrolytic conductance - Definitions of specific, equivalent and molar conductances - Relations between them - measurement of conductance and cell constant. Variation of conductance with dilution - Qualitative explanation - Strong and weak electrolytes. Migration of ions - transport number - determination by Hittorf and moving boundary methods - Kohlrausch's law - applications - calculation of equivalent conductance for weak electrolytes and determination of transport number. Ionic mobilities and Ionic conductances. Diffusion and ionic mobility- molar ionic conductance and viscosity- Walden rule-Applications of conductance measurements - Degree of dissociation of weak electrolytes - Determination of Ionic product of water - Determination of solubility of sparingly soluble salts - conductometric titrations.

Unit V Electrochemistry –II (12 hrs.)

Galvanic cells - Reversible and Irreversible cells - EMF and its measurement - Weston Standard cell - types of reversible single electrodes - standard Hydrogen electrode - calomel electrode - Derivation of Nernst equation both for emf of cells and single electrode potentials–significance.Application of emf measurements – Application of Gibbs -Helmholtz equation to galvanic cells - calculation of thermodyamic quantities - pH using hydrogen, quinhydrone and glass electrodes - potentiometric titrations. Concentration cells - electrode concentration cells- electrolyte concentration cells- concentration cells with and without transference .

References :

1. B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, Vishal
2. Publishing Co., Jalandhar.
3. P.L. Soni, O.P. Dharmarha& U.N. Dash, Text book of Physical Chemistry, 22nd Edn., Sultan Chand & Sons, New Delhi.

4. Essentials of Physical Chemistry– B.S.Bahl, Arun Bahl, G.D.Tuli, Reprint 2006,S.Chand & Company Ltd., New Delhi-110055.
5. Physical Chemistry volumes I & II- S.Pahari, 2004, New Central Book Agency,Kolkotha.
6. Physical Chemistry-G.M.Barrow, 2005, Tata McGraw Hill Publishing Company,New Delhi.
7. Physical Chemistry-G.K.Vemulapalli, 2004, Prentice Hall of India.
8. Thermodynamics for Students of Chemistry- Rajaram & Kuriacose, 2013.
9. Thermodynamics for Chemists- Samuel Glasstone, 2017.

ORGANIC CHEMISTRY - III

Objectives

L (hrs)	Credits
60	4

1. To study the Stereochemistry and aromatic substitution of organic molecules
2. To learn about the Polynuclear hydrocarbons, Heterocyclic Compounds and Dyes

Unit I Stereochemistry (12 hrs.)

Stereoisomerism - definition - classification into optical and geometrical isomerism. Projection Formulae - Sawhorse and Newman projection formulae - Notation of Optical isomers - D-L notation- Cahn-Ingold-Prelog rules - R-S notations for optical isomers.

Optical isomerism - optical activity - optical and specific rotations - conditions for optical activity - asymmetric centre - chirality - achiral molecules. Elements of symmetry - Racemisation - methods of racemisation. Resolution - methods of resolution (mechanical, seeding, biochemical)

Geometrical isomerism - cis-trans and E-Z notations - Geometrical isomerism in maleic and fumaric acids and unsymmetrical ketoximes - Methods of distinguishing. Geometrical isomers using melting point, dipole moment, dehydration and cyclisation.

Unit II Aromatic substitution (12 hrs.)

General mechanism of electrophilic substitution, mechanism of halogenation, nitration, sulphonation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Direct influence of substituents - rules of orientation- Aromatic Nucleophilic substitutions- unimolecular, bimolecular and benzyne mechanisms- homolytic aromatic substitution (side chain halogenation of alkyl benzenes.).

Unit III Polynuclear hydrocarbons (12 hrs.)

- ✓ Isolatedsystems :-Preparation of diphenyl, diphenyl methane, triphenyl methane and stilbene.
- ✓ Condensed systems:- Synthesis, reactions, structure and uses of naphthalene.Preparation and reactions of naphthols, naphthylamine and naphthaquinone.

Synthesis, Reactions, structure and uses of anthracene – Preparation and reactions of anthraquinone. Synthesis and structure of alizarin phenanthrene..

UNIT IV Heterocyclic Compounds (12 hrs.)

Preparation, properties and uses of furan, pyrrole & thiophene - aromatic character.Synthesis and reactions of pyridine and piperidine - comparative study of basicity of pyrrole, pyridine and piperidine with amines.

Condensed five and six membered heterocyclics - preparation and reactions of indole, quinoline and isoquinoline - Fischer indole synthesis, Skraup synthesis and Bischer-Napieralski synthesis.

UNIT V Dyes (12 hrs.)

Theory of colour and constitution – Witt's chromophore theory - resonance theory, valence bond theory and modern theory.

Dyes - requirements of a dye - Classification - according to structure and method of application.

Preparation, structure and uses of

a. Nitro dyes – Picric acid and Naphthol green
b. Azo dyes - Methyl orange and Bismark brown
c. Triphenyl methane dyes - Malachite green and Crystal violet
d. Phthalein dyes - Phenolphthalein
e. Vat dyes - Indigo
f. nthraquinone dyes - Alizarin.

References

1. Textbook of Organic Chemistry - A.K.Bansal - New Age, 2017.
2. Organic Chemistry - I.L.Finar - Volume I & II – AddisionWesley, 2011.
3. Organic Chemistry - R.T.Morrison and Boyd - Prentice Hall, 2001.
4. Stereochemistry of Organic Compounds - D.Nasipuri - New Age, 1994.
5. Stereochemistry, Conformation and Mechanisms - Kalsi New Age, 2005.
6. Advanced General Organic Chemistry – Sachin K.Ghosh - Books and Allied (P) Ltd, 2008.
7. Textbook of Organic Chemistry - P.S. Kalsi – Macmillan, 2008.

SKILL BASED CORE – I-AGROCHEMISTRY

L (hrs)	Credits
60	4

Objectives

1. To study detailed about fertilizers, pesticides, Insecticides, fungicide and herbicide
2. To learn about Soil characteristics and soil testing

UNIT I Fertilizers (12 hrs.)

Fertilizers : Classification, macronutrients -role of nitrogen, potassium and phosphorus on plant growth - manufacture of urea, muriate potash and triple superphosphate. Complex fertilizers, mixed fertilizers & biofertilizers - their composition. Micronutrients - their role in plants.

Manures : Bulky organic manures - Farm yard manure - oil cakes- blood meal - fish manures- Composting process - handling and storage

UNIT II Pesticides (12 hrs.)

Pesticides – Definition- Classification of Pesticides based on the use and chemical composition - examples - general methods of application - Benefits of pesticides-Potential hazards. Safety measures -first aid.

Insecticides : Plant products – Nicotine, pyrethrin - Inorganic pesticides – borates. Organic pesticides - D.D.T. and BHC.

Fungicide : Sulphur compounds, Copper compounds, Bordeaux mixture.

Herbicides : Acaricides - Rodenticides. Attractants - Repellants.

UNIT III origin of soil (12 hrs.)

Soil: Origin of soil- definition of soil-rock system-weathering of rocks and minerals-main components of soil-organic, inorganic constituents-soil formation – factors favouring soil formation.

UNIT IV Characteristics of soil (12 hrs.)

Characteristics of soil: Physical aspects-soil texture- pore space-bulk density, particle density-soil colour-surface area-soil colloids-plasticity, shrinkage-flocculation and deflocculation,soil air, soil temperature and their importance in plant growth.

Acid, alkaline and saline soils-diagnosis- Methods of reclamation and after care.

UNIT V Soil testing (12 hrs.)

Soil testing: concept and objectives - soil sampling , tools, collection, processing, dispatch of soil sample.Estimation of total organic compound, available nitrogen and phosphorus in the soil sample.Determination of pH, EC, moisture content, bulk density and particle density of the soil sample.

References

1. A text book of Soil Science – Daji.A, Asia Publishing House, Madras 1970.
2. Textbook of soil Chemical Analysis – Hesse,P.R.A John Murray Newyork,1971.
3. Textbook of Soil Science - Biswas,T.D and Mukherjee,S.K.Second edition, Tata McGraw-Hill Education.
4. Chemistry for Agriculture and Ecology-Y.MidoM.Satake, Discovery Publishing House.
5. Soil Fertility &Fertilisers – Samuel L.Tisdale,Werner L. Nelson, James D.Beaton, John L. Havlin. Fifth edition, Macmillan.
6. Nature and properties of soils - Harry, O Buckman N Yle C. Brandy, Macmillan.
7. Insecticides, Pesticides and Agro based Industries –R.C.Paliwal, K.Goel, R.K.Gupta, Small Business Publications.

SKILL BASED CORE – I- FOOD CHEMISTRY

Objectives:

1. To acquire the basic knowledge of food chemistry

L (hrs)	Credits
60	4

Unit I Constitution of food (12 hrs.)

Food - definition - classification of food - energy requirements of individuals - source, classification and function of carbohydrates, proteins, lipids, vitamins and minerals - calorific values of food - rice, wheat, milk, fish, vegetables, fruits and cereals.

Unit II Food additives and preservatives (12 hrs.)

Food additives: Definition - permitted food additives, characteristics and their role: antioxidants, stabilizers, flavours, sweeteners, emulsifiers, thickeners, food colourants.
Preservatives: Definition – methods of food preservation - heat, cold, deep-freezing, radiation.

Unit III Food adulterations (12 hrs.)

Definition - adulterant, adulteration - types of adulterants - common adulterants and their determination in milk, oils, ghee, honey, chilly powder, coriander powder, turmeric powder, coffee powder, tea dust, asafoetida - food poisoning and its prevention – Prevention of Food Adulteration Act- food laboratories and their functions.

Unit IV Quality standards (12 hrs.)

Quality control - specification and standards - FA, FDA, WHO standards - ISI specifications, packing and labeling of foods - Essential Commodities Act, Consumer Protection Act - AGMARK.

Unit V Estimation and analysis methods (12 hrs.)

a. Determination of fat, protein and carbohydrate in food stuff.
b. Analysis of fats and oils - iodine value, acid value and RM value.
c. Estimation of glucose by Bertranel method
d. Analysis of starch in foods
e. Isolation of casein from milk

References

1. Sivasankar B, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
2. Swaminathan M. Textbook on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore, 1993.
3. N. S. Gnanaprakasam, G. Ramamurthy, Organic Chemistry, Lab Manual, S. Viswanathan Printers and Publishers Ltd.
4. Food Science – III Edition – B. Sri Lakshmi, New Age International Publisher, 2005.
5. Fundamentals of Foods and Nutrition – Mudambi. R. Sumathi, and Rajagopal, M.V. Willey Eastern Ltd, Madras.

MAJOR ELECTIVE I- ANALYTICAL CHEMISTRY

Objective

1. To know the importance of analytical chemistry and to study about the different types of analytical techniques

L (hrs)	Credits
60	4

Unit I Errors and Data Analysis (12 hrs.)

Definition and explanation with examples of the terms – mean, median, mode, range, deviation, mean deviation, relative mean deviation, standard deviation, coefficient of variation and variance – accuracy and precision – types of errors – random and systematic errors – methods of detection and elimination of systematic errors – student's t-test – confidence levels – Q-test for rejection of result – curve fitting – method of least squares – significant figures and computational rules.

Unit II Water Analysis (12 hrs.)

Sampling and preservation of water samples – physical examination of water : color, odour, turbidity, taste and electrical conductivity – chemical characterisation : pH, acidity, alkalinity, TDS, total, temporary, permanent, calcium and magnesium hardness, chloride, fluoride, BOD, COD, detergents and pesticides – residual chlorine and chlorine demand – Bacteriological examination : total and faecal coliforms.

Unit III Fuel Analysis (12 hrs.)

Solid fuels : coal – classification – proximate analysis : moisture content, ash content, volatile matter and fixed carbon – ultimate analysis : carbon, hydrogen, nitrogen, sulphur and oxygen – heating values – grading of coal – comparison of coal and coke – liquid fuels : flash point, aniline point, octane number and carbon residues – gaseous fuels : producer gas and water gas – calorific values.

Unit IV Electroanalytical Techniques (12 hrs.)

Electrogravimetry : principle, instrumentation and applications. Coulometry : constant current coulometry – coulometric titrations – applications – potentiostatic coulometry – Polarography : principle – experimental assembly – working – advantages and disadvantages of DME – applications to qualitative and quantitative analysis. Amperometric titrations : theory – apparatus – general procedures – applications – advantages

Unit V Spectroanalytical and Thermoanalytical Method (12 hrs.)

Spectroanalyticalmethods : principle, instrumentation and applications of colorimetry, spectrophotometry and fluorimetry – light scattering techniques: nephelometry and turbidimetry.

References

1. D.A.Skoog, D.M.West and Holler, Analytical Chemistry : An introduction, 6th Ed., Saunders College Publising,1978.
2. Gary D. Christian, Analytical Chemistry, 6th Ed., John Wiley & Sons, 1972.
3. S.M.Khopkar, Environmental Pollution Analysis, 1st Ed., Wiley Eastern Ltd.,1998.
4. APHA, Standard Methods for Estimation of Water and Waste water, 19th Ed., American Public Health Association, 2007.
5. O.P.Vermani and A.K. Narula, Applied Chemistry, 2nd Ed., New Age International Publishers, 2001.
6. A.K.Shaha, Combustion Engineering and Fuel Technology, Oxford & IBH Publising Company,1975.
7. D.A.Skoog, Holler and Nieman, Principles of Instrumental Analysis, 5th Ed., Saunders College publishing, 1996.
8. Hobart H.Willard, Lynne L.Merritt, John A.Dean and Frank A. Settle, Instrumental Methods of Analysis, 7th Ed., CBS Publishers & Distributors Pvt. Ltd., 2008.

MAJOR ELECTIVE I-PHARMACEUTICAL CHEMISTRY

Objectives

L (hrs)	Credits
60	4

1. To understand the concepts and terminologies of pharmaceutical chemistry
2. To know the mechanism of action and metabolism of drugs
3. To study the functions of various drugs
4. To know the important diseases and their treatment
5. To study the common diseases and important disorders of human beings and the drugs used in the treatment.

Unit I Important Terminologies, Classification and Assay (12 hrs.)

Important terminologies - Pharmacology, Molecular pharmacology, Pharmacophore , metabolites, Antimetabolites, Pharmacokinetics, Pharmacodynamics, Bioavailability, Pharmacognosy, Pharmacotherapeutics, Toxicology, Chemotherapy – Classification of drugs – nomenclature of drugs – nonproprietary names – sources of drugs – assay of drugs (biological, chemical, immunological)

Unit II Mechanisms, Metabolisms and Medicinal Plants (12 hrs.)

Mechanism of drug action – absorption, drug delivery, drug excretion –Metabolism of drugs – chemical pathways of drug metabolism – phase – I (oxidative, reductive and hydrolytic reactions) and phase - II (conjugate reactions). Physiological effects of different functional groups in drugs –biological role of Na, K, Ca, Cu, Zn and iodine.

Indian medicinal plants – Phytoconsituents and their biological actions in Tulsi, neem, Keezhanelli, adathode, thoothuvalai

Unit III Drugs and their actions (12 hrs.)

Analgesics- narcotic analgesics- analgesic action, uses and structure activity of morphine.Non-narcotic analgesics –aspirin and paracetamol. Anaesthetics- local anesthetics –procaine- General anaesthetics- chloroform and halothane. Antibiotics – Therapeutically values of penicillin, tetracycline, chloramphenicol and streptomycin. Sulpha drugs – sulphanilide, sulphadiazine and cotrimoxazole. Antiseptics and disinfectants – phenols, chloramines and organicmercurials. Antidepressants – barbiturates – mechanism of action and uses.Antipsychotic drugs – piperazine and benzamides.

Unit IV Diseases and treatment (12 hrs.)

Composition of blood – blood grouping and matching – Rh factor. Aneaemia – causes and control – antianemic drugs. Blood pressure – causes, control and treatment- antihypertension drugs, antianginal agents - cardiovascular drugs, cardiac glycosides, vasodilators (one example for each). Diabetes – causes and control – hypoglycemic drugs – insulin – oral hypoglycemic drugs (tolubutamide and chlorpropamide). Cancer- causes and treatment – cobalt therapy - antineoplastic drugs (chlorambucil, methotrexate, plant products and hormones).

Unit V Common disorders and health care medicines (12 hrs.)

Common diseases – causes and treatment of insect borne diseases (Malaria and Filariasis), airborne diseases (Diptheria, Whooping cough, Influenza, common cold, TB) and Water borne diseases (Cholera, Typhoid and Dysentery).Digestive disorder – Jaundice.Respiratory disorder – Asthma.Nervous system disorder – epilepsy. Other diseases – Leprosy.Health care medicines – Sources and deficiency diseases of Vitamins A, B complex, C, D, E and K.

References

1. A text book of pharmaceutical chemistry, Jayashree ghosh, S. Chand, 2003.
2. Pharmaceutical Chemistry by S. Lakshmi, Sultan Chand & Sons, 3rd edition (2004).
3. Medicinal Chemistry, A. shutoshkar, New Age International, 1992
4. Pharmaceutical chemistry – G.R. Chatwal.
5. Pharmacology and Pharmatherapeutics – R.S. Satoskar and S.D. Bhandarkar.
6. Drugs , G.L.D. Krupadanam, D.V. Prasad, K.V.Rao, K.L.N.Reddy and C.Sudhakar, Tata McGraw- Hill Publishing Company,New Delhi.
7. Medicinal chemistry, G.R.Chatwal, Himalaya Publishing House, New Delhi (2002).

Skill Based Subject (1 Course)

Effective Communication / Personality Development

PHYSICAL CHEMISTRY PRACTICAL – I

L (hrs)	Credits
60	2

Objectives

1. To provide training in the identification of physical properties like molar mass, molecular weight and solubility of some chemical compounds
2. To provide training in freundlich isotherm and phase equilibrium of the chemical reaction
3. To provide training in the estimation of compounds using conductometric and potentiometric methods

Practicals

a. Determination of molar mass of the given substance by Rast micro/macro method
b. Determination of molecular weight of the given substance by Transition temperature method
c. Determination of solubility of a substance at different temperatures and calculation of heat of solution
d. Study of adsorption of oxalic acid on charcoal and verification of Freundlich isotherm
e. Study of phase equilibrium – Simple eutectic
f. Estimation of HCl by conductometric method using standard oxalic acid (to be prepared) and link NaOH
g. Estimation of Fe(II) by potentiometric method using standard ferrous ammonium sulphate (to be prepared) and link $KMnO_4$.

References

1. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987.
2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
3. avid P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in Physical Chemistry, 5th Edi., McGraw- Hill Book company, 1989.
4. Alexander Findlay and J.A. Kitcher.Practical Physical Chemistry, Longmans
5. Y.B. Yadav, Practical Physical Chemistry, Goel publishing house

PHYSICAL CHEMISTRY PRACTICAL – II

L (hrs)	Credits
60	2

Objectives

1. To provide training in comparison of strength of acids
2. To provide training in the determination of critical solution temperature and strength
3. To provide training in the determination of viscosity
4. To provide training in potentiometric and conductometric methods in estimation of some compounds
5. To provide training in determination of equivalent conductance and calculation of dissociation constant

Practicals

a. Comparison of the strengths of acids by studying the kinetics of ester hydrolysis
b. Determination of CST of phenol-water system. Study of the effect of impurity on CST and determination of the strength of unknown
c. Determination of the viscosity using Oswald viscometer.
d. Estimation of $MgSO_4$ by conductometric method using standard $MgSO_4$ (to be prepared) and link $BaCl_2$
e. Estimation of $K_2Cr_2O_7$ by potentiometric method using standard $K_2Cr_2O_7$ (to be prepared) and link $KMnO_4$
f. Determination of equivalent conductance of weak electrolyte and calculation of dissociation constant

References

1. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987.
2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
3. David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in Physical Chemistry, 5th Edi., McGraw - Hill Book company, 1989.
4. Alexander Findlay and J.A. Kitcher, Practical Physical Chemistry, Longmans
5. Y.B. Yadav, Practical Physical Chemistry, Goel publishing house

SEMESTER VI

SKILL BASED CORE - II- CHROMATOGRAPHY

Objectives

1. To understand the principle behind various types of chromatographic techniques and their applications

L (hrs)	Credits
60	4

Unit I Paper Chromatography (12 hrs.)

Introduction, Classification of chromatography methods.

Paper Chromatography: Principles, significance of R_f values. Experimental procedures, choice of paper and solvent systems, developments of chromatogram.Detection of the spots.Ascending, descending and radial Paper Chromatography Two-dimensional chromatography.Applications.

Unit II Thin Layer Chromatography (12 hrs.)

Thin Layer Chromatography:Advantages of thin layer chromatography – principles, factors affecting R_f values. Experimental procedures.Choice of adsorbents and solvents.Preparation of plates.Development of the chromatogram.Detection of the spots.Applications.

Unit III Column Chromatography (12 hrs.)

Column Chromatography – Principles, experimental procedures, stationary and mobile phases,Choice of solvent systems. Separation technique.Applications.

Unit IV Ion Exchange Chromatography (12 hrs.)

Principle, ion exchange resins & their types- cation exchange resins, anion exchange resins, ion exchange reactions, ion exchange equilibria properties of ion exchange resins, ion exchange capacity and applications.

Unit V Gas Chromatography (12 hrs.)

Principle, instrumentation, choice of injectors, column and detectors – Programmed temperature chromatography, flow programming chromatography, gas-solid chromatography and hyphenated techniques in chromatography – Applications of Gas Chromatography.

References

1. B. Fried, J. Sharma: Thin-Layer Chromatography, Fourth Edition, revised and
2. expanded, Marcel Dekker Inc.,New York – Basel,2005.
3. Scott, R. P. W. Techniques and Practices of Chromatography; 2nd ed. Marcel Dekker Inc., New York,1995
4. Hinshaw, J. V. Ettre, L. S. Introduction to Open Tubular Column Gas Chromatography; Advanstar,1989.
5. Poole, C. F. Poole, S. K. Chromatography Today; Elsevier, 1991.
6. HPLC: Analytical Chemistry by Open Learning John Wiley & Sons, New York, (1991).

SKILL BASED CORE - II - DAIRY CHEMISTRY

L (hrs)	Credits
60	4

Objectives

1. To learn the composition and properties of milk
2. To understand the chemical composition of milk and milk processing.
3. To know the chemistry of cream and butter
4. To study to fermented milk products
5. To know the condensed milk and dairy detergents

Unit I Properties of milk (12 hrs.)

Definition, Composition, Milk lipids, Milk proteins, vitamins and minerals. Factors affecting the composition of milk - adulterants, preservatives, and neutralizer - examples and their detection.

Unit II Processing of milk (12 hrs.)

Destruction of microorganisms in milk – physicochemical changes during processing – boiling, pasteurization – pasteurization types – bottle pasteurization –batch pasteurization – HTST (High Temperature Short Time) – vacuum pasteurization –(UHT) Ultra High Temperature Pasteurisation.

Unit III Milk products-I (12 hrs.)

Milk Products: Cream – definition, classification – manufacturing – chemistry of creaming process –50hysic–chemical properties – separation of cream , estimation of fat in cream , Butter – definition, classification, composition, theory of churning, desibutter, salted butter. Ghee –major constituents, common adulterants and their detection.

Unit IV Milk products-II (12 hrs.)

Fermented milk products - fermentation of milk - definition and conditions. Ice creams - definition, composition, types, manufacture of ice - cream, stabilizers, emulsifiers, and their role, milk powder – definition, process of making milk powder.

Unit V Condensed milk and dairy detergents (12 hrs.)

Condensed milk – definition, classification and differences between condensed milk and skim – condensed milk – sanitation – pasteurization – nutritive value of milk –

difference between cow milk and bauffalo milk- milk enzymes. Dairy Detergents : Definition-characteristics – classification-washing procedure (modern method) sterilization – chloramine -T and hypochlorite solution.

References :

1. Applied Chemistry-K.BagavathiSundari MJP Publishers Chennai. 2006.
2. Principles of dairy technology – Robert Jenness, Wiley, New York,2001.
3. Indian Dairy Products - Rangappa and Acharya, K.T. Asia Publishing House, Bombay, India,1999.
4. Fundamentals of Dairy chemistry –Wond. F.P. Springer,2000.
5. Outlines of Dairy Technology – Sukumar De. – Oxford University Press,1997.
6. Applied chemistry for home science & allied science –T.Jacob, Mcmillan,2005.

MAJOR ELECTIVE II - POLYMER CHEMISTRY

Objectives:

L (hrs)	Credits
60	4

1. To know the concept of polymerization and types of polymers
2. To understand the characteristics of polymers
3. To acquire knowledge about the polymerization techniques and polymer processing
4. To know the chemistry of individual polymers
5. To have an idea about the recent advances in polymer sciences

Unit I Introduction to polymers (12 hrs.)

i. Definition - Monomer, polymer and polymerisation - classification of polymers.)
ii. Physical properties and applications - Rubbers, plastic, fibres
iii. Thermal response - thermoplastics, thermosetting
iv. Structure - Homopolymers, Copolymers
v. Mode of formation - Addition, Condensation Polymerisation (definition and examples only)
vi. Methods of polymerization - Bulk, Solution, Suspension Polymerisation (definition and examples only)
vii. Chemistry of polymerization: Chain polymerization, free radical, ionic, co-ordination, step polymerization, polyaddition and polycondensaion, miscellaneous ring opening and group transfer polymerizations.

Unit II Characteristics of polymers (12 hrs.)

Glass transition temperature (Tg) - definition – Factors affecting Tg – relationships between Tg and molecular weight and melting point. Number average, weight average (problems), sedimentation and viscosity average molecular weights - degree of polymerization, vulcanisation. Polymer degradation - basic idea of thermal, photo and oxidative degradation of polymers.

Unit III Polymerization techniques and processing (12 hrs.)

Bulk, solution, suspension, emulsion, melt condensation and interfacial poly condensation polymerizations. polymer processing - calendaring - die-casting, rotational casting - compression moulding - injection moulding - blow moulding - extrusion moulding and reinforcing.

Unit IV Chemistry of some commercial polymers (12 hrs.)

i. Thermoplastics, polyethylene, polypropylene, polystyrene, polyacrylonitrile, polyvinyl chloride, nylon, polyester.
ii. Thermosetting plastics: Phenol formaldehyde resin, urea formaldehyde resin, melamine formaldehyde, epoxy resin, polycarbonate.
iii. Elastomers: Natural rubber and synthetic rubber, Styrene and neoprene rubber.

Unit V Advances in polymer (12 hrs.)

Biopolymers - contact lens, dental polymers, artificial heart, kidney, skin and blood cells, Polymer industries in India.

Books for References:

1. V.R. Gowarikar, N.V. Viswanathan and J. Sreedhar. Polymer Science, Wiley Eastern, 1995.
2. F.N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.
3. Material Science II edition, P.K. Palanisamy SCITECH Publications India Pvt., Ltd., Chennai-600001.
4. Engineering Chemistry, V Srinivasan, S.D. Uma Maheshwari, M. Meena. SCITECH Publications India Pvt., Ltd., Chennai- 600001.
5. Introduction to Organic Chemistry. John McMurry Brooks/coleCenage Learning India Private Limited. First Reprint, 2008.
6. Modern Chemistry, David. W. Oxtoby, H.P. Gills, Alan Campion Brooks/coleCenage Learning India Private Limited. First Reprint 2008.

MAJOR ELECTIVE II - INDUSTRIAL CHEMISTRY

Objectives:

L (hrs)	Credits
60	4

1. To gain knowledge about systems of units and conversion factor
2. To understand utilities in chemical industries
3. To know the severity of corrosion and methods of preventing it
4. To study the industrial process of silicate industry
5. To acquire the knowledge about the unit process

Unit I Cement (12 hrs.)

Introduction-Cement manufacturing process, chemical composition of various types cement, chemical characteristics of cement raw materials and their phase relation, various unit operation of cement manufacture.

Hydration of clinker minerals, role of gypsum in cement hydration process, hydration of Portland and strength of Portland cement.

Unit II Fuels and furnaces (12 hrs.)

Fuels - types of fuels - calorific values - ignition point - pyrometric effect - explosives range - Flue gas analysis by Orsat's method - explosives - classifications - low explosives - `initiating explosives – high explosives - rocket propellants - nuclear fuels.

Furnaces - types of furnaces - Kilns - Blast furnace, reverberatory furnace - muffle furnace - electric furnace - regenerative furnace, open hearth furnace - Bessemer converter - vertical retort furnace.

Unit III Corrosion and protective coating (12 hrs.)

Introduction - severity of corrosion - chemical and electrochemical corrosion - mechanism - factors influencing corrosion - control of corrosion - cathodic and anodic protection.

Paints - characteristics of paint - constituents of paints - pigments - vehicles - thinners - driers - fillers - plasticizers - anti skinning agents - their function and properties.

Metallic coating - removal of surface contamination - removal of superficial corrosion products - polishing - galvanizing - tinning - electroplating.

Unit IV Silicate industry (12 hrs.)

Refractories - requirements of refractories - properties of refractories – solid refractories - fire clay refractories - magnesite refractories, dolomite bricks, graphite refractories, zirconia refractories, silicon carbide.

Abrasives - classifications – natural (diamond, corundum, emery, garnet, quartz and flint) and artificial (carborundum, alundum, boron carbide, metallic abrasives). Uses of abrasives - cement manufacture - setting and hardening of cements - gypsum - plaster of Paris - manufacture – setting and hardening - uses. White wares manufacture - types – glazing.

Unit V Unit processes in organic manufacture (12 hrs.)

Sulphonation - uses and applications of sulphonates and sulphates - sulphonating agents - sulphur trioxide. Hydrolysis - hydrolyzing agents - mechanism of hydrolysis.

Oxidiation - oxidizing agents - permanganate and dichromate – liquid phase oxidation -vapour phase oxidation - commercial manufacture of acetic acid. Hydrogenation - catalysts for hydrogenation - hydrogenation of vegetable oils.

References

1. Industrial Chemistry, B. K. Sharma, Goel Publishing House, Meerut, 2005.
2. Industrial Chemistry, B. N. Chakrabarthy, Oxford & IBH Publishing Co. Pvt. Ltd. Calcutta, 2000.
3. Unit Processes in Organic Synthesis, P. H. Groggins, Tata McGraw-Hill Publishing Company limited, New Delhi,1992.
4. Stoichiometry – B. Z. Bhatt and S. M. Vora, 2001.
5. Engineering Chemistry, Jain and Jain, 2007.
6. F.M. Lea, Chemistry of Cement and concrete, Arnold, London,1999.
7. R.H.Bouge, Chemistry of Portland Cement, Reinhold, New York,1991.

SEMESTER III

CHEMISTRY - Allied Paper – I

Objectives

L (hrs)	Credits
45	3

1. To study the nature of inert gases and their compounds
2. To learn the chemistry of basic heterocyclic compounds.
3. To study about photochemical reactions
4. To learn about the importance of polymers and polymer science.
5. To study about lubricants and some cosmetics in the modern world.

Unit I Inorganic chemistry - Zero group elements (9 hrs.)

Isolation of inert gases by physical and chemical methods - preparation and properties of xenon tetra fluoride, xenon hexafluoride xenon oxytetrafluoride - uses of noble gases – clathrates and their uses.

Unit II Organic chemistry – Principles of reactions (9 hrs.)

Heterolytic and homolytic cleavage - nucleophiles and electrophiles - reaction intermediates – preparation and properties of carbonium ions, carbanions and free radicals -type of reactions - substitution, addition, elimination and polymerisation reactions.

Unit III Physical chemistry - Photochemistry (9 hrs.)

Definition - comparision between thermal and photochemical reactions - Laws of photochemistry-Beer Lambert's law-Grothus Draper law-Einstein's law-Quantum yield-low and high quantum yields - determination of quantum yield-fluorescence, phosphorescence, thermoluminescence, chemiluminescence and bioluminescence-definition with examples-photosensitisation

Unit IV Polymer Chemistry (9 hrs.)

Definition - Monomers, Oligomers, Polymers - Classification of polymers-: Natural synthetic, linear, cross linked and network- plastics, elastomers, fibres, Homopolymers and Co-polymers

Thermoplastics- Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly vinyl Chloride, nylon and polyester - Thermosetting plastics -: Phenol formaldehyde and epoxide resin-Elastomers- Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.

Unit V Applied Chemistry **(9 hrs.)**

Lubricants – classification-criteria of good lubriacting oils-synthetic lubricating oils-poly glycols and poly alkene oxides-greases or semi solid lubricants – examples-solid lubricants-graphite.

Preparation and uses of shampoo, nail polish, sun screens, tooth powder, tooth paste, boot polish, moth ball, chalk piece.

References

1. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry,1978.
2. P. L. Soni, Text Book of Inorganic Chemistry,1987.
3. K. S. Tewari and N. K. Vishnoi,A Text Book of Organic Chemistry,1991.
4. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons,1998.
5. M.K. Jain and S. C. Sharma, Modern Organic Chemistry,2007.
6. K.K.Rohatgi Mukherjee, Fundamentals of photochemistry , Wiley Eastern Ltd,1996.
7. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, chand& Co,2000.
8. Malcom P. stevens, Polymer Chemistry – An Introduction,2001.
9. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995.
10. Sawyer.W, Experimental cosmetics,Dover publishers, New york, 2000.

Allied Practicals - I

Quantitative Analysis

Objectives

L (hrs)	Credits
60	2

1. To provide training in basic volumetric titrations like acidimetry, alkalimetry, permanganometry, iodometry, dichrometry and complexometry.

Practicals

I. Acidimetry and alkalimetry
   a. Estimation of oxalic acid – Std oxalic acid
   b. Estimation of Na_2CO_3 – Std Na_2CO_3

II. Permanganometry
   a. Estimation of ferrous ammonium sulphate – Std ferrous ammonium sulphate

III. Iodometry
   a. Estimation of $K_2Cr_2O_7$ – Std $K_2Cr_2O_7$

IV. Dichrometry
   a. Estimation of ferrous iron – Std ferrous ammonium sulphate

V. Complexometry
   a. Estimation of Zn – Std $ZnSO_4$
   b. Estimation of Mg – Std $ZnSO_4$

SEMESTER IV

CHEMISTRY - Allied Paper – II

Objectives

L (hrs)	Credits
45	3

1. To study about the properties of transition and inner transition elements
2. To learn the chemistry of basic aromatic compounds.
3. To understand the nuclear particles and few nuclear reactions
4. To know about carbohydrates, amino acids, proteins and nucleic acid.
5. To know about some common diseases and the drugs used.

Unit I Inorganic Chemistry (9 hrs.)

Transition and Inner Transition elements

Transition Elements: - general characteristics - metallic character - oxidation states - size - density - melting and boiling points - ionization energy - colour - magnetic properties - reducing properties - catalytic properties.

Inner Transition elements:-Lanthanides - Electronic configuration and general characteristics - occurrence of lanthanides - separation by ion exchange method - lanthanide contraction. Actinides - Electronic configuration and general characteristics - comparison with lanthanides.

Unit II Organic Chemistry (9 hrs.)

Aromatic compounds

General characteristics of aromatic compounds - aromaticity - Huckel's rule with examples- non - benzenoid aromatic compounds (definition and examples only) Preparation, properties and structure of benzene, naphthalene and anthracene.

Unit III Physical Chemistry (9 hrs.)

Nuclear chemistry

Nuclear stability - n/p ratio - packing fraction - mass defect - binding energy - isotopes, isobars, isotones with examples. Separation of isotopes by diffusion method - group displacement law - radioactive series - Nuclear fission, fusion - Application of radio isotopes (radio diagnosis and therapy, C^{14} dating).

Unit IV Biochemistry (9 hrs.)

Carbohydrates - definition and classification - artificial synthetic sweeteners.Amino acids - classification - amphoteric nature - isoelectric point. Proteins - classification according to composition, solubility and shape - colour reactions -biological action .Nucleic acids - purines, pyrimidines, nucleocides, nucleotides - DNA - structure of DNA - RNA - different types of RNA

Unit V Pharmaceutical Chemistry (9 hrs.)

Common diseases - infective diseases - insect borne - air borne - water borne - hereditary diseases.Definition and examples of analgesics, antipyretics, sulpha drugs, antimalarials and, antibiotics. Diabetes - causes - hyper and hypoglycemic drugs. Indian medicinal plants - tulsi, neem, keezhanelli- their importance.

References

1. Puri, Sharma & Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, 2008.
2. P.L. Soni, Text book of Inorganic Chemistry, Sultan Chand and Sons, 2007.
3. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi , 2005.
4. Morrison & Boyd, Organic Chemistry, VIth ed, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.
5. P. L. Soni, Text book of Organic Chemistry, S. Chand and Company Ltd., New Delhi
6. J. L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry, S. Chand and Company Ltd.,New Delhi, 2005.
7. S. Lakshmi, Pharmaceutical Chemistry, S. Chand and Sons, New Delhi , 1995.

Allied Practicals - II

Organic Analysis Qualitative

Objective

1. To provide training in qualitative analysis of organic compounds like identification of functional groups, test for saturation and unsaturation and detection of elements, particularly nitrogen.

L (hrs)	Credits
60	2

Practicals

a. Detection of N, , S and halogen Qualitative analysis
b. Test for aliphatic and aromatic nature of substances.
c. Test for saturation and unsaturation.
d. Identification of functional groups
   i. Carboxylic acid
   ii. Phenols
   iii. Aldehydes
   iv. Ketones
   v. Carbohydrates
   vi. Primary amines
   vii. Amides