DEPARTMENT OF CHEMISTRY

Aim

To impart theoretical knowledge, develop practical skills and create interest for higher studies in chemistry so as to promote research.

Objectives

1. To gain knowledge on the fundamental principles of the different branches of chemistry.
2. To provide a firm foundation in chemical concepts, laws, and theories.
3. To relate chemistry with medicine, food, environment, and polymer science.
4. To develop and sharpen the scientific knowledge.
5. To impart theoretical knowledge about practical.

B. Sc Chemistry 2017-2020
Courses Offered

Semester	Course	Subject Code	Paper	Hours / Week	Credits
I	Part I	TL1711 FL1711	Language: Tamil French	6	3
	Part II	GE1711 GE1712	General English: A Stream B Stream	6	3
	Part III	CC1711	Major Core I: Inorganic Chemistry - I	4	4
		CC17P1	Major Practical I: Volumetric Analysis - I	2	-
		CA1711	Allied I: Theory: General Chemistry	4	4
		CA17P1	Allied I: Practical – Volumetric and Organic Analysis	2	-
	Part IV	AEC171	Ability Enhancement Compulsory Course (AECC): English Communication	2	2
		CNM171	Non Major Elective Course (NMEC): Molecules of Life	4	2
		VEC171	Foundation Course I: Value Education - I	-	-
	Part V	SDP172	Skill Development Programme (SDP): Certificate Course	-	-
		STP174	Student Training Programme (STP): Clubs & Committees / NSS	-	-
	Part I	TL1721	Language: Tamil	6	3

		FL1721	French		
	Part II	GE1721 GE1722	General English: A Stream B Stream	6	3
	Part III	CC1721	Major Core II: Physical Chemistry - I	4	4
		CC17P1	Major Practical I: Volumetric Analysis – I	-	2
		CC17P2	Major Practical II: Volumetric Analysis - II	2	2
		CA1721	Allied I: Theory: Inorganic and Physical Chemistry	4	4
II		CA17P1	Allied I: Practical: Volumetric and Organic Analysis	2	2
	Part IV	*AEC172*	Ability Enhancement Compulsory Course (AECC): *Environmental Studies*	2	2
		CNM172	Non Major Elective Course (NMEC): Fuel Chemistry	4	2
		VEC172	Foundation Course I:Value Education – I	-	1

	Part V	SDP172	Skill Development Programme (SDP): Certificate Course	-	1
		STP174	Student Training Programme (STP): Clubs & Committees / NSS	-	-
		CER172	Certificate Course	-	1
	Part I	TL1731 FL1731	Language: Tamil French	6	3
	Part II	GE1731 GE1732	General English: A Stream B Stream	6	3
	Part III	CC1731	Major Core III: Organic Chemistry - I	4	4
		CC1732 CC1733 CC1734	Elective I: (a) Dairy Chemistry (b) Nutritional Chemistry (c) Applied Electro Chemistry	4	3
		CC17P3	Major Practical III: Organic Preparation and Determination of Physical Constants	2	-
		CA1731	Allied II: Theory: General Chemistry	4	4
III		CA17P1	Allied II: Practical: Volumetric and Organic Analysis	2	-
	Part IV	SBC173 / SBC174	Skill Based Course (SBC): Meditation and Exercise / Computer Literacy	2	2

		VEC174	Foundation Course II: Personality Development	-	-
	Part V	STP174	Student Training Programme (STP): Clubs & Committees/NSS	-	-
		SLP173	Service Learning Programme (SLP): Extension Activity (RUN)	-	1
IV	**Part I**	TL1741 FL1741	Language: Tamil French	6	3
	Part II	GE1741 GE1742	General English: A Stream B Stream	6	3
	Part III	CC1741	Major Core IV: Organic Chemistry - II	4	4
		CC1742 CC1743 CC1744	Elective II: (a) Polymer Chemistry (b) Industrial Chemistry (c) Pharmaceutical Chemistry	4	3
		CC17P3	Major Practical III: Organic Preparation and Determination of Physical Constants	-	2
		CC17P4	Major Practical IV: Organic Analysis	2	2

		CA1741	Allied II: Theory: Inorganic and Physical Chemistry	4	4
		CA17P1	Allied II: Practical – Volumetric and Organic Analysis	2	2
	Part IV	SBC173/ SBC174	Skill Based Course (SBC): Meditation and Exercise / Computer Literacy	2	2
		VEC174	Foundation Course II: Value Education - II	-	1
	Part V	STP174	Student Training Programme (STP): Clubs & Committees / NSS	-	1
V	**Part III**	CC1751	Major Core V: Organic Chemistry - III	5	5
		CC1752	Major Core VI: Inorganic Chemistry - II	5	5
		CC1753	Major Core VII: Physical Chemistry - II	6	5
		CC1754 CC1755 CC1756	Elective III: (a) Green Chemistry (b) Applied Chemistry (c) Leather Chemistry	4	3
		CC17P5	Major Practical V & VI: Organic Estimation and Inorganic Semi-micro Analysis	8	-
		CSK175	*SBC – Chemistry for Competitive Exam	2	2

	Part IV	HRE175	Foundation Course III: Human Rights Education (HRE)	-	1
VI	**Part III**	CC1761	Major Core VIII: Organic Chemistry - IV	5	5
		CC1762	Major Core IX: Inorganic Chemistry - III	5	5
		CC1763	Major Core X: Physical Chemistry - III	6	5
		CC1764 CC1765 CC1766	Elective IV: (a) Bio Chemistry (b) Instrumental methods (c) Forensic Chemistry	4	4
		CC17P5	(a) & (b) Major Practical V: Organic Estimation and Inorganic Semi-micro Analysis	-	4
		CC17P6	Major Practical VI: Gravimetric Analysis and Inorganic complex preparation	4	3
		CC17P7	Major Practical VII: Physical Chemistry	4	3
	Part IV	CSK176	*SBC – Project	2	2
		WSC176	Foundation Course IV: Women's Studies (WS)	-	1
			TOTAL	**180**	**140 + 3**

Semester - I
Core – I : Inorganic Chemistry – I
Sub. Code: CC1711

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	4	60	100

Objectives

- To study the atomic structure from wave mechanical concept, arrangement of elements in the periodic table and the variation of periodic properties.

- To understand the various types of chemical bond formation in molecules, metallurgy, properties and compounds of s and p block elements.

Unit – I: Atomic Structure

Atom models – Bohr's atom model – orbit and orbital, dual nature of matter – deBroglie equation, Heisenberg's uncertainty principle and its significance. Schrodinger wave equation (no derivation) and its applications – Eigen value and Eigen function – significance of Ψ and Ψ^2. Quantum numbers and their significance – nodal planes. Sign of wave functions – shapes of s, p,

d and f orbitals. Photo electric effect, Davisson & Germer experiment, derivation of radius & energy. Principles governing the occupancy of electrons around the nucleus – Pauli's exclusion principle, Hund's rule, Aufbau principle, stability of half filled and fully filled orbitals, electronic configuration of elements with atomic number upto 30.

Unit – II : Periodic Table

Modern periodic law – long form of periodic table - features of long form of periodic table – classification as s, p, d and f block elements based on electronic configuration. Periodicity in properties – effective nuclear charge, shielding or screening effect, Slatar rule. Variation of effective nuclear charge, atomic radii, ionic radii, covalent radii in periodic table (group & period). Variation of electron affinity and electro negativity along a group. Ionization enthalpy - successive ionization enthalpies and factors affecting ionization enthalpy, applications of ionization enthalpy. Electronegativity – Paulings, Mulliken and Alfred Rochow's scale of electronegativity, applications of electronegativity.

Unit – III: Chemical Bonding

Ionic bond: Properties of ionic compounds – lattice energy, Born – Haber cycle.Valence bond theory – postulates - hybridization of atomic orbitals and geometry of molecules – sp, sp^2, sp^3, sp^3d, sp^3d^2 and sp^3d^3 with examples. MO theory – LCAO approximation, bonding, antibonding and nonbonding orbitals. Filling of molecular orbitals. Differences beween bonding MOand antibonding MO. Applications of MOT to H_2, N_2, O_2, F_2, HF, CO and NO.

Unit – IV: s-block elements

Group – I: General characteristics of group 1 elements – comparison of lithium with other members of the family - diagonal relationship of lithium with magnesium. Extraction of lithium – uses of alkali metals.

Compounds: lithium carbonate, sodamide, sodium cyanide, potassium cyanide - preparation and uses.

Group – II: General characteristics – comparison of beryllium with other elements of group 2, diagonal relationship between beryllium and aluminium. Extraction of beryllium and properties.

Compounds: Basic beryllium acetate, calcium carbide, calcium cyanamide – preparation and uses.

Unit – V: Hydrogen and Water

Hydrogen : Position in the periodic table – resemblance with alkali metals – resemblance with halogens – types of hydrogen – nascent hydrogen – active hydrogen – atomic hydrogen– ortho and para hydrogen (brief study). Hydrogen as a future fuel. Hydrides – classification, preparation, properties and uses, occlusion of hydrogen. Isotopes of hydrogen-Dueterium and tritium–preparation, properties and uses. Heavy water - preparation, properties and uses.

Water: Hardness – temporary and permanent hardness - determination of hardness of water by EDTA method, DO – definition and determination, BOD, COD – definition and significance.

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Text Books

1. Puri, B.R., Sharma, L.R. and Kalia, K.C. (2010). Principles of Inorganic Chemistry, Milestone Publishers & Distributors.
2. Madan, R.D. (2005). Modern Inorganic Chemistry. (13th ed.). Sultan Chand Publishers.

Reference Books

1. Lee, J.D. (2008). Concise Inorganic Chemistry. (5th ed.). John Wiley and Sons Publications.
2. Douglas, B.E., McDaniel, D.H., and Alexander, J.J. (1994). Concepts & Models of Inorganic Chemistry. (3rd ed.). John Wiley and sons Publications.

Semester - I
Major Practical Paper I - Volumetric Analysis - I
Sub. Code: CC17P1

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	2	30	50

Objective:

To develop skill in doing volumetric estimations

Acidimetry-alkalimetry

Estimation of Na_2CO_3 using std. Na_2CO_3 – Link HCl

1. Estimation of H_2SO_4 using std. oxalic acid – Link NaOH
2. Estimation of oxalic acid using std. oxalic acid – Link NaOH

Permanganometry

1. Estimation of oxalic acid using std. oxalic acid – Link $KMnO_4$
2. Estimation of ferrous ion using std. oxalic acid – Link $KMnO_4$
3. Estimation of ferrous ammonium sulphate using std. ferrous sulphate - Link $KMnO_4$

Dichrometry

1. Estimation of ferrous ion using std. ferrous sulphate - Link – $K_2Cr_2O_7$
2. Estimation of ferrous sulphate using std. ferrous sulphate - Link – $K_2Cr_2O_7$

Text Books

1. Thomas, A.O. (1999). Practical Chemistry for B.Sc Main students. Cannanore, Scientific book center.
2. Vogel, A.I. (1990). A Text Book for Qualitative Inorganic Analysis. The English Language Book Society and Longmans.

Semester - I & III
Allied Chemistry
General Chemistry
Sub. Code: CA1711/CA1731

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	4	60	100

Objectives:

1. To acquire knowledge about the atomic structure and bonding in molecules
2. To know about the fundamentals of organic chemistry.

Unit – I: Atomic Structure

Dual nature of electron – de-Broglie equation – Davisson and Germer experiment - Heisenberg's uncertainity principle and its significance. Schrodinger's wave equation and its significance (derivation not necessary) – eigen value and eigen functions, quantum numbers and their significance. Atomic orbitals – significance – shapes, difference between orbit and orbital. Rules for filling up of orbitals – Pauli's exclusion principle – Aufbau principle – Hund's rule – electronic configuration of elements with atomic number up to 20.

Unit – II: Chemical Bonding

Ionic bonding: Formation of ionic compound with examples – general characteristics of ionic compounds. Lattice energy – Born Haber cycle and its applications. Factors affecting dissolution of ionic compounds. Fajan's rules – ionic character in covalent compounds percentage of ionic character, bond moment. Dipole moment – applications of dipolemoment – structure of CO_2, H_2O, SO_2, BF_3, NH_3, CH_4 and cis-trans isomerism.

Unit – III: Covalent Bonding

VB approach – postulates, formation of single, double and triple bond with examples, characteristics of covalent compounds. VSEPR theory – shapes of inorganic molecules – hybridisation with suitable examples of linear ($BeCl_2$), trigonal planar(BCl_3) and tetrahedral molecules (CH_4). Hydrogen bonding – types with examples and effects of hydrogen bonding.

Unit – IV: Fundamentals of Organic Chemistry

Cleavage of bonds – homolysis and heterolysis, nucleophiles and electrophiles with examples. Reaction intermediates - carbocations, carbanions and free radicals (preparation, structure and stability). Types of reactions – substitution, addition, elimination and polymerization.

Aromaticity : General characteristics of aromatic compounds, Huckel's rule – benzenoid compounds.

Unit – V: Aliphatic Hydrocarbons

Alkanes (upto five carbons) – preparation - catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis. Reactions - free radical substitution – halogenations.

Alkenes (upto five carbons) – preparation - dehydration of alcohols and dehydrogenation of alkyl halides (Saytzeff's rule), reactions - hydration, ozonolysis, and oxidation, Markowni Koff's and anti Markowni Koff's addition.

Alkynes: Preparation – acetylene from calcium carbide, dehalogenation of tetrahalides, reactions – formation of metal acetylides, addition of Br_2 and alkaline $KMnO_4$.

Text Books

1. Puri, B.R., Sharma, L.R.and Kalia, K.C. (2010). Principles of Inorganic Chemistry, Milestone Publishers & Distributors.
2. Madan, R.D. (2005). Modern Inorganic Chemistry. (13th ed.). Sultan Chand Publishers.

Reference Books

1. Lee, J.D. (2008). Concise Inorganic Chemistry. (5th ed.). John Wiley and sons publishers.
2. Douglas, B.E., McDaniel, D.H. and Alexander, J.J. (1994). Concepts & Models of Inorganic Chemistry. (3rd ed.). John Wiley and sons Publishers.

Semester : I & III Allied Practical
Name of the course : Volumetric and Organic Analysis
Subject code : CC17P1/

Semester - I
NMEC
Molecules of Life
Sub. Code: CNM171

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	3	60	100

Objectives

1. To make the students understand the different types of nutrients like carbohydrates, vitamins and minerals essential for the growth of mankind.
2. To make the students understand the various aspects of fatty acids, lipids, amino acids, proteins and nucleic acid.

Unit – I: Carbohydrates

Carbohydrates: Introduction – classification with examples. Manufacture of cane sugar – functions of carbohydrates in the body – energy source, maintenance of heart action and central nervous system. Digestion – absorption – metabolism of carbohydrates – bio-synthesis of sugar. Tests for carbohydrates – Molisch's, Benedict, Seliwanoff's, Iodine, Bial's, Fehlings and Barfoed's test. Regulation of blood sugar – diabetes mellitus – sources of carbohydrates in the diet.

Unit - II: Amino acids , Proteins and Nucleic acids

Amino acids: Definition**,** classification of amino acids on the basis of their chemical structure and nutritional requirement, isolation of amino acid from proteins, peptide linkage – polypeptides.

Proteins: Definition - classification based on biological functions – functions of proteins – deficiency diseases – Marasmus and Kwashiorkor, tests for proteins.

Nucleic acids: Functions of DNA & RNA – difference between DNA and RNA

Unit – III: Lipids

Lipids: Definition – classification – biological significance of lipids — metabolic and structural functions of lipids – digestion of lipids – absorption of lipids – lipid in blood – quantitative analysis of lipids and qualitative tests for lipids. Biological importance of cholesterol and bile acids – tests for cholesterol and normal level of cholesterol.

Unit – IV: Enzymes

Enzymes: Introduction, general properties – classification, factors influencing enzyme action, regulatory enzymes – allosteric enzymes and covalently modulated enzymes – isoenzymes. Industrial and medical applications of enzymes.

Unit – V: Minerals, Vitamins and water

Minerals: Introduction – source, function, deficiency and toxicity of calcium, phosphorous, sodium, potassium, iron and iodine.

Water: Source and distribution of water in the body – functions of water – absorption, metabolism and storage of water.

Vitamins: Classification, source, biological function and deficiency diseases of Vitamin A,B,C,D,E and K.

Text Books

1. Alex V. Ramani. (2014). Food Chemistry. MJP Publishers.
2. Carroll Lutz and Karen Przytulski. (2001). Nutrition and Diet Therapy (3rd ed.). F.A. Davis Company (Philadelphia) publishers.

Reference Books

1. Morrison, R.T., & Boyd, R.N. (1991). Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I.L. (2001). Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I.L. (2001). Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D.L., & Cox, M.M. (1989). Lehninger's Principles of Biochemistry. (7^{th} ed.). W.H. Freeman publications.
5. Berg, J.M., Tymoczko, J.L. & Stryer, L. (2002). Biochemistry, W.H. Freeman Publishers.

Semester - II
Core – II : Physical Chemistry - I
Sub. Code: CC1721

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	4	6 0	100

Objectives

1. To acquire knowledge about gaseous state, liquid state and solid state.
2. To learn about ionic equilibria and colloids.

Unit - I: Gaseous State

Kinetic molecular theory of gases – postulates and derivation of kinetic gas equation – Maxwell's law of distribution of molecular velocities. Types of molecular velocities – most probable velocity, average velocity and root mean square velocity. Collision diameter, collision number and mean free path. Kinetic theory and molar heat capacities of ideal gases – molar heat capacity at constant temperature and pressure. Viscosity of gases – calculation of mean free path, degrees of freedom of gaseous molecules – translational, rotational and vibrational. Principles of equipartition of energy – contributions to heat capacity of ideal gases. Deviation of real gases from ideal behavior, equations of state for real gases – Vanderwaal's equation of state (problems wherever necessary).

Unit - II: Liquid State

Liquid state – structure of liquids – physical properties of liquids – vapour pressure, heat of vapourisation – Trouton's rule. Surface tension - definition – surface energy, some effects of surface tension and surface active agents. Viscosity – definition – co-efficient of viscosity, effect of temperature and pressure. Refraction – refractive index – specific and molar refraction (definition only). Physical properties and chemical constitution – additive and constitutive properties – molar volume and chemical constitution, parachor and chemical constitution, viscosity and chemical constitution.

Unit - III: Solid State

Crystalline and amorphous solids – differences. Symmetry in crystal system - elements of symmetry, space lattice and unit cell – Bravais lattices – seven crystal systems – law of rational indices – Miller indices. X-ray diffraction – Bragg's equation – derivation, rotating crystal technique and powder technique, analysis of powder diffraction patterns of NaCl, CsCl and KCl. Types of crystals – molecular, metallic, covalent and ionic crystals (definition, examples and structure).

Unit - IV: Ionic Equilibria

Strong, weak and moderate electrolytes – ionic product of water, common ion effect. pH scale – buffer solutions – calculation of pH using Henderson Hasselbalch equation, hydrolysis of salts – hydrolysis constant and degree of hydrolysis of salts of strong acid and strong base, weak acid and strong base, strong acid and weak base, weak acid and weak base. Acid base indicators - solubility product –applications in qualitative analysis.

Unit – V: Colloids

Definition and classifications of colloids – lyophobic and lyophilic colloids – differences between them. True solutions, colloidal solutions and suspension – definition and characteristics. Preparation of colloidal solutions – dispersion methods and condensation methods. Purification of colloidal solutions, optical properties – Tyndall effect. Brownian movement. Electrical properties – electrical double layer. Protective colloids – coagulation of colloids, Hardy - Schulze Law, Hofmeister series – electro kinetic property – definitions of electrophoresis and electro osmosis.

Surfactants : Definition and examples.

Emulsions : Types and examples – emulsifiers. Gels – preparation, types and properties – imbibition, syneresis and thixotrophy. Applications of colloids.

Text Books

1. Puri, B.R. and Sharma, L.R. (2013-2014). Elements of Physical Chemistry, Vishal Publishing Co., India.
2. Castellan, G.W. (2004). Physical Chemistry. (4^{th} ed.), Narosa.

Reference Books

1. Atkins, P.W., & Paula, J. de Atkin's. (2014). Physical Chemistry. (10^{th} ed.), Oxford University Press.
2. Ball, D.W. (2007). Physical Chemistry, Thomson Press, India.
3. Mortimer, R.G. (2009). Physical Chemistry. (3^{rd} ed.). NOIDA(UP): Elsevier.
4. Engel, T., & Reid, P. (2013). Physical Chemistry. (3^{rd}ed.). Pearson Publishers.

Semester - II
Major Practical Paper II - Volumetric Analysis - II
Sub. Code: CC17P1

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	2	30	50

Objective:

To develop skill in doing volumetric estimations

Double Titrations involving preparation of standard solutions

Iodometry – Estimation of Copper and $K_2Cr_2O_7$.
Complexometric Titrations using EDTA - Estimation of Zinc(II), Calcium(II), Manganese (II), Lead (II), Cobalt (II), Copper (II) and Nickel (II).

Text Books

1. Thomas, A.O. (1999). Practical Chemistry for B.Sc Main students. Scientific book center, Cannanore.
2. Vogel, A.I. (1990). A Text Book for Qualitative Inorganic Analysis. The English Language Book Society and Longmans.

Semester – II & IV
Allied Chemistry Practical - Volumetric and Organic Substance Analysis
Sub. Code: CC17P1

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	2	30	100

Objectives:

1. To learn the principles of volumetric analysis.
2. To analyse an organic substance systematically.

Volumetric analysis - 40 marks

Organic analysis - 20 marks

Acidimetry & Alkalimetry

1) Estimation of sulphuric acid.
2) Estimation of sodium carbonate

Permanganometry

3) Estimation of ferrous sulphate
4) Estimation of ferrous ammonium sulphate
5) Estimation of oxalic acid

Iodometry

6) Estimation of copper sulphate

Complexometry

7) Estimation of magnesium
8) Estimation of zinc sulphate

Organic Substance Analysis

- Systematic analysis of the organic compound with the view to find out the following.
- Detection of extra element
- Aliphatic or Aromatic
- Saturated or unsaturated
- Nature of the functional group (phenol, mono carboxylic acid, ester, aldehyde, reducing sugar and primary amine)

Text Books

1. Thomas, A.O. (1999). Practical Chemistry for B.Sc Main students. Cannanore: Scientific book center.
2. Vogel, A.I. (1990). A Text Book for Qualitative Inorganic Analysis. The English Language Book Society and Longmans.

Semester - II & IV
Allied Chemistry
Inorganic and Physical Chemistry
Sub. Code: CA1721/ CA1741

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	**4**	**60**	**100**

Objectives

1. To acquire knowledge about thermodynamics and electrochemistry
2. To know nuclear chemistry, hydrocarbons and metallurgy

Unit – I: Hydrogen and Water

Types of hydrogen – nascent hydrogen, active hydrogen, atomic hydrogen, ortho and para hydrogen. Hydrogen as a future fuel.

Dueterium and tritium – preparation, properties and uses.

Water: Hardness – types5, determination of degree of hardness by EDTA method.

Heavy water: Preparation, properties and uses.

DO, BOD and COD (definition only).

Unit II: Metallurgy

Minerals and ores – difference between them. Methods of dressing – roasting, calcinations, reduction by aluminothermic process, smelting, purification by electrolysis, zone refining, Kroll's process and Van Arkel de-Boer method.

Extraction, properties and uses of titanium, molybdenum and tungsten. Preparation and uses - TiO_2 and $TiCl_4$, preparation and properties of MoO_2.

Unit – III: Thermodynamics

Exothermic and endothermic reactions with examples, change of enthalpy in a chemical reaction – sign of ΔH. Hess's law of constant heat summation, first law of thermodynamics – definition and mathematical statement. Enthalpy – heat capacity, relation between Cp and Cv in gaseous systems, Kirchoff's equation - derivation. Reversible and irreversible processes – difference between them. Isothermal and adiabatic processes – expression for q, w, ΔE & ΔH for reversible and irreversible isothermal expansion of an ideal gas.

Unit – IV: Electrochemistry

Strong and weak electrolytes with examples – degree of ionization – factors affecting degree of ionization – ionization constant – ionic product of water – pH scale – common ion effect and its applications. Salt hydrolysis – types of salts with examples, derivation of hydrolysis constant and degree of hydrolysis of a salt formed from weak acid and strong base, buffer solutions with examples. Solubility, solubility product and its applications.

Unit – V: Nuclear Chemistry

Radioactivity – properties of α, β and γ rays. Soddy's group displacement law – radioactive decay, derivation of decay constant, half life period- derivation from decay constant. Average life, radioactive series. Nuclear reactions - nuclear fission and fusion – Stellar energy. Applications of radioactivity – in medicine, agriculture, industry and radio carbon dating.

Text Books

1. Puri. B.R., Sharma. L.R.and Kalia, K.C. (2010). Principles of Inorganic Chemistry, Milestone Publishers & Distributors.
2. Madan, R.D. (2005). Modern Inorganic Chemistry. (13^{th} ed.), Sultan Chand Publishers.

Reference Books

1. Soni, P.L.and Chawla, H.M. (2014). A Text book of Organic Chemistry. (20^{th} ed.). Sultan Chand Publishers.

2. Castellan, G.W. (2004). Physical Chemistry. (4th ed.). Narosa Publishers.
3. Levine, I.N. (2010). Physical Chemistry. (6th ed.). Tata Mc Graw Hill Publications.

Semester - II

NMEC
Fuel Chemistry
Sub. Code: CNM172

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	3	60	100

Objectives

1. To learn about the various energy sources and their applications.
2. To gain knowledge on different types of fuels, applications of fuels and petrochemicals.

Unit – I: Energy sources

Renewable energy sources – solar energy, wind energy, geothermal energy, bioenergy, hydropower and ocean energy - definition and examples.
Non-renewable energy sources – fossil fuels and nuclear fuels – definition and examples.
Fuel – definition – calorific value – determination of calorific value – classification of fuels– primary fuels, secondary fuels – criterion for selection of fuel – properties of fuel – ignition temperature, flame temperature, flash point, fire point.

Unit – II: Solid fuels

Natural, artificial and industrial solid fuels. Coal – formation of coal – properties of coal – classification of coal. Coking, non coking coals and pulverised coal. Role of Sulphur and ash in coal. Advantages and disadvantages of solid fuels. Carbonization – low temperature carbonization. Coal gas – preparation, composition and uses. Fractionation of coal tar – uses of coal tar based chemicals – coal gasification – liquefaction of coal.

Unit – III: Liquid fuel

Petroleum and petrochemicals – refining of petroleum – composition and uses of main petroleum fractions. Cracking – thermal and catalytic cracking - advantages of catalytic cracking – octane rating – anti knock agents – unleaded petrol – cetane rating – antidiesel knock agents – hydrocarbons from petroleum. Petrochemicals – direct and indirect petrochemicals – catalysts used in petroleum industry. Methods involved in manufacture of petrochemicals – alkylation, pyrolysis, halogenation, hydration, and polymerization.

Unit – IV: Gaseous fuel

Classification – natural and artificial. Natural gaseous fuels – examples and their importance. Natural gasoline – aviation gasoline – artificial gaseous fuels.
Water gas and producer gas - manufacture, composition and uses.

Semi water gas and LPG – composition and uses. Bio gas (Gobar gas) – biogas generator. Advantages and disadvantages of gaseous fuels.

Unit – V: Rocket and Nuclear fuels

Definition – solid and liquid propellants – homogeneous and heterogeneous propellants – propellants used in rocket and guided missiles.

Nuclear propellants: definition, fertile materials, differences between nuclear and chemical fuels. Nuclear fuel cycle in India. Heavy water reactor and fast breeder reactors.

Text Books

1. Sharma, B.K. (2002). Industrial Chemistry. (13^{th} ed.). Goel Publishing House.
2. Jain, P.C. & Jain. (2001). M. Engineering Chemistry. Delhi: Dhanpat Rai Publishers.

References Books

1. Stocchi, E. (1990). Industrial Chemistry, Vol. I, Ellis Horwood Publishers.
2. Murugesan, (2009). Environmental studies. (2^{nd} ed.). Millennium Publishers.

Semester - III
Core – III : Organic Chemistry - I
Sub. Code: CC1731

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
4	4	60	100

Objectives:

1. To understand the basic concepts of Organic chemistry, hydrocarbons and stereochemistry.
2. To learn about the electronic displacements and polar effects in organic compounds

Unit – I: Basic Concepts of Organic Chemistry

Organic Compounds: Classification and IUPAC system of nomenclature - longest chain rule, lowest number rule, naming of hydro carbons, alcohols, aldehydes, ketones, amines, and compounds with additional functional groups.

Hybridization: Definition, shapes of molecules, sp, sp^2 and sp^3 hybridisation with acetylene, ethylene and methane as examples - influence of hybridization on bond properties.

Homolytic and heterolytic fission - examples.

Electrophiles and nucleophiles - examples.

Reaction intermediates: Preparation, structure and stability of Carbanions, carbocations and free radicals.

Unit – II: Electronic Displacements

Polar effects: Inductive effect – definition – types – comparison of strength of substituted acids and bases. Electromeric effect – definition – types – examples – applications. Resonance effect – definition – relative strength of acids, conjugated system. Hyper conjugation effect – definition – stability of carbocations and free radicals.

Types of reactions: Introduction to types of organic reactions – substitution, addition, elimination and polymerization reactions with examples.

Unit – III: Chemistry of Aliphatic Hydrocarbons

Carbon-Carbon sigma bonds: Chemistry of alkanes, general methods of preparation, Wurtz reaction, free radical substitutions - halogenation.

Carbon-Carbon pi bonds: Formation of alkenes and alkynes by elimination reactions - Saytzeff and Hofmann rule - eliminations.

Reactions of alkenes: Electrophilic addition of hydrogen halide - mechanisms of Markowni koff and Anti - Markownikoff addition, hydroboration, oxidation, ozonolysis, reduction (catalytic and chemical), cis and trans-hydroxylation. 1, 2- and 1, 4 - addition reactions in conjugated dienes - Diels-Alder reaction.

Reactions of alkynes: Acidity, electrophilic and nucleophilic additions, Birch reduction-mechanism.

Unit – IV: Chemistry of halogenated hydrocarbons

Alkyl halides: General methods of preparation, nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent, differences between S_N1 & S_N2 reactions ; elimination – E1 and E2 mechanisms.

Alkenyl halides: preparation, properties of vinyl chloride and allyl chloride.

Fluorocarbons: – preparation of tetrafluoro ethylene and freon. Preparation and uses of westron and westrosol.

Poly - halogenated alkanes: Preparation and properties of chloroform, iodoform and carbon tetrachloride.

Unit –V: Functional groups containing Oxygen

Alcohols: Preparation, properties and distinction among 1°, 2° & 3° alcohols - oxidation method, Victor Meyer method & Lucas method.

Dihydric alcohols: Preparation and properties of glycols - Oxidation by periodic acid and lead tetra acetate, Pinacol-Pinacolone rearrangement.

Trihydric alcohols: Glycerol -manufacture (hydrolysis of fats and oils), synthesis of glycerol from propene, reactions, preparation of nitroglycerine. Estimation of number of hydroxyl groups.

Ethers and Epoxides: Preparation and reactions of ethers and epoxides, ethers with acids, reactions of epoxides with alcohols.

Text Book

Jain, M. K. & Sharma, S.C. (2016). Modern Organic Chemistry, (4th ed.). Vishal Publishers.

Reference Books

1. Soni, P. L. & Chawla, H. M. (2014). A Text book of Organic chemistry (20th ed.). Sultan Chand & Sons.
2. Arun Bhal & Bhal B. S. (2013). A Text book of Organic chemistry (21st ed.). S. Chand & Company Pvt. Ltd.
3. Tewari (2016). Advanced Organic Chemistry, (1st ed.). Books and Allied Pvt. Ltd.
4. Finar, I. L. (2014). Organic Chemistry Volume 1&II (18th ed.). Pearson publishers.

Semester - III
Elective I - Dairy Chemistry
Sub. Code: CC1732

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
4	4	60	100

Objectives

1. To learn about the dairy products.
2. To make the students to understand the various aspects of health and hygiene and to practice lab to land.

Unit I: **Properties of milk**

Milk – definition - composition - physio chemical properties – colour, odour, acidity, specific gravity, conductivity of milk. Indian standards of milk. Factors affecting composition of milk - food and nutritive value. Physio-chemical properties of milk constituents – water, fat, proteins, lactose and mineral matter. Action of milk on metals. Flavour defects in milk - their causes and prevention - uses of milk. Estimation of fat, acidity and total solids in milk.
Adulterants in milk – definition, common adulterants and their detection.
Preservatives in milk – definition, common preservatives and their detection.
Neutralizers in milk – definition, the different types of neutralizers and their detection.

Unit II : **Microbiology of milk**

Introduction, growth of micro-organisms, destruction of micro-organisms – heat treatment, use of ionizing radiation, electricity, high frequency sound waves and application of pressure. Pasteurization – definition, objectives and requirements of pasteurization. Methods of pasteurization – in-the-bottle pasteurization, batch / holding pasteurization or Low-Temperature – Long Time pasteurization (LTLT), High Temperature – Short Time pasteurization (HTST), Ultra-High Temperature pasteurization (UHT), Uperization (Ultra-pasteurization), vacuum pasteurization (vacreation) and stassanization.
Dairy detergents – definition – desirable properties, different types, cleaning and sanitizing procedure, cleaning-in-place (CIP).
Sterilizers – definition – desirable properties – cleaning and sterilization of dairy utensils – Chloramine – T and hypo chlorite solution.

Unit III : Special Milks

Sterilized milk – definition, requirements, advantages and disadvantages and method of manufacture. Homogenized milk – definition, merits and demerits, methods of manufacture.
Flavoured milks – definition, purpose, types of flavoured milks, method of manufacture. Chocolate flavoured milk and Fruit flavoured milk. Vitaminized milk – definition, purpose Standardized milk – definition, merits, method of manufacture. Toned milk (single and double toned milk) – manufacture. Humanised milk.
Dried milk : Definition**,** composition, objectives of productions **-** principle involved in manufacture, food and nutritive value, role of milk constituents, keeping quality.
Condensed Milk: Definition**,** composition, objectives of production - principle involved in manufacture of condensed milk (flow chart and explanation) - uses of condensed and evaporated milk. Types of condensed milk – plane condensed milk, super heated condensed milk & frozen condensed milk.

Unit: IV: **Cream, Butter, Ghee, Ice cream and Cheese**
Cream: Definition – composition - gravitational and centrifugal methods of separation of cream - estimation of fat in cream.
Butter: Definition - percentage composition - manufacture of butter, estimation of fat in butter - determination of acidity and moisture content - desibutter.
Ghee: Major constituents of ghee - common adulterants added to ghee - detection of the adulterants. Rancidity of ghee – definition, different types – hydrolytic, oxidative and ketonic rancidity - prevention of rancidity - antioxidants
Ice cream: Introduction – definition – classification – composition – food and nutritive value – defects in ice cream, their causes and prevention.
Cheese: Introduction – definition – classification – composition – food and nutritive value – cottaged cheese - processed cheese – defects in cheese - their causes and prevention.

Unit V : Proteins, Carbohydrates, Vitamins in milk and dairy sweets

Milk Proteins: Physical properties of milk proteins - electrical properties - hydration of proteins, solubility - effect of heat on milk proteins, milk enzyme and functions.
Milk carbohydrate: Lactose - structure of lactose (both α- and β–forms), reactions of lactose – hydrolysis, oxidation and reduction. Estimation of lactose in milk – picric acid method and chloramine – T method.
Milk vitamins: Water soluble vitamins and fat soluble vitamins in milk - form of occurrence in milk - importance of the vitamins with respect to physiological activity - effect of heat treatments and exposure to light radiation.
Dairy Sweet: Preparation of peda, gulabjamun, rossogolla and kheer paneer.
Kheer – Khoa/ Mawa – Khurchan – Rabri-Kulfi/Malai –Ka- baraf- Dahi – Panir- Chhana – Makkhan – Lassi - Ghee Residue.

Text Books

Sukumar De. (1991). Outlines of Dairy Technology, (1st ed.). Oxford University Press.

Reference Books

1. Webb Johnson & Alfond, Fundamentals of Dairy Chemistry. Delhi: C.B.S. Publishers and Distributers.
2. Rangappa, K.S & Achaya, K.T. (1974). Indian Dairy products, Bombay: Asia Publishing House.
3. Webb, B.H. & Whittier, E.O. (1970). By-products from Milks, Westport, Connecticut: A.V.I. Publ. Co. Inc.,
4. Srinivasan, M. R. & Anantakrishnan, C.P.: (1957). Milk Products of India, ICAR Animal Husbandry Series No. 4, New Delhi.
5. Murray, R.K.,Granner, D.K., Mayes, P.A. & Rodwell (1990). V.W.Harper's Biochemisry, (21st ed.). McGraw-Hill.

Semester - III
Elective I - Nutritional Chemistry
Sub. Code: CC1732

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
4	2	60	100

Objectives:

1. To make the students understand the different types of nutrients essential for the growth.
2. To have an idea about the dairy products and various aspects of health and hygiene and to practice what they learn to cherish a healthy life.

Unit I:

Nutrients: Discovery of nutrients-total energy need for the human body, energy and nutrient-calorific value of food.

Carbohydrates: Definition – classification - sources and energy released from sucrose, lactose and maltose, tests for carbohydrates, manufacture of sucrose, function of carbohydrates - digestion and absorption - regulation of blood sugar - important sources -carbohydrate in the diet.

Unit II

Proteins: Definition **-** amino acids - classification and function.Classification-sources and function of common proteins viz egg albumin, insulin, casein, collagen, keratin and haemoglobin-tests for proteins - nucleic acids-RNA, DNA (Structure not necessary).

Lipids: Definition-biological significance-tests for lipids-preservation of egg, milk, meat, fish, fruits and vegetables by physical (temperature control refrigeration) and chemical methods (preservative).

Unit III

Minerals: Calcium – sources – deficiency, phosphorus - food sources – functions, iron – sources – deficiency and potassium - functions, deficiency.
Vitamins: Classification - sources - deficiency diseases.
Adulteration of food: Simple methods to find adulteration of milk, food, oils (edible and mineral) and honey. Food poisoning and its prevention. Antibodies, food preservation, colouring, flavouring and sweeting agents in catering technology. Carcinogens in food materials.

Unit IV: Enzymes

Introduction, properties, nomenclature and classifications of enzymes. Oxido-reducatases, transferases, hydrolases, lyases, isomeases, ligases. Cofactors and coenzymes. Mechansim of enzyme catalysis, factors affecting enzyme activity, regulation of enzyme activity. Reversible/ competitive inhibitors and irreversible / noncompetitive inhibitors.

Unit V: Hot and Cold beverages

Hot beverages – Tea, coffee and soups.
Tea - Quality of the ingredients, time of extraction
Coffee: Methods of preparation-filtration-percolation-instant coffee powder.
Soup: Clear soup, cream soup, chowder soup and vegetable soup.
Cold beverages-Lassi-definition-composition-nutritive value. Fresh juices - orange, mosuombi and mango. Synthetic fruit flavoured drinks-carbonated drinks-alcoholic beverages.

Text Book

Swaminathan, M. (1977). Handbook of Food and Nutrition, (1st ed.). Chennai: Ganesh & Co.

Reference Books

1. Sukumar De., (2002). Outlines of Dairy Technology (17th ed.). New Delhi: Oxford University press.
2. Clarence Henry, Eckles, Willes Barnes Combs and Harold Macy (2002). Milk and Milk products (3rd ed.). Tata McGrow Hill publishing company.
3. Byron H. Webb, Arnold H. Johnson and John A. Alford, (1987). Fundamentals of Dairy Chemistry (2nd ed.). New Delhi: CBS Publishers.
4. A Manual (2005). Analysis of milk and milk products, Milk Industry Foundation.

Semester - III
Elective I - Applied Electro Chemistry
Sub. Code: CC1732

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
4	4	60	100

Objectives

1. To learn about industrial electro chemistry, hydrometallurgy, electro metallurgy and pyrometallurgy
2. To gain knowledge about electro plating and electro chemical power sources.

Unit I

Industrial electrochemistry – electrochemical processes in industry - components of electrochemical reactors. Types of electrolytes, cathodes and anodes in electrochemical reactor – separators. Inorganic electrochemicals - caustic soda and chlorine productions. Mercury cells, diaphragm cells, membrane cells, advantages of membrane cells. Other inorganic electrochemicals – chlorates, perchlorates, hydrogen peroxide. Organic electrochemicals. Special features of electro- organic synthesis – electrochemical oxidation – Kolbe synthesis, Electro reduction of carbonyl compounds, adiponitrile synthesis.

Unit II

Electrometallurgy: Electrodeposition of metals – principles – nucleation and growth of crystals. Nature of electro deposits.

Hydrometallurgy: Recovery of metals from aqueous electrolytes – recovery of silver from photographic emulsion. Electrorefining – production of high purity copper – process description.

Pyrometallurgy: Necessity for using molten electrolytes – reactors for molten salt electrolysis production of aluminum – electrodes and electrode reactions in cryolite melt–electrochemical purification of aluminum, other metals through molten salt electrolysis – Mg and Na – brief outline.

Unit III

Electroplating: Fundamental principles, Nature of deposits for electroplating – Hull cell experiments – operating conditions and nature of deposits – throwing power, preparation of samples for electroplating – chemical and electrochemical cleaning –electroplating of copper, nickel and cadmium. **Electrodes plating:** Importance – plating on non-metals, bath composition, electroless plating of copper and nickel.

Unit IV

Electrochemical power sources: Basic principles – chemical and electrical energies – interconversion charging and discharging. Requirements for a good power source. Types of power sources. Primary Batteries - description of primary cells – alkaline – manganese cells, Button cells, silver oxide - zinc cells, Lithium primary cells – applications. Secondary Batteries - important applications – charge discharge efficiency – cycle life – energy density lead acid batteries – Nickel, metal hydride batteries – Lithium, secondary batteries – Batteries for electric vehicles. Fuel cells - basic principles – H_2, 0_2 fuel cells – gas diffusion electrodes for fuel cells – alkaline fuel cells only.

Unit V

Corrosion: Principles – stability of metals – EMF series active and noble metals – P^H effect on stability, Pourbaix diagram – Kinetics of corrosion – Mixed potential process – cathodic reaction – anodic reaction – corrosion current – Active dissolution – passivation - breakdown of passivity – Evans diagram.

Methods of corrosion protection: Principle –inhibition of anodic, cathodic processes – inhibitive additives for corrosion protection – protective coatings – types of coatings – protection of structures and pipelines - cathodic protection – examples, sacrificial anodes – protection of ships in sea water.

Text book:

Hamann, C.H. A. Hamnett & W. Vielstich, W. (2007). Electrochemistry, (2^{nd} ed.). Wiley – VCH.

Reference books

1. Pletcher, D. & Walsh, F. C. (1990). Industrial Electrochemistry (2^{nd} ed.). London: Chapman Hall.
2. Hibbert, D. B. (1993). Introduction to Electrochemistry (18^{th} ed.). Mac Millan Publication.

Semester - III
Practical Paper III
Organic Preparation and Determination of Physical Constants

Sub. Code: CC17P3

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
2	2	30	100

Objectives:

1. To develop skill in preparing Organic compounds.
2. To find out the exact melting and boiling point of Organic Substances.

Preparation of organic compounds

Acetylation	a) Preparation of acetanilide from aniline
	b) Preparation of aspirin from salicylic acid
Benzoylation:	a) Preparation of benzanilide from aniline
	b) Preparation of Beta naphthyl benzoate from beta naphthol.
Nitration:	a) Preparation of m - dinitro benzene from nitrobenzene
	b) Preparation of P-nitro acetanilide from acetanilide
	c) Preparation of Picric acid from phenol.
Halogenation:	a) Preparation of P- bromoacetanilide from acetanilide
Hydrolysis:	a) Preparation of salicylic acid from methyl salicylate
	b) Preparation of Benzoic acid from Benzamide
Oxidation:	a) Preparation of Benzoic acid from Benzamide
Condensation:	a) Preparation of Osazone from glucose

Finding the exact melting and boiling point of some organic substances

Text Books

1. Thomas, A. O. (1999). Practical Chemistry for B.Sc Main students, Scientific book center, Cannanore.
2. Vogel, I. (1990). A Text Book for Qualitative Inorganic Analysis, English Language Book Society and Longmans.

Semester - IV
Core – IV : Organic Chemistry - II
Sub. Code: CC1741

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
4	4	60	100

Objectives:

1. To study the chemistry of halogenated hydrocarbons
2. To learn about aromaticity of organic compounds
3. To understand oxygen derivatives and carbonyl derivatives

Unit – I: Carbonyl Compounds

Structure, reactivity and general methods of preparation of aldehydes and ketones. Nucleophilic addition and condensation reactions. Mechanisms of Aldol condensation, Benzoin condensation, Knoevenagel condensation, Perkin & Cannizzaro reaction and Benzil-Benzilic acid rearrangement.

Addition reactions of unsaturated carbonyl compounds: Michael addition.,Oxidations – Baeyer-Villiger - oxidation, Reductions **-** Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions.

Unit - II: Carboxylic Acids and their Derivatives

Preparation and reactions of monocarboxylic acids. Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids - succinic, phthalic, malic, tartaric, maleic and fumaric acids.

Preparation and reactions of acid chlorides, anhydrides, esters and amides. Mechanism of Claisen condensation and Hofmann rearrangement.

Unit – III: Functional Groups Containing Nitrogen

Preparation and important reactions of nitro compounds, nitriles and iso nitriles

Amines: Preparation - Gabriel phthalimide synthesis, properties- carbylamine reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; distinction among 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.

Diazonium Salts: Preparation and synthetic applications, Curtius rearrangement.

Unit – IV

Active methylene compounds

Reactivity of active methylene group.

Acetoacetic ester: Preparation, properties - acid hydrolysis and ketonic hydrolysis, synthetic applications - synthesis of mono alkyl acetone, butanoic acid, 2 - pentanone, acetonyl acetone, succinic acid, α,β unsaturated acid, 2,5 - diketone, 1,3 – diol, γ - keto acid and 4 - methyl uracil.

Malonic ester: Preparation, synthetic applications - synthesis of pentanoic acid, succinic acid, pentanedioic acid, adipic acid, β - keto acid, α,β - unsaturated acid, cyclo alkane carboxylic acid and barbituric acid.

Cyano acetic ester: Preparation, synthetic applications - synthesis of malonic acid, propionic acid, α,β unsaturated acid, succinic acid and β-amino ester.

Cycloalkanes : Preparation and properties of cycloalkanes. Relative stability - Baeyer's strain theory and modification.

Unit V: Aromatic hydrocarbons

Aromaticity: Concept of Aromaticity and characteristics of aromatic compounds, Huckel's rule, aromatic character of cyclic hydrocarbons, arenes, cyclic carbocations, carbanions and heterocyclic compounds. Benzene - isolation, preparation and structure.

Aromatic Substitution reactions: Electrophilic aromatic substitution - halogenation, nitration, sulphonation, Friedel-Craft's alkylation and acylation with their mechanisms. Directing effects of the groups.

Text book

Jain, M. K., & Sharma, S.C. (2016). Modern Organic Chemistry (4th ed.). Vishal Publishers.

Reference Books

1. Soni, P. L. & Chawla, H. M.(2014). A Text book of Organic chemistry (20th ed.). Sultan Chand & Sons.
2. Arun Bhal & Bhal B. S, (2013). A Text book of Organic chemistry (21st ed.). Chand & Company pvt. Ltd.
3. Tewari (2016). Advanced Organic Chemistry (1st ed.). Books and Allied Pvt. Ltd.
4. Finar, I.L. (2014). Organic Chemistry, Volume 1&II (18th ed.). Pearson publishers.

Semester - IV
Elective II – Polymer Chemistry
Sub. Code: CC1742

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
4	4	60	100

Objectives

1. To know about the different types of polymerization reactions.
2. To understand the importance and the biomedical application of polymers.

Unit – I: Polymer types and types of polymerization:

Distinction among plastics, elastomers and fibres – nomenclature of polymers – homo and hetero polymers – copolymer – tacticity – isotactic, atactic, syndiotactic polymers. General characteristics of polymers in comparison with common organic compounds. Plastics – thermosetting and thermoplastics – differences. Functionality – cross linking – linear, branched and cross linked polymers. Types of polymerization – addition, condensation and copolymerization. Mechanism of addition polymerization – initiation, propagation and termination processes. Initiators and inhibitors. Methods of polymerization – bulk, suspension, emulsion and solution polymerization. Block and graft copolymers.

Unit – II: Synthetic polymers

Synthesis, properties and applications of phenol-formaldehyde resin, melamine – formaldehyde resin, polyurethanes and epoxy resins. Grades, Curing processes and its importance with mechanisms. Polycarbonates, natural rubber - vulcanization. Synthetic rubber – styrene rubber, nitrile rubber, butyl rubber, polysulphide rubber and neoprene. Synthetic polymers – polyolefins – polyethylene – HDPE, LDPE, LLDPE – polypropylene – polyvinyl chloride – grades of PVC – teflon, polymethyl methacrylate (Plexiglass) – polystyrene. Homo polymers, copolymers (SBR, ABS, SAN) – polyester, polyamide – nylon 66, natural polymers – cellulose, starch, silk, wool – cellulose acetate and cellulose nitrate.

Unit – III: Properties of polymers

Molecular mass – number average, weight average, viscosity average. Practical significance of molecular mass distribution – size of polymers. Kinetics of polymerization and

Carother's equation. Viscosity, solubility, optical, electrical, thermal and mechanical properties of polymers. Degradation of polymers by thermal, oxidative, mechanical, chemical ultrasonic waves, high energy radiation and photodegradation methods.

Unit – IV: Glass transition Temperature

Glass transition temperature and crystallinity – factors influencing glass transition temperature – glass transition temperature and molecular weight – glass transition temperature and plasticizers – glass transition temperature of copolymers – glass transition temperature and melting point. Heat distortion temperature, e-determination of glass transition temperature – significance of glass transition temperature.

Crystalline solids and their behavior towards X-rays – polymers of X-ray diffraction – degree of crystallinity – crystallisability – polymer crystallization – crystallites – factors affecting crystallinity – Helix structures – spherulites – polymers single crystals – folding of chains during formation – effect of crystallinity on properties of polymers.

Unit – V: Polymer dissolution and Advances in polymers

Process of polymer dissolution – thermodynamics of polymer dissolution – general principles – effect of molecular weight on solubility – solubility of crystalline and amorphous polymers. Flory - Huggins theory of polymer solution. Heat of dissolution and solubility parameters. Biomedical applications of polymers – contact lens, dental polymers, artificial heart, kidney, skin and blood cells. High temperature and fire resistant polymers.

Silicones & conducting polymers - poly sulphur nitrite, poly phenylene, poly pyrrole and poly acetylene.

Text Book

Bhatnagar, M.S. (2004), A text book of Polymers, (1st ed.). New Delhi: S. Chand and Company Ltd.

Reference Books

1. Billmeyer, F.W. (1984). Text book of Polymer Science. (3rd ed.). John Wiley and Sons.
2. Raymond B. Seymour, (1981). Introduction to Polymer Chemistry, (1st ed.).
3. Gowarikar, Viswanathan, N.V & Sreedhar, J. (2015). Polymer Science. (2nd ed.). New Age International Publishers.
4. P.K Palanisamy, (2015). Material Science (2nd ed.). Chennai : Scitech Publication India, Pvt. Ltd..

Semester – IV
Elective II - Industrial Chemistry - II
Sub. Code: CC1742

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
4	4	60	100

Objectives

1. To understand the applications of chemical industries.
2. To gain knowledge on working of industries.
3. To know the impact of industry on environment.

Unit I: Industrial Requirements

Requirements of a Industry – location – water – industrial water treatment. Fuels- types of fuels with examples. Coal – carbonization of coal – coal tar distillation – liquid fuels – gaseous fuels – selection of fuels – nuclear fuels. Energy – sources of energy – renewable and non renewable energies – non conventional energy resources. Industrial catalysts – types of catalysts – functions and applications of Raney Nickel, Pd, TiO_2, Al, V and Pt, base catalysts and Zeolites.

Unit II: Petrochemical Industries

Petrochemical industries in India, Crude oil – constitution and distillation composition of different distillates – pour points – depressants, drag reducers, viscosity reducers, ignition point, flash point, acetone number – cracking – catalysts used in petroleum industries – structure selectivity and applications. Manufacture of synthetic petrol - Bergius and Fisher Tropsh process – main feature of petrochemicals – manufacture of higher olefines, acetaldehyde, acetic acid, ethylene glycol, glycerin, acetone, phenol, CS_2, vinyl acetate,Cumene, chloroprene, butane diols and xylenes.

Unit III Fertilizers

Fertilizers and speciality chemicals. Manufacture, properties and industrial uses of industrial solvents – DMF, DMSO, THF and dioxane. Fertilizers – raw materials, manufacture of ammonium nitrate, ammonium sulphate, urea, calcium cyananide, CAN, Sodium nitrate, ammonium chloride, Ammonium phosphate, super-phsophate of lime, Potassium fertilizers and NPK fertilizers, manufacture in pure form of the following-sodium carbonate, oxalic acid, potassium dichromate and perchloric acid.

Unit IV: Oils, soaps and detergents

Manufacture of chlorine, sodium hydroxide and chlorates of Na and K, manufacture of perchlorate.

Oils – difference between oils and fats – manufacture of cotton seed oil and soyabean oil – refining of oil–manufacture of soaps – toilet and transparent soaps.

Detergents: synthetic detergents – surface active agents and their classification, manufacture of anionic, cationic and non-ionic detergents and shampoo.

Unit V: Industrial waste and Treatment processes

Environmental problems of chemical industries – solid and liquid waste from industries - methods of control – sewage treatment and waste management. Treatment of some industrial effluents. The nature and treatment of some important chemical wastes. Protection of surface waters from pollution with industrial sewage. Protection of biosphere. Man power in chemical industries - labour problems.

Text Book

Sharma, B.K., (2003). Industrial chemistry (47^{th} ed.). Meerut: Goel publishing House.

.

Reference books

1. Dryden, C.E., (1973). Outline of chemical Technology (2nd ed.). New Delhi: East - west press.
2. Steiner, H., (1961). Introduction to Petrochemicals (2nd ed.). Pergaman press Newyork.
3. Sharma, B. K. & Kaur, H., (1997). Environmental Chemistry. Meerut: Goel Publishing House.

Semester - IV
Elective II – Pharmaceutical Chemistry - I
Sub. Code: CC1742

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
4	4	60	100

Objectives:

1) To impart knowledge about various diseases and their treatment.
2) To study about common drugs and their action and to compare natural and synthetic drugs.

Unit I

Introduction: Pharmacology–pharmacophore, metabolites, anti metabolites, classification of drugs, nomenclature of drugs – non proprietary names, sources, assay (biological, chemical and immunological) testing of potential of drugs and their side effects.

Unit II

Action of drugs: Mechanism of drug action in absorption, drug delivery, drug extraction. Indian medical plants and trees -tulsi, neem, keezhanelli and thoothuvalai. Biological role of salts of Na, K, and Ca, Cu, Zn and Iodine. Source, deficiency and uses of $MgSO_4 7H_2O$, milk of magnesia, magnesium trisilicate and aluminum hydroxide gel.

Unit III

Common drugs: Analgesics- salicylates, Narcotics-Opiates, Pethadine and morphine. Anaesthetics - local and general anaesthetics -chloroform, ether and barbiturate , antipyretics, antiseptics and disinfectants–distinction, phenols and chloramines. Antibiotics-therapeutical values of pencillin and streptomycin. Hypoglycaemic drugs–Insulin, oral hypoglycaemic agents. Hypnotics, drug addition-sedatives and tranquillizers.

Unit IV

Common diseases and treatment-I: Common diseases – causes and treatment, insect born diseases - malaria and filariasis. Air born diseases- Diphtheria, Influenza and TB. Water born diseases-Cholera and Typhoid. Jaundice and Leprosy, Health care medicines. Biological role of sodium, Potassium, Calcium, iodine and their compounds.

Unit V

Common diseases and treatment-II: Blood grouping, Rh factor, test for urea and sugar. Clotting mechanism of blood, blood pressure – causes and control. Causes of anaemia, antianaemic drugs, cardiovascular drugs, antianginal drugs, causes for cancer, antineoplastic agents – cobalt therapy, Aids – causes, HIV virus, prevention and treatment.

Text Book

Jayashree Ghosh. S. (2010). A text book of pharmaceutical chemistry (1st ed.). New Delhi: Chand and company.

Reference Books

1. Lakshmi, S. (2012). Pharmaceutical chemistry (2nd ed.). Sultan Chand publishers.
2. Ashutosh kar, (2010). Medical Chemistry (1st ed.). New age international pvt. Ltd.
3. Satoskar,R.S. & Bhandarkar,S.D.(2015). Pharmacology and Pharmatherapeutics (24th ed.). Elsevier publishers.
4. Gurdeep R. Chatwal. (2009). Synthetic Drugs (3rd ed.). Goel Publishing Company.

Semester - III

Practical Paper III
Organic Preparation and Determination of Physical Constants

Sub. Code: CC17P3

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
2	2	30	100

Objectives:

1. To develop skill in preparing Organic compounds.
2. To find out the exact melting and boiling point of Organic Substances.

Preparation of organic compounds

Acetylation	a) Preparation of acetanilide from aniline
	b) Preparation of aspirin from salicylic acid
Benzoylation:	a) Preparation of benzanilide from aniline
	b) Preparation of Beta naphthyl benzoate from beta naphthol.
Nitration:	a) Preparation of m - dinitro benzene from nitrobenzene
	b) Preparation of P-nitro acetanilide from acetanilide
	c) Preparation of Picric acid from phenol.

Halogenation: a) Preparation of P- bromoacetanilide from acetanilide
Hydrolysis: a) Preparation of salicylic acid from methyl salicylate
b) Preparation of Benzoic acid from Benzamide
Oxidation: a) Preparation of Benzoic acid from Benzamide
Condensation: a) Preparation of Osazone from glucose

Finding the exact melting and boiling point of some organic substances

Text Books

3. Thomas, A. O. (1999). Practical Chemistry for B.Sc Main students, Scientific book center, Cannanore.
4. Vogel, I. (1990). A Text Book for Qualitative Inorganic Analysis, English Language Book Society and Longmans.

Semester – IV, Practical Paper - IV
Organic Analysis
Sub. Code: CC17P4

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
2	2	30	100

Objectives:

1. To develop skill in doing Organic Substance Analysis.

Organic Qualitative Analysis

Systematic analysis of the organic compound with the view to find out the following.
Detection of extra element
Aliphatic or Aromatic
Saturated or unsaturated
Nature of the functional group
(Phenol, aromatic aldehyde, aromatic mono carboxylic acid, Dicarboxylic acid, aromatic esters, carbohydrate (glucose), aromatic primary amine, urea, aromatic amide, aromatic nitro compound, anilide).
F) Preparation of a solid derivative to confirm the functional group.

Text Books

1. Thomas, A. O. (1999). Practical Chemistry for B.Sc Main students, Scientific book center, Cannanore.
2. Vogel, I. (1990). A Text Book for Qualitative Inorganic Analysis, English Language Book Society and Longmans.

Semester : IV **Major Practical - IV**
Name of the Course : Organic Analysis
Subject Code : CC17P4

Semester – V

Core - V: Organic Chemistry - III

Sub. Code: CC1751

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
5	5	75	100

Objectives:

1.To study about phenols and their derivatives
2.To learn poly nuclear, heterocyclic and organometallic compounds
3.To impart knowledge about alkaloids, drugs and pharmaceuticals

Unit -1

Phenols: Preparation and properties; acidity and factors affecting it, ring substitution reactions, Reimer–Tiemann reaction, Kolbe's–Schmidt reaction, Fries and Claisen rearrangements with mechanisms.

Derivatives of monohydric phenols: Preparation and properties of nitrophenol - picric acid, amino phenol -m-amino phenol.

Dihydric phenols: Preparation, properties and uses of catechol, resorcinol and quinol.
Trihydric phenols: Preparation, properties and uses of phloroglucinol.

Unit – I1:

Polynuclear Hydrocarbons: Isolated polynuclear compounds - preparation and properties of diphenyl, dimethyl methane, triphenyl methane and stilbene.
Naphthalene: Haworth synthesis, reactions and structural elucidation, derivatives of naphthalene. Naphthols, naphthylamine, naphtha quinone - preparation and uses.
Anthracene: Haworth synthesis, structural elucidation, reactions and uses. Derivatives – anthraquinone, alizarin - preparation and uses.
Phenanthrene: Synthesis, structure and reactions.

Unit – II1: Heterocyclic Compounds

Classification with examples, aromaticity in 5 - membered and 6-membered rings containing one hetero atom.
Furan: Preparation, chemical properties - electrophilic substitution reactions, Diel's Alder reaction and reduction reactions.
Pyrrole: Preparation from acetylene and Paal-Knorr synthesis, properties - basic nature, electrophilic substitution reactions, ring expansion, oxidation and reduction reactions.

Pyridine: Isolation from coal tar, synthesis, basic nature, electrophilic substitution, nucleophilic substitution – Chichibabin reaction.
Quinoline: Skraup synthesis, structural elucidation and reactions.
Isoquinoline: Pictet – Spengler synthesis and reactions.
Indole: Preparation, properties and uses.

Unit – IV
Alkaloids: Natural occurrence, structural features, isolation and their physiological action, Hoffmann's exhaustive methylation. Structure elucidation and synthesis of coniine, piperine and nicotine. Medicinal importance of nicotine, quinine and morphine.
Terpenoids : Occurrence, classification and isoprene rule. Elucidation of structure and synthesis of citral, geraniol and limonene.

Unit – V: Drugs & Pharmaceuticals

Discovery, design and development, Procedures followed in drug design. Lead components and modification. Concept of prodrugs. Physical and chemical factors of drug design. Pharmacological activities of drugs – receptors (definition only), metabolites and antimetabolites.

Synthesis of drugs - chloramphenicol, benardyl and paracetamol, anti-inflammatory drugs, antiviral agent - Acyclovir. Central Nervous System (CNS) agents- Phenobarbital and diazepam, cardiovascular drug - Glyceryl trinitrate. antileprosy drug - Dapsone, HIV - AIDS related drug- AZT- Zidovudine.

Text book
Jain, M. K. & Sharma, S.C. (2016). Modern Organic Chemistry (4th ed.). Vishal Publishers.

Reference Books

1. Soni, P. L. & Chawla, H. M. (2014). A Text book of Organic chemistry (20th ed.). Sultan Chand & Sons.
2. Arun Bhal & Bhal B. S. (2013). A Text book of Organic chemistry (21st ed.). Chand & Company pvt. Ltd.
3. Tewari (2016). Advanced Organic Chemistry (1st ed.). Books and Allied Pvt. Ltd.
4. Finar, I. L. (2014). Organic Chemistry, Volume 1&II (18th ed.). Pearson publishers.

Semester – V
Core - VI: Inorganic Chemistry - II

Sub. Code: CC1752

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
5	5	75	100

Objectives

1. To study the characteristics of p-block elements, noble gases and their compounds.

2. To understand the various metallurgical process.
3. To understand the principles of atom bomb, nuclear reactors and hydrogen bomb.

Unit – I: Chemistry of p-block elements - I

Group – 13: General characteristics – extraction of boron – properties and uses.

Compounds: Boron trifluoride and boron trichloride – aluminium trichloride-preparation, properties and structure. Hydrides of boron – preparation, properties and structure of diborane and carboranes. Preparation, properties and structure of boron nitride and borazine.

Group – 14: General characteristics– comparison of carbon and silicon – structure of diamond and graphite – Fullerenes (definition and examples).

Compounds: Metal carbides – classification with examples – their applications in industry. Preparation and uses of silica, silicic acid an silica gel. Silicones – preparation and uses. Silicon carbide – preparation, properties and uses.

Unit – II: Chemistry of p-block elements - II

Group 15: General characteristics – allotropes of phosphorous and arsenic. Structure of oxides of nitrogen, structure of oxy acids of phosphorus. Preparation, properties and uses of hydrazine, hydrazoic acid and hydroxyl amine.

Group 16: Anomalous behaviour of oxygen, allotropes of sulphur, oxyacids of sulphur - Caro's acid and Marshall's acid – preparation, properties and structure.

Group 17: General characteristics of halogens, peculiarities of fluorine, inter halogen compounds – definition, preparation, types and structure of XY, XY_3, XY_5 and XY_7.

Pseudohalogens - preparation and properties of cyanogens, thiocyanogen, selenium cyanogen and azido carbondisulphide, inter pseudohalogen compounds.

Unit – III :

Noble gases: Occurrence, electronic configuration and rationalization of inertness of noble gases. Isolation of noble gases from the atmosphere - Rayleigh's and Dewar's method. Hydrates of noble gases. Clathrates compounds – preparation, properties and uses. Preparation , properties and structure of XeF_2, XeF_4, XeF_6,$XeOF_2$,$XeOF_4$ and XeO_3.

Inorganic polymers: Definition – properties, types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of siloxanes. Preparation and properties of silicates, phosphazenes and polysulphates.

Unit – IV: Metallurgy and Alloys

Minerals and ores – difference between minerals and ores, metallurgical processes – gravity separation, magnetic separation, froth floatation, roasting, calcination and smelting. Purification by electrolysis, oxidative refining, zone refining, Mond's process, Van - Arkel de-Boer process and Kroll's process. Extraction, properties and uses of V, W, Mo and Ti. Poly valency of vanadium.

Alloys: Definition, purpose of making alloys. Types of alloys – ferrous alloys and non ferrous alloys with examples. Preparation of alloys - heat treatment of alloys – composition and uses – bronze, german silver, nichrome, monel metal, stainless steel, gun metal and bell metal.

Unit – V: Nuclear Chemistry

Nuclear forces - nuclear size - atomic mass unit and N/P ratio. Packing fraction - mass defect - binding energy. Nuclear models- shell and liquid drop. Radioactivity - α, β, γ radiations - their properties. Soddy's group displacement law. Natural radioactivity- detection and measurement of radioactivity by Geiger - Muller method. Rate of radioactive disintegration - decay constant - half life period- average life period. Radioactive equilibrium, artificial radioactivity - artificial transmutation of elements.

Nuclear reactions - nuclear fission – principle of atom bomb. Nuclear reactor – thermal and fast breeder reactor. Nuclear fusion – principle of hydrogen bomb and stellar energy. Principle and working of cyclotron. Applications of radio activity - radioactive tracers in agriculture, medicine and industry. Radiocarbon dating.

Text books

1. Puri. B.R., Sharma, L.R. &d Kalia, K.C. (2014). Principles of Inorganic Chemistry, Milestone Publishers.
2. Madan, R.D. (2005). Modern Inorganic Chemistry, (13th ed.). S. Chand and Company.

Reference Books

1. Lee, J. D. (2008). Concise Inorganic Chemistry, (5th ed.). John Wiley and Sons.
2. Greenwood, N.N. & Earnshaw, (1997). Chemistry of the Elements, Butterworth-Heinemann.
3. Cotton, F.A. & Wilkinson, G. (1999). Advanced Inorganic Chemistry, Wiley, (6th ed.). VCH Publishers.
4. Miessler, G.L. & Donald, A. Tarr. (2010). Inorganic Chemistry (4th ed.). Pearson.
5. Atkin, P. Shriver & Atkins. (2010). Inorganic Chemistry, (5th ed.). Oxford University Press.

Semester - V
Core - VII: Physical Chemistry - II
Sub. Code: CC1753

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
6	6	90	100

Objectives

1. To know and learn the principles of thermodynamics and colligative properties.
2. To understand the types of solutions and their behaviour.
3. To impart knowledge about the symmetry elements and symmetry operations.

Unit – I: Solutions and Colligative Properties

Solutions of non-electrolytes – solutions of liquids in liquids – vapour pressure of non-ideal solutions - type I, type II and type III. Vapour pressure - composition and boiling point - composition curves of completely miscible binary solutions - type I, type II and type III. Theory of fractional, azeotropic and steam distillations. Solubility of partially miscible liquids - phenol-water system, triethylamine – water system and nicotine water system.

Colligative properties – definition and examples – thermodynamic derivation of relation between concentration and elevation of boiling point. Osmosis – reverse osmosis - osmotic pressure (definition only) – determination of molar mass by depression of freezing point,Van't Hoff factor – degree of association and dissociation.

Unit – II: Thermodynamics - I

Chemical thermodynamics – importance of thermodynamics – basic terms – system, boundary and surroundings. Types of systems – open, closed and isolated. Types of processes - isothermal, adiabatic, isobaric and isochoric, reversible and irreversible process. Difference between reversible and irreversible process. First law of thermodynamics – different statements. Internal energy and first law – mathematical derivation of first law of thermodynamics. State and path functions. Heat capacity of a system – heat capacity at constant volume (Cv) and heat capacity at constant pressure (Cp) – relationship between Cp and Cv. Joule Thomson effect – Joule Thomson Coefficient of ideal, real gases and real gases obeying Vanderwaal's equation. Inversion temperature - definition – derivation. Zeroth law of thermodynamics – statement – calculation of ΔE, q, ΔH and w for an ideal and real gas. Enthalpy of a system – enthalpy of combustion, enthalpy of neutralization and enthalpy of formation. Variation of enthalpy of a reaction with temperature (Kirchoff's equation). Hess's law of constant heat summation and its applications.

Unit – III: Thermodynamics - II

Limitation of first law and need for second law of thermodynamics – second law of thermodynamics - spontaneous process. Carnot's cycle – efficiency of heat engine – Carnot's theorem. Third law of thermodynamics - concept of entropy – entropy changes in reversible and irreversible processes – entropy changes of an ideal gas, isothermal, isobaric and Isochoric processes. Entropy of mixing – physical significance of entropy. Work function (A) and Gibb's Free Energy Function (G) and their significances. Gibb's Helmholtz equation – applications. Partial molar quantities – partial molar free energy - Gibb's Duhem equation –applications – Clapeyron equation – applications. Clausius – Clapeyron equation and applications.

Unit – IV: Thermodynamics – III

Thermodynamic treatment of law of mass action – Van't Hoff reaction isotherm and its significance. Van't Hoff isochore and significance. Fugacity – concept – determination of fugacity of real gases – variation of fugacity with temperature and pressure. Physical significance of fugacity. Activity – activity coefficient. Nernst Heat theorem and its applications. Determination of absolute entropy of solids, liquids and gases, exceptions to the third law of thermodynamics. Thermodynamic interpretation of Le-chatelier principle – statement – effect of change of temperature and pressure on chemical equilibria.

Unit – V: Group Theory

Symmetry elements and symmetry operations – definition of identity (E), proper rotational axis (n) – mirror plane (σ) – inversion centre (i) and rotation reflection axis (Sn). Symmetry operations generated by symmetry elements- H_2O, NH_3, BF_3, $[PtCl_4]^{2-}$, H_2O_2 (Planar, cis and trans) and CH_4 as examples. Group postulates – abelian and cyclic group – group multiplication table – molecular point groups – assignment of point groups to simple molecules like H_2O, NH_3 and CO_2. Determination of a point group.

Text book

Puri,B.R., Sharma, L. R. & Pathania, M. S. (2013). Elements of Physical Chemistry, India : Vishal Publishing Co.

Reference Books

1. Castellan, G. W. (2014). Physical Chemistry, (4th ed.). Narosa.
2. Engel, T. & Reid, P. (2012). Physical Chemistry, (3rd ed.). Prentice-Hall
3. Levine, I .N. (2010). Physical Chemistry, (6th ed.). Tata Mc Graw Hill
4. Metz, C.R. (2006). Solved Problems in Chemistry, Schaum Series.

Semester – V
Elective III - Green chemistry
Sub. Code: CC1754

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
4	4	60	100

Objectives

1. To know the principles of green chemistry.
2. To study the important techniques and green synthesis of compounds.
3. To study the concept of atom economy in chemical synthesis.

Unit – I

Green chemistry – definition – need - goals – limitations, twelve principles of green chemistry – designing a green synthesis using alternative green reagents. Prevention of hazardous products and reducing toxicity – waste management by green technology. Atom economy, calculation of atom economy of the rearrangement, addition, substitution, hydrogenation and elimination reactions. Important techniques and directions in practicing green chemistry.

Unit – II: Green Solvents

reen solvents – supercritical fluids, water as a solvent for organic reactions – advantages of ionic liquids – fluorous biphasic solvent – PEG – solventless processes –immobilized solvents – comparison of greenness of solvents. Energy requirements for reactions – alternative sources of energy – use of microwaves and ultrasonic energy. Selection of starting materials – avoidance of unnecessary derivatization – careful use of protecting groups.

Unit – III: Catalysis

Catalytic reagents – importance – catalysis and green chemistry – comparison of heterogenous and homogenous catalysis – biocatalysis – asymmetric catalysis and photocatalysis. Prevention of chemical accidents by designing greener processes – principle of ISD, greener alternative to Bhopal Gas Tragedy – safer route to carbaryl. Greener alternative to flixiborough accident – safer route to cyclohexanol. Subdivision of ISD – minimization,

simplification, substitution, moderation and limitation. Analytical techniques to Aprevent the generation of hazardous substances in chemical processes.

Unit – IV: Green Synthesis – I

Green synthesis of adipic acid, catechol, disodium iminodiacetate. Microwave assisted reactions in water – Hofmann elimination, hydrolysis of methyl benzoate to benzoic acid and oxidation of toluene. Microwave assisted reactions in organic solvents - Diels – Alder reaction and decarboxylation reaction. Ultrasound assisted reactions - sonochemical Simmons – Smith reaction. Surfactants for carbon dioxide – designing of environmentally safe marine antifoulant – Rightfit pigment – replacement of toxic pigments by synthetic azopigments.

Unit – V: Green Synthesis and Future Trends

synthesis of plastic made from corn – enzymatic inter esterification for production of no trans-fats and oils – development of fully recyclable carpet – cradle to cradle carpeting. Oxidation reagents and catalysts – Biomimetic and multifunctional reagents. Combinatorial green chemistry. Proliferation of solventless reactions – cocrystal controlled solid state synthesis (C^2S^3). Green chemistry in sustainable development.

Text Book

Ahluwalia, V.K. & Kidwai, M.R. (2005). New Trends in Green Chemistry, Anamalaya Publishers.

Reference Books

1. Anastas, P.T. & Warner, J.K. (1998).Green Chemistry Theory and Practical, Oxford University Press
2. Matlack, A.S. (2001). Introduction to Green Chemistry, Marcel Dekker
3. Lancaster, M. (2010). Green Chemistry, (2^{nd} ed.). An Introductory Test RSC Publishing.
4. Ahluwalia V.K & Rajender S. Varma (2009), Green Solvents for Organic synthesis, Narosa Publishing House Pvt. Ltd.

Semester – V

Elective IV – Applied Chemistry

Sub. Code: CC1754

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
4	4	60	100

Objectives

1. To understand the industrial applications of electro chemistry.
2. To gain knowledge of nanochemistry
3. To know the applications of computers in chemistry.

Unit I: Applied Electrochemistry

Industrial applications of electrolysis – principles and process in the manufacture of caustic soda and hydrogen peroxide. Organic electrochemistry – electrochemical oxidation-Kolbe's synthesis. Electro reduction of carbonyl compounds – adiponitrile synthesis. Electroplating – principle – process – electroplating of Cu, Ni and Cd. Power sources – primary cells – principle – selection of anode and cathode – alkaline MnO_2 cells. Secondary cells – characteristics – lithium battery and Ni-Cd battery. Fuel cells – principle – hydrogen – oxygen fuel cells – alkaline fuel cells. Corrosion – principle, stability of metals – active and noble metals – anode and cathode process – protective coating – types of coating – protection of structures and pipelines – protection of ships in sea.

Unit II: Nano Chemistry

Nanotechnology – introduction, fundamental principles. Nano particles – definition, size - nano particles of metals - semiconductors and oxides. Synthesis of nano sized compounds - reduction methods by sodium citrate and borohydride, sol–gel method and chemical vapour deposition method. Properties - optical and electrical. Nano clusters, carbon nano tubes – single walled nano tubes and multi-walled nanotubes. Properties of carbon nanotubes, applications. Application of nano chemistry in various fields.

Unit III: Chemotherapy

Chemotherapy : definition – classification of chemotherapeutic agents.

Antibacterials: Definition, preparation of sulphanilamide, sulphapyridine, sulphathiazole, sulphadiazine, sulphadimetine, sulphamethazine and their uses.

Antimalarials: Definition, examples and uses

Antimonials and Arsenicals: Preparation and uses of Tartar emetic, Salvarsan and Neosalvarsan.

Antibiotics: Definition, classification, chemotherapeutic uses of Penicillin, Streptomycin, Chloromycetin, Tetracycline, Aureomycin, neomycin, gentamycin and erythromycin.

Antiprotozoals: Definition and uses.

Antiseptics: Preparation of tincture of iodine, chloramine T, Salol, Thymol, Dettol and their uses.

Antifungals: Definition and examples.

Antipyretics and Analgesics: Definition and examples, preparation and structure of Aspirin, Paracetamol and Phenacetin.

Unit IV: Petroleum

Refining of petroleum – fractional distillation – cracking – types – octane rating – antiknocking agents – cetane rating – antidiesel knock agents – flash point – petrochemicals – direct and indirect – synthetic petroleum – Bergious process – Fisher Tropsch process – catalysts used in petroleum industries.

Rocket fuels: Definition – solid and liquid propellants – homogeneous and heterogeneous propellants – propellants used in rockets and guided missiles.

Unit V : Computers in Chemistry

Programming in C++ - operators in C++ - library functions – square root, log etc. operator precedence and solving expressions – branching statement - looping statement. Simple

programs for problems in chemistry - determination of RMS velocity, average velocity and most probable velocities of gases and calculation of half life of radioactive nuclei. MS Excel - drawing graphs and excel program

Text Book

Sharma, B.K. (2002). Industrial Chemistry including chemical engineering (13th ed.). Goel publishing House, Meerut.

Reference Books

1. Ederer, H. J. Klaus Heinrich Ebert & Thomas L. Isenhour, (1989). Computer applications in Chemistry – An introduction for PC users with two Diskettes in basic and pascal (1st ed.). VCH publishers.
2. Richard Selley, (1997). Barnes & Noble, Elements of petroleum Geology (2nd ed.). Elsevier Science publishers.
3. Geofrey A Ozin, (2008). A Chemical approach to Nanomaterials (2nd ed.). RSC publishers.
4. Balagurusamy, E. (2008). Object Oriented Programming (4th ed.). Tata McGraw Hill Publishing Company Ltd.

Semester – V
Elective III - Leather chemistry
Sub. Code: CC1754

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
4	4	60	100

Objectives

1. To know the principles involved in leather industry.
2. To understand the process of tanning, properties and uses of leather

Unit I

Hides, skins and leather - an elementary knowledge of the structure, composition and characteristics of hides and skin proteins. Anatomy and histology of protein constituents of leather (an elementary concept). Basic principles involved in pre – tanning such as soaking, liming, deliming, bating, pickling and depickling.

Unit II

Types of tanning – vegetable and mineral tanning. Different types of vegetable tanning – materials classification and chemistry of vegetable tanning. Factors and physico – chemical principles involved in vegetable tanning.Fixation of vegetable tanning- synthetic tannings – their classification, general methods of manufacture and use.

Unit III

The preparation and chemistry of chrome tanning liquids - olation, oxolation and hydrolysis of chrome liquids. Effect of adding tanning agents - role of pH in the reaction of chromium complexes with hide proteins. Factors governing chrome tanning – chemistry of neutralization process. A brief survey of chemistry of other tannings like Al, Zr and Te salts and their relative merits in contrast with chrome tanning.Chemistry of combination of tannages involving vegetable tanning aldehydes, chrome and other mineral tanning agents.

Unit IV

Chemical methods of curing and preservation of hides and skins in acid and alkaline solutions. Principles of analytical methods employed in curing, liming, deliming, bating, pickling. Analysis of vegetable tanning materials and extract. Process of dyeing leather, use of mordants, dyeing auxillaries such as leveling, wetting and dispersing agents – Dye fixations.

Unit V

Animal by products – their collection, handling and preservation methods (such as hair, blood, bones, glands, keratinous materials and their utilization.).Tannary effluents and treatment - Types of water pollution – physical, chemical, physiological and biological. Different types of tannary effluents and wastes - beam – house waste – liquors – tanning and finishing Yard waste liquors – solid waste- origin and disposal.

Text book

Anthony D. Covingtan, (2011). The Science of Leather, (3rd ed.). RSC publishers

Reference Books

1. Thomas C. Thorstensen, (1969). Practical Leather Chemistry, World press.com.
2. Leather processing & Tanning technology, Hand book, Niir board of consultants and engineers.
3. Nelson D.L. & Cox M.M., (2000). Hand Book of Leather Chemistry.
4. B.K. Sharma, (2002). Industrial Chemistry (13th ed.). Goel Publishing Home.

Semester - V
Practical Paper V & VI
Organic Estimation and Inorganic Semi-micro Analysis
Sub. Code: CC17P5

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
8	4	120	100

Objectives

1. To train the students in organic estimation

2. To make the students know about the interfering ions.
3. To study the principles of qualitative Analysis.

Organic Estimation

1. Estimation of Phenol
2. Estimation of Aniline
3. Estimation of Ethyl methyl ketone
4. Estimation of the number of hydroxyl groups in a given compound

Analysis of an Inorganic mixture containing two anions and two cations.

Instruction to Examiners

1. Preparation of mixtures

Two anions and two cations may be selected from the following:

Anions

1. Carbonate	2. Sulphate	3. Nitrate	4. Chloride	5. Bromide
6. Oxalate	7. Borate	8. Fluoride	9. Phosphate	

Cations

1. Lead	2. Copper	3. Bismuth	4. Cadmium	5. Manganese
6. Nickel	7. Cobalt	8. Zinc	9. Barium	10. Strontium
11. Calcium	12. Magnesium		13. Ammonium	

Text Books

1. Thomas, A. O. (1999). Practical Chemistry for B.Sc Main students, Scientific book center, Cannanore.
2. Vogel, I. (1990). A Text Book for Qualitative Inorganic Analysis, English Language Book Society and Longmans.

Semester - VI
Core – VIII : Organic Chemistry - IV
Sub. Code: CC1761

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
6	5	90	100

Objectives:

1. To understand the spectroscopic analysis of organic compounds
2. To learn about carboxylic acids and carbohydrates
3. To study about dyes and their synthesis

Unit – I: Stereochemistry

Optical isomerism: Optical activity - elements of symmetry, optical activity of compounds containing asymmetric carbon atoms - lactic and tartaric acids, Chirality-a chiral carbon

molecules, meaning of (+) and (-) and D and L notations. Projection formulae-Fischer, Flying Wedge, Sawhorse and projection formulae notation for optical isomers, Cahn Ingold and Prelog rules, R-S notation, enantiomers and diastereomers, racemic and meso forms. Racemisation - resolution of racemic mixtures. Walden inversion and asymmetric synthesis. Optical activity of compounds without asymmetric carbon atoms - biphenyl, allenes and spiranes.

Geometrical isomerism : Maleic and fumaric acid- aldoximes and ketoximes. Methods of distinguishing geometrical isomers, determination of configuration of ketoximes, Beckmann rearrangement, E-Z notation.

Conformational Analysis : Introduction of terms-configuration and conformation, dihedral angle, torsional strain,conformational analysis of ethane and n- butane and cyclohexane energy diagrams.

Unit - II

Spectroscopy: General principles, introduction to absorption and emission spectroscopy, electromagnetic region (EMR).

UV Spectroscopy: Types of electronic transitions - λ_{max}, chromophores and auxochromes. Bathochromic and hypsochromic shifts. Intensity of absorption - hyper chromic and hypo chromic shifts.

Application of Woodward Rules for calculation of λ_{max} for α, β unsaturated aldehydes, ketones, carboxylic acids and esters.

Conjugated dienes - acyclic, homoannular and heteroannular, extended conjugated systems-aldehydes, ketones and dienes. Distinction between cis and trans isomers and applications.

Photochemistry: Photochemical reactions of ketones, Norrish type I and type II reactions - photo reactions of alkyl nitrites (Barton reaction), photo induced reactions of α, β- unsaturated ketones and photochemical rearrangement of unsaturated ketones.

Unit - III

IR Spectroscopy: Molecular vibrations and origin of IR spectra - IR absorption positions of O, N and S containing functional groups - effect of H-bonding, conjugation. IR absorptions-fingerprint region and its significance. Application in functional group analysis. IR spectrum of alkane, alkene, alkyne, alkyl halide and aldehyde.

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it. Significance of number of peaks and peak area. Spin-spin coupling and coupling constant. Interpretation of NMR spectra of simple compounds - ethyl alcohol, benzene, methyl chloride, benzaldehyde and mesitylene.

Unit - IV: Carbohydrates

Occurrence, classification and their biological importance.

Monosaccharides: Preparation and chemical reactions of glucose and fructose, differences between them. Structural elucidation and absolute configuration of glucose and fructose. Epimerization- epimers and anomers, mutarotation. Haworth projections and conformational structures. Conversion of an aldose to next higher aldose (Kiliani-Fischer synthesis) and aldose to next lower aldose (Wohl's method). Intercoversion between aldoses and ketoses.

Disaccharides : Structural elucidation of maltose and sucrose.

Polysaccharides : Structure of starch and cellulose.

Unit – V: Dyes

Classification based on application and chemical structure with examples. Colour and constitution of dyes. Chemistry of dyeing. Valence bond theory of colour.
One method of synthesis and applications of Azo dyes **-** methyl orange and congo red .
Triphenyl methane dyes - malachite green, rosaniline and crystal violet.
Phthalein dyes - Phenolphthalein and fluorescein.
Anthraquinine dyes **-** Alizarin
Indigo dyes - Indigo.

Text book

Jain, M. K. & Sharma, S.C.(2016), Modern Organic Chemistry (4th ed.). Vishal Publishers.

Reference Books

1. Soni, P. L. & Chawla, H. M.(2014). A Text book of Organic chemistry (20th ed.). Sultan Chand & Sons.
2. Arun Bhal & Bhal B. S, (2013). A Text book of Organic chemistry (21st ed.). Chand & Company Pvt. Ltd.
3. Tewari (2016). Advanced Organic Chemistry(1stEdn.), Books and Allied Pvt. Ltd.
4. Finar, I.L. (2014). Organic Chemistry, Volume 1&II (18th ed.). Pearson publishers.

Semester – VI

Core – IX : Inorganic Chemistry – III

Sub. Code: CC1762

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
5	5	75	100

Objectives

1.To know the nomenclature, isomerism in co-ordination compounds, the theories, and stability of metal complexes.
2. To study the characteristics of transition and inner transition elements.
3. To learn the types of errors and principles of gravimetric analysis.

Unit – I: Co-ordination chemistry I

Double salts – co-ordination compounds – difference, definition and terminology – co-ordination complexes and complex ions – central ion and ligands – co-ordination number – co-ordination sphere – charge on a complex ion. Types of ligands - examples for each. Nomenclature of co-ordination compounds, isomerism in co-ordination compounds, structural isomerism – ionisation, hydrate, co-ordination, linkage and co-ordination position isomerism. Steroisomerism – geometrical isomerism in four and six co - ordinated complexes and optical isomerism in tetrahedral and octahedral complexes.

Unit – II: Co- ordination Chemistry – II

Theories of co-ordination compounds- Werner's theory- postulates – verification of Werner's theory- cobalt ammine complexes. EAN rule – calculation of EAN with reference to metal complexes and carbonyls. Pauling's theory (VBT) – postulates - application of VBT to square planar and tetrahedral complexes, inner and outer complexes – merits and demerits of VBT. Shapes of d-orbitals. Crystal field theory – Crystal field splitting of tetrahedral, square planar and octahedral systems. Factors affecting the value of Δ - crystal field splitting energy values and its application in the stability of complexes. Distortion from perfect symmetry – Jahn Tellar theorem and its effect.

Unit - III: Co-ordination chemistry - III

Molecular Orbital Theory (MOT)– MO diagrams of ML_6 type complexes – weak and strong field ligands – spectrochemical series.

Stability of metal complexes – relation between stability constant and dissociation constant – factors affecting the stability of metal complexes from thermodynamic data. Irving William series – stabilization of unstable oxidation state. Substitution reactions of square planar complexes – trans effect – theories of trans effect. Metal carbonyls - classification – examples – structure and nature of M-L bond in metal carbonyls – structures of mono, di and polynuclear carbonyls of Ni, Cr, Fe, Co and Mn. Application of complexes in qualitative, volumetric and gravimetric analysis.

Unit - IV:

Transition Elements: General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Difference between the first, second and third transition series. Extraction, properties and uses of Cu, Co and Ni. Preparation and uses of titanium(II) oxide, vanadium (V) oxide, potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, vsaka's compound, platinum (IV) chloride, chloroplatinic acid and purple of Cassius.

Inner transition Elements: Electronic configuration, oxidation states, colour, spectral and magnetic properties. Causes and consequences of lanthanide contraction – extraction of lanthanides from monazite sand - separation of lanthanides by ion-exchange method - uses of lanthanides. Comparison between lanthanides and actinides. Extraction, properties and uses of thorium and uranium.

Unit - V: Analytical Chemistry

Errors: Types of errors - determinate and indeterminate errors - minimization of errors. Precision and accuracy- ways of expressing precision. Standard deviation- mean deviation – relative mean deviation and coefficient of variance. Accuracy- absolute error- relative error- confidence limit- Rejection of a doubtful value – Q Test and related problems of the above.

Principles and requirements of gravimetric analysis - mechanism of precipitation – factors affecting solubility of precipitate - co-precipitation- different types – prevention - post precipitation – prevention and difference between co-precipitation and post precipitation, precipitation from homogenous solution with examples – digestion, filtration, washing, drying and ignition.

Text books

1. Puri. B.R., Sharma, L.R. & Kalia, K.C. (2014). Principles of Inorganic Chemistry, Milestone Publishers.
2. Madan, R.D. (2005). Modern Inorganic Chemistry, (13th ed.). S. Chand and Company.

Reference Books

1. Lee, J.D. (2008). Concise Inorganic Chemistry, (5th ed.). John Wiley and Sons.
2. Soni, P.L. & Katyal, M., (2006). A text book of Inorganic Chemistry, (12th ed.). S. Chand and Co.
3. Asim K. Das, (2007). Bio-inorganic Chemistry, Books and Allied (P) Ltd.
4. Mendham, J., Denney, R.C., Barnes, J.D., Thomas, M.J.K. (1968).Test Book of Quantitative Inorganic Analysis (6th ed.). English Language Book Society.
5. Satake. M., (2011), Coordination Chemistry, (1st ed.). Discovery Publishing House.

Semester - VI
Core – X : Physical Chemistry - III

Sub. Code: CC1763

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
5	5	75	100

Objectives

1. To acquire the knowledge of phase diagram and chemical kinetics.
2. To have an idea about electrochemistry and photochemistry.
3. To impart knowledge about spectroscopy.

Unit – I: Phase Equilibria

Concept of phase – components and degrees of freedom (definitions and examples), derivation of Gibb's phase rule. Phase diagram for one component system – water system and sulphur system. Two component system – reduced phase rule – simple eutectic system – lead-silver system – Pattinson's process of de-silverisation of lead and KI-H_2O system – freezing mixtures. Systems in which two components form a stable compound - formation of compounds with congruent melting point – zinc-magnesium system and $FeCl_3$-H_2O system. Formation of compounds with inconcruent melting points – NaCl-H_2O system, Na_2SO_4-H_2O system. Solid-gas equilibria – $CuSO_4$-H_2O system. Efflorescence, deliquescence and hygroscopy.

Unit – II: Chemical Kinetics

Rate of reaction – expression of rate – factors influencing rate of reaction – order of a reaction – various orders of reaction – zero, first and second order reaction – definition, examples and derivation of rate constant and half life period. Methods of determining order of reaction – use of differential, integral, half-life method and Ostwald's isolation methods. Molecularity of a reaction – definition and examples – differences between order and

molecularity of a reaction. Concept of activation energy – effect of catalyst – calculation of energy of activation (Arrhenius equation) – theories of reaction rates – collision theory of bimolecular gaseous reactions, activated complex theory – comparison of collision theory and activated complex theory. Lindeman's theory of unimolecular reactions (Problems wherever necessary).

Unit III : Electrochemistry - I

Definition – conductance, specific conductance, equivalent conductance and molar conductance – factors affecting conductance of a solution. Strong and weak electrolytes – variation of equivalent conductance with dilution. Debye-Huckel theory of strong electrolytes – Debye-Huckel Onsagar equation. Kohlrausch's law of independent migration of ions and its applications. Applications of conductance measurements – determination of degree of dissociation of weak electrolytes, determination of solubilities and solubility products of sparingly soluble salts and conductometric titrations. Transport number – determination of transport number by Hittorf's method and moving boundary method (Problems wherever necessary).

Unit - IV: Electrochemistry – II

Electrochemical cells – chemical cells – reversible and irreversible cells - emf of cells – determination. Cell representation. Single electrode potential – types of electrodes – metal- metal ion electrodes, amalgam electrodes, gas electrodes, metal – insoluble metal salt electrodes and oxidation – reduction electrodes. Standard electrode – hydrogen electrode (SHE) and calomel electrode. Nernst equation for electrode potential – Nernst equation for emf of cells – standard electrode potential – electro chemical series – thermodynamics of galvanic cells $-\Delta G$, ΔH and ΔS and equilibrium constant (K). Concentration cells – concentration cells with transference and without transference – liquid junction potential and its elimination. Applications of emf measurements – determination of transport number, valency of an ion, pH of a solution using hydrogen, quinhydrone and glass electrode. Potentiometric titrations - acid-base, oxidation – reduction and precipitation titrations. Decomposition potential and overvoltage (Problems wherever necessary).

Unit - V: Spectroscopy

Different regions of electromagnetic spectrum and general spectroscopic methods – Born-Oppenheimer approximation – types of molecular spectra – microwave (rotational) spectra – theoretical principle, intensity, selection rule and applications in the determination of bond distance in diatomic molecules. Vibrational (IR) spectra – theoretical principle, harmonic oscillator and unharmonicity – selection rule, intensity, modes of vibrations and types – force constant – applications of IR – hydrogen bonding – Fermi resonance – overtones and combination bands. Electronic spectra - selection rules, Frank Condon Principle - types of transitions – applications. Raman spectra - theoretical principle – stokes, antistokes lines - comparison of IR & Raman Spectroscopy using CO_2 and H_2O. ESR spectra – theory and principle – splitting - hyperfine splitting - ESR spectra of methyl radical .

Text book

Puri, Sharma & Pathania, (2013). Elements of Physical Chemistry, India : Vishal Publishing Co.

Reference Books

1. Peter Atkins & Julio De Paula (2014). Physical Chemistry (10th ed.). Oxford University Press,.
2. Castellan, G. W. (2004). Physical Chemistry, (4th ed.). Narosa.
3. McQuarrie, D. A. and Simon, J. D., (2004). Molecular Thermodynamics, Viva Books Pvt. Ltd. New Delhi.
4. Engel, T. & Reid, P. (2012). Physical Chemistry (3rd ed.). Prentice-Hall.
5. Mortimer, R. G. (2009). Physical Chemistry (3rd ed.). Elsevier: NOIDA, UP.
6. Levine, I. N. (2011). Physical Chemistry (6th ed.). Tata McGraw-Hill.
7. Metz, C. R. (2009). Physical Chemistry (2nd ed.). Tata McGraw-Hill.

Semester – VI
Elective IV – Bio Chemistry
Sub. Code: CC1764

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
4	4	60	100

Objectives

1. To know the biological action of carbohydrates
2. To know the functions of lipids, proteins and amino acids.
3. To impart knowledge about nucleic acids.

Unit I

Carbohydrate

Definition and classification of carbohydrates. Glycosides – their physiological significance. Amino sugars – importance. Chemistry of poly saccharides – starch, glycogen, cellulose, inulin, hemi-celluloses, chitin, pectin and lignin. Glycosamino glycans - hyaluronic acid, chondroitin sulphate, keratan sulphate, heparin and dermatan sulphate. Blood group substances. Carbohydrate metabolism – Embden – Meyerhof pathway - TCA cycle.

Unit II

Lipids

Definition and classification of lipids. Types of fatty acids – saturated, unsaturated, unusual and essential fatty acids. Triacyl glycerols – chemistry. Characterization - saponification number, iodine number, acid number, RM value and acetyl value. Chemistry and functions of phospholipids – lecithin and cephalin. Sphingolipids – sphingomycin. Glycolipids - cerebroside, ganglioside (structure and function only). Cholesterol – spot tests and structure (structural elucidation not required). Biochemical functions of cholesterol.

Unit III

Amino acids and proteins

Classification of amino acids and proteins – structure, classification and biochemical importance – one method each to identify 'C' terminal and N terminal aminoacids, secondary, tertiary and quaternary structures. Abbreviated names - structure and importance of simple peptide - glutathione, carnosine, anserine, vasopressin and oxytoxin. Peptide antibiotics - Geramicidin, bacitracin and actinomycin. Transamination – deamination- urea cycle.

Unit IV

Nucleic Acids

Purines, pyrimidines, deoxyribose, ribose, Nucelosides, Nucleotides, cyclic nucleotides. Structure and functions of DNA and different types of RNAs (m-RNA, t-RNA and r- RNA) DNase , RNase and Nucleoprotiens.

Unit V

Enzymes

Enzymes – classification of enzymes, enzyme specificity. Factors affecting enzyme reaction – Michaelis – Menten equation - derivation- inhibition of enzyme action – competitive, non - competitive and uncompetitive coenzymes and their mechanism of NAD+ and PLP. Immobilisation of enzymes - industrial and medical application of enzymes.

Text Books

Satyanarayana, U. & Chakrapani, U. (2008). Essentials of Biochemistry, (2^{nd} ed.). Arunabha Sen publishers.

Reference Books

1. Eric E.Conn, Roy H & Doi,John,(1987). Outlines of Bio Chemistry, Wiley publishers.
2. Abraham white and Philip Handler, (2008). Principles of Bio Chemistry, McGraw Hill publishers.
3. Weil, J. H. & Wilfy, (1987). General Bio Chemistry, (6^{th} ed.). Eastern publishers.
4. Lehninger, Nelson & Cox, (2006). Principles of Bio Chemistry, (2^{nd} ed.). CBS publishers.

Semester – VI
Elective IV – Instrumental methods
Sub. Code: CC1764

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
4	4	60	100

Objectives

1. To understand the instrumental methods to analyze chemical compound.
2. To gain knowledge on working of instrumentation.
3. To know the applications of spectroscopy.

Unit I

Chromatography

Chromatography-Definition, plate and rate theories and classification. Paper chromatography-Principle. Types-ascending, descendingand radial paper chromatography, applications. Thin layer chromatography - experimental technique and applications.Coloumn chromatography –principle, experimental technique and applications.Ion exchange chromatography- principle, experimental techniques, applications, separation of zinc and magnesium, chloride and bromide.

Unit II: Thermo Analytical and Electroanalytical Methods

Thermogravimetric analysis (TGA) - principle, automatic thermogravimetric analysis, factors affecting TGA, applications. Thermometric titrations. Differential thermal analysis (DTA), simultaneous DTA, TGA curves. Electrogravimetric analysis - theory, instrumentation, applications. Coulometric analysis – coulometric titrations, applications. Potentiostatic coulometry. Polarography – principle, dropping mercury electrode, experimental assembly, polarographic curves, applications to qualitative and quantitative analysis, concept of pulse polarography. Amperometric titrations – principles and applications.

Unit III: Colorimetric and Spectrophotometric Analysis

Colorimetry: Instrumentation for visual colorimetry, photoelectric colorimetry. Spectrophotometry: Instrumentation. Fluorometry - principle, instrumentation, applications. Flame photometry- principle, instrumentation and application. Nephelometry and turbidimetry – theory and instrumentation, turbidimetric titrations and applications.

Unit IV: Spectroscopy – 1

Introduction – types – UV Spectroscopy instrumentation – Theory – Adsorption laws – types of electronic transition, chromophore concept – solvent effect –woodward – Fieser rule for calculating λ max for benzene and its simple derivatives (alcohol, aldehyde, Ketone) – applications of ultraviolet spectroscopy.

IR spectroscopy – principle and instrumentation – sampling Techniques – vibrational frequencies and factors affecting IR spectra – Finger print region – Applications.

Unit: V: Spectroscopy II

Raman spectroscopy instrumentation – Rayleigh and Raman Scattering, stokes and antistokes lines — Raman effect and molecular structure – Raman Spectra of CO_2, H_2O. Advantages and limitations of Raman Spectroscopy.

NMR spectroscopy–principle relaxation effect, chemical shift, factors influencing chemical shift, solvent used–instrumentation, spin– spin coupling and coupling constant, NMR spectrum of simple organic molecules of 1- Propanol, 1, 1, 2 – Tribromoethane, ethyl acetate, benzaldehyde – applications of NMR spectroscopy, 2D NMR and nuclear Overhauser effect.

Constitutional Problems wherever necessary.

Text Book

Sharma, B.K. (2004). Instrumental methods of analysis (23rd ed.). GOEL Publishing House, Meerut.

Reference Books

1. Higson, S. (2003). Analytical Chemistry (1st ed.). USA: Oxford University Press.
2. Christian, G.D. (2007). Analytical Chemistry (6th ed.). John Wiley &Sons.
3. Kemp, W. (1994). Organic Spectroscopy (3rd ed.). Macmillam.

Semester – VI
Paper XIV - Elective IV – Forensic Chemistry
Sub. Code: CC1764

Number of Hours Per week	Number of Credit	Total No. of hours	Marks
4	4	60	100

Objectives

1. To understand the applications of Forensic chemistry.
2. To gain knowledge on detective materials.
3. To know the applications of forensic laboratories.

Unit I

History and development of forensic science the beginning of forensic toxicology – principles, governing the practice of Forensic science – history of forensic science laboratory in Tamil Nadu. FSD's services – anthasapology – Ballistin – Biology – Chemistry – Document – Excise – explosives – Narcotives – Photo – Physics prohibition – Research and Development – serology – Toxicology – Mobile forensic Science laboraties – role of forensic scientist injustice – administration system – Legal recognition to forensic science in India.

Unit II

Physical evidence – Common types of physical evidence – Information – Physical evidences – Classification – crime – material general nature – Physical state – question to be resolved – interaction – striations – tears – break and cuts – deposits – dispenals and residences – sources of trace evidence – foor wear – body trace metal detection – other soruces – fibres – buttons –cordage and rope metallic fragments – soil – paint flakes / smear – glass particles – purnt paner of glass – Glass splinters – dust and airborne particles.

Unit III

DNA profiling – background – nuclear DNA – mithochonrial DNA – Technique Blood – Blood groups and their significance – blood strains field test precipitin test – location of stains – semen – identification – micro crystalline test – acid phophatase – test – Saliva – identifications – characteristics. Sweat – hair significance – human hair – distinguishing features.

Unit IV

Foot prints – methods used for collection – propellant – Gum powder – smoke less powder – semi smokeless power – Arson – Chemistry of fire. Explosiver – low explosives – high explosives.

Unit V

Alcohol poisoning – stage of excitement – symptoms and signs – incoordination – stage of narcosin – cause of death – medical aspects – drumlessess – instrumental methods of analysis – atomic absorption spectrophotometry.

Text book

David. E. Newton. (2014). Forensic Chemistry (6th ed.). Viva books private Ltd.

Reference Books

1. Chatterjea. M.N. & Chawla. R., (2010), Clinical Chemistry (2nd ed.). Jaypee Brothers Medical Publishers Pvt. Ltd.
2. Nanda Maheswari (2008), Clinical Biochemistry (1st ed.). Jaypee Brothers Medical Publishers Pvt. Ltd.