SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE, UJIRE-574240

(Autonomous)

(Re-Accredited by NAAC at 'A' Grade with CGPA 3.61 out of 4)

DEPARTMENT OF CHEMISTRY

Syllabus of
Bachelor's Degree in
SCIENCE

(CHOICE BASED CREDIT SYSTEM SEMESTER SCHEME)
2019 – 2020 onwards

Approved by the BOS meeting held on 14-06-2019
Approved by the Academic Council meeting held on 10-10-2019

CHEMISTRY AS A DISCIPLINE

Preamble

The Board of Studies in Chemistry restructured and prepared the revised syllabus for B.Sc Degree in its meeting held on 14/06/2019 as per the Choice Based Credit System Semester Scheme suggested by Mangalore University and University Grants Commission, New Delhi.It was resolved to implement this revised syllabus from the Academic year 2019-20.

The Chemistry Syllabus for B.Sc. Degree covers three academic years consisting of six semesters with 28 credits for the entire programme including core courses and elective courses. The goal of the syllabus is to make the study of chemistry stimulating, relevant and interesting. The syllabus has been prepared in a participatory manner,after discussions with a number of faculty members in the subject and after referring the existing syllabi,U.G.C. model curriculum and the syllabi of other Universities and National Institutes.

The syllabus is designed with a view to equipping the students with the potential to contribute to academic and industrial environments. Chemistry being an experimental science, sufficient emphasis is given in the syllabus for training in laboratory skills and instrumentation. The units of the syllabus are well defined. The number of contact hours required for each unit is also given. A list of reference books is provided at the end of the each semester.

Eligibility for Admission

Only those candidates who have passed Pre University course in science or an equivalent course with Chemistry as one of the subjects are eligible to take Chemistry as one of the optional subjects in B.Sc Programme

Programme Objectives

The syllabus aims to enable the students :

- To impart knowledge in fundamental aspects of all branches of chemistry
- To teach students the principles of applied chemistry
- To create inquisitiveness and problem solving skills
- To prepare students for higher education and career in chemistry
- To develop skills in the proper handling of apparatus and chemicals

Programme Outcomes

The learner will be able to:

- Employ critical thinking and efficient problem solving skills in the four basic areas of chemistry (analytical, inorganic , organic, and physical)
- Understand major concepts, theoretical principles and experimental findings in chemistry
- Explore new areas of research in both chemistry and allied fields of science and technology use modern instrumentation for chemical analysis and separation
- Understand and practice safe handling of chemicals and environmental issues
- Carry out scientific experiments, accurately record data and analyze the results while observing responsible and ethical scientific conduct
- Communicate the results of scientific work in oral, written and electronic formats

Course Discription (Core and elective courses)

Sl.No	Semester	Paper	Credits	Marks		
				IA	Sem End	Total
1	I	CHC-131	2	20	80	100
2	I	CHP -132	1	10	40	50
3	I	CHCE-133	1	10	40	50
4	II	CHC -181	2	20	80	100
5	II	CHP -182	1	10	40	50
6	II	CHCE-183	1	10	40	50
7	III	CHC-231	2	20	80	100
8	III	CHP -232	1	10	40	50
9	III	CHCE-233	1	10	40	50
10	IV	CHC -281	2	20	80	100
11	1V	CHP -282	1	10	40	50
12	IV	CHOE-283	1	10	40	50
13	V	CHC-331	2	20	80	100
14	V	CHC-332	2	20	80	100
15	V	CHP -333	2	20	80	100
16	VI	CHC-381	2	20	80	100
17	VI	CHC-382	2	20	80	100
18	VI	CHP-383	2	20	80	100
	Total		**28**	**280**	**1120**	**1400**

COURSE PATTERN AND SCHEME OF EXAMINATION

Core/ Elective	Paper Code	Title of the Paper	Instru-ction Hours	Duration of the Examination(Hrs.)	Max. Marks			Cre-dits
					Exam	IA	Total	
I Semester B.Sc.								
Group I Core Subject	Theory CHC-131	Chemistry Paper I	4	3	80	20	100	2
	Practical CHP -132	Chemistry Practical I	3	3	40	10	50	1
Group II Elective	Theory CHCE-133	Food Chemistry & Biomolecules	2	2	40	10	50	1*
Total number of Credits for Subject in I Semester:04								
II Semester B.Sc.								
Group I Core Subject	Theory CHC-181	Chemistry Paper II	4	3	80	20	100	2
	Practical CHP-182	Chemistry Practical II	3	3	40	10	50	1
Group II Elective	Theory CHCE-183	Chemistry of consumer products	2	2	40	10	50	1*
Total number of Credits for Subject in II Semester:04								
III Semester B.Sc.								
Group I Core Subject	Theory CHC-231	Chemistry Paper III	4	3	80	20	100	2
	Practical CHP -232	Chemistry Practical III	3	3	40	10	50	1
Group II Elective	Theory CHCE-233	Corrosion and Green Techniques	2	2	40	10	50	1*
Total number of Credits for Subject in III Semester:04								

IV Semester B.Sc.								
Group I Core Subject	Theory CHC-281	Chemistry Paper IV	4	3	80	20	100	2
	Practical CHP-282	Chemistry Practical IV	3	3	40	10	50	1
Group II Elective	Theory CHOE-283	Chemistry in daily life	2	2	40	10	50	1*
Total number of Credits for Subject in IV Semester:04								
V Semester B.Sc.								
Group I Core Subject	Theory CHC-331	Chemistry Paper V	3	3	80	20	100	2
	Theory CHC-332	Chemistry Paper VI	3	3	80	20	100	2
	Practical CHP-333	Chemistry Practical V	4	4	80	20	100	2
Total number of Credits for Subject in V Semester:06								

VI Semester B.Sc.								
Group I Core Subject	Theory CHC-381	Chemistry Paper VII	3	3	80	20	100	2
	Theory CHC -382	Chemistry Paper VIII	3	3	80	20	100	2
	Practical CHP-383	Chemistry Practical VI	4	4	80	20	100	2
Total number of Credits for Subject in I Semester to IV Semester:16								
Total number of Credits for Core Subject in I-VI Semesters:28								

*Credits for Elective Papers will be considered for the entire B.Sc. Programme

Syllabus

I SEMESTER

CHC 131: CHEMISTRY PAPER I

Total No of lecture hours : 4 Hrs / Week (48 Hrs) and Credits 2

Learning Objectives:

LO1: To learn the basic analytical methods and chromatographic techniques

LO2: To understand the different kinds of chemical bonds in molecules

LO3: To introduce and give an insight into the structure and properties of solids

LO4: To understand the principles of kinetics and and factors affecting the rate of reaction

LO5: To have a basic understanding about the structure and bonding in organic compounds and fundamentals of reaction mechanism

Course Outcomes :

CO1: Understand the basics of analytical methods and chromatographic techniques

CO2: Describe quantitatively the molecular structure of solids relating their properties to the forces and distances

CO3: Understand the concept of rate of change associated with a given chemical reaction and its measurement

CO4: Explain the basics of nature of bonding in organic molecules and criteria for aromaticity

CO5: Describe the fundamental techniques of predicting mechanism of organic reactions

CO6: Understand and practice safe handling of chemicals and environmental issues

CO7: Carryout the experiments, record data and analyse the results

UNIT-I

1.Chromatography: **3 Hours**

Chromatographic methods for the separation, purification and identification of organic compounds-Thin layer, paper and column chromatography. R_f value and its significance. Principle and applications of Gas chromatography.

Self study: Liquid Chromatography (basic idea only)

2.Methods of Analysis: **5 Hours**

Qualitative analysis - Sample size and techniques- macro, semimicro and micro. Type of tests- wet, dry and spot tests. Quantitative analysis - Volumetry, Gravimetry and Instrumental analytical methods. Principles of gravimetric analysis-methods of precipitation, optimum conditions for precipitation and co-precipitation. Solvent extraction-basic principles and applications. Errors in quantitative analysis, types of errors- determinate and indeterminate, methods of minimising errors. Accuracy - absolute error / relative error. Precision - mean deviation / relative mean deviation, standard deviation, t-test, F-test and Q-test. Significant figures. Rules for computation of results.

Self study: Problems on errors and significant figures.

3.Periodic Properties: **4 Hours**

Methods of determination of Atomic properties -Atomic size by Lande's method, Ionization energy by Discharge tube method, Electron affinity from Bom-Haber cycle and Electronegativity from Pauling and Muiliken scales. Predicting and explaining the chemical behaviour of elements on the basis of periodic properties (metallic/non metallic, ionic/covalent, reducing/oxidizing). Effective nuclear charge-shielding effect. Slater's rule and its applications.

Self study: Atomic radius – covalent, vander Waals and Ionic radius

UNIT-II

1.Chemical Bonding: **12 Hours**

Nature of covalent Bond: Valence band theory. Concept of hybridization, Valence Shell Election Pair Repulsion (VSEPR) theory, Comparative study of structure and bonding between F_2O and H_2O; H_2S and H_2O; NH_3 and NF_3; ClF_3 and $XeOF_2$. Basic principle of Molecular orbital theory. Molecular orbital diagrams of homo and heteronuclear species- N_2, O_2, CO, NO and CN. Ionic bond-Nature, Lattice energy, Bom-Lande equation, Solvation and Solubility of ionic solids. Polarising power and Polarisability of ions. Fajan's rule to explain bond character, covalent character of ionic compounds, relative covalent character, diagonal relationship. Comparative trend in properties: a) Melting point-e.g NaBr, $MgBr_2$, $AlBr_3$; LiF, LiCl, LiBr, LiI, $CaCl_2$, $HgCl_2$ b) Solubility-e.g AgF, AgCl, AgBr, AgI. c) Thermal stability-e.g $BeCO_3$,$MgCO_3$,$CaCO_3$,$SrCO_3$, $BaCO_3$; $CdCO_3$, $PbCO_3$. Metallic bond-Application of

Band theory for explaining the electrical and thermal conductance in Lithium, Beryllium, Silicon and Diamond.

Self study: Coordinate covalent bond or dative bond, Factors influencing the formation of Ionic bond: Ionization energy, electron affinity.

UNIT-III

1.Solid state: 6 Hours

Laws of crystallography: Law of constancy of interfacial angle-explanation taking hexagonal crystal system as an example. Law of symmetry. Elements of symmetry- axis of symmetry, plane of symmetry and centre of symmetry-explanation taking cubic crystal system as an example. Law of rationality of indices. Miller indices- calculation of Miller indices for different planes in a cubic crystal system. Bravais lattices. X-ray diffraction by- crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCl and determination of Avogadro number. Cesium Chloride. Zinc blend, Wurtzite, Fluorite and Rutile crystal structures.

Self Study: Types of crystals and examples, Space lattice and unit cell, crystal systems, Bravais lattices. Bravais lattices of cubic crystal

2.Chemical Kinetics: 4 Hours

Concentration dependence of rates, differential rate laws of simple chemical reactions, Zero,First,Second , n^{th} and pseudo first order reaction.

Derivation of rate constants for second order and n^{th} order reactions with equal initial concentrations. Determination of order of a reaction- Differential, Integration, Half life period and Isolation methods. Transition state theory-Derivation of relationship between rate constant and equilibrium constant. Thermodynamic aspects of activation.

Self Study: Law of mass action, rate of a reaction, molecularity and order, differences between order and molecularity, factors affecting the rate of reactions.

3.Catalysis: 2 Hours

Role of catalyst in altering reaction rate, Acid-base catalysis, specific and general acid base catalysis, mechanism and kinetics, Enzyme catalysis, Derivation of Michaelis- Menten equation.

Self Study: Catalyst- Definition and examples, general characteristics of catalysts, catalytic promoters and poisons - definition and examples, Adsorption and types of adsorption.

UNIT-IV

1.Nature of bonding in organic molecules: 4 Hours

Localized and delocalized bonding,conjugation,cross conjugation. Resonance and aromaticity- explanation for aromaticity in compounds and ions. Huckel rule. Concept of antiaromaticity with suitable examples. Hyperconjugation- explanation for relative stabilities of 1°, 2° and 3° carbocations. Field effects like Inductive effect-Explanation with examples, relative strengths of aliphatic and aromatic carboxylic acids (Acetic acid and Chloroacetic acid, Acetic acid and Propionic acid, Acetic acid and Benzoic acid). Steric effect-Explanation with examples, Bonding weaker than covalent bond-Van der Waal's forces, Hydrogen bonding. Charge-transfer complexes.

Self study: Electron displacement effect applications. Vander walls interactions. Types of hydrogen bonding.

2.Reactive intermediates: 8 Hours

Generation, stability and reactions of-i) carbocations ii) carbanions iii) Free radicals iv) Nitrenes v) Carbenes. Reactions involving these intermediates:Dienone-Phenol, Demajnov, Hofmann, Curtius, Reimer-Tieman and Wolf rearrangement, Perkin & Claisen Condensation, Sandmeyers reaction, vi) Arynes- Benzyne mechanism for the conversion of Bromobenzene to aniline.Methods of determination of reaction mechanism-Product analysis, Identification of intermediates, Cross over experiments,Stereochemical evidences, isotope effects, kinetic isotopic studies.

Self study: Comparison of stability of reaction intermediates. Mechanism of addition of HCN and $NaHSO_3$ to carbonyl compounds**.** Oxidation and Reduction, Reducing agent, Oxidising agent .Electrophilic addition to carbon- carbon multiple bond in aromatic system.

CHP 132: CHEMISTRY PRACTICAL I

3Hrs/Week (12x3 Hrs) and Credit 1

I. Systematic qualitative analysis of mono and bifunctional organic compounds. 8 weeks

Determination of melting point/boiling point, preparation of suitable solid derivative and identification by referring to the literature. The following compounds may be given - Resorcinol, oxalic acid, urea, thiourea, cinnamic acid, benzoic acid, salicylic acid, phenol, p-cresol, aniline, p-nitroaniline, p-toluidine, benzaldehyde, ethyl methyl ketone, acetophenone, benzophenone, chlorobenzene, bromobenzene, nitrobenzene and benzamide, Ethylbenzoate, Benzyl alcohol.

II.Thin Layer Chromatography 2 weeks

Determination of R_f values and identification of organic compounds,

(a) Separation of green leaf pigments(Spinach leaves may be used)

(b) Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexan-2- and 3-one, using toluene and light petroleum (40:60)

(c)Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5: 1.5)

III.Paper Chromatography: Ascending and Circular 2 weeks

Determination of Rf values and identification of organic compounds,

(a) Separation of a mixture of phenylalanine and glycine, Alanine and aspartic acid, Leucine and glutamic acid. Spray reagent-ninhydrin.

(b) Separation of a mixture of D, L-alanine, glycine and L-Leucine using n-butanol, acetic acid-water (4:1:5). Spray reagent-ninnydrin

(c) Separation of monosaccharides-mixture of D-galactose and D- fructose using n-butanol:acetone: water (4:5:1), Spray reagent-aniline hydrogen phthalate.

IV.Column Chromatography:

Separation of fluorescein and methylene blue, Separation of leaf pigments from spinach leaves.

Reference books

Basic Reading List

1. J. D. Lee, (1996) Concise Inorganic Chemistry, 5th ed., Blackwell Science,London
2. F. A. Cotton, G. Wilkinson and P. L. Guas, (1994) Basic Inorganic Chemistry, 3rd ed, John Wiley
3. B. Douglas, D. McDaniel and J. Alexander, (1994) Concepts and Models of Inorganic Chemistry, 3rd ed., John Wiley
4. B. R. Puri, L. R. Sharma, K. C. Kalia, (1996) Principles of Inorganic Chemistry, Shoban LalNagin Chand and Co.
5. W.U. Malik, G.D. Tuli and R.D. Madan, (2003)Selected Topics in Inorganic Chemistry, S. Chand Publication
6. L Finar, (1973) Organic Chemistry ,Volume I and II ,Pearson Education
7. P.L.Soni , (2012) Text Book of Organic Chemistry , 29th ed., Sultan Chand &Sons
8. Peter Sykes, (2003) A Guide Book to Mechanisms in Organic Chemistry ,6th ed., Pearson Education
9. O.P. Agarwal, Reactions and Reagent , Goel Publishing House
10. Gurdeep Chatwal, (2016) Organic Reaction Mechanisms, 5th ed., Himalaya Publishing House
11. K.S.Tewari,N.K.Vishol,S.N.Mehrotra ,A Text Book of Organic Chemistry , Vikas Publishing House
12. B.R. Puri, Sharma and Patiana, (1998) Principles of Physical Chemistry, 37th ed., Shobanlal Nagin
13. Dash.U.N, Dharmarha.O.P, Soni.P.L, (2014) A Text Book of Physical Chemistry ,Sultan Chand & Co. Sultan Chand & Sons
14. Glasstone and Lewis , (1961) Elements of Physical Chemistry,Macmillan
15. S.Glasstone, (1969) Text book of Physical Chemistry ,2nd ed.,Macmillan Ltd
16. C.N.R. Rao , (1973) Universal General Chemistry, Macmillan
17. S. M. Khopkar , (2008) Basic Concepts of Analytical Chemistry, 3rd Edn.

18.
19. M R Wright, (1999) Fundamentals of Chemical Kinetics,1st ed.,Hardwood Publishing
20. A.I.Vogel (2001) Practical Organic Chemistry,Longman-ELBS,England
21. G.H.Jeffrey, J.Bassetti, J.Mendham and R.C.Denny (1999)
22. Vogel's Text Book of Quantitative and Qualitative Analysis,5th ed.,Longman,London

Additional Reading List

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, (1993) Inorganic Chemistry,4th ed., Harper Collins,New York
2. D. F. Shriver and P. W. Atkins, (1999) Inorganic Chemistry, 3rd ed., W. H. Freeman and Co, London
3. T. Moeller,(1990) Inorganic Chemistry: A Modern Introduction, Wiley, New York
4. Cotton and Wilkinson , (1988) Advanced Inorganic Chemistry ,V Edition, Wiley & Sons
5. R.T.Morrison & R.N.Boyd, (2003) Organic Chemistry, 6th Edition, Pearson Education Pvt Ltd., Singapore
6. Bahl and Arun Bahl, (2014) Advanced Organic Chemistry , S. Chand&Company Ltd
7. Jerry March, (2007) Advanced Organic Chemistry, 6th ed., Willey, Newyork,
8. Bruice, (2012) Organic Chemistry , 7thed.,Pearson Education.
9. Negi and Anand , (1985) Physical Chemistry , Eastern Wiley Pvt.Ltd
10. Kundu and Jain , (1984)Physical Chemistry , S. Chand & Co.
11. K.L Kapoor, (2004) A *Text Book of Physical Chemistry*, Volume-5, 3rd ed., *Macmillan*
12. Maron and Lando , (1974) Fundamentals of Physical Chemistry , Colier -Macmillan
13. G.W. Castellan, (2004) Physical Chemistry , 3rd ed.,Narosa publishing house
14. Walter J.Moore,(1998)Physical Chemistry,5th ed.,Orient LongmanPublishing Group
15. Gashal , (2013) Numerical Problems on Physical Chemistry, 6th Revised ed., . Books and Allied (P) Ltd
16. Mukherji,Singh and Kapoor, (1994)Organic chemistry, Vol.-1,2 & 3 Wiley Estern
17. B K Sharma,Instrumental Methods of Chemical analysis,Goel PublishingHouse.

II SEMESTER
CHC 181: CHEMISTRY PAPER II
Total No of lecture hours : 4 Hrs / Week (48 Hrs) and Credits 2

Learning Objectives:

LO1: To know the types as well as chemical and physical properties of solvents

LO2: To understand the general characteristics and properties of s and p block elements

LO3: To understand molecular velocities and concept of liquefaction of gases

LO4: To understand the structure and properties of liquids and liquid crystals

LO5: To understand the nature of organic reagents and their synthetic utility

LO6: To explain the basic concepts of electrophilic addition to carbon carbon multiple bonds

LO7: To provide knowledge about industrial chemistry

Course Outcomes :

CO1: Explain the types as well as physical and chemical properties of solvents

CO2: Understand the general characteristics and properties of s and p block elements

CO3: Describe different types of molecular velocities and conditions for liquefaction of gases

CO4: Differentiate between structures of solids, liquids and gases, and determination of physical properties of liquids and compounds

CO5: Discribe the nature of organic reagents and their synthetic utility in organic reactions

CO6: Understand the basic concepts of electrophilic addition to carbon carbon multiple bonds

CO7: Gain knowledge about the fundamentals of industrial chemistry

CO8: Learn analytical skills involved in volumetric analysis

UNIT-I

1. Gaseous State: **4 Hours**

Maxwell's distribution of molecular velocities- explanation with graph. Most probable, average and RMS velocities. Relation between RMS, average and most probable velocity. Qualitative discussion of the collision number, mean free path and collision diameter.

Critical phenomena: P-V isotherms of real gases - Andrews isotherms of carbon dioxide. Continuity of states-principles. Isotherms of van der Waals equation. Relationship between critical constants and van der Waals constants-derivation of the expressions for a, b, T_c, P_c and V_c, Law of corresponding states- statement, reduced equation of state- derivation of the equation.

Self study: Gas laws – Boys law, Charles law, Avogadro's law, Dalton's law of partial pressure, Combined gas equation, Ideal and real gases – Definition and examples, Kinetic theory of gases, postulates, Kinetic gas equation

2. Liquid state: **4 Hours**

Structure of liquids-qualitative description. Structural differences between solids, liquids and gases. Liquid crystals- Explanation, classification with examples - smectic, nematic, cholesteric, disc shaped and polymeric. Structures of nematic and cholestric phases-molecular arrangements in nematic and cholestric liquid crystals. Application of liquid crystals in LCDs and thermal sensing.

Self study: Liquid crystals, differences between liquid crystal, solid & liquid, classification of liquid crystals, examples.

3. Solvents: **4 Hours**

Physical properties of a solvent - density, dipole moment, specific conductance, dielectric constant, heats of fusion and vaporisation, Types of solvents - classification into protic - aprotic, acidic - basic - amphiprotic, ionising - non ionizing (examples), Characteristics-liquid range, auto-ionisation and solvating properties. Reactions in aqueous and non-aqueous solvents (two examples in each case). Water-hydration, hydrolysis, acid- base. reduction-oxidation, complex formation and precipitation. Ammonia-ammoniation, ammonolysis, acid-base, reduction-oxidation, complex formation, precipitation, alkali metals in ammonia, levelling effect- examples.

Self study: Aqueous and non aqueous solvents.

UNIT II

1. s-Block Elements : **4 Hours**

Hydrogen-position of hydrogen in the periodic table. Hydrides-types, preparation, properties

and applications. Structure of BeH_2 and NaH. Complex hydrides-$LiAlH_4$, $NaBH_4$-Preparation and applications. Comparative study of Li and Be with other members of the same group. Comparative study of lattice energy, enthalpy of formation, enthalpy of hydration and solubility's of alkali metal and alkaline earth metal halides, hydroxides and sulphates. Comparison of standard reduction potentials and reducing properties of alkali metals and alkaiine earth metals. Complexation tendencies of alkali metals with crown ether, Cryptates. BeF_4^{2-} and Basic beryllium acetate-preparation, properties and structure.

Self study: General characteristics of s-block elements and role of Na^+ and K^+ in biological systems.

2. p-Block Elements: 8 Hours

Comparative study of p-Block elements and their compounds-comparison between Boron and other members of the group. Boranes: Diborane- Preparation, properties, structure and bonding, chemical evidences to bridge hydrogen. $B_4H_{!0}$. B_5H_9, $B_6H_6^{2-}$ - Preparation and structure, styx number, Wade's rule. Silicates-types, basic units, structure and applications. Hydrazine and hydroxylamine-structure and reducing property. Hypo phosphorus acid, phosphorus acid, phosphoric acid, orthophosphoric acid, meta phosphoric acid and pyrophosphoric acid- structure, evidence in favour of structure. Halogens in positive oxidation state. Inter halogen compounds-ICl, BrF_3, $IF_5$and IF_7- preperation, properties, structure and uses. Noble gases-Clathrates, XeF_2 XeF_4 XeF_6 and XeO_3- structure and bonding.

Self study: General characteristics of p-block elements.

UNIT III

1. Industrial Chemistry: 9 Hours

Explosives: Composition and types

Fuels: Composition, production and applications of natural gas, water gas, producer gas, LPG and bio gas.

Propellants: Characteristics and applications.

Glasses: Types, composition and uses of glasses- hard, soft, pyrex, jena, flint, safety, optical, fibre, coloured and Crooke's glasses. Raw materials, manufacture- tank furnace, steps in

manufacture and annealing of glass.

Cement: Raw materials, manufacture of cement, mechanism of setting of cement.

Ceramics: Raw materials used in modem ceramics, stages in ceramic making, glazing, applications of porcelain.

Insulators: Classification and applications,

Superconductors: Discovery, types, examples and applications.

Paints: Constituents of paints and their functions with examples. Manufacture of white lead and lithopone.

Refractories: Characteristics, classification with examples and applications,

Abrasives: natural abrasives, synthetic abrasives, characteristics and applications. Silicon carbide and boron nitride- structure and production.

Cane sugar: Outline of production and composition, molasses, its composition,

Paper: Production of wood pulp and preparation of paper.

Chemical fertilizers: Different types of fertilizers, importance, production of urea, CAN and superphosphate of lime.

Solid acids: Introduction-zeolites, structure and applications

Self Study: Compressed natural gas (CNG): Composition and applications, Coal gas : Production and Uses, Oil gas : Composition and applications

2. Pesticides, Fungicides and Herbicides **3 Hours**

Introduction, structure, synthesis and properties of Pesticides: organochlorine compounds-DDT, BHC; Orgnophosphorus compounds-Malathion, Parathion, Endosulphan;Pyrethrin, Alethrin, Baygon. Herbicides:2,4-dichlorophenoxy acetic acid,Synthesis and properties.

Fungicides: Bordeaux mixture, Dithiocarbamate. Method of preparation. composition and applications.

Self study: Different types of pesticides with example

UNIT IV

1. Reagents and their synthetic utility: **10 Hours**

Reagents used for the synthesis of organic compounds and the reactions with mechanism-$KMnO_4$-Oxidation of alkenes to vicinal diols; SeO_2-Conversion of benzyl phenyl ketone into

benzyl; Ozone-Synthesis of carbonyl compounds from alkenes; Periodic acid-Oxidation of vicinal diols into carbonyl compounds; Lead tetra acetate- Oxidative cleavage of vicinal diamines; Osmium tetroxide-Synthesis of cis-1,2-diols; Per acids-Baeyer Villiger Oxidation; CrO_3-Sarett oxidation; Aluminium iso propoxide-Meerwein-Pondorf-Verley reduction, $LiAlH_4$ Reduction of carbonyl compounds into alcohols; $NaBH_4$ Reduction of carbonyl compounds into alcohols; Sodamide-Chichibabin reaction; N-Bromo succinimide-Allylic bromination ; Diazomethane-Methylation of carboxylic acids/phenols; Na/ethyl alcohol-Reduction of ester to alcohol; H_2O_2-Dakin reaction. CrO_2Cl_2-Etard's reaction; Hydrazine-Wolf-Kishner reduction.

Self study: Oxidation and Reduction, Reducing agent, Oxidising agent .Electrophilic addition to carbon- carbon multiple bond in aromatic system

2. Electrophilic addition to carbon-carbon multiple bonds: 2 Hours

Electrophilic addition to carbon-carbon double and triple bonds- Mechanism, relative reactivity, regioselectivity and stereoselectivity. Reactions- halogenation, hydrohalogenation and ozonolysis. electrophilic addition to conjugated dienes, Radical addition, Addition of HBr in presence of light and in dark. Pericyclic addition, Diels- Alder reaction and l,3-dipolar addition.

CHP 182: Chemistry Practical II

3Hrs/ Week (12x3 Hrs) and Credit 1

Volumetric Analysis

1. Microscale experiment-Two butette titration and beral pipette titration.
2. Preparation of standard sodium carbonate solution, standardization of hydrochloric acid and estimation of sodium hydroxide in solution.
3. Preparation of standard solution of potassium biphthalate, standardization of sodium hydroxide solution and estimation of hydrochloric acid in solution.
4. Preparation of standard solution of oxalic acid, standardization of potassium permanganate solution and estimation of Mohr's salt in solution.
5. Preparation of standard ferrous ammonium sulphate solution, standardization of Potassium dichromate solution and estimation of ferric chloride in solution.

6. Preparation of standard potassium dichromate solution, standardization of sodium thiosulphate solution and estimation of copper sulphate in solution.
7. Estimation of mixture of oxalic acid and sulphuric acid in a solution using standard Potassium permanganate solution and standard sodium hydroxide solution.
8. Estimation of calcium content in lime stone as calcium oxalate by permanganometry.
9. Estimation of hardness of water by EDTA method.
10. Estimation of manganese in pyrolusite by volumetric method.
11. Determination of acetic acid in commercial vinegar using NaOH.
12. Determination of alkali content in antacid tablet using HC1.
13. Estimation of glucose using iodine and sodium thiosulphate
14. Estimation of Vitamin C.

Reference books

Basic Reading List

1. J. D. Lee, (1996) Concise Inorganic Chemistry, 5th ed., Blackwell Science,London
2. F. A. Cotton, G. Wilkinson and P. L. Guas, (1994) Basic Inorganic Chemistry, 3rd ed, John Wiley
3. B. Douglas, D. McDaniel and J. Alexander, (1994) Concepts and Models of Inorganic Chemistry, 3rd ed., John Wiley
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5. W.U. Malik, G.D. Tuli and R.D. Madan, (2003) Selected Topics in InorganicChemistry, S. Chand Publication
6. I. L Finar, (1973) Organic Chemistry ,Volume I and II ,Pearson Education
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8. Peter Sykes, (2003) A Guide Book to Mechanisms in Organic Chemistry ,6th ed., Pearson Education
9. O.P. Agarwal, Reactions and Reagent , Goel Publishing House
10. Gurdeep Chatwal, (2016) Organic Reaction Mechanisms, 5th ed., Himalaya Publishing House
11. K.S.Tewari,N.K.Vishol,S.N.Mehrotra ,A Text Book of Organic Chemistry , Vikas Publishing House
12. B.R. Puri, Sharma and Patiana, (1998) Principles of Physical Chemistry, 37th ed., Shobanlal Nagin
13. Dash.U.N, Dharmarha.O.P, Soni.P.L, (2014) A Text Book of Physical Chemistry ,Sultan Chand & Co. Sultan Chand & Sons
14. Glasstone and Lewis , (1961) Elements of Physical Chemistry,Macmillan
15. S.Glasstone, (1969) Text book of Physical Chemistry ,2nd ed.,Macmillan Ltd C.N.R. Rao, (1973) Universal General Chemistry, Macmillan

16. A.I.Vogel (2001) Practical Organic Chemistry,Longman-ELBS,England
17. G.H.Jeffrey, J.Bassetti, J.Mendham and R.C.Denny (1999)
18. Vogel's Text Book of Quantitative and Qualitative Analysis,5th ed.,Longman,London

Additional Reading List

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, (1993) Inorganic Chemistry,4th ed., Harper Collins,New York
2. D. F. Shriver and P. W. Atkins, (1999) Inorganic Chemistry, 3rd ed., W. H. Freeman and Co, London
3. T. Moeller,(1990) Inorganic Chemistry: A Modern Introduction, Wiley, New York
4. Cotton and Wilkinson , (1988) Advanced Inorganic Chemistry ,V Edition , Wiley and Sons
5. R.T.Morrison & R.N.Boyd, (2003) Organic Chemistry, 6th Edition, Pearson Education Pvt Ltd., Singapore
6. Bahl and Arun Bahl, (2014) Advanced Organic Chemistry , S. Chand & Company Ltd
7. Jerry March, (2007) Advanced Organic Chemistry, 6th ed., Willey, Newyork,
8. Bruice, (2012) Organic Chemistry , 7thed.,Pearson Education.
9. Negi and Anand , (1985) Physical Chemistry , Eastern Wiley Pvt.Ltd
10. Kundu and Jain , (1984)Physical Chemistry , S. Chand & Co.
11. K.L Kapoor, (2004) A *Text Book of Physical Chemistry*, Volume-5, 3rd ed., *Macmillan*
12. Maron and Lando , (1974) Fundamentals of Physical Chemistry , Colier - Macmillan
13. G.W. Castellan, (2004) Physical Chemistry , 3rd ed.,Narosa publishing house
14. Walter J. Moore, (1998)Physical Chemistry , 5th ed., Orient Longman Publishing Group
15. Gashal , (2013) Numerical Problems on Physical Chemistry, 6th Revised ed., Books and Allied (P) Ltd

III SEMESTER
CHC 231: CHEMISTRY PAPER III
Total No of lecture hours : 4 Hrs / Week (48 Hrs) and Credits 2

Learning Objectives:

LO1: To understand the general characteristics and properties of d and f block elements

LO2: To know the characteristic properties and occurance of lanthanides and actinides in nature and their uses

LO3: To understand various liquid mixtures and their separation techniques

LO4: To understand the concept of oxidation and reduction tendency and stability

LO5: To study the preparation and applications of Nano materials

LO6: To understand the various concepts of acids, bases and indicators

LO7: To study the principles invoved in the manufacture alloys and the applications of alloys

LO8: To understand the concepts of thermodynamics and its applications to physical and chemical systems

Cource Outcomes :

CO1: Distinguish between d and f block elements by studying their general properties

CO2: Understand the concept of lanthanides, actinides and biological role of alkali and alkaline earth metals.

CO3: Understand the principles of thermodynamics and its applications to physical and chemical systems.

CO4: Describe the chemistry of phenols, ethers , epoxides and structure and reactivity of carbonyl compounds

CO5: Gain the knowledge and skills of preparation of Nano materials

CO6: Describe principles invoved in the manufacture alloys and the applications of alloys

CO7: Analyse the radicals present in inorganic salt mixtures

UNIT I

Thermodynamics **12 Hours**

First law of thermodynamics, Joule-Thomson effect-isoenthalpic nature. Joule-Thomson coefficient-derivation of mathematical expression. Inversion temperature- explanation in

terms of Joule-Thomson coefficient. Bond dissociation energy and its calculation from thermo chemical data. Temperature dependence of enthalpy- Kirchhoff's equation. Second law of thermodynamics- Need for the law, different statements of the law. Carnot's cycle. Efficiency of Carnot's cycle, Carnot's theorem. Thermodynamic scale of temperature. Concept of entropy from Carnot's cycle, Entropy as a state function. Entropy change for an ideal gas as a function of V and T, entropy change for an ideal gas as a function of P and T. Entropy change in mixing of ideal gases. Entropy change in physical change-fusion, evaporation, sublimation and transition. Clausius inequality, Entropy as a criterion for spontaneity and equilibrium. Third Law of thermodvnamics-its significance, unattainability of absolute zero. Gibbs function (G) and Helmholtz function (A) as thermodyanamic quantities. A and G as criterion for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G with P, V and T (Illustrative problems to be worked out).

Self study: Definition of terms – System and surrounding, types of systems and examples, thermodynamic process and types. Heat capacity, heat capacities at constant volume and at constant pressure and their relationship.

UNIT II

1.Chemistry of d- and f-block elements: 7 Hours

General electronic configuration, stabilities of oxidation states and complexing ability. Magnetic property-dia, para and ferromagnetism. Expression for magnetic moment-spin only formula, μ_S and Lande's calculation of theoretical magnetic moment, μ_{S-L} and comparison with experimental value, reasons for observed trend. Comparative treatment of 4d and 5d series with their 3d analogues in respect of ionic radii, oxidation states, magnetic behaviour and stereochemistry. Lanthanide contraction-causes and consequences. Occurrence and isolation of lanthanides by ion-exchange method. Comparison between lanthanides and actinides. Separation of Neptunium , Plutonium and Americium from Uranium.

Self study: Catalytic properties and complexing abilities of d-block elements Colours of their compounds. Electronic configuration of lanthanides and actinides and their position in the periodic table.

2.Alloys **2Hours**

Manufacture of steel by L.D Process. Principles and purpose of alloying, effect of alloying - carbide formation, solid solution formation and deoxidation. Presence of impurity elements- Cr, Mn, Ni, V, Mo, W, S, P, Si. Special steel-Alnico, Stainless steel and inverse steel- constituents, properties and applications.

Self study: Applications of copper alloys

3.Nano Chemistry **3Hours**

Introduction,general methods of synthesis,characterization techniques, preparation of nano particle by chemical method, application of nanomaterials.

Self study: Synthesis, properties and applications of nanocomposites and nanofibres

UNIT III

1.Binary mixtures **5Hours**

Liquid - liquid mixtures, completely miscible liquids, ideal liquid mixtures, Raoult's law, non-ideal systems showing positive and negative deviation from Raoult's law, Vapour pressure - composition and boiling point - composition curves, Azeotropes, HCl-H_2O and ethanol-H_2O systems. Partially miscible liquids, Miscibility temperature and critical solution temperature(CST), Phenol water system, Trimethylamine-water system and Nicotine - water system. Effect of impurity on CST. Immiscible liquids, Steam distillation-principle and experimental details, Nernst Distribution law- statement and applications.

Self Study: Solutions, types of solutions and examples, definitions of solvent and solute, Vapour pressure and boiling point and relationship between them

2.Acids and Bases: **2 Hours**

Lewis concept of acids and bases. Modern concepts of acids and bases- Usanovich concept, Lux -Flood concept. Hard and Soft Acids and Bases (HSAB)- Classification of acids and bases as hard and soft-examples and comparison, Pearson's HSAB concept-acid base strengths and hardness and softness. Electro negativity and hardness and softness.

3.Oxidation and Reduction: **5 Hours**

Use of redox potential data -thermodynamic feasibility using free energy, reducing and oxidizing tendency. Analysis of redox couple - example of Zn/Zn^{2+} couple. Redox stability in water - reaction with water, one example each for oxidation by water and reduction by water.

Frost, Latimer and Pourbaix diagrams - presentation of potential data, Frost diagram for Nitrogen, Latimer diagram for Chlorine,Pourbaix diagram for Iron

Self study: Frost diagram for oxygen in acidic solution.

UNIT IV

1.Reactions and reactivity of Phenols: 3 Hours

Comparison of acidic properties of phenols with carboxylic acids, alcohols and carbonic acid. Mechanism of - Fries rearrangement, Claisen rearrangement, Gattermann synthesis, Mannidh reaction, Ene reaction. Synthesis of aryloxy acetic acids.

Self study: Comparative acidic strenghs of alcohols and phenols. Di and trihydric phenols - definition and examples

2.Ethers and Epoxides: 3 Hours

Chemical reactions of ethers-Cleavage and auto-oxidation with examples. Ziesel's method of estimation of methoxy/ethoxy group in ethers. Synthesis of epoxides, acid and base catalyzed ring opening of epoxides. Orientation and reactivity in epoxide ring opening .

Self study: Classification of ethers-simple and mixed ethers.Williamsons ether synthesis.Nomenclature of epoxides

3.Structure and reactivity of carbonyl compounds: 6 Hours

Structure of carbonyl group, Nucleophilic additions to carbonyl group, relative reactivities of aldehydes and ketones-explanation, Mechanism of reactions involving Hydride shift-Tischenko reaction; C-C bond formation- Bucherer reaction, hydantoin synthesis; C=C bond formation-Wittig reaction; C=N bond formation-addition of NH_3 derivatives; C-O bond formation-Acetal formation, Michael addition and Robinson annulations. α, β- unsaturated aldehydes and ketones-preparation and their synthetic applications.

Self study: Crossed aldol condensation reaction with suitable examples. Synthesis of carboxylic acids and halo compounds from α, β – unsaturated aldehydes and ketones

CHP 232: CHEMISTRY PRACTICAL III

3 Hrs/Week (12x3 Hrs) and Credit 1

Systematic semimicro qualitative analysis of mixtures of two simple inorganic salts (containing two cations and two anions).

Anions: CO_3^{2-}, HCO_3^-, SO_3^{2-}, $S_2O_3^{2-}$, S^{2-}, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, PO_4^{3-}, SO_4^{2-}

Cations: Pb^{2+}, Cu^{2+}, Bi^{3+}, Cd^{2+}, Co^{2+}, Ni^{2+}, Al^{3+}, Fe^{3+}, Mn^{2+}, Zn^{2+}, Ca^{2+}, Ba^{2+}, Sr^{2+}, Mg^{2+}, Na^+, K^+, NH_4^+

IV SEMESTER
CHC 281: CHEMISTRY PAPER IV

Total No of hours: 4Hrs/Week (48 Hrs) and Credits 2

Learning Objectives:

LO1: To understand the importance of nomenclature, isomerism and theory of coordination compounds

LO2: To know the relation between collegative properties and molecular weight of solutes

LO3: To enable the students to understand chemical equilibrium, effect of pressure, temperature and concentration on chemical equilibrium

LO4: To know the basic terms involved in phase equilibrium and to know the applications of phase diagram

LO5: To study the relationship between physical properties and molecular structure

LO6: To study the various aspects of reactive methylene compounds, elimination and substitution reactions

Cource Outcomes :

CO1: Describe the concept of nomenclature, EAN rule, isomerism and theory of coordination compounds

CO2: Explain the relationship between colligative properties and molecular weight of solutes

CO3: Understand the relationship between physical properties and molecular structure

CO4: Understand the basic terminology of phase equilibrium and chemical equilibrium

CO5: Explain the synthesis and reactivity of active methylene compounds and stereochemistry of elimination reactions

CO6: Learn the skills of predicting the mechanism of aromatic nucleophilic and electrophilic substitution reactions

CO7: Practice the skills of determination of physical properties of organic compounds

UNIT I

1.Co-ordination Compounds: 6 Hours

Nomenclature-order of naming ion, naming the coordination sphere, naming ligand, order of naming the ligand, ending the name, oxidation state of metal ion, naming geometrical and

optical isomers, bridge ligands, isomerism in coordination compounds-Ionisation isomerism, hydrate isomerism, coordinate isomerism, linkage isomerism. Stereoisomerism-geometrical isomerism and optical isomerism - Coordination numbers 4 and 6.

Self study: Poblems on calculation of EAN. Applications of coordination compounds

2. Metal-ligand Bonding in Transition Metal Complexes: 6 Hours

Valence bond theory-examples for sp^3, dsp^2, dsp^3, d^2sp^3 and sp^3d^2 hybridisation-$Ni(CO)_4$, $[Ni(CN)_4]^{2-}$, $[CU(NH_3)_4]^{2+}$, $Fe(CO)_5$, $[Fe(CN)_6]^{5-}$, $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$. Explanation for magnetic properties. Limitations of Valence bond theory. Crystal field theory-important concepts of CFT, Crystal field splitting in octahedral, tetrahedral and square planar complexes, crystal field stabilization energy. Calculation of CFSE, weak and strong field ligands, spectrochemical series, explanation for stability, geometry, magnetic and spectral properties. Factors affecting the crystal field splitting-nature of metal ions, charge, size, principal quantum number of d-electron , number of ligands and nature of ligands. Limitations of CFT.

Self study: Comparison of VBT and CFT ,Crystal field splitting in tetragonal complexes. Calculation of CFSE for tetragonal complexes.

UNIT II

1.Chemical Equilibrium 4 Hours

Derivation of relationship between equilibrium constant and free energy $\Delta G° = -RT\ln K_p$. Thermodynamic derivation of law of mass action, Le Chatelier's principle-statement and applications. Van't Hoff's reaction isotherm and reaction isochore (Van't Hoff equation).Illustartive problems to be worked out.

Self study: Reversible reaction, chemical equilibrium and equilibrium constant, dynamic equilibrium, characteristics of chemical equilibrium

2.Phase Equilibrium: 6 Hours

Phase rule-Statement (mathematical expression) and meaning of the terms. Explanation for the terms phase, component and degrees of freedom-suitable examples for each term. Derivation of phase rule from thermodynamic consideration. Phase equilibria of one component system (water and sulphur systems)-phase diagram and explanation. Two component system- classification with examples, simple eutectic system (lead- silver

system)-phase diagram and explanation, desilverisation of lead (Pattinson's Process). Solid solutions- compound formation with congruent melting point (Mg-Zn system) -phase diagram and explanation. Compound formation with incongruent melting point (NaCl-water system)-phase diagram and explanation. Freezing mixtures (acetone-dry ice). Solid solution formation. Fractional crystallization.

Self study: Phase diagram of Potassium Iodide- Water system

3.Surface chemistry: **2 Hours**

Adsorption of gases on solids: Frandlich and Langmuir adsorption isotherm. Multilayer adsorption-BET equation. Determination of surface area and area of cross section of a molecule. Adsorptiom from solution- Gibb's Adsorption isotherm.

Self study: Adsorption, Absorption, Types of adsorption

UNIT-III

1.Solutions, dilute solutions and colligative properties : **6 Hours**

Ideal and non-ideal solutions, Methods of expressing concentrations-Activity and Activity coefficients. Colligative properties: Raoult's law of relative lowering of vapour pressure. Osmosis and laws of Osmotic pressure. Elevation of boiling point and depression of freezing point. Thermodynamic derivation of the relation between elevation of boiling point/depression of freezing point and molecular mass of solute (Illustrative problems to be worked out).

Self Study: Abnormal molar mass, degree of dissociation and association of solutes.

2.Physical properties and molecular structure : **4 Hours**

Optical activity, polarization (Clausius-Mosotti equation), orientation of dipoles in an electric field, dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties-paramagnetism and ferromagnetism.

Self Study: Polar and non polar molecules –definition and examples

3. Refractometry: **2 Hours**

Introduction, Abbe's Refractometer, applications of Refractometry

Self study: Refractive index

UNIT IV

1.Reactive methylene compounds: **3 Hours**

Keto-enol tautomerism in ethylacetoacetate , diethyl malonate and acetylacetone. Reactions supporting keto and enol forms. Synthetic applications of reactive methylene compounds- Synthesis of alkyl and dialkyl acetic acids, succinic acid, keto acids, α, β- unsaturated acids(crotonic acid), 4- Methyl uracil and antipyrine.

Self study: Reactive methylene compounds-definition and examples. Tautomerism

2. Nucleophilic substitution at saturated carbon: **3 Hours**

Mechanism of nucleophilic substitutions : S_N1 and S_N2 reactions with energy profile diagrams. Stereochemistry and factors affecting S_N1 and S_N2 reactions.

3. Elimination reactions: **2Hours**

El and E2 mechanisms, evidences, orientation and stereochemistry. Hofmann and Saytzeff rules.

4. Aromatic electrophilic and nucleophilic substitutions: **4 Hours**

Aromatic electrophilic substitution-general pattern of the mechanism with energy profile diagram. Role of σ and π complexes. Activating and de-activating substituents, Orienting influence, ortho/ para ratio. Nucleophilic aromatic substitution reactions- Bimolecular displacement mechanism and Elimination-addition mechanism (Benzyne mechanism).Vilsmeier-Haack reaction,Sommelet rearrangement. Stevens rearrangement.

Self study: Mechanism of nitration, halogenation, sulphonation and Friedel – Crafts reaction

CHP 282: Chemistry Practical IV

3 Hrs/ Week (12x3 Hrs) and Credit 1

Determination or study of the following:

1. The specific reaction rate for the acid catalysed hydrolysis of methyl acetate at room temperature using 0.5N HC1 or 0.5N H_2SO_4.
2. Effect of acid strength on the hydrolysis of an ester.'
3. Comparison of the catalytic strengths of HCI and H_2S0_4 by studying the kinetics of hydrolysis of methyl acetate.
4. The rate of decomposition of iodide by H_2O_2
5. The distribution of iodine between water and CCl_4.

6. The distribution of benzoic acid between benzene and water.
7. Preparation of arsenious sulphide sol and comparison of the precipitating power of mono-, bi- and trivalent anions.
8. Density and viscosity of the given liquid (using specific gravity bottle and viscometer).
9. The percentage composition of a given mixture of glycerol and water by viscometry.
10. The density and surface tension of a liquid.
11. Composition of binary liquid mixture (Alcohol & toluene) by Refractometry,
12. Cystallization and decolorisauon of impure naphthalene(100g of naphthalene mixed with 0.3g of Congo Rec using ig decolourising carbon from ethanol).
13. Critical Solution Temperature of phenol - water system.
14. The percentage ofNaCl present in water - phenol system.
15. The molecular weight of a non-volatile solute by Walker - Lumsden method.

Reference books

Basic Reading List

1. J. D. Lee, (1996) Concise Inorganic Chemistry, 5th ed., Blackwell Science, London
2. F. A. Cotton, G. Wilkinson and P. L. Guas, (1994) Basic Inorganic Chemistry, 3rd ed, John Wiley
3. B. Douglas, D. McDaniel and J. Alexander, (1994) Concepts and Models of Inorganic Chemistry, 3rd ed., John Wiley
4. B. R. Puri, L. R. Sharma, K. C. Kalia, (1996) Principles of Inorganic Chemistry, Shoban LalNagin Chand and Co.
5. W.U. Malik, G.D. Tuli and R.D. Madan, (2003)Selected Topics in Inorganic Chemistry, S. Chand Publication
6. I. L Finar, (1973) Organic Chemistry ,Volume I and II ,Pearson Education
7. P.L.Soni , (2012) Text Book of Organic Chemistry , 29th ed., Sultan Chand & Sons
8. Peter Sykes, (2003) A Guide Book to Mechanisms in Organic Chemistry ,6th ed., Pearson Education
9. O.P. Agarwal, Reactions and Reagent , Goel Publishing House
10. Gurdeep Chatwal, (2016) Organic Reaction Mechanisms, 5th ed., Himalaya Publishing House

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12. B.R. Puri, Sharma and Patiana, (1998) Principles of Physical Chemistry, 37th ed., Shobanlal Nagin
13. Dash.U.N, Dharmarha.O.P, Soni.P.L, (2014) A Text Book of Physical Chemistry ,Sultan Chand & Co. Sultan Chand & Sons
14. Glasstone and Lewis , (1961) Elements of Physical Chemistry,Macmillan
15. S.Glasstone, (1969) Text book of Physical Chemistry ,2nd ed.,Macmillan Ltd
16. C.N.R. Rao , (1973) Universal General Chemistry, Macmillan
17. A.I.Vogel (2001) Practical Organic Chemistry,Longman-ELBS,England
18. G.H.Jeffrey, J.Bassetti, J.Mendham and R.C.Denny (1999) Vogel's Text Book of Quantitative and Qualitative Analysis, 5th ed.,Longman,London

Additional Reading List

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, (1993) Inorganic Chemistry,4th ed., Harper Collins,New York
2. D. F. Shriver and P. W. Atkins, (1999) Inorganic Chemistry, 3rd ed., W. H.Freeman and Co, London
3. T. Moeller,(1990) Inorganic Chemistry: A Modern Introduction, Wiley,New York
4. Cotton and Wilkinson , (1988) Advanced Inorganic Chemistry ,V Edition , Wiley and Sons
5. R.T.Morrison & R.N.Boyd, (2003) Organic Chemistry, 6th Edition, Pearson Education Pvt Ltd., Singapore
6. Bahl and Arun Bahl, (2014) Advanced Organic Chemistry , S. Chand & Company Ltd
7. Jerry March, (2007) Advanced Organic Chemistry, 6th ed., Willey, Newyork, Bruice, (2012) Organic Chemistry , 7thed.,Pearson Education.
8. Negi and Anand , (1985) Physical Chemistry , Eastern Wiley Pvt.Ltd
9. Kundu and Jain , (1984)Physical Chemistry , S. Chand & Co.
10. K.L Kapoor, (2004) A *Text Book of Physical Chemistry*, Volume-5, 3rd ed., *Macmillan*
11. Maron and Lando , (1974) Fundamentals of Physical Chemistry , Colier -Macmillan

12. G.W. Castellan, (2004) Physical Chemistry , 3rd ed.,Narosa publishing house
13. Walter J. Moore, (1998) Physical Chemistry , 5th ed., Orient Longman Publishing Group
14. Gashal , (2013) Numerical Problems on Physical Chemistry, 6th Revised ed., Books and Allied (P) Ltd

V SEMESTER
CHC 331: CHEMISTRY PAPER V
Total No of lecture hours : 3Hrs / Week (40 Hrs) and Credits 2

Learning Objectives:

LO1: To study applications of complexes and complex formation in metallurgy,qualitative and gravimetric analysis

LO2: To provide the knowledge about magnetic properties, electronic spectra, thermodynamic and kinetic aspects of metal complexes

LO3: To understand the types conductances of electrolytes and their measurements

LO4: To understand the kinetics of electron transfer reactions and thermodynamics of electrochemical cells at the electrode electrolyte interface

LO5: To learn the basic principles and applications of rotational and vibrational spectroscopy in structural analysis

LO6: To provide the basic knowledge of stereochemistry of organic compounds and importance of vitamins and harmones

Course Outcomes:

CO1: Understand the basic principles of rotational spectroscopy and its applications.

CO2: Apply spectral data in the determination of structure of organic compounds

CO3: Describe the determination of emf of different types electrochemical cells and its applications

CO4: Provide the knowledge of magnetic properties, electronic spectra, thermodynamic and kinetic aspects of metal complexes

CO5: Describe the fundamentals of stereochemical aspects of organic compounds

CO6: Apply and practice skills of gravimetric estimations

UNIT I

1.Application of metal complexes and complexation: 3 Hours

Applications of complexes and complex formation in metallurgy - Ag, Au, Al, Ni extractions. Volumetric analysis - Complexiometry, masking, demasking, external indicator.

Qualitative analysis - tests for ferrous and ferric ions, separation of copper from cadmium.

Gravimetric analysis - precipitation of nickel, magnesium and aluminium ions.

Self study: Role of metal complexes in biological systems.

2.Thermodynamic and Kinetic Aspects of Metal Complexes: 3 Hours

Thermodynamic stability of metal complexes(brief outline), stepwise formation of complexes, stepwise formation and overall formation constants. Relation between K andβ, $\Delta G = - 2.303\ RT \log \beta$. Factors affecting the stability - chelate effect, account for high ΔS values. Labile and inert nature of complexes. Substitution reactions of square planar complexes - Pt(II) complexes, synthesis of cis and trans $[Pt(NH_3)2]Cl2$ complexes, trans effect.

3.Magnetic Properties of Transition Metal Complexes: 4 Hours

Origin of magnetism, magnetic induction, magnetic flux density, magnetic moment per unit volume, χ_M, χ_{Mcor},Types of magnetic behaviour - dia, para and ferromagnetic properties-examples, cause (origin), magnetic susceptibility-data, sign, magnitude, temperature and field dependence.

Factors determining para-magnetisum, study of magnetic behaviour of first row transition elements. Methods of determining magnetic susceptibility- Gouy method, expressions for μ_{eff} and χ_{Mcor} (no derivation). Correlation of μ_s and μ_{eff} values, $\mu_{eff} = \mu_s\ (1 - \alpha\ .\ \lambda/D)$. Orbital-contribution to magnetic moments, L-S coupling - Russell- Saunder coupling, quenching of orbital angular moment. Application of magnetic moment data tor 3d-metal complexes - predicting geometry of complexes.

Self study: Calculation of magnetic moment of 3d series by using spin only formula

UNIT II

Electrochemistry: 10 Hours

Transport number-Defmition, determination of transport number by Hittorfs method using attackable and unattackable electrodes and Moving Boundary method. Equivalent conductance and its determination. Strong and weak electrolytes, Debye- Huckel- Onsager equation for strong electrolytes (no derivation). Applications of conductivity measurements: Determination of (a) Degree of dissociation, (b) Ka of weak acids (c) Solubility product of sparingly soluble salt. Conductometric titrations, calculations. Reference electrodes, Calomel,

Quinhydrone, Ag-AgCl and glass electrode(Construction, Electrode reaction, Nernst equation), E.M.F of cells and its measurements by potentiometric method, calculation of electrode potential, computation of cell EMF, relation between AG° and K for a celi reaction, calculations. Concentration cells: Electrolyte concentration cells with and without transport, liquid junction potential, calculations. Applications of concentration cells: Determination of a) valency of ions, b) solubility product and c) activity coefficient. Applications of E.M.F measurements: a) Potentiometric titrations (acid- base and redox), b) Determination of pH using hydrogen electrode, Quinhydrone electrode and Glass electrode by potentiometric methods. Decomposition potential, polarization and over voltage. Applications of hydrogen over voltage.

Self study: Electrode potential, cell reactions and representation of a cell, conductometric titration of weak acid –strong base ,weak acid – weak base, Construction and working of SHE and its limitations.

UNIT III

1.Rotational Spectroscopy: 4 Hours

Diatomic molecules (rigid Rotator), Derivation of expression for moment of inertia, energy levels of a rigid rotator, selection rules, intensity of spectral lines, Limitations of rotational spectra, applications of rotational spectra (determination of bond length), Qualitative description of non- rigid rotator, the effect of isotopic substitution(Illustrative problems to be worked out).

Self study: Electromagnatic radiations, characteristics of electromagnetic radiations, regions of electromagnetic spectrum

2.Vibrational Spectroscopy (Infrared spectroscopy) 6 Hours

Diatomic molecules as simple harmonic oscillators, energy levels of SHO, selection rules, pure vibrational spectrum, limitations of vibrational spectra. Applications of vibrational spectra (determination of Force constant). Qualitative relation of Force constant and Bond energies, Effect of anharmonic motion on the spectrum. Finger print region, characteristic absorption of various functional groups and interpretation of IR spectra of organic molecules

Self Study: Degrees of freedom of a molecule, calculation of degrees of freedom of linear and non-linear molecules taking H_2O and CO_2 as examples.

UNIT IV

1.Stereochemistry of Organic Compounds: 8 Hours

Configurational isomerism-optical, geometrical and conformational isomerism. Optical isomerism-elements of symmetry, molecular chirality, stereogenic centre-chiral and achiral molecules with two stereogenic centres-Eg., Lactic acid and Tartaric acid. Enantiomers-properties. Resolution of enantiomers. Diastereomers-definition and examples, threo and erythro diastereomers, meso compounds-definition and examples. Inversion (of sugars) and racemization. Relative and absolute configuration, sequence rules, D and L, R and S systems of nomenclature. Geometric isomerism: Determination of configuration of geometric isomers. E and Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism-conformational analysis of ethane and 1,2-dichloroethane. Conformations of cyclohexane-Newman projection. Differences between configuration and conformation.

Self study: Detailed study on specifying configuration of asymmetric molecules by R and S notations.E,Z system of nomenclature for geometrical isomers.Optical isomerism in compounds containing no asymmetric carbon atom.

2.Vitamins and Hormones: 2 Hours

Definition, classification with examples and their importance. Synthesis of vitamin A from β-ionone, vitamin C from D-glucose, Adrenaline form catechol and Thyroxine from p-nitroaniline.

Self study: Diseases caused by the deficiency of vitamins. Abnormalities by the deficiency of Hormones.

V SEMESTER

CHC 332: CHEMISTRY PAPER VI

Total No of lecture hours : 3Hrs / Week (40 Hrs) and Credits 2

Learning objectives:

LO1: To study the basic principle and applications of Raman spectroscopy

LO2: To learn the fundamentals quantum mechanics

LO3: To have an elementary idea of flame photometry and thermoanalytical methods

LO4: To learn the basic principle of electronic spectra of transition metal complexes

LO5: To learn the basic aspects of preparation and properties of heterocyclic and organometallic compounds

Course outcomes :

CO1: Understand the theories of Raman effect and vibrational Raman spectra

CO2: Explain quantum theory, quantum numbers and postulates of quantum mechanics

CO3: Describe principle, instrumentation and applications of flame photometry and thermoanalytical methods

CO4: Gain knowledge on electronic spectra of transition metal complexes

CO5: Explain basic aspects of preparation and properties of heterocyclic and organometallic compounds

CO6: Understand the importance of essential and trace elements in biological processes

UNIT I

1.Elementary Quantum Mechanics: 8 Hours

Quantum Theory of radiation (Black body radiation), Planck's radiation law, Heat capacities of solids, Photoelectric effect, Compton effect, de Broglie hypothesis, Heisenberg's uncertainity principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation (SWE) and its importance, Physical interpretation of wave function, Postulates of quantum Mechanics(statements only), Particle in one dimensional box, Setting up of SWE for H atom (no separation of variables or solution), Quantum numbers and their importance.

Self Study: Wave nature of light, Bohr's model of an atom and its limitations.

2.Raman spectroscopy : **2 Hours**

Classical and quantum theories of Raman effect.Concept of polarizability and ellipsoid. Rotations and vibrational Raman spectra, Selection rules.

Self study: Comparison of Raman and IR Spectroscopy.

UNIT II

1.Electronic Spectra of Transition Metal Complexes: **5 Hours**

Types of electronic transitions: d-d transition or crystal field transition, charge transfer from ligand to metal and metal to ligand, intra ligand transition. Selection rules for d-d transitions-spin selection rule, Laporte selection rule, relaxation of selection rule(vibronic coupling), forbidden transition. Spin multiplicity, Term symbols and Spectroscopic ground states. Spectroscopic ground states for d^1 to d^9 systems. Orgel diagram-explanation. Orgel diagram for d^1 and d^9 systems. Discussion of electronic spectra of $[Ti(H_2O)_6]^{3+}$ and $[Cu(H_2O)_6]^{2+}$

Self study: Orgel-energy level diagram for d^2 metal ions in octahedral environment

2. Flame Photometry: **2 Hours**

General principle, instrumentation , interferences and applications.

3. Thermoanalytical methods **3 Hours**

Principle, instrumentation and applications of Thermo gravimetric Analysis, Derivative Themogravimetry and Differential Thermal Analysis. Nature of TGA, DTG and DTA curves.

UNIT III

1.Bioinorganic chemistry: **3 Hours**

Essential and trace elements in biological processes - biochemical roles.

Metalloporphyrins with reference to haemoglobin and myoglobin-skeletal structure, functions, brief explanation for transportation of oxygen and carbon dioxide.

Self study: Biological role of metals like Fe^{2+}, Cu^{2+}, Zn^{2+} etc., Effect of excess intake of metals.

2.Organometaliic Chemistry: **7 Hours**

Definition, nomenclature and classification of organometaliic compounds – ionic organometaliic compounds containing metal-carbon sigma bonds, non-classicaiiy bonded

organometaliic compounds (multi centred bonds and interaction between π orbitals and delocalised electron clouds).

Preparation, properties, bonding and applications of alkyls and aryls of Li, Al and Hg, Mononuclear carbonyls and the nature of bonding in metal carbonyls (back bonding, synergic effect).Wilkinson catalyst-Hydrogenation of alkenes, Hydroformylation of alkanes by cobalt carbonyl.Wacker oxidation of alkenes to acetaldehyde and Fischer Tropsch synthesis.

Self study: Preparation, properties and applications of organo copper compounds.

UNIT IV

Heterocyclic Compounds: **10Hours**

Classification and nomenclature. Molecular orbital pictures and explanation for the aromatic characteristics of pyrrole, furan, thiophene, pyridine, pyrazole, oxazole and thiazole. Comparison of aromaticity of these compounds. General methods of synthesis (3 methods) and reactions of these compounds, mechanism of electrophilic substitution in furan and pyridine. Mechanism of nucleophilic substituition in pyridine. Comparison of basicity of pyridine, piperidine and pyrrole, condensed five or six membered heterocycles- explanation with examples. Preparation and reactions of indole, quinoline, isoquinoline with special reference to Fischer- Indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis, Mechanism of electrophilic substitution, reactions of indole, quinoline and isoquinoline.

Self study: Molecular orbital picture, aromatic characteristics, methods of synthesis and chemical reactionsof furan and thiophene

CHP 333 Chemistry Practical V

4Hrs/Week (12x4 Hrs) and Credits 2

1. Inorganic gravimetric Experiments:

a) Estimation of barium as barium sulphate in barium chloride solution.

b) Estimation of copper as cuprous thiocyanate in copper sulphate solution.

c) Estimation of Ni as nickel dimethyl glyoximate in nickel ammonium sulphate solution.

d) Estimation of iron as ferric oxide in ferrous ammonium sulphate solution.

e) Estimation of chloride/ silver as AgCl.

f) Estimation of magnesium as oxinate in magnesium sulphate solution.

2. Solvent Extraction: Separation and estimation of Mg(ll) and Fe(ll) ions.

3. Colorimetry: Verification of Beer-Lambert Law, Job's and Mole-ratio methods.

4. Adulteration: Determination of adulteration in food stuffs.

5. Effluent analysis: Analysis of effluent water.

6. Steam Distillation: Steam distillation of Naphthalene from its suspension in water/clove oil from cloves/Separation of o-and p-nitro phenols.

7. Resolution of racemic mixture of (+) mandelic acid.

8. Stereochemical Study of organic compounds via models

a) R and S configuration of optical isomers.

b) E and Z configuration of geometrical Isomers

c) Conformational analysis of cyclohexane and substituted cyclohexanes

Reference books

Basic Reading List

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

5. W.U. Malik, G.D. Tuli and R.D. Madan, (2003)Selected Topics in Inorganic Chemistry, S. Chand Publication
6. I. L Finar, (1973) Organic Chemistry ,Volume I and II ,Pearson Education
7. P.L.Soni , (2012) Text Book of Organic Chemistry , 29th ed., Sultan Chand & Sons
8. Peter Sykes, (2003) A Guide Book to Mechanisms in Organic Chemistry ,6th ed., Pearson Education
9. O.P. Agarwal, Reactions and Reagent , Goel Publishing House
10. Gurdeep Chatwal, (2016) Organic Reaction Mechanisms, 5th ed., Himalaya Publishing House
11. K.S.Tewari,N.K.Vishol,S.N.Mehrotra ,A Text Book of Organic Chemistry, Vikas Publishing House
12. B.R. Puri, Sharma and Patiana, (1998) Principles of Physical Chemistry, 37th ed., Shobanlal Nagin
13. Dash.U.N, Dharmarha.O.P, Soni.P.L, (2014) A Text Book of Physical Chemistry ,Sultan Chand & Co. Sultan Chand & Sons
14. Glasstone and Lewis , (1961) Elements of Physical Chemistry,Macmillan
15. S.Glasstone, (1969) Text book of Physical Chemistry ,2nd ed.,Macmillan Ltd
16. C.N.R. Rao , (1973) Universal General Chemistry, Macmillan
17. Colin N. Banwell & Elaine M.McCash, (2014.) Fundamentals of Molecular Spectroscopy:5th ed.,Tata McGraw Hill.
18. W. Kemp (1991) Organic Spectroscopy,3rd ed.,Pagrave Publishers,NewYork

Additional Reading List

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, (1993) Inorganic Chemistry,4th ed., Harper Collins,New York
2. D. F. Shriver and P. W. Atkins, (1999) Inorganic Chemistry, 3rd ed., W. H. Freeman and Co, London
3. T. Moeller,(1990) Inorganic Chemistry: A Modern Introduction, Wiley, New York
4. Cotton and Wilkinson , (1988) Advanced Inorganic Chemistry ,V Edition ,Wiley and Sons

5. R.T.Morrison & R.N.Boyd, (2003) Organic Chemistry, 6th Edition, Pearson Education Pvt Ltd., Singapore
6. Bahl and Arun Bahl, (2014) Advanced Organic Chemistry , S. Chand & Company Ltd
7. Jerry March, (2007) Advanced Organic Chemistry, 6th ed., Willey, Newyork,
8. Bruice, (2012) Organic Chemistry , 7thed.,Pearson Education.
9. Negi and Anand , (1985) Physical Chemistry , Eastern Wiley Pvt.Ltd
10. Kundu and Jain , (1984)Physical Chemistry , S. Chand & Co.
11. K.L Kapoor, (2004) A *Text Book of Physical Chemistry*, Volume-5, 3rd ed., *Macmillan*
12. Maron and Lando , (1974) Fundamentals of Physical Chemistry , Colier - Macmillan
13. G.W. Castellan, (2004) Physical Chemistry , 3rd ed.,Narosa publishing house
14. Walter J. Moore, (1998)Physical Chemistry , 5th ed., Orient Longman Publishing Group
15. Gashal , (2013) Numerical Problems on Physical Chemistry, 6th Revised ed., Books and Allied (P) Ltd
16. A.I.Vogel (2001) Practical Organic Chemistry,Longman-ELBS,England
17. B.P.Levitt (1973) Findlay's Practical Physical Chemistry, 9th ed.,Longman London

VI SEMESTER
CHC 381: CHEMISTRY PAPER VII
Total No of lecture hours : 3Hrs / Week (40 Hrs) and Credits 2

Learning Objectives:

LO1: To learn about the types of polymers , polymerization techniques and applications of polymers

LO2: To study the basic concepts of photochemistry

LO3: To understand the chemistry of radiation exposure and its measurement

LO4: To learn the mechanism of interconversion, chain lengthening and shortening of carbohydrates

LO5: To understand the structure and functions of amino acids,peptides and proteins

LO6: To study the structure and reactions carboxylic acids and their derivatives

Course Outcomes :

CO1: Describe the types of polymers , polymerization techniques and applications of organic and inorganic polymers

CO2: Understand the basic concepts of photochemistry and photochemical reactions

CO3: Understand the mechanism of radiochemical reactions and extent of radiolysis

CO4: Predict the mechanism of interconversion, ascending and descending of carbohydrates

CO5: Explain the biological importance and functions of amino acids, peptides and proteins,

CO6: Describe the structural aspects and chemical properties of carboxylic acids and their derivatives

CO7: Conduct independent experiments using modern instruments

UNIT I

1.Inorganic polymers: 4 Hours

Preparation, properties, structure and applications of Silicones, Flurocarbons and Phosphonitrilie halides. Production and structural features of borazine, boron nitride, sulphur nitride(SN)x and silican carbide.

Self study: General properties of inorganic polymers.

2.Composites: **2 Hours**

Introduction, role of matrix in composites, types of matrix, different matrix materials, reinforcement, classification of composites and applications of composites in industry.

3.Synthetic Polymers: **4 Hours**

Types of polymerization (i) radical polymerization (ii) cationic polymerization and (iii) anionic polymerization. Zeigler-Natta polymerization. Phenol formaldehyde resins-e.g. Bakelite, urea-formaldehyde resins, epoxy resins and polyurethanes-preparation and applications. Natural rubber-composition. Synthetic rubbers: Buna-S and SBR-preparation and applications, advantages of synthetic rubber over natural rubbers

Self study: Free radical vinyl polymerization. Bakelite. Natural and synthetic rubbers.

UNIT II

1.Photochemistry: **6 Hours**

Interaction of radiation with matter, difference between thermal and photochemical processes, primary and secondary processes of a photochemical reaction, laws of photochemistry- Grothus -Draper Law, Stark's - Einstein Law (only statement). Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non- radiactive processes (internal conversion and intersystem crossing), Quantum yield- definition, reasons for low and high yield, one example for low yield (combination of H_2 and Br_2) and one example for high yield (combination of H_2 and C_2), Photosensitised reactions: energy transfer proceses. definition of photosensitisation, (e.g: Photosynthesis in plants, dissociation of H_2, dissociation of ethylene, Isomerisation of 2-butene).

Self Study: Beer-Lambert law- statement and mathematical expression, Chemiluminiscence and bioluminescence

2.Radiation and Nuclear chemistry: **4 Hours**

Radiolysis of water, radiation dosimetry, dosimeter, applications in organic and inorganic reactions. Application of radioisotopes in the study of oganic reaction mechanism, medicine and soil fertility, industrial applications.

Self study: Ceric sulphate dosimeter construction

UNIT III

1.Carbohydrates: 6 Hours

Monosaccharides: interconversions of glucose and fructose, chain lengthening of aldoses (Kiliani-Fischer method), Chain shortening (Ruff degradation), Conversion of glucose into mannose-epimerisation, Mechanism of osazone formation-Amadori rearrangement, Formation of glycosides, ethers (methyl), esters (acetates). Configuration of glucose and fructose-deduction. Determination of ring size of monosaccharides (methylation and periodic acid method), Elucidation of cyclic structure of D(+) glucose. Mechanism of muta rotation.

Self study: Classification and nomenclature of carbohydrates**.** Examples(with structure) of oligo and polysaccharides

2.Amino acids, Proteins and peptides: 4 Hours

Classification based on functional group. Essential and non essential amino acids, structure and stereochemistry of amino acids- explanation. Acid-base behaviour, isoelectric point and electrophoresis- explanation. Preparation of α- amino acids from α- halogenated acids, Strecker synthesis and Gabriel synthesis. Reactions due to COOH and NH_2 groups, Action of heat, structure and nomenclature of di-, tri- and polypeptides, classification of proteins based on chemical composition and molecular shape. Peptide structure determination- end group analysis, selective hydrolysis of peptides, classical peptide synthesis, solid phase peptide synthesis, levels of protein structure- primary, secondary, tertiary and quaternary structures, Denaturation of proteins. **Self study:** Classification of amino acids and proteins.

UNIT IV

1.Structure and reactions of Carboxylic acids and their derivatives: 5 Hours

Structure of carboxylic acid and carboxylate ion, Effect of substituents on the acidity of aliphatic and aromatic carboxylic acids(ortho effect). Reactions of carboxylic acids, with mechanism-i) Homologation-Arndt-Eisten reaction ii) Degradation to alkyl halides-Hunsdiecker reaction iii) Conversion to primary amines-Curtius rearrangement iv) Conversion to haloacids-HVZ reaction. Derivatives of carboxylic acids- acid chlorides, amides esters, anhydrides-preparation and reactions. **Self study:** Synthesis of carboxylic acids from acid esters & amides. Preparation of carboxylic acid derivatives.

2.Alkaloids: **5 Hours**

Classification with examples-pyridine, piperidine, quinoline, isoquinoline and indole alkaloids. General properties-formation of salts and exhaustive methylation, physical properties and physiological activity. Structural elucidation of nicotine and Ephedrine including synthesis. Structural formulae of atropine, cocaine, hygrine and morphine.

Self study: Occurrence and classification of terpenoids and alkaloids. Physiological activties of individual alkaloids

VI SEMESTER
CHS 382: CHEMISTRY PAPER VIII
Total No of lecture hours : 3Hrs / Week (40 Hrs) and Credits 2

Learning Objectives:

LO1: To provide knowledge about theory and instrumentation of colorimetry and spectrophotometry

LO2: To impart knowledge about principle and applications of different spectroscopic techniques

LO3: To have an elementary idea of principles of green chemistry and its applications.

LO4: To have an elementary idea of isolation and structural ilucidation of terpenoids

LO5: To acquire knowledge about drugs,chemotherauptic agents and synthetic dyes

Course Outcomes :

CO1: Explain the theory and instrumentation of colorimetry and spectrophotometry

CO2: Describe the principle and applications of different spectroscopic techniques

CO3: Understand the principles of green chemistry and its applications

CO4: Understand the techniques of isolation and structural ilucidation of terpenoids

CO5: Understand the fundamentals of synthesis of drugs and synthetic dyes

UNIT I

1.Colorimetry and Spectrophotometry: 4 Hours

Introduction, theory of colorimetry and spectrophotometry. Beer-Lambert's law. Instrumentation and applications of colorimetry and spectrophotometry.

2. Ultraviolet absorption spectroscopy : 6 Hours

Absorption laws- Beer-Lambert law, Concept of molar absorptivity,energy level,types of electronic excitations,Frank-Condon principle(explanation about red shift and blue shift), presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated dienes, dienones and
β-unsaturated carbonyl compounds.

Self Study: Beer's law, Lambert law, Instrumentation of electronic spectrometer.

UNIT II

1. Nuclear Magnetic Resonance Spectroscopy: 8 Hours

Introduction, origin of spectra, instrumentation of PMR spectrometer, solvents used,scales, nuclear shielding and desheilding, number of signals obtained from the sample, position of signals and chemical shift and molecular structure, spin -spin splitting,spin notation and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2- tribromoethane and ethyl acetate.

Self study: Structural analysis of benzaldehyde, aniline, phenol and acetone based on PMR spectra

2. Photoelectron Spectroscopy: 2 Hours

Basic principles,valence and core binding energies,shifts in energies due to chemical forces,photoelectron spectra of simple molecules.

UNIT III

1.Mass Spectrometry: 4 Hours

Principle and instrumentation of mass spectrometer. Applications in the determination of molecular mass and isotopic abundance. Nitrogen rule,even electron rule, Meclafferty rearrangement.

Self study: Interpretation of mass spectra of simple organic compounds such as Anisole, Benzaldehyde, Ethyl Bromide, and Isopropyl phenyl ketone

2.Green Chemistry: 6 Hours

Need for Green chemistry – Goals of green chemistry – Limitations.

Twelve principles of green chemistry with their explanations and examples. Designing a green synthesis – Prevention of waste / byproducts – Atom economy. Minimization of hazardous / toxic products. Green synthesis – Microwave assisted reactions in water – Hoffmann Elimination – Microwave assisted reaction in organic solvent – Diels Alder reaction, Ultrasound assisted reaction – Esterification.

Self study: Prevention of chemical accidents by green synthesis. Ultrasound assisted reaction – Saponification

UNIT IV

1.Terpenes: **3 Hours**

Classification with examples, methods of isolation, Structural elucidation of citral and geraniol including synthesis. Structural formulae of menthol, α-pinene and camphor.

Self Study: Occurance and general properties of Terpenes.

2.Drugs and Chemotherapeutic agents: **3 Hours**

Synthesis and mode of action of antipyrine, sulphathiazole, sulphanilamide, benzocaine and aspirine.

Self Study: Classification of Drugs with examples.

3.Synthetic Dyes: **4 Hours**

Colour and constitution (electronic concept). Chemistry and synthesis of methyl orange, Congo red, malachite green, crystal violet, phenolphthalein, Fluorescein, Alizarin and Indigo.

Self study: Classificatiicion of dyes based on structure and method of application

CHP383:Chemistry Practical V I

4 Hrs/week (12x4 Hrs) and Credits 2

1.Organic Preparations

a) Preparation of acetanilide from aniline/Benzoylation of aniline.
b) Preparation of p-bromoacetanilide
c) Nitration of acetanilide to p-nitroacetanilide and hydrolysis to p-nitroaniline.
d) Preparation of iodoform from ethanol
e) Preparation of m-dinitrobenzene.
f) Preparation of adipic acid from cyclohexanol.
g) Preparation of benzoic acid from toluene.
h) Preparation of tribromoaniline from aniline.and conversion to tribromo benzene.

2.Green Synthesis:

3. Instrumental Methods:

a) To determine the strength of the given acid mixture (acetic acid+ hydrochloric acid) conductometrically using standard alkali solution.

b) To determine the dissociation constant of a weak acid by potentiometric method.

c) To determine equivalent conductance of sodium chloride by conductometric method.

d) To determine the ionization constant of a weak acid.

e) Potentiometric titration of ferrous ammonium sulphate using potassium dichromate as titrant and calculation of the redox potential of Fe^{+3} /Fe^{+2}system on the hydrogen scale.

f) To study the rate of inversion of cane sugar.

g) To determine the concentration of cupric ions present in a solution using a colorimeter.

4.Preparation of Inorganic Complexes

a) Preparation of sodium trisoxalatoferrate(lll), $Na_3[Fe(C_204)3$

b) Preparation of tetraammine copperfll) sulphate, $[Cu(NH_3)_4]S0_4$

c) Preparation of hexaamminecobalt(lll) chloride, $[Co(NH_3)_6]Cl_3$

Reference books

Basic Reading List

1. J. D. Lee, (1996) Concise Inorganic Chemistry, 5th ed., Blackwell Science, London
2. F. A. Cotton, G. Wilkinson and P. L. Guas, (1994) Basic Inorganic Chemistry, 3rd ed, John Wiley
3. B. Douglas, D. McDaniel and J. Alexander, (1994) Concepts and Models of Inorganic Chemistry, 3rd ed., John Wiley
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6. L Finar, (1973) Organic Chemistry ,Volume I and II ,Pearson Education
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14. Chemistry ,Sultan Chand & Co. Sultan Chand & Sons
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19. Gurdeep Chatwal, Chemistry of Natural Products, Himalaya Publishing House
20. B. K Sharma, (1983) Industrial Chemistry, Goel Publications
21. R. K Das, (1982) Industrial Chemistry, Kalyani Publications, New Delhi
22. H.J. Arnikar,(1987) Nuclear Chemistry,2nd ed., Wiley Eastern Co.
23. A.I.Vogel (2001) Practical Organic Chemistry,Longman-ELBS,England
24. B.P.Levitt (1973) Findlay's Practical Physical Chemistry, 9th ed.,Longman London
25. G.H.Jeffrey, J.Bassetti, J.Mendham and R.C.Denny (1999) Vogel's Text Book of Quantitative and Qualitative Analysis,5th ed.,Longman,London

Additional Reading List

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, (1993) Inorganic Chemistry,4th ed., Harper Collins,New York
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3. 3.T. Moeller,(1990) Inorganic Chemistry: A Modern Introduction, Wiley, New York
4. Cotton and Wilkinson , (1988) Advanced Inorganic Chemistry ,V Edition, Wiley & Sons
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8. Bruice, (2012) Organic Chemistry , 7thed.,Pearson Education.
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15. Walter J. Moore, (1998)Physical Chemistry, 5th ed., Orient Longman Publishing Group
14. Gashal , (2013) Numerical Problems on Physical Chemistry, 6th Revised ed., Books and Allied (P) Ltd

Question Paper Pattern (Theory)

Chemistry Paper - …..

Time: 03 hours **Max Marks: 80**

Part A

Three questions **(including one question from self study curriculum)** from each unit

Answer any **TEN** of the following 2x10 = 20

1

2

3

4

5

6

7

8

9

10

11

12

Part B

Three questions from each unit

Answer any **TEN** of the following 3x10 = 30

13

14

15

16

17

18

19

20

21

22

23

24

Part C

Two questions from each unit

Answer any **SIX** of the following 5x6 = 30

25

26

27

28

29

30

31

32

Practical Examination Pattern

B.Sc, Semester I to IV

Time: 3 hours **Max Marks: 50**

1. Internal assessment	10 marks
2. Records	10 marks
3. Practical Exam	30 marks

(Pattern of a paper, scheme of valuation – depends upon the expt. set for the candidate)

B.Sc, Semester V

Time: 4 hours **Max Marks: 100**

1. Internal assessment	20 marks
2. Records	10 marks
3. Practical Exam	70 marks

B.Sc, Semester VI

Time: 4 hours **Max Marks: 100**

1. Internal assessment	20 marks
2. Records	10 marks
3. Viva	10 marks
4. Practical Exam	60 marks

SKILL COMPONENTS INCORPORATED IN THE CURRICULUM

In addition to developing strong scientific and mathematical/numerical ability, the BOS identified the following transferable skill components incorporated in the curriculum.

- Chemical literature survey and information retrieval skills
- Communication and oral presentation skills
- Analytical skills of logical approach to solve problems
- Skills of monitoring and maintaining records and data
- Safe handling of chemical materials and laboratory safety skills
- Preparing standard solutions and reagents for laboratory use
- Skills with chemical instrumentation
- Project and time management
- Skills of analysing both organic and inorganic compounds to determine their physical and chemical properties
- Skills to Interpret structure of compounds using IR , NMR and mass spectral data
- Skills of separation, identification and purification of compounds by chromatographic techniques
- Techniques of predicting the mechanism of organic reactions

Elective Courses
I SEMESTER
CHCE133: FOOD CHEMISTRY AND BIOMOLECULES
Total No of lecture hours : 2Hrs / Week (24 Hrs) and Credits 1

Learning Objectives:

LO1: To know the basics of constituents of food stuffs

LO2: To understand the impotance of food chemistry and biomolecules like proteins carbohydrates etc

LO3: To provide knowledge about the chemistry of biomolecules

Cource Outcomes :

CO1: Understand the importace of food nutrition and able give the tips to family members regarding this

CO2: Awareness about sources of vitamins and the deficiency diseases caused

CO3: Gain knowledge about food chemistry and its importance

UNIT I

Food and Nutrition: **12 Hours**

Introduction, Terminology used in food chemistry, classification of food,pH of foods., functions. Food as source of energy and structural material. Components of food – Carbohydrates, Proteins, Oils and Fats. Micronutrients-Vitamins, minerals. Chemical substances used in food preparation - water, common salt, baking powder, vinegar. Digestion of food- dissolution in the mouth, digestion in stomach and small intestine, absorption of food. Digestion of carbohydrates, proteins, oils and fats -Explanation. Food Processing.drying, salting, canning, pickling, smoking, packing and refrigeration Food additives, emulsifying agents,Texuring agents, flavoring and coloring agents,antioxidants,sweeteners ,low caloric sweeteners, artificial sweeteners like glycamates,D-aminoacids, saccharin, aspartame, designer sweetners,sugaralcohols,corn sweeteners

Naturally occurring sweeteners: Stevioside, Monellin,curculin,Pentodin, Isovanillyll sweeteners. Soft drinks-Components. Effects on health.

Self Study: Minerals, starch ,Glycogen,Denaturation of proteins.

UNIT-II

Vitamins: 12 Hours

Introduction, classification, Fat soluble vitamins, sources of vitamins,vitamin D, Niacin, structure and synthesis. Water soluble vitamins, pantothenic acid, cyanocobalamin,synthesis , structure and deficiency disease's.

Photosynthesis of carbohydrate, mechanism of light phase reaction,.

Proteines : Oxytocin and vasopressin ,chemical synthesis and biological activity.

Antibiotics: Introduction, classification, synthesis of chloramphenicol

Lipids: Introduction, occurance,biologicalfunctions,chemical and physical properties, Derivedlipids, cholesterol and its biological functions .

Reference Books

1. Tom Coultate (2016), Food: The Chemistry of its components, Kindle Edition, Royal Society of Chemistry, London
2. Geoffrey Campbelt-Platt (2017), Food Science and Technology, Kindle Edition,Wiley Blackwell
3. John Emsley (2015),Chemistry at Home: Exploring the ingredients in everyday products,First Edition,Royal Society of Chemistry London.
4. Kripal Singh(2012), Chemistry in daily life, Third Edition, Eastern Academy Education, PHI Learning Pvt. Ltd, New Delhi.
5. ShardenduKislaya (2011), Chemistry in everyday life, Discovery Publishing House Pvt.Ltd.
6. H.K.Chopra and P.S.Panesar(2015),Food chemistry, Narosa Publishing House
7. GurudeepR.Charwal and M.Arora (2009), Organic Chemistry of Natural Products, (Vol-I and II) , Himalaya Publishing House.

II SEMESTER

CHCE183: CHEMISTRY OF CONSUMER PRODUCTS

Total No of lecture hours : 2Hrs / Week (24 Hrs) and Credits 1

Learning Objectives:

LO1: To provide the basic knowledge in consumer product Chemistry and modern trends in the industry.

LO2: To provide the practical training to the students in consumer product preparation

LO3: To get a good exposure to the basic concepts of chemistry to enable them to pursue careers related to chemistry.

Cource Outcomes :

CO1: Knowledge about raw materials required for the preparation of house hold products

CO2: Understand the functions of various ingradients used in the preparation of house hold products

CO3: Hands on experience promotes the scope for self employment opportunities

UNIT I

1.Soaps

Saponification of oils and fats. Manufacture of soaps. Formulation of toilet soaps.

Different ingredients used. Their functions. Medicated soaps. Herbal soaps. Mechanism of action of soap. Soft soaps. Shaving soaps and creams. ISI specifications. Testing procedures/limits.

2.Detergents

a. Anionic detergents: Manufacture of LAB (linear alkyl benzene). Sulphonation of LAB – preparation of acid slurry. Different ingredients in the formulation of detergent powders and soaps. Liquid detergents. Foam boosters. AOS (alpha olefin sulphonates. b. cationic detergents: examples. Manufacture and applications. c. Non-ionic detergents: examples. Manufacture of ethylene oxide condensater. d. Mechanism of action of detergents. Comparison of soaps and detergents. Biodegradation – environmental effects. ISI specifications / limits.

UNIT II

1.Shampoos

Manufacture of SLS and SLES. Ingredients. Functions. Different kinds of shampoos – anti-dandruff, anti-lice, herbal and baby shampoos. Hair dye. Manufacture ofconditioners. Coco betaines or coco diethanolamides – ISI specifications. Testingprocedures and limits.

2.Skin Preparations

Face and skin powders. Ingredients, functions. Different types. Snows and face creams.Chemical ingredients used. Anti perspirants. Sun screen preparations. UV absorbers. Skin bleaching agents. Depilatories. Turmeric and Neem preparations. Vitamin oil.Nail polishes: nail polish preparation, nail polish removers. Article removers. Lipsticks, roughes, eyebrow pencils. Ingredients and functions – hazards. ISI specifications.

Reference books

1. M.Gopala Rao (1998), Outlines of chemical technology, Affiliated East West press Kafarow (1985), Wasteless chemical processing, Mir publishers, Moscow, Russia. Sawyer.W (2000), Experimental cosmetics,Dover publishers, New york.
2. T.P. Coultate, Food – The Chemistry of its components, Royal Society of Chemistry London.
3. Shashi Chawla (2013), Engineering Chemistry, Darpat Rai and Co. (P) Ltd, New Delhi.
4. B.K. Sharma(2000), Industrial Chemistry, Reprinted, Goel publishing house.
5. CNR Rao (2000), Understanding Chemistry, Universities Press (India) Limited.

III SEMESTER

CHCE233: CORROSION AND GREEN TECHNIQUES

Total No of lecture hours : 2Hrs / Week (24 Hrs) and Credits 1

Learning Objectives:

LO1: To know the basics of Green Chemistry and its developments.

LO2: To study the fundamentals of corrosion and its prevention

LO3: To understand the importance of green chemistry techniques and corrosion prevention techniques

Cource Outcomes :

CO1: Aware of how chemical processes can be designed, developed and run in a sustainable way

CO2: Acquire theoretical and practical knowledge related to corrpsion

CO5: Knowledge about green techniques and new materials to suit the current industrial requirements

UNIT I

Corrosion : 12 Hours

Introduction,definition,Types of corrosion,Galvenic corrosion, Crevice corrosion, Pitting corrosion, Erosion corrosion, Stress corrosion, Corrosion rate,-definition, Factors affecting on corrosion rate

Metallic factor-Purity, Electrode Potential of metal, hydrogen over voltage, nature of corrosion product

Environmental factors-Temperature, pH of the medium, humidity, presence of impurities, electrical conductivity of the medium, velocity of the medium, concentration of the medium.

Prevention of corrosion: Material selection-Metals and alloys, metal purification, non-metallic, Alteration of environment-Changing media, inhibitors, Design-wall thickness,design rules, Coating-Metallic and other inorganic coatings, organic coating

UNIT-II

Green Chemistry: 12 Hours

Introduction, Principles, atom-economy, Prevention of waste, byproducts, hazardous products/chemicals, water as a solvent for organic reactions, ionic liquids, solidstate-solventless reactions, use of microwaves, careful use of protecting and deprotecting agents, use of catalytic reagents, Phase transfer catalysts and its synthetic applications.

Examples of Green synthesis: Synthesis of adipic acid, catechol, disodium iminodiacetate, Boots synthesis of brufen, Microwave assisted reactions in water-Hofmann elimination, Methyl benzoate to benzoic acid, oxidation of toluene and alcohols

Microwave assisted reactions in organic solvents:-Diels-Alder reaction and decarboxylation reaction, Green synthesis of compostable and widely applicable polylactic acid, plastic from corn. Limitations of green techniques.

References Books

1. Anthony Fuscaldo and others (1980),Laboratory Safety, theory and Practice, 1st Edition, Elsevier Publications.
2. Board on Chemical Sciences and Technology , Division on Earth and Life Studies (2016), Chemical Laboratory Safety and Security: A Guide to Developing Standard Operating Procedures. National Academies Press.
3. Chemistry Laboratory Safety Manual, Inndian Institute of Science Education & Research, Tirupati
4. Laboratory Safety Manual, National Centre for Biological Science, 2016.
5. Puri,Sharma & Pathania (2018),Text book of Physical Chemistry,Vishal publishing Company.
6. Samuel Glasstone (1943), Introduction to ElectroChemistry, American Chemical Society, Washington.
7. Peter Atkins,Julio de Paula (2010), Text book of Physical Chemistry, 9th Edition, Oxford University press ,Oxford
8. B.S Bahl,Arun Bahl,G.D Tuli (2000), Essentials of Physical chemistry,S.Chand Publication
9. Gurudeep Raj (2009) Advanced Physical Chemistry, 35th Edition, Goel Publishing House.

IV SEMESTER
CHOE283: CHEMISTRY IN DAILY LIFE (OPEN ELECTIVE)
Total No of lecture hours : 2Hrs / Week (24 Hrs) and Credits 1

Learning Objectives:

LO1: To know the basic idea of chemicals used in our daily life and their importance

LO2: To know about the food, food preservatives, food flavours,adulteration and health hazards

LO3: To study the need for the search of renewable sources of energy.

Course Outcomes :

CO1: Understand the importance of chemistry of different household products

CO2: Awareness about food preservatives, flavours, colours and adulterants and health hazards

CO3: Understand the importance of alternative enegy sources

UNIT I

1.Food: 6 Hours

Food as source of energy and structural material. Components of food– Carbohydrates, Proteins, Oils and Fats. Micronutrients-Vitamins, minerals. Chemical substances used in food preparation - water, common salt, baking powder, vinegar. Digestion of food- dissolution in the mouth, digestion in stomach and small intestine, absorption of food.Digestion of carbohydrates, proteins,oils and fats -Explanation. Food Processing. Food additives, preservatives and flavours. Explanation with examples for the preservation of food by the use of inhibitors, drying, salting, canning, pickling, smoking, packing and refrigeration. Food safety. Soft drinks-Components. Effects on health.

2.Chemistry of our household requirements: 6 Hours

Cleansing agents: Chemical composition of Soaps, detergents, dish washers, drain cleaners, bleaching powder, Tooth paste and shampoo. Stain removers – Explanation with some common examples.

Domestic items:**S**afety matches, vax candles, shoe polish, mosquito coils, household germicides and pesticides-their chemical composition.

Cosmetics: Talcum powder, nail polish,thinners, skin care, hair care, Lipsticks, sun protection lotions and creams, eye shadow and eyebrow pencils, antiperspirants, perfumes and deodorants-explanation with examples.

UNIT II

Chemistry for our future: **12 Hours**

Alternative sources of energy: Need for the search of renewable sources of energy.

Solar Energy: Basic properties of solar energy. Applications of solar energy. Transformation of solar energy. Solar heat collectors. Solar photovoltaic collectors. Applications of solar collectors. Examples. Solar power plant.

Wind Energy: Basic properties of wind energy. Applications of wind energy. Transformation of wind energy. Wind turbines. Operative characteristics of wind turbines. Wind power plant. Utilization of wind power. Examples. Trends in wind energy utilization.

Hydro power: Basic properties water energy. Transformation of water energy. Hydro power plant. Utilisation of hydro power. Examples. Trends in hydro power utilization. 6hrs.

Hydrogen energy:Production and applications.

Food adulterations-Definition, common harmful effects, detection of adulteration, Prevention, Food adulteration act, artificial ripening of fruits, explanation with examples'. Transformation of biomass energy. Applications of biomass.

Ocean energy- Principles of ocean thermal energy, conversion system.Principles of wave and tidal energy conversion. **6 Hr**

Reference Books

1. Tom Coultate, Food: The Chemistry of its components, 6th Edition, The Royal Society of Chemistry
2. Geoffrey Campbelt-Platt (2009), Food Science and Technology, Wiley Blackwell Publishers John Emsley (2015), Chemistry at Home: Exploring the ingredients in everyday products,Royal Society of Chemistry
3. Kirpal Singh (2012), Chemistry in daily life, 3rd Edition, Eastern Academy Education, PHI Learning Pvt. Ltd, New Delhi

4. Shardendu Kislaya (2011), Chemistry in everyday life, Discovery Publishing House Pvt.Ltd
5. D.P.Kothari, K.C.Singal and Rakesh Ranjan, (2011), Renewable energy sources and emerging technologies, 2nd Edition, Eastern Academy Education, PHI Learning Pvt. Ltd, New Delhi.
6. H.P.Garg and J.Prakash(1997), Solar energy: fundamentals and applications, First revised Edition Mc Graw Hill publishing Company Limited.
7. D.O.Hall and R.P.Overend (1987), Biomass regenerable energy, Wiley-Blackwel Publishers.
8. Alois Peter Schaffarczyk (2014), Introduction to wind turbine aerodynamics, Springler Publishers
9. DetlefStolten(2010), Hydrogen and fuel cells:Fundamentals,technologies and applications,Wiley-Vest Publishers.
10. Ahluwalia V.K and Kidwai M.R (2005), New Trends in Green Chemistry,Anamalaya Publishers
11. Anastas.P.T and Warner J.K (1998), Green Chemistry-Theory and Practical,Oxford University Press
12. Matlack, A.S. (2001), Introduction to Green Chemistry, Marcel Dekker Publishers
13. Ryan.M.A.and Tinnesand.M. (2002), Introduction to Green Chemistry, American Chemical Society, Washington

Question Paper Pattern for Elective Cources

Paper Title:…….

Max. Marks: 40 **Time: 2hrs**

General instructions:

PART A

Four questions from each unit

Answer any 6 of the following questions (2x6 = 12 marks)

1.

2.

3.

4.

5.

6.

7.

8.

PART B

Four questions from each unit

Answer any 6 of the following questions (3x6= 18 marks)

9.

10.

11.

12.

13.

14.

15.

16.

PART C

Two questions from each unit

Answer any 2 of the following questions (5x2= 10 marks)

17.

18.

19.

20.

CERTIFICATE COURSES

SYLLABUS

1. CHEMISTRY IN DAILY LIFE

Objectives

- To know the basics of chemistry in our life
- To know about the food, nutrition and health hazards
- To give an elementary idea of drugs used for different diseases
- To give an elementary idea about Ayurvedic Medicines

UNIT-I

Chemistry in housing and household: (2 Hours)

Chemistry and house hold products, household cleaners, soaps and detergents, strain removers, tooth pastes. Preparations of house hold chemicals.

Cosmetics: (3 Hours)

General formulations and preparation of Talcum Powder, Tooth Pastes, Shampoos, Nail Polish, Perfumes, Skincare, Hair care, Antiperspirants, Mascara, Eye Shadow and Eyebrow Pencils, Sun protection lotions and creams. Possible hazards of cosmetics use.

Chemistry in consumer products (3 Hours): Diamonds and Gems, Jewellary and Ornaments, Metals and Metal-alloys, Electroplating, Wax, Candles, Shoe polish, Mosquito coils, Common salt.

Plastics: (2 Hours)

Definition of monomer and polymer. Types of polymers. Elementary idea of polymers like Polythene, PVC, Bakelite, Polyesters, Resins and their applications. Natural Rubber and Synthetic Rubber, Vulcanization.

UNIT-II

Food and Nutrition: (4 Hours)

Definitions, sources and physiological importance of Carbohydrates, Proteins, Fats, Minerals and Vitamins. Balanced diet.

Detection and Identification of Adulterants in Milk, Ghee, Oil, Curd, Sugar, Honey, Rice flour, Jaggery, Common salt, Coffee powder, Tea, Chili powder, Pulses and turmeric powder.

Practicals: Detection of Adulterants in food stuffs.

Chemicals used in food and its health hazards: (3 Hours)

Food additives, leavening agents, and sweeteners. Food preservatives -Methods of preservation-Low and High temperature, Dehydration. Chemicals in food production. Food safety methods.

Chemicals in food production: **(3 Hours)**

Manures and Fertilizers. Need and uses of nitrogenous fertilizers , phosphates fertilizers and potassium fertilizers. Hazards of user fertilizers. Pesticide - definition and examples.

UNIT III

Chemicals of life: (3 Hours)

Water-The Fundamental Substance of Life, Purification of water, Hormones, Lipids, Nucleic acids, Vitamins, Minerals, Carbohydrates and Proteins.

Chemistry and Our Environment: (4 Hours)

Air, Major Regions of the Atmosphere, Chemical Composition of the Atmosphere, Impact of chemical Pollutants in the Environment, Climate Change and global Warming. Motor Vehicles and Chemical Pollution, Photochemical Smog, Acid Rain, Atmospheric Hazards of ionizing Radiations, Chemistry and the Oceans, Earthquake and Tsunami. Nuclear Energy, Solar Energy, Water Energy, Wind Energy, Energy from Biomass and Garbage.

Environmental Pollution: (3 Hours)

Types of pollution-Air Pollution, Water Pollution, Noise Pollution, Soil Pollution, Marine Pollution, Thermal Pollution, Green Chemistry for Clean Technology.

UNIT IV

Chemistry in Medicine and Health Care : (6 Hours)

Definition – Important Aspects –History and development. Important terms used in chemistry of drugs. Classification of drugs- anti bacterials, anti fungals, analgesics, antibiotics, anesthetics, anti malarials, anti histamines, anti hypertensives, antipsychotics, anti virals, sedatives and hypnotics, anti neoplastic agents, cardiovascular drugs, anti inflammatory drugs and anti fertility drugs. Prescriptions–Reading and understanding of prescriptions. Calculation involved in dispensing. Dose and dosage of drugs. Applications of Chemistry in Health care: X-ray, CT scan, and MRI

Ayurvedic medicines: **(4 Hours)**

Introduction, philosophy, classification and identification of biological activity of plants, plant products, bhasmas- formulation, methods of formation and analysis of active ingredients.

Reference Books

1. Kirpal Singh,(2012) Chemistry in Daily Life, Third Edition, PHI Learning Private Limited, New Delhi.
2. Dr.S.S. Dara & Dr.D.D. Mishra,(2011) A Text book of Environmental Chemistry and Pollution Control, Fifth Edition, S. Chand & Company Limited, New Delhi.
3. Ashutoshkar (2010), Medicinal Chemistry, Fifth Edition, New Age International (P) Limited, Bengaluru.
4. G.R.Chatwal (2009), Biopharmaceutics and Pharmacokinetics, Himalaya Publishing House, Mumbai
5. M.M.Uppal (2001), Engineering Chemistry, Khanna Publishers, New Delhi
6. S.S.Dara (1993), A Text Book of Environmental Chemistry and Pollution Control, S Chand and Company Ltd. New Delhi.
7. Raghupathi Mukhopadhyay, Sriparna Datta, Rajib Kumar Das (2011) ,Text Book of Pharmaceutical Chemistry and Medicinal Chemistry, Books and Allied(P) Ltd., Kolkata

2. PHARMACEUTICAL CHEMISTRY

Objectives

- To explain basic principles of body chemistry
- To relate basic concepts of structures and functions of cells and histology
- To give an elementary idea of medicines in daily life
- To give primary idea of clinical chemistry
- To give an elementary idea of common diseases and their treatment

UNIT I

Anatomy and Physiology: (10 hours)

Introduction – mitochondria and microsomes.Elementary tissues of the body.Classification of joints and their disorders. Blood –Function and composition of blood, RBC,WBC, platelets , Mechanism of blood clotting ,Anemia, Blood groups and functions of lymph glands. Brief description and functioning of Digestive system, Respiratory system, cardiovascular system, Urinary system, Reproductive system, Nervous system, Eye, Ear

UNIT II

Medicines in daily life: (10 hours)

Introduction to drug- History and development .Types of medicines- Ayurvedic,Allopathic,Homeopathic. Important terms used in drugs- Chemotherapy, Chemotherapeutic agents, Pharmacokinetics, Pharmacodynamics, Absorption, Distribution, Elimination and Dissolution. Medicines used in daily life- anti bacterials, anti fungals, analgesics, antibiotics, anesthetics, anti malarials, anti histamines, anti hypertensives, antipsychotics, anti virals, sedatives and hypnotics, anticonvulsants , antihypertensive drugs, antineoplastics, cardiovascular drugs, anti inflammatory drugs and anti fertility drugs

Prescriptions –Reading and understanding of prescriptions. Calculation involved in dispensing. Dose and dosage of drugs, Different dosage forms of drugs. Over the counter medicines and Generic medicines.

UNIT III

Clinical chemistry: (10 hours)

Clinical significance and analysis. Detection and importance of blood glucose, cholesterol, triglycerides, hypertension, creatine and creatinine. Role and diagnostic tests of electrolytes. Clinical significance of enzymes, uric acid and urine analysis. Detection of anemia, sign and symptoms, diagnosis and testing. Importance and detection of liver function, kidney function and gastric function. Imaging-X-ray, ultrasound sonography, MRI, CT scan.

UNIT IV

Common diseases: (10 hours)

Introduction, elementary account of air borne and water borne diseases- symptoms and treatment. Diseases due to nutritional deficiency, organ disfunction, injuries, allergies, genetic defects, life style diseases like diabetes , piles, obesity , hypoglycemic cells and their treatment .Diseases of nervous system, AIDS, cancer, respiratory diseases and their treatment, Diseases due to metal and metal ions imbalance, Diseases associated with hypo and hyper secretion of harmones. Diseases caused by deficiency of vitamins and their treatment. Cardiovascular diseases.

Reference Books

1. Ashutosh Kar,(2010) Text Book of Medicinal Chemistry, Fifth Revised and Expanded Edition, New Age International Publishers, Bangalore
2. Chatwal,(2009) Biopharmaceutics and Pharmacokinetics, Second Revised and Enlarged Edition, Himalaya Publishing House, Bangalore
3. Raghupathi Mukhopadhyay, Sriparna Datta, Rajib Kumar Das,(2011) Text Book of Pharmaceutical Chemistry and Medicinal Chemistry, Books and Allied(P) Ltd., Kolkata
4. PrafulB.Godkar,(2006) Textbook of MedicalLaboratoryTechnology, Second Edition, Bhalani Pulication House, Mumbai
5. P.S Verma &V.K.Agarwal,(2016)Cell Biology,S.Chand and CompanyPvtLtd.,New Delhi
6. Aminul Islam,(2011) A Text Book of Cell Biology, Books and Allied (P)Ltd., Kolkata
7. S.Rastogi,(1996) Cell and Molecular Biology, New Age International Publishers,New Delhi
8. C.B.Powar ,(1981) Cell Biology,Himalaya Publishing House Girgaon
9. Dr.P.S Verma,Dr.V.K.Agarwal(1974) Cell Biology, Molecular Biology, Evolution and Ecology, S.Chand and Company Pvt Ltd.,New Delhi