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

(CREDIT BASED SEMESTER SCHEME)

2017 – 2018 onwards

Reviewed and modified on 04-09-2017

Approved by the : BOS meeting held on 04-09-2017

Academic Council meeting held on 14-10-2017

CHEMISTRYAS A DISCIPLINE

Preamble:

The Chemistry Syllabus for B.Sc. Degree covers three academic years consisting of six semesters and this curriculum is prepared to give sound knowledge and understanding of chemistry to undergraduate students. 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 , the new syllabi Pre-University class, U.G.C. model curriculum and the syllabi of other Universities and National level institutes.

The syllabus is prepared 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.

Course Objectives

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

Learning 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

PAPER DESCRIPTION

Sl.No	Semester	Paper	Title
1	I	CH 101	Chemistry Paper I
2	I	CH 102	Chemistry Practical I
3	II	CH 151	Chemistry Paper II
4	II	CH 152	Chemistry Practical II
5	III	CH 201	Chemistry Paper III
6	III	CH 202	Chemistry Practical III
7	IV	CH 251	Chemistry Paper IV
8	1V	CH 252	Chemistry Practical IV
9	V	CH 301	Chemistry Paper V
10	V	CH 302	Chemistry Paper VI
11	V	CH 303	Chemistry Practical V
12	VI	CH 351	Chemistry Paper VII
13	VI	CH 352	Chemistry Paper VIII
14	VI	CH 353	Chemistry Practical VI

SCHEME OF EXAMINATION

Sl.No	Semester	Paper	Credits	Marks		
				IA	Sem End	Total
1	I	CH 101	2	20	80	100
2	I	CH 102	1	10	40	50
3	II	CH 151	2	20	80	100
4	II	CH 152	1	10	40	50
5	III	CH 201	2	20	80	100
6	III	CH 202	1	10	40	50
7	IV	CH 251	2	20	80	100
8	1V	CH 252	1	10	40	50
9	V	CH 301	2	20	80	100
10	V	CH 302	2	20	80	100
11	V	CH 303	2	20	80	100
12	VI	CH 351	2	20	80	100
13	VI	CH 352	2	20	80	100
14	VI	CH 353	2	20	80	100
	Total		**24**	**240**	**960**	**1200**

I SEMESTER - Paper I

CH 101: Chemistry Paper I

Teaching Hours : 3hrs per week

Learning Objectives:

- To learn the basic analytical methods and chromatographic techniques
- To understand the different kinds of chemical bonds in molecules
- To introduce and give an insight into the structure and properties of solids.
- To understand the principles of kinetics and and factors affecting the rate of reaction
- To have a basic understanding about the structure and bonding in organic compounds and fundamentals of reaction mechanism

Unit – I

Methods of Analysis **3hrs**

Qualitative, Quantitative – Volumetric, Gravimetric and Instrumental Analysis. Errors in Quantitative Analysis, Classification and minimization, Accuracy, Precision, Significant figure and rules for computation.

Self study: Problems on errors and significant figures, Q-Test, F-Test

Chromatography **3hrs**

Chromatographic methods for separation, concentration and characterisation of organic compounds – Column chromatography, TLC. R_f values, impotance of R_f values.

Self study: Paper, Gas Chromatography(basic idea only)

Chemical Bonding **6hrs**

Limitations of valence bond theory. Valence shell electron pair repulsion (VSEPR) theory explanation using H_2S and ClF_3. Elementary account of Molecular orbital Theory. LCAO – Bonding and anti-bonding molecular orbitals.Conditions for the combination – Energy level diagrams of molecular orbitals – Filling up of electrons in molecular orbitals. Molecular orbital configuration and bond order of species like He_2, F_2, CO and NO. Comparison of valence bond and molecular orbital theories. Lattice energy and Born – Haber cycle, Solvation energy, solubility of ionic solids, polarizing power and Polarisability of ions, Fajan's rule. Metallic bond – free electron and band theories.

Self study: Valence Bond Theory (Pauling's), directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Molecular orbital configuration and bond order of species like H_2, N_2 and O_2.

Unit – II

Solid state **4hrs**

Laws of crystallography - Law of Constancy of interfacial angles, Law of rational indices, Law of symmetry. Symmetry elements in crystals.X-ray diffraction by crystals.Bragg's equation- derivation, determination of crystal structure of NaCl by Bragg's method, determination of Avogadro number.

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

Chemical kinetics **5hrs**

Derivation of rate constant for second and n^{th} order reactions with equal concentrations.Determination of order by differential, integration, half-life period and isolation methods.Simple collision theory, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Self Study: Differential rate laws of simple chemical reactions-zero, first, second, nth and pseudo order, half life of a reaction.

Catalysis **3hrs**

General characteristics of catalytic reactions, acid-base catalysis, enzyme catalysis explanation with example. Michalis-Menten equation and its significance

Self Study: Adsorption. Types of adsorption.

Unit – III

Structure and Bonding **5hrs**

Modern concept of bonding.Ionic and covalent bond. Hybridization and shapes of simple molecules –methane, ethane, ethylene, acetylene. Bond length ,bond angles and bond energy.Localized and delocalized chemical bond. Polarity of bonds – Inductive effect, electromeric effect, hyperconjugation, resonance, aromaticity, Huckel rule, aromatic ions and steric effect .

Self study: Electron displacement effect applications. Vander walls interactions.Hydrogen bonding-types of hydrogen bonding

Mechanism of Organic Reactions **7hrs**

Curved arrow notation, drawing electron movements with arrows, half- headed and double-headed arrows, homolytic and heterolytic bond breaking.Types of reagents - electrophiles and nucleophiles.Types of organic reactions and reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes. Study of the mechanism of following reactions to illustrate the above examples . Friedel Crafts reaction, Addition of HBr to propene, Cannizzaro reaction, Hoffmann rearrangement and Reimer – Tiemann reaction.

Self study: Comparison of stability of reaction intermediates. Mechanism addition of HCN and $NaHSO_3$ to carbonyl compounds.

I SEMESTER - Paper I

CH 102: Chemistry Practical I

Teaching Hours : 3Hrs per week

I. Laboratory safety, first aid and laboratory maintenance

II. Organic Chemistry Practicals

(a)Identification of organic compound through functional group analysis, determination of melting point, boiling point and preparation of suitable derivatives

(Note: Compounds may be mentioned)

(b) Microscale experiment - Capillary reaction

III. Thin layer chromatography

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-dinitrophenyl hydrazones 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)

IV. Paper Chromatography: Ascending and circular

Determination of R_f values and identification of organic compounds,

(a)Separation of a mixture of phenyl alanine 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 – Ninhydrin

(c)Separation of monosaccharide – a mixture of D-galactose and D- fructose using n-butanol : acetone : water(4:5:1), spray reagent – aniline hydrogen phthalate

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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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. M R Wright, (1999) Fundamentals of Chemical Kinetics,1st ed.,Hardwood Publishing
19. A.I.Vogel (2001) Practical Organic Chemistry,Longman-ELBS,England
20. 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,
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. Mukherji,Singh and Kapoor, (1994)Organic chemistry, Vol.-1,2 & 3 Wiley Estern
17. B K Sharma,Instrumental Methods of Chemical analysis,Goel Publishing House.1

II SEMESTER - Paper II

CH 151: Chemistry Paper II

Teaching Hours : 3Hrs per week

Learning Objectives:

- To know the types as well as chemical and physical properties of solvents
- To understand the general characteristics and properties of s and p block elements.
- To understand molecular velocities and concept of liquefaction of gases
- To understand the structure and properties of liquids and liquid crystals
- To understand the preparation ,properties and important reactions of alkenes ,dienes alkynes and simple aromatic hydrocarbons

Unit-I

Solvents **2 hrs**

Physical properties of Solvents and their characteristics, solvating properties, acid – base, redox, complex formation and precipitation, reactions in aqueous and non – aqueous solvents with reference to liquid NH_3.

Self study: Classification of Solvents. Aqueous and non aqueous solvents

s – block elements **4hrs**

Comparative study, diagonal relationships, salient features of hydrids and solvation. Complexation tendencies of alkali metals with crown ethers

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

p–block elements **6hrs**

Comparative study including Diagonal relationship of groups 13-18 elements, important compounds like hydrides, oxides, oxyacids and halides of groups 13-16, hydrids of boron – diborane (structure and bonding), structure and bonding in silicates, chemistry of xenon, structure and bonding in xenon comp

Self study: General characteristics of p-block elements. Interhalogens and polyhalides

Unit II

Gaseous state **6hrs**

Critical phenomena: liquefaction of gases – PV isotherms of real gases, continuity of states, the isotherms of vanderwaal equation (explanation in the forms of PV- isotherm of CO_2), relation between critical constants and Vanderwaal's constants, the law of corresponding states, reduced equation of state.

Molecular velocities, Qualitative discussion of the Maxwell distribution of molecular velocity, RMS, average and most probable velocities, collision number, mean free path, Collision diameter

Self study: Molecular velocities, RMS, average and most probable velocities and related problems

Liquid state **4hrs**

Structure (qualitative description) and properties of liquids-viscosity, surface tension and parachor (principles & determination).Structural differences between solids, liquids and gases.

Self study: Liquid crystals, d ifferences between liquid crystal, solid & liquid, classification of liquid crystals, examples. Structure of nematic & cholesteric phases

Physical properties and Molecular structure **2hrs**

Polarization of molecules in an electric field, Clausius–Mosotti equation,orientation of polar molecules in an electric field, Debye- equation, Dipole moment and molecular structure.

Self Study: Problems on dipole moment, structure of some compounds

Unit – III

Alkenes, Dienes and Alkynes **7hrs**

Alkenes:Mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides.Regioselectivity in alcohol dehydration. Saytzeff rule, Hoffmann's elimination. Chemical reactions of alkenes: hydroboration-oxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes.

Dienes: Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and 1,3-butadiene, methods of formation, polymerization, reaction , 1,2 and 1,4 addition of bromine, Diels- Alder reaction.

Alkynes: Acidity of alkynes, ozonolysis, controlled hydrogenation, mechanism of electrophlic addition of bromine and HBr. Nucleophilic addition of methanol and ammonia to propyne. Polymerization.

Self study: Industrial applications of ethene,propene and acetylene.
Hydroboration-oxidation of alkynes

Aromatic Hydrocarbons **5hrs**

Aromatic electrophilic substitution – general pattern of the mechanism, role of sigma and pi- complexes . Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio.Side chain reactions of benzene derivatives. Birch reduction

Aromatic nucleophilic substitution : Addition - elimination and Elimination - addition reactions and their mechanisms.

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

II SEMESTER - Paper II

CH 152: Chemistry Practical II

Teaching Hours : 3Hrs per week

Volumetric Analysis

1. Preparation of standard solution and calibration of pipette
2. Preparation of standard sodium carbonate solution, standardization of HCl and estimation of NaOH in solution.
3. Preparation of standard solution of potassium bipthalate, standardization of NaOH solution and estimation of HCl in solution.
4. Preparation of a 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 a 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 ferrous and ferric by dichromate method.
10. Estimation of hardness of water by EDTA method.
11. Estimation of manganese in pyrolusite by volumetric method.
12. Estimation of glucose using iodine and sodium thiosulphate.
13. Estimation of Vitamin C.
14. Microscale experiment - Two burette titration and Beral pipette titration.

Reference books

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III SEMESTER - Paper III

CH 201: Chemistry Paper III

Teaching Hours : 3hrs per week

Learning Objectives:

- To understand the general characteristics and properties of d block elements
- To know the characteristics, properties and occurance of lanthanides and actinides in nature and their uses
- To understand the role of metal ions in biological systems.
- To understand the concepts of thermodynamics and its applications to physical and chemical systems.
- To learn the chemistry of alcohols, phenols, ethers and epoxides.
- To understand and study the mechanism of reactions of aldehydes and ketones

Unit I

Chemistry of d-block elements **3hrs**

Comparative treatment of 4d and 5d block elements with their 3d- analogues in respect to ionic radii, oxidation states, magnetic behaviour, stereochemistry.

Self study: Catalytic properties and complexing abilities of d-block elements Colours of their compounds

Chemistry of f-block elements **6hrs**

Lanthanides: Electronic structure, oxidation states and ionic radii and lanthanide contraction and its consequences, complex formation, colour and magnetic properties, occurrence and isolation, lanthanide compounds.

Actinides: General features, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides, comparison with lanthanides.

Self study: Electronic configuration of lanthanides and actinides and their position in the periodic table.

Bioinorganic chemistry **3hrs**

Essential and trace elements in biological processes.Metalloporphyrins with reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals -Na^+, K^+, Ca^{2+}, Mg^{2+}

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

Unit II

Thermodynamics **12hrs**

Joules law, Joule- Thomson coefficient and inversion temperature. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of

enthalpy.Kirchoff'sequation.II Law of thermodynamics: need for the law, different statements of the law. Carnot cycle and derivation of its efficiency. Carnot theorem.Thermodynamic scale of temperature.Concept of entropy.Entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change.Clausius inequality, entropy as a criteria of spontaneity and equilibrium, entropy change in ideal gases and mixing of gases.

III Law of thermodynamics: Gibbs and Helmholtz functions Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G with P and T,Variation of G with T(isobaric process),Variation of G with P(isothermal process),Variation of H with T and V, Variation of H with V (isothermal process , Variation of H with T(isobaric process)

Self study: Heat capacity, heat capacities at constant volume and pressure and their relationship.

Unit – III

Alcohols and Phenols **6hrs**

Alcohols: Dihydric alcohols – Nomenclature, methods of preparation, chemical reactions of vicinal glycols, oxidative cleavage with Pb $(OAC)_4$ and HIO_4. Pinacol – Pinacolone rearrangement.

Trihidric alcohols – Nomenclature and methods of formation.Chemical reactions of glycerol (Specify reactions).

Phenols: Mechanisms of Fries rearrangement, Claisen rearrangement, Gattermann synthesis, Lederer-Manasse reaction and Kolbe's reaction.

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

Ethers and Epoxides **3hrs**

Chemical reactions of ethers – cleavage and autoxidation, Ziesel's method.Synthesis of epoxides. Acid and base – catalyzed ring opening of epoxides, orientation of epoxide ring opening. Reaction of organolithium reagents with epoxides.

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

Aldehydes and Ketones **3hrs**

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel condensations.Condensation with ammonia and its derivatives.Wittig's reaction and Mannich reactions.Uses of acetals as protecting groups. Oxidation of aldehydes ,Clemmensen and Wolf-Kishner reductions .

Self study: Electrophilic substitution reactions in aromatic aldehydes and ketones

III SEMESTER - Paper III

CH 202: Chemistry Practicals III

Teaching Hours : 3hrs per week

Semi micro Qualitative Analysis of Salt Mixtures

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^+

Reference books

Basic Reading List

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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*
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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

IV SEMESTER - Paper IV

CH 251: Chemistry Paper IV

Teaching Hours : 3hrs per week

Learning Objectives:

- To understand the various concepts of acids, bases and indicators
- To understand the importance and basic concepts of nomenclature and isomerism of co-ordination compounds
- To know the relation between collegative properties and molecular weight of solutes
- To understand various liquid mixtures and their separation techniques
- To understand the chemistry of colloids and their applications in daily life
- To have an elementary idea of principles of green chemistry.
- To provide the basic knowledge of stereochemistry of organic compounds

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Unit – I

Acids and Bases **6hrs**

Lewis concepts of acids and bases,Solvent system, Lux-Flood theory of acids and bases. Hard and Soft Acids and Bases (HSAB):Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid – base strength and hardness and softness, electronegativity and hardness and softness. Applications of HSAB principle

Indicators

Ostwald's theory of indicators with respect to phenolphthalein and methyl orange

Self study: Arrhenius concept of acids and bases. Bronsted–Lowry concept of acids and bases. Conjugate acid - base pair. Auto catalysis.

Coordination Compounds **6hrs**

Werner's coordination theory & its experimental verification. Effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds. Valence bond theory of transition metal complexes.

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

Unit – II

Dilute solutions & Colligative properties **4hrs**

Activity & activity co-efficient. Colligative properties: Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight & elevation in boiling point and depression in freezing point.Experimental

methods for determining colligative properties.
Problems to be worked out
Self Study: Abnormal molar mass, degree of dissociation and association of solutes.

Binarymixtures **4hrs**

Liquid- liquid mixture: Partially miscible liquids – Phenol – water, trimethyl amine – water and nicotine- water systems. Lower and upper consolute temperature.Effect of impurity on consolute temperature of phenol-water system.
Completely miscible liquid mixtures ideal liquid mixtures, Raoult's law, Non- ideal liquid mixtures, boiling point composition curves and Vapour pressure composition curves of Type I, II and III mixtures, azeotropes – HCl-H_2O and ethanol – water systems. Completely immiscible liquid mixtures, principle of steam distillation.
Self Study: Nernst distribution law- definition and applications.

Colloidal State **4hrs**

Solids in liquids (sols): Properties- Kinetic, optical and electrical: Stability of colloids, protective action, Hardy – Schulze law, gold Number . Liquids in liquids (emulsions): Types of emulsions, preparation, Emulsifiers. liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.
Self Study: Micelle formation and cleansing action of soap

Unit – III

Green chemistry **5hrs**

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 – Hoffann 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

Stereochemistry of Organic Compounds **7hrs**

Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres: Example: Lactic acid and Tartaric acid. Diastereomers, threo and erythrodiasteromers, meso compounds, resolution of enantiomers,Walden inversion and racemization. Relative and absolute configuration, sequence rules, D& L, R & S systems of nomenclature.
Geometrical isomerism- determination of configuration of geometrical isomers.E & Z system of nomenclature, geometrical isomerism in oximes and alicyclic compounds.
Conformational isomerism – conformational analysis of 1,2 – dichloroethane.

Conformations of cyclohexane (Newman projection). Difference 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.

IV SEMESTER - Paper IV

CH 252: Chemistry Practical IV

Teaching Hours : 3hrs per week

Physical Chemistry: Determination or study of the following

1. The specific reaction rate of hydrogen ion catalysed hydrolysis of an ester at room temperature.
2. Effect of acid strength on the hydrolysis of an ester.
3. Comparison of the catalytic strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of an ester.
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 arsenioussulphide solution and comparison of the precipitating powers of mono-, bi- and trivalent anions.
8. The percentage composition of a given mixture of glycerol and water by viscometry.
9. Determination of the density and surface tension of a given liquid using specific gravity bottle and stalagmometer .
10. Determination of composition of a binary liquid mixture (Alcohol and toluene) by Refractometry.
11. Crystallization and decolorisation of impure naphthalene (100g of Naphthalene mixed with 0.3g of Congo red using 1g decolorizing Carbon from ethanol.
12. The percentage of NaCl present in water – phenol system.
13. The molecular weight of a non-volatile solute by Walker-Lumsden method.
14. Determination of density and viscosity of the given organic liquid using specific gravity bottle and viscometer.

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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11. K.S.Tewari,N.K.Vishol,S.N.Mehrotra ,A Text Book of Organic Chemistry , Vikas Publishing House
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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. F. A Kettle, (1973)Coordination Chemistry, ELBS
18. K. Burger, (1973) Coordination Chemistry, Butterworthy,
19. P,S Kalsi. (1993) Stereochemistry, conformations and mechanisms, Wiley Eastern
20. E.L.Eliel,(1994).Stereochemistry of Corbon Compounds,Tata McGraw Hill, New Delhi
21. V.K.Ahluwalia,Green Chemistry,Ane Books India
22. A.I.Vogel (2001) Practical Organic Chemistry,Longman-ELBS,England
23. B.P.Levitt (1973) Findlay's Practical Physical Chemistry, 9th ed.,Longman London
24. G.H.Jeffrey, J.Bassetti, J.Mendham and R.C.Denny (1999) Vogel's Text
25. Book of Quantitative and Qualitative Analysis,5th ed.,Longman,London
26. A.I.Vogel (2001) Practical Organic Chemistry,Longman-ELBS,England

27. B.P.Levitt (1973) Findlay's Practical Physical Chemistry, 9th 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
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V SEMESTER - Paper V

CH 301: Chemistry Paper V

Teaching Hours : 3hrs per week

Learning Objectives:

- To study the theories of bonding in the coordination complexes
- To enable the students to understand chemical equilibrium, effect of pressure, ,temperature and concentration on chemical equilibrium
- To know the basic terms involved in phase equilibrium and to know the applications of phase diagram
- To learn the chemistry of carboxylic acids and their derivatives
- To understand and learn the methods of preparation, mechanism and separation of compounds containing nitrogen

Unit – I

Metal – Ligand Bonding in Transition Metal Complexes 6hrs

Valence bond theory of transition metal complexes.Limitations of valence bond theory. An elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes. Factors affecting the crystal field parameters. Calculation of crystal field stabilization energy for octahedral complex. Elementary account of Jahn-Teller effect

Self study: Comparison of CFT and VBT. Calculation of crystal field stabilization energy for tetrahedral complexes.Colour of the complexes.

Application of metal complexes and complexation 2hrs

Applications of complexes and complex formation in metallurgy, volumetric analysis, qualitative analysis and gravimetric analysis

Self study: Role of metal complexes in biological systems.

Oxidation and Reduction 4hrs

Use of redox potential data- analysis of redox cycle, redox stability in water – Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of elements.

Self study: Frost diagram for oxygen in acidic solution

Unit II

Chemical equilibrium **6hrs**

Equilibrium constant and free energy.Thermodynamic derivation of law of mass action, Le-chatelier's principle, reaction isotherm and reaction isochore.Clapeyeon equation,Clasius – Clapeyron equation,(with derivation) and theirapplications.

Self study: Definition, dynamic equilibrium,Characteristics of chemical equilibrium

Phase equilibrium **6hrs**

Statement &Meaning of terms with examples – phase, component and degree of freedom, Gibb's phase rule and its derivation. Applications of phase rule to one compoment system – H_20 & S systems. Phase equilibria of two component system - simple eutectic – Pb-Ag system, desilverisation of lead,solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point ($NaCl-H_2O$), freezing mixtures - acetone-dry ice.

Self study: Phase diagram of Potassium Iodide- Water system

Unit III

Organic synthesis Via Enolates **3 hrs**

Acidity of α- hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetooacetate - claisen condensation (Mechanism).Keto – enol tautomerism of ethyl acetoacetate.

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

Carboxylic acids and their derivatives **6hrs**

Carboxylic acids : Reaction of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acids from acid chlorides .Methods of formation and chemical reactions of haloacids.Hydroxyacids: malic, tartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids (mention examples). Dicarboxylic acids (specify the examples): Methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides (Urea) and acid anhydrides.Relative stability of acyl derivatives. Mechanisms of esterification and hydrolysis (acidic)

Self study: Synthesis of carboxylic acids from acid esters & amides. Preparation of carboxylic acid derivatives.

Organic Compounds of Nitrogen **3hrs**

Nitro Compounds: Preparation of nitroalkanes and nitroarenes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline media.Picric acid.

Amines: Seperation of a mixture of primary, secondary and tertiary amines.Structural features affecting the basicity of amines.Reactions of amines:reactions of amines with nitrous acid. Electophilic aromatic substitution in aryl amines. Diazotisation.

Self study: Synthetic transformations of aryl diazonium salts

V SEMESTER - Paper VI

CH 302: Chemistry Paper VI

Teaching Hours : 3hrs per week

Learning objectives:

- To study the principle and applications of electronic, Raman and mass spectroscopic techniques
- To study the preparation and applications of Nano materials
- To have an elementary idea of flame photometry and thermoanalytical methods
- To learn the basic principles and applications of molecular and NMR spectroscopy in structural analysis
- To learn the basic aspects of carbohydrates ,synthetic polymers ,synthetic dyes and organomettalic compounds.

Unit I

Electronic spectroscopy **2hrs**

Introduction.Concept of potential energy curves for bonding &antibonding molecular orbitals, qualitative description of selection rules & Franck Condon principle.

Raman spectroscopy **2hrs**

Introduction, principles of Raman spectroscopy, selection rules and applications.

Self study: Comparison of Raman and IR Spectroscopy.

Mass spectroscopy **2hrs**

Principle, instrumentation, fragmentation pattern and applications. Interpretation of mass spectra of simple organic compounds such as Acetone, Ethyl acetate, Ethylamine and Toluene

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

Flame photometry **2hrs**

Introduction, Principle, Instrumentation, applications and limitations.

Thermo analytical methods(TG & DTA) **2hrs**

Thermogravimetric Methods (TG): Instrumentation, applications. Differential Thermal Analysis (DTA): General principles and applications.

Nano Chemistry **2hrs**

Introduction , importance, nanoparticles -synthesis and properties of carbon nano structures and applications of nano technology in catalysis, biology, nano filters, nano switches.

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

Unit II

Rotational spectrum **3 hrs**

Diatomic molecules- energy levels of a rigid rotor, selection rules,
spectral intensity, determination of bond length, qualitative description of non-rigid rotor, isotope effect. Problems to be worked out .Limitations of rotational spectroscopy.

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

Vibrationalspectrum(Infrared Spectrum) **4hrs**

Molecular vibrations, Hooke's law, energy levels of a simple harmonic oscillator, selection rules, measurement of IR Spectrum, intensity & position of IR bands, determination of force constant, qualitative relation of force constant and bond energies, effect of anharmonic motion. Finger print region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds (specify examples).

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.

Nuclear magnetic resonance (NMR) Spectroscopy **5hrs**

Proton magnetic resonance (H-NMR) Spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo- ethane and ethyl acetate.

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

Unit – III

Carbohydrates **4hrs**

Monosaccharides: Mechanism of osazone formation, interconversion of glucose and fructose. Chain lengthening by Killiani-Fischer synthesis and chain shortening of aldosese by Ruff 's degradation method . Conversion of glucose into mannose.Formation

of glycosides and esters.Elucidation of cyclic structure of D (+) glucose.Mechanism of mutarotation.

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

Synthetic polymers **3hrs**

Importance of polymes. Addition or chain – growth polymerization. Mechanism of addition polymerization, Condensation or step growth polymerization- Polyesters, polyamides, urea formaldehyde resin. Epoxy resins and polyurethanes. Plasticizers.

Biodegradalepolymers.Conducting polymers-carbon fibres(Basic idea only)
Self study: Free radical vinyl polymerization, Ziegler- Natta polymerization. Bakelite. Natural and synthetic rubbers.

Synthetic Dyes **3hrs**
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

Organometallic compounds **2hrs**
Introduction - nomenclature and classification of organometallic compounds.Preparation and properties of Grignard reagent, Organolithium compounds, Organo zinc compounds,
Self study: Preparation, properties and applications of organo copper compounds.

V SEMESTER - Paper V

CH 303: Chemistry Practical V

Teaching Hours : 4hrs per week

Inorganic Gravimetry Exercises
1. Estimation of barium sulphate in barium chloride solution.
2.Estimation of copper as cuprous thiocyanate in copper sulphatesolution.
3.Estimation of Ni as nickel dimethylglyoximate in nickel ammoniumsulphate solution.
4.Estimation of iron as ferric oxide in ferrous ammonium sulphate solution.
5.Gravimetric estimation of chloride/silver as AgCl in NaCl/silver nitrate solution.
6. Estimation of magnesium as oxinate in magnesium sulphate solution
7. Solvent Extraction: Separation and estimation of Mg (II) and Fe (II) ion
8.Verification of Beer-Lambert law by Job's and Mole- ratio methods.
9. Adulteration: Determination of adulteration in food stuffs.
10. Effluent Analysis: Analysis of Effluent water.

11.Steam Distillation: Steam distillation of Naphthalene from its suspension in water/clove oil from cloves/separation of o-and p-nitrophenols.
12. Column Chromatography: Separation of fluorescein and methyl blue,
13. Separation of leaf pigments from spinach leaves.
14.Resolution of racemic mixture of (±) mandelic acid.
15.Stereo chemical Study of organic compounds via models: R and S configuration of optical isomers, E and Z configuration of geometrical isomers
16. Conformational analysis of cyclohexane and substituted cyclohexane.

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

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17. B.P.Levitt (1973) Findlay's Practical Physical Chemistry, 9th ed.,Longman London

VI SEMESTER - Paper VII
CH 351: Chemistry Paper VII

Teaching Hours : 3hrs per week

Learning Objectives:

- To provide the knowledge about magnetic properties, electronic spectra, thermodynamic and kinetic aspects of metal complexes.
- To study the basic concepts of photochemistry
- To learn the fundamentals of quantum mechanics
- To understand the structure and functions of amino acids,peptides, proteins and Nucleic acids
- To study the impotanant methods of preparation and properties of heterocyclic
- compounds.

Unit I

Magnetic Properties of Transition Metal Complexes **4hrs**

Types of magnetic behavior, methods of determining magnetic susceptibility, spin – only formula. L-S coupling, correlation of μ_s and μ_{eff}, values, orbital contribution to magnetic moments, applications of magnetic moment data for 3d – metal complexes.

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

Electronic spectra of Transition Metal Complexes **4hrs**

spectrochemical series, Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic Types of electronic transitions, selection rules for d-d transition, spectroscopic ground states, spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

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

Thermodynamic and Kinetic Aspects of Metal Complexes **4hrs**

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability. Substitution reaction of square planar complexes.

Unit – II

Photo Chemistry **5hrs**

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry : Grothus – Draper' s- law, stark – Einstein law, Jablonski diagram depicting various processes occuring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, inter system crossing), quantum yield, photosensitized reactions- energy transfer processes (simple examples). Specify example.

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

Elementary quantum mechanics **7hrs**

Black body radiation, Planck's radiation law, heat capacity of solids, photoelectric effect, Compton effect, de Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrödinger wave equation & its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrödinger wave equation for H-atom, quantum number and their importance.

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

Unit III

Heterocyclic compounds: **7hrs**

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution.Mechanism of nucleophilic substitution reactions in pyridine derivatives.Comparisons of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six – membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference of fischerindole 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

Amino Acids, Peptides , Proteins and Nucleic acids **5hrs**

Structure and stereochemistry of amino acids. Acid base behavior, Isoelectric point and electrophoresis. Preparation and reactions of amino acids, structure and nomenclature of peptides and proteins. Peptide structure determination-end group analysis.Selective hydrolysis of peptides.Levels of protein structure.Protein denaturation/ renaturation.

Nucleic acids – Nucleotides – bases present in nucleic acids – structure of DNA – Watson-crick model – replication of DNA –structure and biological function of RNA – biosynthesis of proteins.

Self study: Classification of amino acids and proteins.

VI SEMESTER - Paper VIII

CH 352: Chemistry Paper VIII

Teaching Hours : 3hrs per week

Learning Objectives:

- To provide the knowledge about various industrially important materials
- To understand the types conductances of electrolytes and their measurements
- To understand the kinetics of electron transfer reactions and thermodynamics of electrochemical cells at the electrode|electrolyte interface
- To understand the chemistry of radiation exposure and its measurement
- To have an elementary idea of terpenoids and alkaloids
- To acquire knowledge about drugs ,oils ,fats ,detergents,chemicals in food ,vitamins and harmones

Unit – I

Industrial chemistry **8hrs**

Explosives: Compositions, types, propellants,
Glass: Raw materials, manufacture, types of glasses, their composition and uses, annealing of glass.
Cement: Raw materials, manufacture, mechanism of setting.
Ceramics: Production and applications of porcelain.
Insulators – Classification and applications.
Paints: Constituents and their functions (examples). Manufacture of white lead & lithophone.

Refractories and abrasives: typical examples and uses.
Cane sugar and paper: A brief account of their production
Chemical fertilizers: Typical examples (specify) production and uses.
Solid acids: Introduction to zeolites, structure and applications.
Superconductors: Discovery, critical temperature, Meissner effect, Types: Conventional and High Temperature superconductors.

Self study: Fuels: Brief account of gaseous fuels – natural gas, water gas, producer gas. Liquid petroleum gas, biogas (Production, composition and applications).
Pesticides – definition and examples

Inorganic polymers **4hrs**

Silicones, fluorocarbons and phosphonitrilic halides - formation, structure and

applications.Structural features and production of boron nitride, sulphur nitride ($S_4 N_4$) and silicon carbide.

Self study: General properties of inorganic polymers.

Unit II

Electrochemistry **10hrs**

Specific conductance and equivalent conductance, relation between them.Cell constant and determination of equivalent conductance.Variation of specific conductance and equivalent conductance with dilution. Debye- Huckel theory of strong electrolytes (qualitative treatment). Debye Huckel Onsager equation for strong electrolytes (elementary treatment only). transport number- definition, determination by Hittorf method and moving boundary method (attackable and unattackable examples).

Application of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility and solubility product of sparingly soluble salts , conductometric titrations of strong acid and strong base and mixture of acids against strong base.

Reference electrode: calomel electrode, quinhydrone electrode and Ag/ Agcl electrode. Emfof cell and its measurement – Computation of cell EMF. Relationship between ΔG and K for a cell reaction, Decomposition potential and its applications, hydrogen overvoltage.Concentration cell with and without transport, liquid junction potential, application of concentration cells 1.determination of solubility and solubility product, 2.valency of ions, 3. potentiometric titrations 4. determination of pH using a) hydrogen electrode b) quinydrone electrode) glass electrode.

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

Radiation Chemistry: **2hrs**

Radiolysis of water vapour, units of dose, Fricke dosimeters and ceric sulphate dosimeter.

Self study: Ceric sulphate dosimeter construction

Unit III

Chemistry in everyday life **8hrs**

Drugs: Classification of drugs, synthesis of antipyrine, chloramine T, sulphathioazole, sulphanilamide. Elementary account of chemotherapy and chemotherapeutic agents, antimalarials, antibacterials, sulpha drugs and antibiotics

Chemicals in food: Food preservatives,colours, flavours ,sweeteners and antioxidants. Food adultrants,detection of adultration in common food items.

Fats, Oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides. Hydrogenation of unsaturated oils. Saponification value, iodine value and acid value of oils. Soaps, synthetic detergents, alkyl and aryl sulphonates.

Vitamins and Hormones: Vitamins:Importance and classification.Synthesis of Vitamins A and C. Hormones: Important hormones and their uses. Synthesis ofThyroxine and Adrenaline .

Self study: Classification of drugs according to use.

Comparison of cleansing action soaps and detergents.

Diseases caused by the deficiency of vitamins. Abnormalities.

Chemistry of Natural Products **4hrs**

Alkaloids: Introduction,extraction, general characteristics and their physiological activities, synthesis and elucidation of structure of nicotine .Structural formula of atropine and cocaine.

Terpenoids: Definition, essential oils, isoprene rule. Isolation, synthesis and structural elucidation of citra. Structural formula of menthol, camphor and zingiberene

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

VI SEMESTER - Paper VI

CH 353: Chemistry Practical VI

Teaching Hours : 4hrs per week

Organic Preparations:

1. Preparation of acetanilide from aniline/ benzoylation of aniline.
2.Preparation of iodoform from ethanol.
3.Preparation of m-dinitrobenzene.
4.Preparation of p-bromoacetanilide.
5.Preparation of benzoic acid from toluene.
6.Microscale preparation

Instrumental Methods:

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

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

9.To determine equivalent conductance of sodium chloride byconductometric method.

10.To determine the ionization constant of a weak acid conductometrically.

11. Potentiometric titration of ferrous ammonium sulphate using Potassium dichromate as titrant and calculation of the red-ox potential of Fe^{2+}/Fe^{3+} system on the hydrogen scale.

12. To study the rate of inversion of cane sugar.

13. To determine the concentration of cuprous ions present in a solution using a colorimeter.

Preparation of Complexes:

14. Preparation of sodium trioxalato ferrate (III), $Na_3[Fe(C_2O_4)]$
15. Preparation of copper tetra ammine complex, $[Cu(NH_3)_4]\ SO_4$
16. Preparation of cis- and trans-bis oxalate diaqua chromate (III) ion.
17. Preparation of hexamine cobalt (II) chloride, $[Co(NH_3)_6]Cl$

Green chemistry preparation

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
14. Chemistry ,Sultan Chand & Co. Sultan Chand & Sons
15. Glasstone and Lewis , (1961) Elements of Physical Chemistry,Macmillan
16. S.Glasstone, (1969) Text book of Physical Chemistry ,2nd ed.,Macmillan Ltd

17. C.N.R. Rao , (1973) Universal General Chemistry, Macmillan
18. O.P Agarwal, Organic Chemistry of Natural products- Volume I and II, Goel Publishing house
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
2. D. F. Shriver and P. W. Atkins, (1999) Inorganic Chemistry, 3rd ed., W. H. Freeman and Co, London
3. 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 &
7. Company Ltd
8. Jerry March, (2007) Advanced Organic Chemistry, 6th ed., Willey, Newyork,
9. Bruice, (2012) Organic Chemistry , 7thed.,Pearson Education.
10. Negi and Anand , (1985) Physical Chemistry , Eastern Wiley Pvt.Ltd
11. Kundu and Jain , (1984)Physical Chemistry , S. Chand & Co.
12. K.L Kapoor, (2004) A *Text Book of Physical Chemistry*, Volume-5, 3rd ed., *Macmillan*
13. Maron and Lando , (1974) Fundamentals of Physical Chemistry , Colier - Macmillan

14. G.W. Castellan, (2004) Physical Chemistry , 3rd ed.,Narosa publishing house
15. 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) L

Question Paper pattern (Theory)

B.Sc, Chemistry

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

Part A

Four 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

Four 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

Three questions from each unit

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

25

26

27

28

29

30

31

32

33

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

CERTIFICATE COURSE IN 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

Syllabus

UNIT-I

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

Cosmetics: 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: Diamonds and Gems, Jewellary and Ornaments, Metals and Metal-alloys, Electroplating, Wax, Candles, Shoe polish, Mosquito coils, Common salt.

Plastics: 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.

10hrs

UNIT-II

Food and Nutrition: 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; 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 - Manures and Fertilizers. Need and uses of nitrogenous fertilizers , phosphates fertilizers and potassium fertilizers. Hazards of user fertilizers.

Pesticide definition and examples.

10hrs

UNIT III

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

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

10hrs

UNIT IV

Chemistry in Medicine and Health care: 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: Introduction, philosophy, classification and identification of biological activity of plants, plant products, bhasmas- formulation, methods of formation and analysis of active ingredients.

10hrs

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

CERTIFICATE COURSE IN 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

Syllabus

Unit I

Anatomy and Physiology: 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

10 hours

Unit II

Medicines in daily life: 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.

10 hours

Unit III

Clinical chemistry: 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

10 hours

Unit IV

Common diseases: 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.

10 hours

References

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. Praful B. Godkar,(2006) Textbook of Medical Laboratory Technology, Second Edition,Bhalani Pulication House, Mumbai
5. P.S Verma and V.K.Agarwal,(2016) Cell Biology, S.Chand and Company Pvt Ltd ., 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