SACRED HEART COLLEGE (AUTONOMOUS)

Tirupattur – 635 601, Tamil Nadu, S.India

Resi : (04179) 220103
College : (04179) 220553
Fax : (04179) 226423

Ready for Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

Department: B. SC. CHEMISTRY

B.Sc. Chemistry

B. Sc Chemistry - Scheme of papers (CBCS) - 2017

Year / Semester	Part	Subject	Title of the Paper	Hrs / Week	Credits	Exam hours	Max Marks		
							CIA	Sem	Total
I Year / I Semester	I	Tamil	Tamil - I	5	3	3	25	75	100
	II	English	English - I	5	3	3	25	75	100
	II		Communicative English		1				
	III	Core	General Chemistry - I	4	4	3	25	75	100
	III	Core	General Chemistry - II	3	3	3	25	75	100
	III	Core Practical	Volumetric Analysis	3	3				
	III	Allied	Allied Mathematics - I	6	4	3	25	75	100
	IV		FC	2	1				
	IV		Religion & Ethics - I	2	1	3	25	75	100
I Year / II Semester	I	Tamil	Tamil - II	5	3	3	25	75	100
	II	English	English - II	5	3	3	25	75	100
	II		Communicative English		1				
	III	Core	General Chemistry - III	4	4	3	25	75	100
	III	Core	General Chemistry - IV	3	3	3	25	75	100
	III	Core Practical	Volumetric Analysis	3	3	3	40	60	100
	III	Allied	Allied mathematics - II	6	4	3	25	75	100
	IV		FC	2	1	3	40	60	100
	IV		Religion & Ethics - II	2	1	3	25	75	100
II Year / III Semester	I	Tamil	Tamil - III	5	3	3	25	75	100
	II	English	General English - III	5	3	3	25	75	100
	III	Core	Organic Chemistry - I	4	4	3	25	75	100
	III	Core	Analytical Chemistry - I	3	3	3	25	75	100
	III	Core Practical	Qualitative Inorganic Analysis	3	3				
	III	Allied	Allied Physics - I	6	4	3	25	75	100

	IV		FC	2	1				
	IV		Human Rights	2	1	3	25	75	100
	V		DEEDS						
	V		SHELTERS						
			Certificate course - I		2*				
II Year / IV Semester	I	Tamil	Tamil - IV	5	3	3	25	75	100
	II	English	English - IV	5	3	3	25	75	100
	III	Core	Inorganic Chemistry - I	4	4	3	25	75	100
	III	Core	Physical Chemistry - I	3	3	3	25	75	100
	III	Core Practical	Qualitative Analysis	3	3	4.5	40	60	100
	III	Allied	Allied Physics - II	6	4	3	25	75	100
	IV		FC	2	1		40	60	100
	IV		Environmental Studies	2	1	3	25	75	100
	V		DEEDS		2				
	V		SHELTERS		2				

III Year / V Semester	III	Core	Organic Chemistry - II	4	4	3	25	75	100
	III	Core	Inorganic Chemistry - II	4	4	3	25	75	100
	III	Core	Physical Chemistry - II	4	4	3	25	75	100
	III	Core	Analytical Chemistry - II	4	4	3	25	75	100
	III	Main Elective	Elective – I	4	2	3	25	75	100
	III	Main Elective	Elective – II	2	2	3	25	75	100
		SSP	Chemistry for Competitive Exam - I		1*				
	III	Core Practical	Gravimetric & Organic Analysis	3	3		40	60	100
	III	Core Practical	Physical Chemistry Practicals	3	3		40	60	100
		NME	Chemistry of Drugs and Disease	2	1		25	75	100
			Certificate Course - II		2*				
III Year / VI Semester	III	Core	Organic Chemistry - III	4	4	3	25	75	100
	III	Core	Inorganic Chemistry - III	4	4	3	25	75	100
	III	Core	Physical Chemistry - III	4	4	3	25	75	100
	III	Subject Skill (SS-I)	Paper - I	5	4	3	25	75	100
	III	Subject Skill (SS-II)	Paper - II	5	4	3	25	75	100

	IV	NME	Chemistry in Everyday Life	2	1	3	25	75	100
	III	SSP	Chemistry for Competitive Exam - II		1*				
	III	Core Practical	Gravimetric & Organic Analysis	3	3	6	40	60	100
	III	Core Practical	Physical Chemistry Practicals	3	3	3	40	60	100
			Project*		2*				
			Total	180	148+ 2+ 2*				

*** Extra credits**

Note:

- SSP/Project/Certificate course - optional

Abbreviations

FC	Foundation Course
Comm. Eng	Communicative English
ET	Ethics
RE	Religion
DEEDS	Dept. of extension and educational services.
HR	Human Rights
SSP	Self study paper
NME	Non-major Elective

List of Electives

Elective - I **4 Hours**

1. Pharmaceutical Chemistry
2. Clinical Biochemistry
3. Bio-Inorganic Chemistry

Elective - II **2 Hours**

1. Applied Chemistry
2. Protein Chemistry
3. Computer for Chemists

Subject Skill Papers **5 Hours**

1. Polymer Chemistry
2. Industrial and Environmental Chemistry

3. Green Chemistry
4. Materials Chemistry
5. Inorganic Materials of Industrial Importance
6. Reaction Mechanisms and Reagents in Organic Chemistry

Certificate Courses **2 Hours**

1. Organic Farming
2. Industrial Safety

S. No.	COURSE CODE	COURSE NAME
1	CH537	Organic Chemistry- II
2	CH5328	Inorganic Chemistry- II
3	CH539	Physical Chemistry-II
4	CH540	Analytical Chemistry- II
5	CH541	Main Elective – I Pharmaceutical Chemistry
6	CH542A	Main Elective – II Applied Chemistry
7	CH542B	Protein Chemistry
8	CH543X	Chemistry for Competitive Exam -I
9	NCH503	Chemistry of Drugs and Disease – Non Major Elective
10	CH633	Organic Chemistry -III
11	CH634	Inorganic Chemistry -III
12	CH635	Physical Chemistry- III
13	CH636A	Subject Skill elective –I* Polimer Chemistry
14	CH636B	Subject Skill elective – II*Industrial and Environmental Chemistry
15	CH636E	Inorganic materials of Industrial Importance
16	NCH603	Chemistry in Everyday Life
17	CH637X	Chemistry for Competitive Exam -II

SYLLABUS

Semester – V CH 537 Organic Chemistry – II 4 Hrs/Week (4 Credits)

Objectives

To learn the stereochemical factors that influence the chemical reactions

To appreciate the importance and applications of photochemical reactions and understand the basic concepts of organic chemistry.

Unit - I: Photochemistry 12 Hours

1.1 Organic photochemistry: Types of Photochemical reactions – photodissociation-gas phase. Photolysis – isomerisation – cyclisation – dimerisation and oxetane formation.

1.2 Norrish - I and II reactions.

1.3 Barton reaction – photo Fries rearrangement. Photochemical formation of smog.

1.4 Photochemistry of vision.

Unit - II: Stereochemistry 12 Hours

2.1 Stereoisomerism: definition – classification into optical and geometrical isomerism. Projection formulae: Fischer, Flying Wedge, Sawhorse and Newmann projection formulae – Rotation of optical isomers – Cahn – Ingold – Prelog rules – R, S notation of optical isomers with one and two asymmetric carbon atoms – D, L notations.

2.2 Optical activities in compounds not containing asymmetric carbon atoms: biphenyl, allenes and spiranes. Geometrical isomerism: cis – trans, syn – anti and E, Z notations – geometrical isomerism in maleic and fumaric acid and unsymmetrical ketoximes .

2.3 Methods of distinguishing geometrical isomers using melting points, dipole moment, solubility, dehydration, cyclisation, heat of hydrogenation and combustion.

2.4 Conformational analysis : Introduction of terms – conformers, configuration, dihedral angle, torsional strain, conformational analysis of ethane and n-butane including energy diagrams.Conformers of cyclohexane – axial and equatorial bonds – ring flipping – conformers of mono and dimethylcyclohexane – 1,2 and 1,3 interactions.

Unit - III: Pericyclic Reactions 12 Hours

3.1 Classification of pericyclic reactions.Theoretical basis of pericyclic reactions: F.M.O theory,Molecular orbitals of conjugated dienes.

3.2 Cyclo addition reactions: (2+2) and (4+2) cycloadditions

3.3 Electrocyclic reactions: cyclisation of 4n systems and (4n+2) systems.

3.4 Sigmatopic rearrangement: Claisen and Cope rearrangements: mechanism.

Unit - IV: Heterocyclic Chemistry 12 Hours

4.1 Aromaticity of hererocyclic compounds. Preparation, properties and uses of furan, Pyrrole, and thiophene.

4.2 Preparation, properties and uses of pyridine and piperidine. Methods of opening of Heterocyclic rings – oxidation, reduction, Hoffman's exhaustive methylation.

4.3 Comparative study of basicity of pyrrole, pyridine and piperidine with amines.

4.4 Synthesis and reactions of quinoline,isoquinoline and indole with special reference to Skraup, Bisler- Napieralski and Fischer indole synthesis.

Unit - V: Polynuclear Hydrocarbons and Dyes 12 Hours

5.1 Polynuclear hydrocarbons – synthesis, properties and uses of naphthalene,anthracene, Phenanthrene.

5.2 Dyes – Theory of colour and constitution – classification according to the structure and method of application.

5.3 Preparation and uses of 1) Azo dye –methyl orange and Bismark Brown 2) Triphenyl methane dye – Malachite green. Phthalein dyes – Phenolphthalein and Flourescein- vat dye- indigo, anthraquinone – Alizarin

5.4 Diazo methane and diazo acetic ester – preparations, Structure and synthetic uses.

References

1. R.T. Morrison and R. N. Boyd, Organic chemistry, 6th Edition, Prentice-Hall of India, New Delhi, 2004.

2. Jagadamba Singh and Jaya Singh, Photochemistry and Pericyclic reactions, 2ndedn., New Age Publications, 2008.

3. P.S. Kalsi, Stereochemistry, Conformation analysis and Mechanism, 2ndEdition, Wiley Eastern Limited, Chennai, 1993.

4. Mc.Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

5. I.L. Finar, Organic Chemistry Vol. I & II, Pearson Education, New Delhi, 2002.

6. O.P. Agarwal, Organic Chemistry of Natural Products Vol. I & II, Goel Publishing House, New Delhi, 2002

7. G. Solomon, T.W., Fryhle, C.B. & Dyner, S.A. Organic Chemistry, John Wiley & Sons, 2014.

8. A. Bahl and B. S. Bahl, Advanced Organic Chemistry, S.Chand Publications, New Delhi, 2006.

Learning Outcomes

Identify isomers, chiral centers, evaluate the type of isomers

Identify the type of photochemical reaction and the type of pericyclic reaction

Explain the properties and synthetic applications of heterocyclic compounds

Semester - V CH 538 Inorganic Chemistry - II 4 Hrs/Week (4 Credits)

Objectives

To understand the periodic properties of transition elements.

To learn the fundamentals of coordination compounds and their importance.

To understand the role of elements in organo-metallic and bio-inorganic chemistry.

Unit - I: Transition elements 12 Hours

1.1 General group trends, electronic configuration.

1.2 General characteristics: metallic character, molar volume and densities, ionisation energies, variable valency, stability of oxidation states, and colour.

1.3 Magnetic properties- para-magnetism, diamagnetism and effective magnetic moment, catalytic properties, determination of magnetic properties

1.4 Comparison between first, second and third transition series.(Ionic radius, coordination number, metal – metal bonding and oxidation state)

Unit - II: Coordination Compounds - I 12 Hours

2.1 Double salts and coordination compounds. Werner's work: primary and secondary valencies.

2.2 Sidgwick's theory and Pauling's theory Effective atomic numbers (EAN).

2.3 Classification of ligands. IUPAC nomenclature of coordination compounds. Chelates and their uses-stereochemistry of complexes.

2.4 Isomerism: Ionization, hydrate, ligand, linkage, coordination, position, geometrical and optical. Methods of detecting complex formation-conductivity and precipitation studies.

Unit - III: Coordination Compounds - II 12 Hours

3.1 Valence bond theory- hybridization-geometry and magnetic properties-demerits of VBT.

3.2 Crystal field theory- crystal field splitting in octahedral, tetragonal, square planar and tetrahedral complexes- CFSE calculation of octahedral complexes.

3.3 Low spin and high spin complexes, spectrochemical series, and explanation of magnetic properties, colour and geometry using CFT. Jahn Teller distortion and trans effect.

3.4 Labile and inert complexes, thermodynamic stability, kinetic stability, factors affecting the stability of complexes.

Unit - IV: Organometallic Compounds 12 Hours

4.1 Metal carbonyls: 18 electron rule, mono and binuclear carbonyls of Ni, Fe, Co and Mn-preparation, structure, chemical properties and uses.

4.2 Structure and bonding in π-metal alkenyl, alkynyl and cyclopentadienyl complexes. Olefin organometallics: preparation and uses. Allyl organometallics: preparation and uses.

4.3 Cyclopentadienyl organometallics: preparation and reactions.

4.4 Synthetic applications of organometallic compounds as homogenous catalyst- Wilkinson catalyst, Fischer-Tropsch reaction.

Unit - V: Bioinorganic Chemistry 12 Hours

5.1 Porphyrin ring systems: cytochromes, structure and functions of Haemoglobin and Myoglobin.

5.2 Chlorophyll: structure, functions and Photosynthesis. Structure and functions of Vitamin B12.

5.3 Biochemistry of Iron. Metalloenzymes- Carboxypeptidase and Carbonic anhydrase.

5.4 Biological fixation of Nitrogen and Nitrogen cycle.

References

1. J. D. Lee, Concise Inorganic Chemistry, Chapman and Hall: London, 1961.

2. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishing Co, Jalandar, 2004.

3. R. D. Madan, Modern Inorganic Chemistry, Second edition, S. Chand publications, New Delhi, 2000.

4. James, E. Huheey, Ellen A. Keiter, Richard, L. Keiter. Inorganic Chemistry Principles Structure and Reactivity, Harper and Row: Newyork, 1999.

Learning Outcomes

Explain the general trends and properties of transition elements

Explain the bonding and isomerism in coordination compounds

Outline the different organometallic compounds and explain their synthetic applications

Semester – V CH 539 Physical Chemistry – II 4hrs/Week (4 Credits)

Objectives

To understand the basic concepts of quantum chemistry and statistical thermodyncamics

To learn the concepts regarding chemical kinetics and apply them for kinetics related problems in photochemistry

Unit - I: Quantum Mechanics 12 Hours

1.1 Postulates of Quantum mechanics – significance of wave function – Eigen value – Eigen function – normalisation of Ψ and Expectation value (Definition only). Schrodinger's wave equation(with respect to space and with respect to time)

1.2 Operators – Algebra of operators – commutative property – Linear operator and Hermitian property – momentum operator, Hamiltonian operator.

1.3 Solution of Schrodinger's wave equation for simple systems: Particle in one dimensional box and particle in three dimensional box.

1.4 Schrodinger equation for One dimensional simple Harmonic Oscillator and Rigid rotor. Schrodinger equation for hydrogen atom (No derivation)

Unit - II: Group Theory 12 Hours

2.1 Symmetry elements and symmetry operations- group postulates- Types of group

2.2 Point groups- representation of molecular point group- Great orthogonality theorem

2.3 Important properties of Irreducible representations- Uses of G.O.T. to construct character tables for the molecular point groups

2.4 Character table for C2V and C3V point group.

Unit - III: Chemical Kinetics 12 Hours

3.1 Definitions of terms – Derivations of Zero, First, Second and Third order reactions (3A→ products)–study of kinetics by Volumetric, Polarimetric and dilatometric methods.

3.2 Determination of order of the reactions-Graphical method, rate equation method, half-life method and Ostwald's method.

3.3 Complex reactions-consecutive, parallel and reversible reactions (no derivation. only examples) – Effect of temperature on reaction rate – temperature coefficient - concept of activation energy- Arrhenius equation.

3.4 Theories of reaction rates: Bimolecular collision theory – Transition state theory – Lindemann'sunimolecular theory. catalysis-concept of active sites-Enzyme catalysis: theory – Mechanism and kinetics of enzyme catalysed reaction-Michaleis-Menton equation.

Unit - IV: Photochemistry 12 Hours

4.1 Interaction of radiation with matter- Difference between thermal & photochemical processes – Laws of photochemistry: Grothus – Draper law, Stark Einstein law-Jablonski diagram depicting various processes occurring in the excited state.

4.2 Qualitative description of fluorescence, phosphorescence, non-radioactive processes (internal conversion, inter system crossing), quantum yield, photosensitized reactions.

4.3 Kinetics of photochemical combination of H2 – Br2 and H2- Cl2.

Unit - V: Adsorption 12 Hours

5.1 Adsorption – Distinction between physical and chemical adsorption-Factors influencing adsorption-

5.2 Adsorption isotherm – Freundlich isotherm. Langmuir isotherm- theory and derivation.

5.3 Postulates of B.E.T isotherm – equation(No derivation) – determination of surface area-

5.4 Gibb's adsorption isotherm– Types and Significance of isotherms-Applications of adsorption.

References

1. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishing Co, Jalandar, 2004.

2. B. R. Puri, L. R. Sharma and M. S. Pathania, Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co, Jalandar, 2016.

3. B. S. Bahl, Tuli and ArunBahl, Essentials of Physical Chemistry, 19th edition, S.Chand publications, New Delhi, 2012.

4. A.S. Negi and S.C. Anand, A text book of Physical Chemistry, Wiley Eastern Ltd, New Delhi, 1984.

5. P. L. Soni, O. P Dharmarha and U. N. Dash, Text Book of Physical Chemistry, Sultan Chand & Company Ltd., New Delhi, 2001.

6. S. Glasstone, Text book of physical chemistry, 2nd revised edition, Macmillan, United Kingdom, 1980.

Learning Outcomes

To understand the physical principles underlying in spontaneous and non spontaneous processes

To attempt to apply the concepts in to applications

Semester - V CH 540 Analytical Chemistry - II 4 Hrs/Week (4 Credits)

Objectives:

To study the basics, principles and instrumentation of spectroscopy.

To learn the basics, principles of polarography and amperometry techniques.

Unit - I: Colorimetric Analysis and UV-Visible Spectroscopy 12 Hours

1.1 Introduction to spectroscopy-spectrum-electromagnetic radiation-Planck's equation-wavelength-frequency-wave number.

1.2 Distinction between line and band spectrum-Classification-based on frequency.

1.3 Colorimetric analysis-laws of colorimetry-photoelectric colorimeter-Estimation of Fe and Ni. Determination of composition of complex Job's methods-Example:Ni-EDTA complex.

1.4 UV-Visible spectroscopy-Types of transition in organic compounds-Types of absorption band-chromophore-auxochrome-bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift.Instrumentation-single and double beam and applications of simple systems.

Unit - II: IR and Raman Spectroscopy 12 Hours

2.1 IR Spectroscopy-theory-types of vibrations-Example: H_2O and CO_2.

2.2 Instrumentation and sampling techniques.

2.3 Applications: Structure of NO_2, study of hydrogen bonding-Identification of simple organic compounds: alcohols, acids, amines, esters, ketones and unsaturated compounds.

2.4 Raman Spectroscopy-theory-advantages over IR Spectroscopy. Instrumentation and sample handling-Depolarization effect-Mutual Exclusion principle, applications-structure of CO_2, nitrous oxide and mercurous chloride.

Unit - III: NMR and ESR Spectroscopy 12 Hours

3.1 NMR Principle: theory-allowed orientation-spin states and relaxation- chemical shift.

3.2 Factors affecting chemical shift, spin-spin coupling, and hydrogen exchange.

3.3 Instrumentation and sample handling-Applications: Structural identification-Examples:1-Bromo Propane, 2-Bromo Propane, Toluene, Phenol and Vinyl Chloride.

3.4 ESR Principle-Theory-Selection rule for transition-Instrumentation- Zero field Splitting-Hyperfine splitting. Applications-ESR of simple organic radicals: CH_3-ESR of V^{4+}, Mn^{2+} and Cu^{2+} ions.

Unit - IV: AAS and AES 12 Hours

4.1 Atomic absorption spectroscopy-principle-Advantages and disadvantages of AAS.

4.2 Instrumentation of AAS, Interferences in AAS. Applications of AAS-Determination of Mg in water and Lead in Petrol.

4.3 Atomic Emission Spectroscopy- Principle of Flame photometry, AES-Principle-Advantages and Disadvantages.

4.4 Instrumentation of AES, Applications- Comparison of AAS and AES.

Unit - V: Polarography and Amperometry 12 Hours

5.1 Polarography-principle and instrumentation -current-voltage curves

5.2 Evaluation of Polarographic waves-half-wave potential, Ilkovic equation..

5.3 Applications of polarography for organic and inorganic systems.

5.4 Amperometry- Principle-Instrumentation-Types of curves. Advantages of amperometric titrations-applications of amperometric titrations.

References

1. R.Gopalan, P. S. Subramanian and K. Rengarajan, Elements of analytical chemistry, 3rd Edition., Sultan Chand, New Delhi, 2003

2. A. K. Srivatsava and P. C. Jain, Chemical Analysis and Instrumental Approach, 3rdEdition, S.Chand and Company Ltd., New Delhi, 2010.

3. A. I. Vogel, A text book of quantitative inorganic analysis, Longman, New York, 1985.

4. H. H. Willard, L. L. Merritt and J. A. Dean,Instrumental methods of analysis, 7thEdition., East West Press, New Delhi, 1986.

5. D. A. Skoog and D. M. West, Principles of instrumental analysis, Holt Saunders, Tokyo, 2001.

6. Gurdeep R Chatwal, Instrumental Methods of Chemical Analysis, 5thEdition. Himalaya Publications, 2005.

7. S. M. Khopkar, Basic Concepts of Analytical Chemistry, New Age Publishers, 2ndEdition. 2000.

8. V. Suryanarayanarao, Polarography and Allied techniques, University Press, 2002.

Learning Outcomes

To learn and understand the basic analytical techniques and their applications

To understand the basic principles that makes each analytical technique possible and useful

Elective Paper - I

Semester - V CH 541 A Pharmaceutical Chemistry 4 Hrs/Week (4 Credits)

Objectives

To acquire a sound knowledge about the chemistry of drugs and their mechanism of action.

To learn about various types of diseases, their cause and cure through conventional and modern medicine.

Unit - I: Pharmacology 12 Hours

1.1 Introduction: Important terminologies used in medicinal chemistry – Drugs, Dose, Pharmacology, Pharmacopoeia, therapeutics, toxicology, chemotheraphy, pharmacophore, metabolite, antimetabolite and mutation.

1.2 Naming of drugs: Chemical name, proprietary name and non – proprietary name with suitable examples.

1.3 Modes of administration of drugs: Enteral routes : oral,buccal , rectal. Parenteral routes: intradermal, subcutaneous, intramuscular, intravenous, intraarterial, intrathecal, intraperitoneal, intramedullary, intraarticular, inhalation, topical (meanings Only) - Enteral dose forms. Disadvantages of enteral and parenteral routes -Definition of LD50, ED50 and therapeutic index.

1.4 Drug Stability – Shelf life – definition and imporatance.

Need for the study of Drug Stability – causes of drug degradation and their prevention.

Hydrolysis (procaine, Chloramphenical, aspirin)

Oxidation (ascorbic acid, adrenaline)

Free radical reaction (rancidity of Oils)

Polymerisation (formaldehyde)

Decarboxylation (procaine)

Unit - II: Viral Infections 12 Hours

2.1 General Pharmacology: Meaning of receptor, agonist, antagonist, partial agonist, pharmaco dynamics and pharmacokinetics. Process of drug adsorption, distribution, metabolism and excretion – Plasma half life period and its significance.

2.2 Viral diseases and antiviral drugs: Small pox, jaundice, rabies, influenza and AIDS – causes,symptoms and treatment.Antiviral Drugs – obstacles in antiviral therapy – Structure and uses of acyclovir, iodoxuridine, amantadine and zidovudine (AZT).

2.3 Protozoal Infections: malaria – the four malarial parasites – life cycle of malarial parasites – antimalarials: chloroquine, primaquine and quinine.

2.4 Helmintic diseases – filaria – anthelmintics: piperazine, Diethyl carbamazine and mebendazole.

Unit - III: Bacterial Infections 12 Hours

3.1 Bacterial Infections: Meaning of bacteristat and bacteriocide, Gram positive and Gram negative bacteria.Antibacterial agents: Structure, uses, mode of action and side effects of pencillins, caphalosporin, streptomycin, chloramphenicol and tetracyclines.

3.2 Sulphonamides: Preparation and uses of sulphanilamide, sulphapyridine, sulphadiazine, Sulphathiazole, sulphaguanidine and prontosil-mode of action of sulphadrugs –General side effects of sulphadrugs.

3.3 Bacterial diseases: Leprosy– Impossibility of culture growth of Leprosy bacillus invitro-meaning of culture,invitro and invivo.

3.4 Tuberculosis – cause, symptoms and treatment of TB, tetanus and typhoid

Unit - IV: Types of Drugs 12 Hours

4.1 Inflammation and anti-inflammatory drugs: Examples for steroidal and non-steroidal anti-inflammatory drugs, Antihistamines - Uses and side effects,

4.2 Analgesics : Narcotic analgesics- Exaction, physiological action, uses and side effects of morphine. Synthetic analgesics : preparation and uses of pethidine and methadone. Antipyretic analgesics: preparation, physiological action, uses and side effects of aspirin and paracetamol.

4.3 Anaesthetics: Definition – Classification – General anaesthetics – Preparation , advantages and disadvantages of diethyl ether, chloroform, Nitrous oxide, halothane. Local anaesthetics: Preparation and uses of procaine and benzocaine.

4.4 Sleep and hypnotics: Meaning of sleep,somnambulism, insomnia hypnotics, sedatives, tranquillisers.Preparation,uses and side effects of benzodiazepines and barbiturates.Psychotropicdrugs:Psycho stimulants – Caffeine, Amphetamine Psychodysleptics – structure,adverse effects and detection of LSD, Drug abuse, Evil effects of alcohol, tobacco, cannabis.

Unit - IV: Miscellaneous Diseases 12 Hours

5.1 Epilepsy, Parkinsonism and Tetanus : Meaning,causes, Symptoms and treatment (two drugs for each.

5.2 Cancer : Meaning of cancer – causes and symptoms – Treatment-Surgery, Radiation Therapy, Chemotherapy – Anti neoplastic agents, Alkylating agents (Nitogen&Sulphur Mustards), Antimetabolites (mercaptopurines, Fluorourcil), Hormones, Antibiotics.

5.3 Diabetes: Meaning, kind, cause and symptoms. Hyperglycaemia and hypolglycaemia- carbohydrate metabolism, Insulin and its action, Types of diabetes mellitus, Treatment of diabetes- Insulin therapy. Hypoglycaemic agents (Sulphonyl urea and biguanidines).

5.4 Blood: composition – blood grouping – Rh factor – blood pressure-Anaemia:causes and treatment. Haematological agents-coagulants and anticoagulants. Antigens, Antibodies

References

1. A. Jayashree Ghosh, Textbook of Pharmaceutical chemistry, Rajendra ravindra printers pvt. Ltd., New Delhi, 2010.

2. James Cross land, Lewis, Pharmacology, 5th Edition, Churchill Livingstone Publications, New York.1980

3. D. Sriram, P. Yogeeswari, Medicinal Chemistry, Second edition, Pearson publications, 2007

4. Alex Gringauz, Introduction to Medicinal chemistry, Wiley India Pvt Ltd., New Delhi, 2011.

5. Burger. Medicinal Chemistry and Drug Discovery, Vol-1, Ed. M. E. Wolff, John Wiley, 1994.

6. Goodman & Gilman. Pharmacological Basis of Therapeutics, McGraw-HilI, 2005.

7. S. S. Pandeya & J. R. Dimmock, Introduction to Drug Design, New Age International, 2000.

8. D. Lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, 1998.

9. Graham & Patrick. Introduction to Medicinal Chemistry, 3rd edition, OUP, 2005.

10. Rama Rao Nadendla, Principles of Organic Medicinal Chemistry, 2nd Edition, New Age Publications, 2008.

11. Ashutosh Kar, Medicinal Chemistry, 2nd Edition, New Age Publications, 2000.

Elective Paper - II

Semester - V CH 542 A Applied Chemistry 2 Hrs/week (2 Credits)

Objectives:

To inculcate the latest sophisticated analytical techniques

To characterize the solid state materials which found applications in day-to-day life.

Unit - I: Analysis of Redox Potentials 6 Hours

1.1. Basic Principles of Voltammetry-Nernst Equation-Applications of Voltammetry-Applications of cathodic and anodic peak potentials and current.

1.2. Linear sweep voltammetry, differential pulse voltammetry, square-wave voltammetry, stripping methods-electrode materials, hydrodynamic effects, microelectrodes, and voltammetric sensors. Determination redox potentials of some inorganic samples.

Unit - II: Analysis of Soil 6 Hours

2.1. Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators

2.2. Estimation of Calcium and Magnesium ions as Calcium carbonate by complex ometrictitration. (Theory only)

Unit - III: Analysis of Water 6 Hours

3.1. Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

3.2. Dissolved oxygen in water. Determination of dissolved oxygen (DO) of a water sample. Determination of pH, acidity and alkalinity of a water sample.(Theory only)

Unit - IV: Analysis of Food Products 6 Hours

4.1. Analysis of food products: Nutritional value of foods, idea about food processing-food preservations, Methods of food preservations and adulteration.

4.2. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc. Analysis of preservatives, flavorants, and colouringmatter.(Theory only)

Unit - V: Analysis using Chromatographic Techniques 6 Hours

5.1. Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC-Identification and comparison of samples using TLC method (Organic, inorganic, paints, etc.,)

5.2. Separation of compounds using Column (Neutral, acidic and basic columns), ion exchange chromatography.

References

1. H. H. Willard, L. L. Merritt, J. Dean, & F. A. Settoe, Instrumental Methods of Analysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.

2. Douglas A. Skoog,; F. James Holler,; Stanley R. Crouch, Principles of Instrumental Analysis, 6thEdition;Cengage Learning, 2006.

3. D. A. Skoog, D. M. West, & F. J. Holler, Fundamentals of Analytical Chemistry, 6th Ed., Saunders College Publishing, Fort Worth, 1992.

4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman, 2010.

5. Dean, J. A. Analytical Chemistry Notebook, 2nd edition, McGraw Hill, 2004.

6. Reuben Alexander Day,; Arthur Louis Underwood, Quantitative Analysis, 6thEdition;Prentice Hall India Learning Private Limited, 1992.

7. D. Freifelder, Physical Biochemistry, 2nd Edition, W.H. Freeman and Co., N.Y. USA, 1982.

8. T. G. Cooper, The Tools of Biochemistry, John Wiley and Sons, N.Y. USA, 1977.

9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall, New Delhi, 2009.

10. Robinson, J.W. Undergraduate Instrumental Analysis, 5th Ed., Marcel Dekker, Inc., New York, 1995.

Elective Paper - II

Semester–V CH 542 B Protein Chemistry 2 Hrs /week 2 Credits

Objectives

To learn the chemistry of Amino acids and proteins.

To learn the importance of enzymes and enzyme catalysis

Unit - I: Introduction to Proteins 6 Hours

1.1 Amino acids-properties and classification of 20 amino acids-Isoelectric point-titration curvepeptide bond-polypeptide-protein-N-ter and C-ter-protein sequence

1.2 Primary, secondary-Ramachandran plot- tertiary structure Stability of protein structure-protein folding

Unit - II: Purification of Proteins 6 Hours

2.1 Separation of proteins-dialysis-column chromatography-ion-exchange chromatography-size-exclusion chromatography-Affinity chromatography,

2.2 Electrophoresis-Isoelectric focussing-two-dimensional electrophoresis. Determination of proteins sequence – N-terminal amino acid analysis-Sanger's Method-Edman degradation-C-terminal amino acid-carboxypeptidases

Unit - III: Enzymes 6 Hours

3.1 Definition-classification of enzymes. Thermodynamics model for enzyme catalysis-Proximity effects-transition state stabilisation-Acid/base catalysis in enzymatic reactions-use of strain energy in enzyme catalysis-

3.2 Enzyme Kinetics-Michaelis - Menton Equation; Lineweaver–Burk plot-Factors affecting catalytic activity of enzymes-temperature-pH-concentration. Allosteric enzymes.

Unit - IV: Chemistry of Enzyme Catalysis 6 Hours

4.1 Mechanism of chymotrypsin (hydrolytic peptide cleavage)-catalytic triad (nucleophilic addition/hydrolysis)Lysosyme-mechanism-cleavage of peptidoglycans (SN1/SN2)

4.2 Mechanism of Alcohol dehydrogenase-Oxidation of alcohol (Redox reaction) Mechanism of Class I fructose-1,6-bisphosphate aldolase (Carbon–Carbon Bond Formation).

Unit -V: Chemistry of Co-Enzymes 6 Hours

5.1 The pyridine nucleotide coenzyme-niacin deficiency-the flavin nucleotide coenzyme.

5.2 Structure and significance of Thiamine phosphate-Biotin-pyridoxal phosphate-tetrahydrofolate.

References

1. Lehninger, Nelson, Cox, Biochemistry, 6th edition, W H Freeman & Co, USA, 2013.

2. Berg, Stryer, Tymoczko, Biochemistry, 3rd edition, W H Freeman & Co, USA, 2015.

3. T. D. H Bugg, Introduction to enzyme and coenzyme chemistry, 3rd edition, Wiley-Blackwell, 2012.

4. Paula Yurkanis Bruice, Organic chemistry, 6th edition, Pearson Edition, New York, 2006.

Semester V Self-Study Paper 1 Credit

Objectives:

To motivate the students for self study

To prepare them for the competitive exams

Chemistry for Competitive Examinations - I

Unit - I: Structure of Matter and Periodic Table

Elementary atomic structure Ionic and covalent bonding Octet rule Periodic trends Inorganic nomenclature.

Unit - II: Chemical Formulas

Percentage composition the mole formula calculations Empirical formula calculations molecular formulas

Unit - III: Electronic structure of atom

Shells sub shells orbitals electronic structure of ions consequences of electronic structure.

Unit - IV: Organic Molecules

Organic nomenclature and classification – structural isomerism – Geometrical and stereo isomerism

Unit - V: Gas Laws

Boyle's law, Charles law, combined gas law, and ideal gas law-molecular weights of gases

References

1. R.L.Madam, Organic Chemistry – Questions and Answers, S. Chand's success guides, 3rd Edn. 2012.

2. I.L.Finar, Problems and their solution in organic chemistry, Pearson edition, 2002.

3. R.L. Madan & G.D Tuli, Inorganic chemistry, Questions and answers, S. Chand success guides, 2012

4. Anil Kumar De, Arnab de, Inorganic Chemistry and analysis through problems, New Age international, New Delhi, 2002.

Non-Major Elective – I

Semester – V NCH504-Chemistry of Drugs & Diseases 2 Hrs / week (2 Credits)

Objectives

To learn the basic scientific facts about common drugs.

To understand about different types of diseases and their treatments for a healthy living.

Unit - I: Drug Administration and Blood 6 Hours

1.1 Terminology in Pharmaceutical chemistry – Pharmacology, Pharmaceutics, toxicology, pharmacopoeia, pharmacy, mutation. Modes of administration of drugs-Enteral routes: oral, buccal and rectal.

1.2 Parenteral routes: intradermal, subcutaneous, intramuscular, intravenous, intramedullary, inhalation. Blood-Composition, grouping and Rh factor-blood pressure. Haemoglobin- functions –anaemia-causes and treatment.

Unit - II: Common Drugs 6 Hours

2.1 Antibiotics, - Uses and side effects of penicillin, Streptomycin, Chloramphenicol and tetracyclines. Analgesics, Anti-inflammatory drugs and Antipyretics: Paracetamol, Aspirin, Brufen, methyl salicylate

2.2 Antiseptics and Disinfectants: Examples and uses. Antihistamines, Hypnotics and Antidepressant drugs-definition, examples and side effects. Anaesthetic-meaning and classification-examples and side effects.

Unit - III: Vital Ailments and Treatment 6 Hours

3.1 Epilepsy and Parkinsonism: Causes, Symptoms and treatment. Cancer: Causes, Symptoms and treatment

3.2 Tetanus, Tuberculosis, Typhoid and Jaundice: Causes, Symptoms and treatment. Diabetes-meaning, types, causes and symptoms-treatment.AIDS – Causes, Spread and prevention.

Semester - VI CH 633 Organic Chemistry – III 4 Hrs / week (4 Credits)

Objectives:

To learn the chemistry of biomolecules.

To understand the significance of biomolecules and natural products.

Unit - I: Carbohydrates 12 Hours

1.1 Carbohydrates: Classifications – reactions of glucose and fructose- osazone formation, mutarotation and its mechanism.

1.2 Structural elucidation of glucose and fructose – pyranose and furanose forms.

1.3 Determination of ring size – Haworth projection formula – configuration of glucose and fructose – epimerisation – chain lengthening and chain shortening of aldoses – inter conversion of aldoses and ketoses.

1.4 Disaccharides and polysaccharides: reactions and structural elucidation of sucrose and maltose. Properties and uses of starch and cellulose.

Unit - II: Protein Chemistry 12 Hours

2.1 Amino acids: Classification of amino acids – preparations with special reference to Gabriel phthalamide synthesis, Strecker synthesis, Erlenmeyer synthesis and properties of alpha amino acids – zwitterion,isoelectric point.

2.2 Poly peptides and proteins: Classification of proteins based on physical and chemical properties and physiological functions.

2.3 Peptides synthesis – Bergmann synthesis and Curtius synthesis.

2.4 Primary structure of proteins – end group analysis – Akabori method, reduction method, Edman method.Secondary structure of protein–helical and sheet structures– Denaturation of proteins.

Unit - III: Natural Product Chemistry 12 Hours

3.1 Nucleic acids: Nucleoside, nucleotide, degradation of nucleotide chain – structure of nucleic acids – RNA and DNA. Elementary idea about protein synthesis.

3.2 Synthesis of pyrimidine and purine bases – guanine, adenine, uracil, cytosine and thymine.

3.3 Terpenes – isoprene rule – structure elucidation of menthol, alphaterpeniol and alpha pinene.

3.4 Alkaloids-General methods of isolation - structural elucidation of piperine and nicotine.

Unit - IV: Lipids 12 Hours

4.1 Introduction to lipids, classification.Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats.

4.2 Hydrogenation, Saponification value, Iodine number. Rancidity of oils and RM value

4.3 Classification and Biological importance of triglycerides, phospholipids, and glycolipids.

4.4 Structure and elucidation of Cholesterol.

Unit - V: Metabolism 12 Hours

5.1 Calorific value of food. Standard caloric content of carbohydrates, proteins and fats.

Oxidation of foodstuff (organic molecules) as a source of energy for cells.Vitamins-Sources, functions, Vitaminoses and deficiency disease

5.2 Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change.

5.3 Conversion of food into energy. Outline of catabolic pathways of Carbohydrate-Glycolysis, Fermentation, Krebs Cycle.

5.4 Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.

References

1. R. T. Morrison, and R. N. Boyd, Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi, 2008.

2. I. L. Finar, Organic Chemistry Volume I, 6th edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 1973.

3. I. L. Finar, Organic Chemistry Volume 2, 5th edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 1956.

4. O.P. Agarwal, Organic Chemistry of Natural Products Vol I & II, Goel Publishing House, New Delhi, 2002.

4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry, 7th Edition, W. H. Freeman, USA, 2013.

5. Berg, Stryer, Tymoczko, Biochemistry, 3rd edition, W H Freeman & Co, USA, 2015.

6. A. Bahl and B. S. Bahl, Advanced Organic Chemistry, S.Chand publications, New Delhi, 2006.

7. Gurdeep chatwal, Organic Chemistry Of Natural Products Vol 1 & 2, Himalaya Publishing House, New Delhi, 2015.

Learning Outcomes

To get familiarized in the advanced concepts of organic chemistry in continuation with the fundamental concepts.

Semester - VI CH 634 Inorganic Chemistry - III 4 Hrs/Week (4 Credits)

Objectives

To understand the chemistry of rare earths elements and their importance.

To learn the fundamental concepts of nuclear chemistry.

To understand the fundamentals of solid state chemistry and acids and bases.

Unit - I: Lanthanides and Actinides 12 Hours

1.1 Electronic structure and position of lanthanides and actinides in the periodic table.

1.2 Extraction from monazite and separation of the lanthanides (Precipitation, fractional crystallization, complex formation, solvent extraction, valency change).

1.3 Chemical properties of lanthanides and actinides-oxidation state, magnetic properties, colour and spectral properties.

1.4 Lanthanide contraction and its consequences. Comparative studies of 3d and 4f block elements

Unit - II: Acids and Bases 12 Hours

2.1 Arrhenius concept. Lowry Bronsted concept-conjugate acid-base pairs, relative strengths of acid-base pairs.

2.2 Lux-flood concept.

2.3 Lewis concept, limitations of lewis concept.

2.4 Pearson concept-HSAB principle.

Unit - III: Nuclear Chemistry 12 Hours

3.1 Fundamental particles of the nucleus- nucleon, nuclides, isotopes, isobars, isotones.

3.2 Nuclear radius, nuclear mass, nuclear density, nuclear forces operating between the nucleons, and packing fraction.

3.3 Natural radioactivity- nuclear reactions, radioactive decay, group displacement law, N/P ratio, curves, stability belts and rate of radioactive disintegration.

3.4 Nuclear binding energy. Mass defect, simple calculations involving mass defect and B.E per nucleon, Q value determination, magic numbers.

Unit - IV: Applications Nuclear Chemistry 12 Hours

4.1 Detection and measurement of radioactivity- G. M counter, and scintillation counter. Application of radioisotopes as tracers: Rock and Carbon dating.

4.2 Artificial radioactivity: artificial transmutation of elements and Particle accelerators- cyclotron. Induced radioactivity and preparation of transuranic elements.

4.3 Nuclear fission reactions: concept of critical mass-liquid drop model - shell model.. Nuclear energy production: components of reactors, types of nuclear reactors. Atom and plutonium bomb.

4.4 Nuclear fusion reactions and applications: nuclear fusion in the sun and hydrogen bomb. Safe disposal of radioactive waste.

Unit-V: Chemistry of solids 12 hours

5.1 Crystalline and amorphous solids-Definition and differences. Symmetry in solid crystals-Basic crystal systems with example to each system.

5.2 Structure of solids- close packing of spheres- Primitive cube-BCC-FCC- Radius ratio rule.

5.3 Types of crystals-ionic-covalent-metallic and molecular crystal with one example. and shape of ionic crystals (AB= NaCl, AB2 = CaF2).

5.4 Defects in solids-stoichiometric defects (Schottky, Frenkel) and nonstoichiometric defects (metal excess and metal deficiency).

References

1. J. D. Lee, Concise Inorganic Chemistry, Chapman and Hall: London, 1961.

2. James, E. Huheey.; Ellen A. Keiter.; Richard, L. Keiter. Inorganic Chemistry Principles Structure and Reactivity, Harper and Row: Newyork, 1999.

3. A. R. West, Basic Solid State Chemistry, John Wiley: Newyork, 1991.

4. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishing Co, Jalandar, 2004.

5. H. J. Arnikar, Essentials of Nuclear Chemistry, New Age International:Delhi, 1995.

6. R. D. Madan, Modern Inorganic Chemistry, Second edition, S. Chand publications, New Delhi, 2000.

Learning Outcomes

To learn and understand the impact of certain inorganic chemical concepts and their applications

Semester - VI CH 635 Physical Chemistry - III 4 Hrs/week (4 Credit)

Objectives

To know the fundamentals theories that govern the electrolytic conductance in solids and solutions and apply them to solve problems related to it.

To learn about the acids and base equilibria

To know about the different types of electrochemical cells and their importance.

Unit - I: Basics of Electrochemistry 12 Hours

1.1 Electrolytic conduction: conductor – non-conductor – types of conductors- Electrolytic and metallic conductors.

1.2 Specific conductance, equivalent conductance and molar conductance – measurement of these quantities Variation of equivalent conductance with dilution. Kohlraush'slaw and its applications.

1.3 Debye Huckel theory of strong electrolytes – Onsagar equation (No derivation) significance and limitations.

1.4 Migration of ions –ionic mobility and its determination. Transport number and its determination by Hittorf and moving boundary methods.

Unit - II: Application of Conductance 12 Hours

2.1 Applications of conductance measurements: Determination of degree of dissociation of weak electrolytes, ionic product of water, solubility of sparingly soluble salts.

2.2 Conduct metric titrations: Strong acid – strong base, weak acid – strong base, Strong acid – weak base, mixture of strong acid and weak acid – strong base, Precipitation titration.

2.3 Oswald's dilution law: dissociation constant of weak acid & weak base. pH and pOH: Definition and explanation.

2.4 Buffer solutions: definition and examples- Explanation of buffer action of acid buffer and basic buffer – Henderson equation.

Unit - III: Ionic Equilibria 12 Hours

3.1 Solubility product and its relationship to solubility. Application in qualitative analysis

3.2 Common ion effect – applications in analysis.

3.3 Hydrolysis of salts: Expression for hydrolysis constants, degree of hydrolysis and pH of salt solution, strong acid and weak base, weak acid strong base, weak acid and weak base.

3.4 Acids and bases: Arrhenius, Lowry – Bronsted and Lewis concepts. Acid base strength and structure.

Unit - IV: Electromotive Forces 12 Hours

4.1 Electromotive force: Galvanic cells – reversible and irreversible cells Daniel cell – EMF of the cell and its determination by potentiometric method. Standard cell (Weston cadmium cell).

4.2 Reversible electrodes –representation, construction and reaction of metal –metal ion electrode, gas electrode (hydrogen, oxygen, chlorine), calomel electrode, single electrode potential and its determination.

4.3 Derivation of Nernst equation for EMF of the cell and single electrode potential. Standard electrode potential, sign and convention.

4.4 Electrochemical series and its significance. Derivation of relationship between thermodynamic quantities ΔG, ΔH, ΔS, and cell EMF.

Unit - V: Applications of EMF 12 Hours

5.1 Application of EMF measurements: Determination of activity coefficient, transport number, valence of doubtful ions, solubility of sparingly soluble salts and equilibrium constant. Determination of PH using hydrogen electrode, quinhydrone electrode and glass electrode. Potentiometric titrations. (Acid base titration, precipitation titration and redox titration).

5.2 Chemical cell with and without transport. Concentration cells with and without transport. Expressions for EMF-Liquid junction potential.

5.3 Applications of concentration cells. Decomposition potential, polarization and overvoltage, fuel cells.

5.4 Storage cells- Lead storage battery and Lithium ion battery Li polymer battery.

References

1. B. R. Puri, L. R. Sharma and M. S. Pathania, Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co, Jalandar, 2016.

2. D. N. Bajpai, Advanced Physical Chemistry, 2nd Edn., S. Chand& Company, New Delhi, 1998.

3. A.S. Negi and S.C. Anand, A text book of Physical Chemistry, Wiley Eastern Ltd, New Delhi, 1984.

4. P. L. Soni, O. P Dharmarha and U. N. Dash, Text Book of Physical Chemistry, Sultan Chand & Company Ltd., New Delhi, 2001.

5. S. Glasstone, Text book of physical chemistry, 2nd revised edition, Macmillan, United Kingdom, 1980.

Learning Outcomes

To understand and comprehend the utility of electrochemical and analytical instruments based of the physical chemistry concepts

Subject Skill

Semester - VI CH 636 A Polymer Chemistry 5 Hrs/week (4 Credits)

Objectives

To understand the mechanism of polymerization, various techniques of polymerization

To learn about the characterization of polymers by molecular weight, reactions and degradation of polymers.

To learn the applications and appreciate the recent developments of polymers.

Unit - I: Introduction to Polymers and Mechanism of Polymerization 15 Hours

1.1 Polymer: introduction, classification of polymers: natural, synthetic, organic, inorganic, elastomers, fibers, resins, and plastics: thermoplastic and thermosetting.

1.2 Copolymers and its types.

1.3 Polymerisation methods: Addition- radical and ionic polymerization, Coordination polymerization.

1.4 Step polymerization-poly condensation, poly addition and ring opening.

1.5 Miscellaneous polymerization reactions: electrochemical, metathetical, group transfer.

Unit - II: Molecular Weight, Structure and Properties of Polymers 15 Hours

2.1 Molecular weight of polymers: number average, weight average, sedimentation and viscosity average molecular weight, degree of polymerization and practical significance of polymer molecular weight.

2.2 Molecular weight determination methods: ultracentrifugation and viscometry.

2.3 Physical properties of Polymers: Mechanical properties (Impact resistance, Tensile strength and Melt viscocity)-Tacticity- nature of chain packing-Chain flexibility.

2.4 Glass transition temperature-Factors affecting Tg- Molecular weight and Tg-Plasticisers and Tg- Importances of Tg.

2.5 Reactions-Hydrolysis, Hydrogenation, addition, substitution, cross linking, vulcanization and cyclisation.

Unit - III: Polymerisation Techniques and Polymer Processing 15 Hours

3.1 Polymerisation techniques: Bulk, solution, suspension and emulsion polymerization –melt polycondensation.

3.2 Polymer processing- Calendaring -Casting methods: Die casting, rotational casting and Film casting.

3.3 Moulding techniques-Compression, Injection, Blow and Extrusion Moulding.

3.4 Thermoforming-Foaming- Reinforcing (hand Lay-up, Filament winding and Spray-up Techniques).

3.5 Fibre spinning methods: (Melt spinning-Dry spinning and Wet spinning)

Unit - IV: Commercial Polymers 15 Hours

4.1 Preparation, properties and uses of the following: Polyethylene, Polystyrene, TEFLON and PVC.

4.2 Preparation, properties and uses of the following:-Polyesters, Polyamides, Polycarbonates Polyurethanes, Polypropylene Glycols (PPG).

4.3 Preparation of Epoxy resins, Styrene butyl rubber, Rayon and Carboxy Methyl cellulose.

4.4 Polymer additives: Fillers (Wood, Flour, Asbestos, Graphite and Mica).

4.5 Plasticizers (Tricresyl phosphate, Dimethyl Phthalate and Camphor)-Fire Retardants and Colourants.

Unit -V: Introduction to Recent Trends in Polymer 15 Hours

5.1 Biodegradable polymers: Polyhydroxyalkonates (Biodegradation and application), Poly Lactic acid (synthesis and application), Aliphatic and aromatic polyesters(Degradation)-Ecoflex, Eastar Bio and Enpol.

5.2 Conducting Polymers: Poly sulphur nitride, Polyacetylene and Poly phenylene.

5.3 Polymers as Biomaterials: artificial heart, Artificial skin, contact lenses, Artificial kidneys.

5.4 Fire retardant Polymers: Pyro Check 68PB, Bisphenol, Polybutylene terphthalate and Polyphenylenesulphone.

5.5 Inorganic Polymers: Preparation and properties of Silicones, polyphosphates.

References

1. F.W. Bill Meyer, Text Book of polymer science, Wiley & Sons, 1984.

2. Gowariker. V.R. Viswanathan, N.V. Jayader Sreedhar. Polymer, Wiley Eastern Ltd., New Delhi, 1978.

3. B.K. Sharma, Polymer Chemistry, Goel Publishing house, Meerut, 1989.

4. M.G.Arora, M.S.Vadar, Polymer Chemistry. Anmol publication (p) Ltd., New Delhi, 1989.

5. Jagadamba Singh and R.C.Dubey, Organic Polymer chemistry- Pragati Publishers Meerut, 2012.

Learning Outcomes

To learn exclusively the usage of chemical principles in selected branches of chemistry that leads to employability and entrepreneurship.

Subject Skill

Semester - VI Industrial and Environment Chemistry 5 Hrs/week (4 Credits)

CH 636 B

Objectives:

To introduce the students about industrial extraction processes.

The pollution induced by the industrial development and the care towards the environment is focused.

Unit - I: Chemical Technology 15 Hours

1.1. Basic principles of distillation, solvent extraction, Solid-Liquid Leaching and liquid-liquid leaching, separation by absorption and adsorption.

1.2. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators.

1.3. Scaling up operations in chemical industry. Problems involving the scaling up of the process. Scale up and process development-Scale up and modeling-

1.4. Introduction to clean technology for speciality chemicals-economic, environment and safety needs.

1.5. Clean technology route to waste management

Unit - II: Industrial Metallurgy 15 Hours

2.1. General Principles of Metallurgy

2.2. Hydrometallurgy, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process.

2.3. Preparation of metals (ferrous and nonferrous)

2.4 ultrapure metals for semiconductor technology.

2.5. Alloys Composition and its importance.

Unit - III: Eco systems and Air Pollution 15 Hours

3.1. Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

3.2. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particulate size and chemical nature;

3.3 Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution.

3.4. Pollution by SO2, CO2, CO, NOx, H2S and other foul smelling gases. Methods of estimation of CO, NOx, SOx and control procedures. Effects of air pollution on living organisms and vegetation.

3.5. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

Unit - IV: Aquatic Ecosystems and Purification Systems 15 Hours

4.1. Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

4.2. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment).

4.3 Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc.

4.4. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange).

4.5. Water quality parameters for waste water, industrial water and domestic water.

Unit - V: Energy & Environment 15 Hours

5.1. Classification renewable and non-renewable. Sources of energy: Coal, petrol and natural gas. Uses and its impact on environment.

5.2. Nuclear Fusion/Fission. Process, its uses and its environmental impacts to aquatic life.

5.3. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

5.4. Clean energy:Solar energy, Wind Energy, Hydrogen, geothermal, Tidal and Hydraulic energy, etc.

5.5. Fuel cells, bio mass, bio gas preparation and its environmental impacts

Books for Reference

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK. 1990.

2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi, 2015

3. K. De, Environmental Chemistry, New Age International Pvt., Ltd, New Delhi, 2006

4. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi, 2007

5. W. Hoyle, Clean Technology for the Manufacture of Speciality Chemicals, Royal Society of Chemistry, Manchester, UK, 2001

Subject Skill

Semester-VI Inorganic Materials of Industrial Importance 5 Hrs/Week (4 Credits)

CH 636 E

Objectives

To learn the principles of Nanotechnology

To understand the principles and properties of Inorganic materials of Industrial importance.

To study the significance and its applications of Inorganic materials of Industrial importance.

Unit - I: Nanomaterials and Catalysis 15 Hours

1.1 Introduction to nanomaterials-nano and nature. Synthesis of Nanomaterials-Principles-Nucleation and growth, processing and synthesis of nanomaterials. Topdown and bottom-up synthesis, one dimensional(1D) growth.

1.2 Experimental methods-Investigating and manipulating materials in the nanoscale. Electron microscopy-SEM-Basics-resolving power-instrumentation-application.

1.3 Catalysis: General principles and properties of catalysts-Catalyst Synthesis

1.4 Homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications.

1.5 Deactivation or regeneration of catalysts.Phase transfer catalysts, application of zeolites as catalysts. Catalyst Synthesis,[Catalytic poison]

Unit - II: Silicate and Ceramics 15 Hours

2.1 Glass: Glassy state and its properties, classification (silicate and non-silicate glasses).

2.2 Manufacture and processing of glass.

2.3 Composition and properties of the following types ofglasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

2.4 Ceramics: Important clays and feldspar, ceramic, their types and manufacture.

2.5 Hightechnology ceramics and their applications, superconducting and semiconducting oxides. Composites: fullerenes, carbon nanotubes and carbon fibre.

Unit - III Cements and Fertilizers 15 Hours

3.1 Cements: Classification of cement, ingredients and their role.

3.2 Manufacture of cement and thesetting process, quick setting cements.

3.3 Fertilizers: Ammonia Synthesis: Haber’s process and Contact Process:Sulphuric acid Nitric acids.

3.4 Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammoniumnitrate, calcium ammonium nitrate, ammonium phosphates;

3.5 Manufacture of the following fertilizers: polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

Unit - IV: Surface Coatings and Batteries 15 Hours

4.1 Surface Coatings: Objectives of coatings surfaces, preliminary treatment of surface, classification of surfacecoatings.Paints and pigments-formulation, composition and related properties.

4.2 Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels,emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plasticpaint),

4.3 Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings, metal spraying and anodizing.

4.4 Batteries:Primary and secondary batteries, battery components and their role.

4.5 Characteristics ofBattery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

Unit -V: Alloy and Chemical Explaosives 15 Hours

5.1 Alloys: Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys.

5.2 Manufacture of Steel (removal of silicon decarbonization, demanganization,desulphurization,dephosphorisation) and surface treatment (argon treatment, heat treatment,nitriding, carburizing).

5.3 Composition and properties of different types of steels.

5.4 Chemical explosives: Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX).

5.5 Introduction to rocket propellants.

References

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK, 1990.

2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi, 2015.

3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi, 2007.

4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi, 2010.

5. P. C. Jain & M. Jain: Engineering Chemistry, DhanpatRai& Sons, Delhi, 1998.

6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, 4th edition, Vikas Publications, New Delhi, 2013.

7. B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meerut, 1998.

8. T.Pradeep, Nano: The Essentials, Mcgraw-Hill Professional, 2008.

Non - Major Elective - II

Semester - VI NCH 603 Chemistry in Every Day Life 2 Hrs / week (2 Credits)

Objectives

To appreciate the importance of chemistry in day-to-day appliances

To understand the role of chemicals involved in different substances, their uses and precautions to be taken.

Unit - I: Chemistry in Agriculture 6 Hours

1.1 Soil chemistry- types of soil, composition.Properties of soil, preliminary idea about soil water, soil temperature, texture, minerals.

1.2 Fertilizers-requisites-composition and types and ill effects. Definition and examples of insecticides, fungicides, herbicides, Toxic effects of pesticides. Introduction to organic farming, benefits and challenges.

Unit - II: Chemistry in Housing and Household 6 Hours

2.1 Major classes of household chemicals-cleaners, pesticides, stain removers, fire extinguishers. Composition of Portland Cement-Types of concrete.

2.2 Paints – Composition and types, Varnishes.Composition of soap, shampoos and detergents.Glass - Variety of glasses and their uses.

Unit - III: Chemical Processing and Preservation of Food 6 Hours

3.1 Chemical Food additives for flavour, colour, sweeteners. Food preservation methods and chemicals used Beverages- Chemicals in drinks. Bakery Products- Bread, butter and cheese.

3.2 Food adulteration-Adulterants in milk, ghee, oil, coffee powder, tea, asafoetida, chilli powder, pulses and turmeric powder-identification

Unit - IV: Plastics and Ceramics 6 Hours

4.1 Polythene, Celluloid, PVC, bakelite, polyesters, resins and their applications.Natural Rubber-Synthetic rubbers-Vulcanisation-definition and its applications.

4.2 Novel plastics and their applications.Ceramics as insulators, semi-conductors and super conductors. Biomedical Ceramics

Unit -V: Chemistry of Leathers 6 Hours

5.1 Structure and compositions of hides and skins, Different stages of leather manufacturing. Flaying, liming, demining, curing, drenching and pickling.

5.2 Tanning, Methods of tanning, Vegetable tanning and chrome tanning, Tannery effluent and by product problems.

References

1. Kirpal Singh, Chemistry in Daily Life, Second Edition, Prentice-Hall of India private Ltd,New Delhi, 2008.

2. C. Jain and Monicka Jain, Engineering Chemistry, Dhanpat Raj Publishing Co., (P) Ltd.,New Delhi, 2002.

3. Jayashree Ghosh, Textbook of Pharmaceutical chemistry, Rajendraravindra printers pvt. Ltd., New Delhi, 2010

4. Jayashree Ghosh, Fundamental concepts of Applied Chemistry, S Chand Publications, New Delhi, 2006

Self-Study Paper - II

Semester - VI Chemistry for Competitive Examinations – II 1 Credit

Objectives

To motivate the students for self study

To prepare them for the competitive exams

Unit - I: Oxidation and Reduction

Oxidation number-oxidizing and reducing agents-balancing redox equations

Unit - II: Concentration Units

Normality- acid base reactions-Normality-redox reactions-mole fraction and molality.

Unit - III: Thermodynamics

Heat-internal energy-enthalpy, free energy change and entropy.

Unit - IV: Chemical Kinetics

Rate laws-order-molecularity-half life-collision theory.

Unit - V: Electrochemistry

Electrical units-electrolysis-galvanic cells-Nernst equation.

References

1. R.L. Madan & G.D Tuli, Physical chemistry, Questions and answers, S. Chand success guides, 2012.

2. Pearson, Super course in physical Chemistry, Dorling Kindersley, 1st edition, 2004.

3. Estelle K Meislich, 3000 problems in organic chemistry vol 1 & 2, Tata McGraw Hill, 2004.

4. Mc Graw Hill education series, Complete Chemistry, JEE – Main, 2014.

Learning Outcomes

The learner is able to compete well in MCQs and descriptive types examinations for various jobs and courses offered in chemistry.