

APPENDIX – 2(S)
UNIVERSITY OF MADRAS
CHOICE BASED CREDIT SYSTEM
04. B.Sc. DEGREE COURSE IN CHEMISTRY
REVISED SYLLABUS
(w.e.f. 2014 – 2015 onwards
i.e. for the batch of candidates admitted from the
academic year 2012-2013 onwards)
PAPER - VII

Semester	Subject Title	Subject Code	Total Hours	Credit
V	Inorganic Chemistry- II		75	4

OBJECTIVES:

- To understand the nature of bonding in co-ordination compounds.
- To appreciate the biological and industrial importance of coordination compounds.
- To understand the chemistry of S, Se, As and Sb compounds.

UNIT I: COORDINATION CHEMISTRY - 1 (15 HRS)

Types of ligands , IUPAC Nomenclature, Isomerism - Ionisation, hydrate, linkage, ligand and coordination isomerism. Stereoisomerism-geometrical and optical isomerism in 4 & 6 coordinated complexes. Theories of coordination compounds – Werner’s and Sidgwick’s EAN concept , Valence Bond theory – hybridisation,

geometry and magnetic properties of $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{NiCl}_4]^{2-}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{CoF}_6]^{3-}$. Crystal field theory – spectrochemical series, splitting of ‘d’ metal orbitals in octahedral and tetrahedral complexes, low spin & high spin complexes. Explanation of colour and magnetic properties using CFT, comparison of VBT and CFT.

UNIT 2: COORDINATION CHEMISTRY II (15HRS)

Stability of Complexes – Factors affecting the stability of complexes. Unimolecular and bimolecular nucleophilic substitution reactions in octahedral and square planar complexes. Trans effect, Magnetic properties of transition metal complexes. Elementary idea of electronic spectra of transition metal complexes.

UNIT 3: APPLICATION OF COORDINATION COMPOUNDS (15HRS)

Application of coordination compounds – Estimation of nickel using DMG and aluminium using oxine. Estimation of hardness of water using EDTA. Biologically important coordination compounds - Chlorophyll, haemoglobin, vitamin - B_{12} . (their structure and applications). Metal Carbonyls : Mono and Poly nuclear Carbonyls of Ni, Fe, Cr, Co and Mn – Synthesis, structures and bonding.

UNIT 4: CHEMISTRY OF ARSENIC, ANTIMONY, SULPHUR AND SELENIUM COMPOUNDS. (15HRS)

Oxides, Oxyacids and Oxyhalides.

Sulphurous acids, Thionic acids, Peroxy acids-Permono and perdisulphuric acids.

UNIT 5: SPECIAL TOPICS (15HRS)

5.1. Composition, properties and uses of beryl, asbestos, talc, mica, zeolites and ultramarines.

5.2. Organo metallic compounds of alkenes, alkynes and cyclopenta diene (ferrocene)- Preparation ,structure and uses.

5.3.Types of solvents-Protic and aprotic solvents,aqueous and non- aqueous solvents, liquid ammonia as a solvents.

BOOKS FOR REFERENCE

01. Lee J.D., Concise Inorganic Chemistry.5th ed.,Blackwell Science,2005.
02. Sharpe Alan G. Inorganic Chemistry .ELBS and Longman,1981.
03. Puri, B.R., L.R.Sharma and K.C. Kalia. Principles of Inorganic Chemistry, 30th ed.,New Delhi,Mile stone publishers and distributors, 2009.
04. Soni P.L,and Mohan katyal. Text book of Inorganic Chemistr,20th ed., New Delhi, S.Chand & Co., 2006.
05. Malik,Wahid U., G.D. Tuli and R.D .Madan . Selected Topics in Inorganic Chemistry,7th ed., New Delhi S.Chand & Company Ltd., 2007.

PAPER-VIII

Semester	Subject Title	Subject Code	Total Hours	Credit
V	Organic Chemistry- I		75	4

OBJECTIVES:

- To enable leaners to understand the chemistry of organic compounds containing Oxygen and Nitrogen.
- To familiarize them with heterocyclics and dyes.

UNIT-I : CHEMISTRY OF ALCOHOLS, ETHERS AND PHENOLS. (15 HRS)

Monohydric alcohols: Nomenclature, preparation of alcohols

from alkenes (by oxymercuration-demercuration), alkyl halides, Grignard reagent and carbonyl compounds (by reduction).

Reactions of alcohols-Dehydration, oxidation, action of Grignard reagent, action of hot reduced copper.

Ethers: Nomenclature, preparation by Williamson ether synthesis, Reactions-acid-catalysed cleavage of ethers.

Phenols: Nomenclature, synthesis of phenol from benzene sulphonic acid, chloro benzene and cumene. Properties - Acidity of phenols (explanation on the basis of resonance stabilization). Ring substitution in phenol-orientation of phenolic group towards electrophiles, halogenation, nitration, sulphonation and Friedel craft's alkylation and acylation. Mechanism of Reimer-Tiemann reaction, Kolbe-Schmidt reaction and coupling with diazonium salts.

Dihydric phenols: condensation reactions.

UNIT-II : CHEMISTRY OF CARBONYL COMPOUNDS. (15 HRS)

Nomenclature, structure of carbonyl compounds, acidity of alpha-hydrogen atom, keto-enol Tautomerism (proof for the two forms).

Mechanism of nucleophilic addition with HCN, ROH, NaHSO₃, ammonia and its derivatives.

Mechanism of Meerwein-Ponndorf Verley reduction, Clemmensen reduction, Wolf-Kishner reduction, aldol condensation, Claisen-Schmidt reaction, Cannizzaro reaction, haloform reaction, Perkin and Benzoin condensation reaction.

UNIT-III : CHEMISTRY OF CARBOXYLIC ACIDS AND THEIR DERIVATIVES. (15 HRS)

Acidity of carboxylic acids, Effect of substituents on acidity, comparison of acid strengths of halogen substituted acetic acids, acid strengths of substituted benzoic acids.

Dicarboxylic acids: Preparation – from alkyl cyanides, cyclic ketones and halo esters. Reactions – action of heat, action of PCl_5 and NH_3 .

Acid derivatives (Aliphatic): Synthesis and important properties of acid derivatives (acid chlorides, acid anhydrides, esters and amides). Relative reactivity of acyl compounds.

Compounds containing active methylene group-Acetoacetic and malonic esters. Preparation and synthetic applications.

UNIT-IV : CHEMISTRY OF NITROGEN COMPOUNDS. (15 HRS)

Nomenclature. Nitrobenzene-preparation, reduction in different media, conversion of nitrobenzene to m-dinitrobenzene and TNT.

Amines: Nomenclature, Basicity of amines, effect of substituents on basicity of aliphatic and aromatic amines. Preparation-primary amines-(Gabriel synthesis and reduction of nitriles), secondary and tertiary amines-by the reduction of N-alkyl substituted amides.

Reactions of amines-primary aliphatic amines with nitrous acid, primary arylamines with nitrous acid, reactions with alkyl halides.

Electrophilic ring substitution in aromatic amine- halogenation, nitration and sulphonation. Mechanism of carbyl amine reaction. Diazotisation and its mechanism. Synthetic applications of benzene diazonium chloride. Preparation and properties of sulphanilic acid, sulphanilamide, saccharin and Chloramine-T.

UNIT-V : HETERO CYCLIC COMPOUNDS AND DYES. (15 HRS)

HETERO CYCLIC COMPOUNDS (10 HRS)

Nomenclature, Preparation and properties of Furan, Pyrrole, Thophene and pyridine. Comparative study of basicity of pyrrole, pyridine and piperidine with aliphatic amines.

Synthesis of Indole by Fischer indole synthesis and reactions of indole.

Synthesis of quinoline by Skraup synthesis and its reactions.

DYES (5 HRS)

Theory of colour and constitution. Preparation and uses of: Azo dye-Bismark brown, triphenyl methane dye - malachite green, phthalein dye-fluorescein, anthraquinone dye- alizarin and vat dye-indigo.

REFERENCE BOOKS:

1. Morrison, R.T. and R.N.Boyd. Organic Chemistry, 6th ed., Pearson Education, Asia 2002.
2. Graham Solomons, T.W.Organic Chemistry, 3rd ed., John Wiley & Sons.
3. Carey Francis A. Organic Chemistry , 7th ed., New Delhi, Tata MacGraw Hill Education pvt Ltd., 2009.
4. Finer, I.L Organic Chemistry, 6th ed., Vol.(1& 2), England, Wesley Longman Ltd (1996).
5. Joule, J.A. and G.F.Smith. Heterocyclic Chemistry, 2nd ed., England, VanNostrand Reinhold (UK) Co.Ltd, 1984.
6. Soni, P.L., and H.M.Chawla-Text book of Organic Chemistry, 29th ed., New Delhi, Sultan Chand & Sons, 2007.

PAPER - XII

Semester	Subject Title	Subject Code	Total Hours	Credit
VI	Organic Chemistry- II		75	4

OBJECTIVES:

- To Provide learners with a knowledge of structural aspects of biomolecules.
- To make them to understand the mechanisms of rearrangement reactions.
- To familiarise them with the importance of organic spectroscopy.

UNIT 1: CHEMISTRY OF CARBOHYDRATES (15HRS)

Carbohydrates – Definition and Classification of carbohydrates with examples. Mono saccharides: Explanation of enantiomers, diastereomers, epimers and anomers with examples. Mechanism of mutarotation, osazone formation. Absolute configurations of glucose and fructose. Structural elucidation of glucose and fructose (includes cyclic and Haworth structure). Inter conversions, ascending and descending the sugar series. Disaccharide – Sucrose, Maltose – Structural elucidation. Polysaccharide – Starch and Cellulose (Elementary treatment).

UNIT 2: CHEMISTRY OF PROTEINS AND VITAMINS (15HRS)

Amino acids – Classification, General methods of preparation and reactions, zwitter ion, isoelectric point. Peptides and proteins – Peptide linkage, Classification of proteins, primary structure, End group analysis – Sanger's method and Edman method, secondary structure, tertiary structure, denaturation.

Vitamins – Classification, biological importance of Vitamins, Structural elucidation of Vitamin C. Structures of Vitamin A and Vitamin D.

UNIT 3: CHEMISTRY OF ALKALOIDS AND TERPENOIDS (15HRS)

Chemistry of natural products – Alkaloids – Isolation, classification, general methods of elucidating structure. Structural elucidation of nicotine and piperine. Terpenes – classification, isoprene rule, isolation and structural elucidation of citral, α -terpeniol and menthol.

UNIT 4: MOLECULAR REARRANGEMENTS (10HRS)

Molecular rearrangements – Types of rearrangements, Mechanisms for the following rearrangements : pinacol – pinacolone, benzil – benzilic acid, benzidine, Favorskii, Claisen, Fries, Hofmann, Curtius, Schmidt and Beckmann.

UNIT 5: ORGANIC SPECTROSCOPY (20HRS)

UV-VIS spectroscopy – Types of electronic transitions, Spectrometer-block diagram, Fieser rules- calculation of λ_{max} : dienes. Bathochrome and Hypochrome shift.

IR spectroscopy - Number and types of fundamental vibrations, Modes of vibrations and their energies. Instrumentation and block diagram. Position of IR absorption frequencies for functional groups like alcohol (ethanol), primary amine (ethylamine), ketone (acetone), ester (ethylacetate) and amide (benzamide).

NMR spectroscopy - Principle, Instrumentation and block diagram. Equivalent and non-equivalent protons, Shielded and deshielded protons, chemical shift - TMS, delta scales, Spin-Spincoupling, analysis of the spectra of EtOH and 4-methoxy benzaldehyde.

BOOKS FOR REFERENCE

1. Finar I.L., Organic Chemistry, Vol 1&2 (6th edition), England, Addison Wesley Longman Ltd. (1996)

- Marrison R.T., Boyd R.N., Organic Chemistry, (4th edition) New York, Allyn & Bacon Ltd., (1976)
- Bahl B.S., Arun Bahl, Advanced Organic Chemistry, (12th edition) New Delhi, Sultan Chand and Co., (1997)
- Pine S.H., Organic Chemistry, (4th edition) New Delhi, Mc-Graw-Hill International Book Company, (1986)
- Seyhan N. Ege, Organic Chemistry, New York, Houghton Mifflin Co., (2004)
- William Kemp, Organic Spectroscopy, 3rd edition, ELBS.

PAPER XIII

Semester	Subject Title	Subject Code	Total Hours	Credit
VI	Physical Chemistry- II		75	4

UNITS LEARNING OBJECTIVES

- To know the reaction rates and pathways
To understand the energy changes involved chemical reactions
- To know the various photochemical processes in the chemical systems
- To know the conducting behaviour of ions
To understand the theory of electrical conductance
- To understand the transformation of chemical energy into electrical energy in Galvanic cells
- To understand the symmetry aspects in chemical systems

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