C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18MCH501 Semester: V

Major - 5 Title: **INORGANIC CHEMISTRY - I**

Credits: 5 Max. Marks. 75

Objective	To effectively impart knowledge and understanding on gravimetry, coordination chemistry, Organometallic chemistry and halogens.
Course Outcome: On successful completion of the course, students will be able to	
CO1	Determine the amount of substances using gravimetric technique.
CO2	Identify the nature of coordination complexes and its isomerism.
CO3	Describe the type of bonding, geometry, properties and the stability of the coordination complexes
CO4	Explain the basics of halogen family and their compounds

UNIT-I

1.1 Principles of gravimetric analysis - Characteristics of precipitating agents - choice of precipitants - conditions of precipitation - specific and selective precipitants - DMG, cupferron, salicylaldehyde, ethylene diamine - use of sequestering agents.

1.2 Co-precipitation - post precipitation - differences - minimization of error - precipitation from homogeneous solution - calculation in gravimetric methods - use of gravimetric factor.

1.3 Thermo analytical methods - principle involved in thermo gravimetric analysis and differential thermal analysis - characteristics of TGA and DTA - thermo grams – factors affecting TGA and DTA curves - discussion of various components of the instrument with block diagrams - Applications of thermogravimetry - Applications of DTA - thermometric titration. Electrogravimetry - principle and applications.

UNIT-II

2.1 Coordination Compounds: Introduction - Ligands- monodentate, bidentate and polydentate ligands, Coordination Sphere, Coordination Number - Chelation and effect of Chelation - Applications of EDTA.

2.2 Types of ligands - Nomenclature of coordination complexes.

2.3 Isomerism in complexes - Ionization Isomerism, hydrate Isomerism, linkage Isomerism, ligand Isomerism, coordination Isomerism, polymerization Isomerism, geometrical and optical Isomerism in 4 and 6 coordinate complexes.

UNIT-III

3.1 Werner's theory – Important postulates and examples - EAN rule – theories of bonding - Valence bond theory – Inner and outer orbital complexes of Cr, Fe and Ni – Drawbacks of VBT.

3.2 Crystal field theory - spectrochemical series - splitting of d - orbitals in octahedral, tetrahedral and square planar complexes - crystal field stabilization energy - calculation of CFSE in octahedral and tetrahedral complexes – Compare VBT and CFT.

3.3 Low spin and high spin complexes – explanation of magnetic properties, colour and geometry using CFT.

UNIT-IV

4.1 Organometallic compounds- Definition and types- Metal-Alkene complexes- Bonding and structure- Zeise's salt- preparation and structural features- Importance of organometallic compounds as catalysts-Wilkinson's catalyst- Preparation and application in Hydrogenation reactions- Advantages and disadvantages of Wilkinson's catalyst.

4.2 Metallic Carbonyls – types – geometry, hybridization and magnetic properties of mononuclear carbonyls of V, Cr, Mo, W, Fe, Ni.

4.3 Geometry, hybridization and magnetic properties of binuclear carbonyls of Mn, Fe, Co.

UNIT-V

5.1 Halogen-comparative study of F, Cl, Br and I - elements - reactivities - comparison of F and O - hydracids - oxides.

5.2 Classification of halide - fluorides of oxygen - exceptional properties of fluorine.

5.3 Oxy acids of halogens - Structure. Interhalogen compounds – pseudohalogens - basic properties of halogens- positive iodine – Evidences.

REFERENCE BOOKS:

1. Inorganic Chemistry - P.L. Soni - Sultan Chand (2013).
2. Inorganic Chemistry - B.R. Puri, L.R. Sharma and K.C. Kallia - Vallabh Publications (2017).
3. Selected Topics in Inorganic Chemistry - W.U. Malik, G.D. Tuli and R.D. Madan - S. Chand Publications (2009).
4. Inorganic Chemistry - J.E. Huheey, Harper and Collins - NY IV edition (2006).
5. Concise Inorganic Chemistry - J.D. Lee – Wiley Publishers- V edition (2008).
6. Industrial Chemistry - B.K Sharma – Krishan Prakashan Publications- XVII Edition (2014).
7. Inorganic Chemistry- Catherine Housecroft and Alan G. Sharpe- Pearson Publishers- IV Edition (2012).
8. Advanced Inorganic Chemistry - Cotton and Wilkinson - VI Edition - Wiley and Sons (1999)
9. The Organometallic Chemistry of Transition metals- Robert H. Crabtree- Wiley and Sons (2014).
10. Basic Organometallic Chemistry: Concepts, Synthesis and Applications- B. D. Gupta and A.J Elias, II Edition (2013).
11. Textbook of Inorganic Chemistry – R. Gopalan- Universities Press (2018).

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18MCH502 Semester: V

Major - 6 Title: **ORGANIC CHEMISTRY - I**

Credits: 5 Max. Marks. 75

Objective	A comprehensive knowledge and understanding on the Carbohydrates, Stereochemistry, Conformational Analysis, Carbonyl compounds and Heterocyclic chemistry.
Course Outcome: On successful completion of the course, students will be able to	
CO1	Aware of the fundamental aspects of carbohydrates.
CO2	Apply quantitative reasoning skills to stereochemistry and its influence on chemical properties.
CO3	Competent organic chemists with adequate knowledge in carbonyl compounds.
CO4	More inquisitive in learning the Mechanistic details in Organic Chemistry through the teaching of the named reactions.

UNIT- I Carbohydrates:

1.1 Carbohydrates – Introduction - Classification – Aldoses and Ketoses, Reducing and Non-reducing Sugars - Reactions of Glucose and Fructose - Osazone formation, Mutarotation and its Mechanism - Structural elucidation of Glucose and Fructose - Pyranose and Furanose forms – Haworth's method.

1.2 Determination of Ring Size- Haworth Projection Formula - Configuration of Glucose and Fructose - Anomerism - Epimerization - Chain lengthening and chain shortening of Aldoses - Inter conversion of Aldoses and Ketoses – Uses of Glucose.

1.3 Disaccharides and Polysaccharides - Reactions and Structural elucidation of Sucrose and Maltose - Properties, Structure and Uses of Starch, Cellulose and Chitin.

UNIT- II Stereo Chemistry:

2.1 Stereoisomerism – Definition - Classification into Optical and Geometrical isomerism. Conditions for Optical Activity – Asymmetric centre – Chirality – Achiral molecules - Elements of symmetry - Projection formulae - Fischer, Flying Wedge, Sawhorse and Newmann projection formulae - Notation of optical isomers - Cahn - Ingold - Prelog rules -

R, S notation of Optical isomers with one Asymmetric carbon atoms – Erythro and Threo conventions.

2.2 Optical activities in Compounds not containing Asymmetric Carbon Atoms - Biphenyl, Allenes and Spiranes - Racemisation - Resolution - Asymmetric Synthesis (Partial and Absolute Synthesis) - Walden inversion.

2.3 Geometrical isomerism - Cis - Trans, Syn - Anti and E-Z Notations - Geometrical Isomerism In Maleic and Fumaric Acids and Unsymmetrical Ketoximes - Methods of Distinguishing Geometrical Isomers using Melting Points, Dipole Moment, Dehydration, Cyclisation, Heat of Hydrogenation and Combustion.

UNIT- III Conformational Analysis:

3.1 Conformational analysis - Introduction of terms - Conformations, Configuration, Dihedral Angle, Torsional Strain - Differences between Conformational isomers and Configurational isomers.

3.2 Conformational analysis of Ethane, n-Butane and ethylene glycol including energy diagrams.

3.3 Conformations of Cyclohexane (Chair, Boat and Twist-Boat forms) - Axial and Equatorial bonds - Ring flipping showing Axial and Equatorial bonds Interconversions – Conformations of Methyl Cyclohexane, Dimethyl Cyclohexane and their stability - 1,2 and 1,3 - Interactions.

UNIT- IV Active Methylene Compounds & α, β-unsaturated carbonyl compounds:

4.1 α, β-unsaturated carbonyl compounds – Structure and properties, preparation, Electrophilic and Nucleophilic additions, Michael addition, Diels Alder reaction.

4.2 Acetoacetic ester: keto-enol tautomerism, Preparation and synthetic utility of acetoacetic and cyanoacetic ester.

4.3 Malonic ester: Preparation and Synthetic applications.

UNIT – V Carbocyles and Heterocycles:

5.1 Polynuclear hydrocarbons and their derivatives: synthetic methods include Haworth, Bardhan-Sengupta, Bogert-Cook and other useful syntheses (with mechanistic details); fixation of double bonds and Fries rule; Reactions of Naphthalene, Anthracene and Phenanthrene and their derivatives (with mechanism).

5.2 Heterocyclic compounds: 5- and 6-membered rings with one hetero atom; reactivity, orientation and important reactions (with mechanism) of Furan, Pyrrole, Thiophene and Pyridine; Synthesis of Pyrrole by Knorr synthesis, Paal-Knorr; Synthesis of Furan by Paal-Knorr synthesis, Feist-Benary; Synthesis of Thiophene by Paal-Knorr synthesis, Hinsberg; Synthesis of Pyridine by Hantzsch synthesis.

5.3 Benzo-fused 5-and 6-membered rings with one heteroatom: reactivity, orientation and important reactions (with mechanistic details) of Indole, Quinoline and Isoquinoline; Synthesis: Indole: Fischer, Quinoline: Skraup, Isoquinoline: Bischler Napieralski synthesis.

REFERENCE BOOKS

1. Advanced Organic Chemistry by Arun Bahl and B.S. Bahl, S. Chand and Co. Ltd. (2012).
2. Textbook of Organic Chemistry by P.L. Soni and H.M. Chawla, Sultan Chand & Sons (2007).
3. Modern Organic Chemistry by M.K. Jain & S.C. Sharma, 4th Edition, Vishal Publishing & Co, (2013).
4. Organic Chemistry - I. L. Finar - Volume I and II - London:ELBS,2002.
5. Organic Chemistry by Morrison and Boyd, 7th Edition, Pearson, (2013).
6. Organic Chemistry by Stanley H Pine, 5th Edition (2008).
7. Advanced Organic Chemistry by Jagadamba Singh & L.D.S. Yadav, (2013).
8. Fundamentals of Organic Chemistry by John McMurry, 7th Edition (2011).
9. March's Advanced Organic Chemistry Reactions, Mechanism and Structure by Michael B Smith and Jerry March, 7th Edition, (2016).
10. Advanced Organic Reaction Mechanism by N. Tewari,(2015).
11. Organic Chemistry of Natural Products - Volume I and II - O. P. Agarwal - Goel Publishing House (2002).
12. Organic Chemistry by T. W. Graham Solomon, C. B. Fryhle – S. A. Dnyder – John Wiley & Sons (2014).
13. Organic Reaction Mechanisms by Ahluwalia V K. Narosa publishing house, New Delhi (2011)
14. A Text Book of Organic Chemistry by Tewari, K.S. and Vishnoi, N. K. 4th edition, Vikas Publishing 2017.

WEB RESOURCES

http://www.organic-chemistry.org/

http://www.chemguide.co.uk/orgmenu.html

http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm

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Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18MCH503 Semester: V

Major - 7 Title: **PHYSICAL CHEMISTRY - I**

Credits: 5 Max. Marks. 75

Objective	To impart knowledge about the Solutions, Phase Rule, Colligative properties, Chemical Equilibrium, Electrochemistry and their Applications.
Course Outcome: At the end of the course, the students can able to	
CO1	Discuss about the various types of solutions and colligative properties.
CO2	Describe the heterogeneous and homogenous phase equilibrium
CO3	Explain the chemistry of electrolytic conductors, application of conductance, pH and buffer solutions

Unit - I Solutions

1.1 Solutions of liquids in liquids - Raoult's law – Vapour pressure of ideal solutions – Activity of a component in an ideal solution – Chemical Potentials of ideal and non-ideal solutions - Gibbs -Duhem-Margules equation – Thermodynamics of Ideal Solutions, ΔG_{mix}, ΔV_{mix}, ΔH_{mix} and ΔS_{mix} for ideal solutions.

1.2 Vapour pressure of Non-ideal solutions – Fractional distillation of Binary liquid solutions –Partially miscible liquids - Phenol – Water, Triethylamine – Water, Aniline – Hexane and Nicotine – Water systems. Effect of impurity on CST and applications.

1.3 Solutions of Gases in liquids – Factors affecting solubility of Gas – Henry's law and its limitations.

Unit - II Phase rule

2.1 Definition of the terms involved in phase rule – Phase, Components and Degrees of freedom – Derivation of Gibbs phase rule.

2.2 Applications of phase rule - One component system - Water and Sulphur system – Reduced phase rule - Two components system - Simple eutectic system – Lead-silver system – Pattinsons process of Desilverization of lead – KI-water system.

2.3 Thermal analysis and cooling curves. Compound formation with congruent melting point – Zn-Mg, $FeCl_3$- Water system - Compound formation with incongruent melting point - Na-K System. System involving salt and water; $CuSO_4$- H_2O and NaCl-H_2O system – Freezing mixtures – Deliquescence and Efflorescence.

Unit-III Colligative properties and Chemical Equilibrium

3.1 Colligative properties - Lowering of vapour pressure - Osmosis and osmotic pressure - Thermodynamic Derivation of Elevation of boiling point and Depression of freezing point – Determination of molar mass – Van't Hoff factor.

3.2 Chemical Equilibrium - Law of Chemical Equilibrium - Thermodynamic derivation of Law of Chemical Equilibrium. Relationship between K_p, K_c and K_x.

3.3 Van't Hoff Reaction Isotherm - Temperature Dependence of Equilibrium Constant – Van't Hoff Isochore – Pressure dependence of Equilibrium constant.

UNIT-IV Electrochemistry – I

4.1 Faradays laws of electrolysis – Metallic and Electrolytic conduction – Mechanism of electrolytic conduction **-** Specific conductance, Equivalent conductance and Molar Conductance - Measurement of equivalent conductance - Variation of Equivalent Conductance and Specific Conductance with Dilution – Ostwald's Dilution Law and Its Limitations.

4.2 Migration of ions - Ionic Mobility - Ionic Conductance - Transport Number and its determination – Hittorff's method and Moving Boundary method.

4.3 Debye-Huckel's theory of Strong Electrolytes - Onsagar equation (No derivation) - Verification and Limitations - Kohlrausch law and its Applications.

UNIT- V Electrochemistry – II

5.1 Applications of Conductance Measurements - Determination of Degree of Dissociation of Weak Electrolytes, Ionic Product of water - Solubility Product of sparingly soluble salt - Conductometric Titrations, precipitation titrations.

5.2 Concept of pH – common ion effect, Buffer solutions, Buffer action - Henderson equation - Applications of Buffer Solutions.

5.3 Hydrolysis of Salts - Expressions for Hydrolysis Constant, Degree of Hydrolysis and pH of aqueous salt solutions.

REFERENCE BOOKS

1. Principles of Physical Chemistry - B. R. Puri, Sharma and Madan S. Pathania, Vishnal Publishing Co., 2017.
2. Text Book of Physical Chemistry - P. L. Soni, O. P. Dharmarha and U. N Dash - Sultan Chand & Co., 2011.
3. Physical Chemistry - Negi and Anand – Eastern Wiley Pvt. Ltd. 2007.
4. Physical Chemistry - Kundu and Jain - S. Chand & Co., 1989.
5. Physical Chemistry - K. L. Kapoor - Macmillan - 5 vol., 2019.
6. Elements of Physical Chemistry - Glasstone and Lewis – Macmillan, .1963
7. Text book of Physical Chemistry - S. Glasstone - Macmillan (India) Ltd., 1948.
8. Fundamentals of Physical Chemistry - Maron and Landor - Collier–Macmillan, 1974.
9. Physical Chemistry - G. W. Castellan - Narosa publishing house, 2004.
10. Physical Chemistry - Walter J. Moore - Orient Longman, 1972.
11. Numerical Problems on Physical Chemistry, Amalendu Ghoshal - Books and Allied (P) Ltd., 2013.
12. Universal General Chemistry, C.N.R. Rao, Laxmi Publications, 2015.
13. Text book of Physical Chemistry – M. V. Sangaranarayanan, V. Mahadevan, Universities Press, 2011.
14. General and Physical Chemistry – Dr. A. Arunabhasan, Books of Allied (P) Ltd., - Ghoshal, 2009.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18ECH501 Semester: V

Elective - 1 Title: **SPECTROSCOPY (ELECTIVE - I)**

Credits: 2 Max. Marks. 75

Objective	To impart knowledge about different spectroscopic techniques.
Course Outcome: At the end of the course, the students can able to	
CO1	Discuss the basic principles of UV/Visible, Microwave, IR and Raman spectroscopy.
CO2	Interpret the NMR and mass spectra of organic compounds by using the principles of NMR and Mass spectroscopy respectively.

UNIT-I

1.1. Electromagnetic radiation – Definition – regions – quantization of energies in molecules – translational, rotational, vibrational and electronic – Born Oppenheimer approximation – Atomic and molecular spectra.

1.2. Microwave Spectroscopy – theory – selection rule – Calculation of moment of inertia and bond length of diatomic molecules.

UNIT-II

2.1. UV-Visible Spectroscopy – Absorption laws, Calculations involving Beer Lambert's law – types of electronic transitions – chromophore and auxochromes – Absorption bands and Intensity – Bathochromic shift, Hypsochromic shift, Hyperchromic shift and Hypochromic shift.

2.2. UV-Visible Spectroscopy – Principle – Instrumentation – Working – Application of UV-Visible spectroscopy

UNIT-III

3.1. IR Spectroscopy – Principle – Selection rules. Types of vibrations, IR activity of diatomic, triatomic linear (CO_2) and nonlinear triatomic molecules (H_2O). IR Spectroscopy – Instrumentation – sampling techniques. Applications of IR Spectroscopy.

3.2. Raman Spectroscopy – Raman Effect – Rayleigh and Raman scattering – stokes and antistokes lines - mutual exclusion principle, comparison between Raman and IR spectroscopy.

UNIT-IV

4.1. NMR Spectroscopy – Principle, Instrumentation and Working. Chemical shift – Factors affecting chemical shift – Shielding and Deshielding – TMS as NMR standard – Number of signals – Spin-spin coupling and coupling constants.

4.2. Interpretation of NMR spectra of simple organic compounds such as Acetone, Ethyl Bromide, Anisole, Benzaldehyde and Toluene.

UNIT-V

5.1. Mass spectroscopy – Principles, Instrumentation and Working – Molecular ion peak, Base peak, Metastable peak and Isotopic peak their uses. Fragmentation – Nitrogen rule – Mac-Lafferty Rearrangement.

5.2. Interpretation of mass spectra of simple organic compounds such as Acetone, Ethyl Bromide, Anisole, Benzaldehyde and Toluene.

Reference Books:

1. Basic concept of Analytical Chemistry - S. M. Khopkar, 2008.
2. Chemical Analysis: An Instrumental Approach - A.K. Srivastava and P.C. Jain, 2015.
3. Spectroscopic Identification of Organic Compounds - R. M. Silverstein, G. C. Basseler & T. C. Morill, 2015.
4. Organic Spectroscopy - W. Kemp, 2019.
5. Spectroscopic Methods in Organic Chemistry - D Williams & I. Fleming, 2011.
6. Fundamentals of Molecular Spectroscopy - C. N. Banwell, 2017.
7. Applications of Absorption Spectroscopy of Organic Compounds - Dyer, 1978.
8. Introduction to Molecular Spectroscopy - Barrow, 1962.
9. Spectroscopy of Organic Compounds - P.S. Kalsi, 2016.
10. Instrumental Methods of Chemical Analysis - B.K. Sharma, 2014.

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Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: Semester: V

Elective - 1 Title: PHARMACEUTICAL CHEMISTRY (ELECTIVE - I)

Credits: 2 Max. Marks. 75

Objective	To effectively impart knowledge about various diseases and their treatment. To learn about the importance of Indian medicinal plants and to know about the different types of drugs.
Course Outcome: At the end of the course, the students can able to	
CO1	Define the basic terms used in Pharmaceutical Chemistry
CO2	Describe the potential use of medicinal plants in the treatment of diseases.

(Preparation, Synthesis and Structural determination are not required for the Compounds mentioned).

UNIT - I

1.1 Definition of the following terms: drug, pharmacophore, pharmacology, pharmacopoeia, bacteria, virus, chemotherapy and vaccine.

1.2 Causes, symptoms and drug for jaundice, cholera, malaria and filaria. First aid for accidents - antidotes for poisoning.

UNIT - II

2.1 Causes, detection and control of anaemia and diabeties. Diagnostic test for sugar, salt and cholesterol in serum and urine.

2.2 Indian medicinal plants and uses-Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothvelai.

UNIT - III

3.1 Antibacterials: Sulpha drugs-examples and actions-prontosil sulphathiazole, sulphafurazole Antibiotics-definition and action of penicillin, streptomycin, chloramphenicol - SAR of chloramphenicol only.

3.2 Antiseptics and disinfectants - definition and distinction-phenolic compounds, chloro compounds, and cationic surfactant.

UNIT – IV

4.1 Analgesics, Antipyretics and anti inflammatory agents : Definition and actions - narcotic and non narcotic- morphine and its derivatives, pethidine and methodone- salicylic derivative, paracetamol, ibuprofen - disadvantages and uses

4.2 Causes, and treatment of cancer - AIDS - AZT, DDC.

UNIT - V

5.1 Anaesthetics - definition-local and general - volatile nitrous oxide, ether, Chloroform, cyclo propane- trichloroethylene - uses and disadvantages.

5.2 Drugs affecting CNS - Definition, distinction and examples for tranquilizers, sedatives, hypnotics, psychedelic drugs - LSD Hashish- their effects.

Reference Books:

1. A Text Book of Pharmaceutical Chemistry - Jayashree Ghosh - S. Chand Company Ltd.
2. Pharmaceutical Chemistry - S. Lakshmi -Sultan Chand.
3. Pharmacology and Pharmatherapeutics - R.S. Satoskar – Popular Prakashan - Vol.I and Vol II.
4. Medicinal Chemistry - Asuthosh Kar - New Age International Publishers.
5. A Text Book of Synthetic drugs - O.D. Tyagi - Ammol Publications.
6. Introduction to Biological Chemistry - J. Awapara Prentice Hall.
7. A text book of Biochemistry - Ambika.S.
8. Biochemistry - A.L. Lehinger.
9. Essentials of Biological Chemistry - James Fanley - East West Press.

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Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: Semester: V

Elective - 1 Title: GREEN CHEMISTRY (ELECTIVE - I)

Credits: 2 Max. Marks. 75

Objective	To impart knowledge about the Green Chemistry.
Course Outcome: At the end of the course, the students can able to	
CO1	Discuss about the principles of green chemistry.
CO2	Describe the application of green chemistry in real cases.

Theory:

Introduction- Definitions of Green Chemistry. Brief introduction of twelve principles of Green Chemistry, with examples, special emphasis on atom economy, reducing toxicity, green solvents, Green Chemistry and catalysis and alternative sources of energy, Green energy and sustainability

The following Real world Cases in Green Chemistry should be discussed:

- Surfactants for carbon dioxide – Replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.
- Designing of environmentally safe marine antifoulant.
- Right fit pigment: Synthetic azo pigments to replace toxic organic and inorganic pigments.
- An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.

Practical:

- Preparation and characterization of biodiesel from vegetable oil.
- Extraction of D-limonene from orange peel using liquid CO_2 prepared from dry ice.
- Mechano-chemical solvent free synthesis of azomethine.
- Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper(II).

Reference Books:

1. Anastas, P.T. & Warner, J.K. *Green Chemistry- Theory and Practical*, Oxford University Press (1998).
2. Matlack, A.S. *Introduction to Green Chemistry*, Marcel Dekker (2001).

3. Cann, M.C. & Connely, M.E. *Real-World cases in Green Chemistry*, American Chemical Society, Washington (2000).
4. Ryan, M.A. & Tinnesand, M. *Introduction to Green Chemistry*, American Chemical Society, Washington (2002).
5. Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. *Green Chemistry Experiments: A monograph* I.K. International Publishing House Pvt Ltd. New Delhi, Bangalore.
6. Lancaster, M. *Green Chemistry: An introductory text* RSC publishing, 2nd Edition.
7. Sidhwani, I.T., Saini, G., Chowdhury, S., Garg, D., Malovika, Garg, N. Wealth from waste: A green method to produce biodiesel from waste cooking oil and generation of useful products from waste further generated *"A Social Awareness Project", Delhi University Journal of Undergraduate Research and Innovation*, **1(1)**: 2015.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18SCH501 Semester: V

Skilled Based - 3 Title: **DATA ANALYSIS AND SEPARATION TECHNIQUES (SBS - III)**

Credits: 2 Max. Marks. 75

Objective	To learn about data analysis, purification techniques, separation of mixtures using chromatography and application of C language in chemistry.
Course Outcome: On successful completion of the course, students will be able to	
CO1	Summarize the theories of errors and illustrate error analysis.
CO2	Describe the purification of organic solids and liquids.
CO3	Explain types of chromatographic techniques and its applications.
CO4	Apply C programming language for the determination of normality, molarity, molality and pH.

UNIT-I

1.1 Data analysis – theory of errors – idea of significant figures and its importance with examples – differences between precision and accuracy – methods of expressing precision and accuracy.

1.2 Error analysis – methods to minimizing errors – problems related to mean, median, mode and standard deviation – confidence limit.

UNIT-II

2.1 Purification of organic solids — crystallization — fractional crystallization – sublimation — Soxhlet extraction and its applications.

2.2. Purification of organic liquids – experimental techniques of distillation – fractional distillation – vacuum distillation – steam distillation – azeotropic distillation - use of miscible and immiscible solvents - tests for purity.

UNIT-III

3.1 Chromatography – Introduction – Classification of chromatographic method – Paper chromatography – Principle, theory – R_f, R_x, R_g values – Factors affecting R_f values, techniques and applications of paper chromatography. TLC – Principle, techniques and

applications. Adsorption Column Chromatography – Principle, Experiment requirement, identification of compounds and applications.

3.2 Ion exchange chromatography-principle – Types of ion exchangers – Factors affecting ion exchangers – Principle, Instrumentation and techniques of ion exchange chromatography and applicaions of ion exchange chromatography in the separation of rare earth metals and the separation of Cl^- and Br^- ions.

UNIT-IV

4.1 HPLC and GC- Principle, instrumentation, types of detectors used and applications

4.2 GC-MS and LC-MS-Principle, instrumentation, types of detectors used and applications

UNIT-V

5.1 Introduction to computer and its application in chemistry – characteristics of a computer – types of computer – block diagram of a digital computer – the art of programming – general features of a programming language – algorithm and flow charts.

5.2 Introduction to C – structure of a C programme – character set of C data types – identifiers – reserved words – variables – constants – keywords – escape sequence – type conversion C operation (basic aspects only). Application of computer in chemistry – determination of molarity, normality and molality of solutions – calculation of pH.

Reference Books:

1. Elements of Analytical Chemistry - R. Gopalan, P.S. Subramanian, K. Rengarajan - S. Chand and sons (2004).
2. Fundamentals of Analytical Chemistry - D.A. Skoog and D.M. West - Holt Reinhard and Winston Publication - VIII Edition (2014).
3. Principles of Instrumental Methods of Analysis - D.A. Skoog and Saunders - College publications - V edition (1998).
4. Analytical Chemistry - S.M. Khopkar - New Age International. II Edition (1998)
5. Instrumental Methods of Chemical Analysis – Chatwal - Anand-Himalaya Publishing house - (2000).
6. Analytical Methods: Interpretation, Identification, Quantification by R. Gopalan and K.S. Viswanathan- Universities Press (2018)
7. Analytical Chemistry S.Usharani, Macmillan India Limited (2008)
8. Instrumental Methods of Chemical Analysis – Sham K Anand and Gurdeep R Chatwal-Himalaya Publishing House- V Edition (2014)
9. Gini Courter and Annette Marquis, Microsoft Office 2000, BPB Publications, New Delhi, (1999).
10. Julia Kelly, Using Microsoft Excel 2000, Prentice-Hall of India, New Delhi, (1999).
11. Robert de Lavie, A spreadsheet workbook for Quantitative Chemical Analysis, McGraw-

Hill, Inc. New Delhi (1997).
12. K.V. Raman, Computers in Chemistry, Tata McGraw-Hill Ltd., New Delhi, (2013).
13. V.K. Srivastava and K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and company, New Delhi, 1991.
14. R.M. Roberts, J.C. Gilbert, L.B. Rodewald, and A.S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders International Edition.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18EINP51 Semester: V

Internship Title: **INTERNSHIP TRAINING**

Credits: 2 Max. Marks. 75

Objectives: Internships are educational and career development opportunities, providing practical experience in a field or discipline.	
Course Outcome : At the end of the course, the student can able to	
CO1	Apply knowledge of theoretical concepts, tools and resources on the project.
CO2	Analyze and solve complex problems in order to reach substantiated conclusions.

Instructions for Internships

1. **Internship –**
   - **a.** Internship with Industry/ Govt. / NGO/ PSU/ Any Micro/Small/Medium enterprise/ Online Internship
   - **b.** Inter/Intra Institutional Activities – Inter/ Intra Institutional Workshop/ Training/ Working for consultancy/ research project
2. **Suggested Periods –** During summer vacation after 4th semester.
3. **Duration –** 2 Weeks
4. **Proposed document to be submitted as evidence –** Internship Report and Certificate

Internship Report:

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor and Faculty Mentor.

5. **Evaluation Method –** Viva-voce Examination by the Faculty mentor and Faculty from other department.

Internal: 25 marks (For attendance)

External: 75 Marks (Internship report)

The Internship report will be evaluated on the basis of following criteria:

i. Originality **(15)**.

ii. Adequacy and purposeful write-up **(15)**.

iii. Organization, format, drawings, sketches, style, language etc **(15)**.

iv. Variety and relevance of learning experience **(15)**.

v. Practical applications, relationships with basic theory and concepts taught in the course **(15)**.

Note: Internships may be full-time or part-time; it should be full-time in the summer vacation and part-time during the academic session.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18MCH601 Semester: VI

Major - 8 Title: **INORGANIC CHEMISTRY - II**

Credits: 5 Max. Marks. 75

Objective	To generate keen interest and thinking in understanding the nuclear, bioinorganic, transition and industrial chemistry.
Course Outcome: On successful completion of the course, students will be able to	
CO1	Calculate nuclear binding energy and relate it to the stability of the nucleus.
CO2	Describe the applications of nuclear chemistry in various fields.
CO3	Learn the chemistry of semiconductors and biologically important elements
CO4	Explain the comparative aspects of'd' and 'f' block elements and their extraction from ores.

UNIT-I

1.1 Nuclear Chemistry: Introduction - composition of nucleus – Gravitons, V-Particles, Quarks, Mesons and Pions- nuclear forces operating between the nucleons - N/P ratio, curves, stability belts - the whole number rule and packing fraction - isotopes, isobars, isotones and isomers- Nuclear Isomerism.

1.2 Nuclear binding energy - Mass defect - simple calculations involving mass defect and binding energy per nucleon - magic numbers - liquid drop model - shell model.

UNIT-II

2.1 Natural radioactivity - Detection and measurement of radioactivity - radioactive series including neptunium series - group displacement law - Rate of disintegration and half - life period - Average life period.

2.2 Artificial radioactivity - induced radioactivity - uses of radioisotopes - hazards of radiations - nuclear fission - nuclear energy - nuclear reactors – Breeder Reactors- Nuclear Reactors in India- nuclear fusion - thermo nuclear reactions - energy source of the sun and stars.

UNIT-III

3.1 Metallic bond – Band Theory - MO theory - semiconductors – intrinsic and extrinsic semiconductors – applications of semiconductor- superconductors.

3.2 Bioinorganic chemistry - Biological aspects of Fe, Zn, Mg, Co, Cu and Mo – Biological functions of Na, K, Ca, and P - toxicity of some heavy metals like Cd, Hg and Cr.

UNIT-IV

4.1 Comparative study of Ti, V, Cr, Mn and Fe group metals - ores, oxidation states, magnetic properties and colour – extraction of titanium and chromium.

4.2 Lanthanide series - occurrence, elements, oxidation states, magnetic properties, colour and spectra - lanthanide contraction - causes, consequences – Actinide series – occurrence, synthesis of some transuranium elements – oxidation states. Extraction of U and Th.

UNIT-V

5.1 Industrial chemistry - Fuel gases - calorific value - composition and sources - formation of water gas, semi water gas, carburetted water gas, producer gas, oil gas, natural gas, LPG and bio gas (manufacture not required)

5.2 Composition and setting of cement - manufacture of cement - examples for pigments - constituents of paints and their functions - type of glasses - manufacture of glass.

REFERENCE BOOKS:

1. Inorganic Chemistry - P.L. Soni - Sultan Chand (2013).

2. Inorganic Chemistry - B.R. Puri, L.R. Sharma and K.C. Kallia - Vallabh Publications (2017).

3. Selected Topics in Inorganic Chemistry - W.U. Malik, G.D. Tuli and R.D. Madan - S. Chand Publications (2009).

4. Inorganic Chemistry - J.E. Huheey, Harper and Collins - NY IV edition (2006).

5. Concise Inorganic Chemistry - J.D. Lee – Wiley Publishers- V edition (2008).

6. Industrial Chemistry - B.K Sharma – Krishan Prakashan Publications- XVII Edition (2014).

7. Inorganic Chemistry- Catherine Housecroft and Alan G. Sharpe- Pearson Publishers- IV Edition (2012).

8. Advanced Inorganic Chemistry - Cotton and Wilkinson - VI Edition - Wiley and Sons (1999)

9. The Organometallic Chemistry of Transition metals- Robert H. Crabtree- Wiley and Sons (2014).

10. Basic Organometallic Chemistry: Concepts, Synthesis and Applications- B. D. Gupta and A.J Elias, II Edition (2013).

11. Textbook of Inorganic Chemistry – R. Gopalan- Universities Press (2018).

12. Bioinorganic Chemistry- K. Hussain Reddy – New Age International (2007).

13. Essentials of Nuclear Chemistry- H.J. Arnikar- New Age International (2011).

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18MCH602 Semester: VI

Major - 9 Title: **ORGANIC CHEMISTRY - II**

Credits: 5 Max. Marks. 75

Objective	To kindle interest in students in learning Bio-organic chemistry through the introduction of topics such as Proteins, Nucleic acids, Terpenes, Alkaloids etc. To generate Keen Interest and Thinking in Understanding the Mechanisms of Molecular Rearrangements and Synthetic Applications of Benzene Diazonium Chloride, Grignard Reagents and Diazomethane.
Course Outcome: On successful completion of the course, students will be able to	
CO1	Know the steps in photo chemistry and the direct and indirect uses of photo chemistry and photochemical reactions.
CO2	Learn how to use organometallic compounds to make C-C bond.
CO3	Learn the chemistry of amino acids, proteins, nucleic acids, vitamins and antibiotics.
CO4	Learn the chemistry of alkaloids and terpenoids.

UNIT – I Organic Photochemistry:

1.1 General principles – Singlet states, triplet states, Fate of excited molecules Jablonski diagram, inter–system crossing, internal conversion.

1.2 Photochemistry of carbonyl compounds - Norrish type I and Norrish type II reactions - Photo oxidation, photo reduction –Paterno Buchi, di - pi methane rearrangement.

1.3 Photochemistry of conjugated dienes, Decomposition of nitrites - Barton rearrangement.

UNIT-II Organometallic Reagents and Rearrangements:

2.1 Organometallic reagents in organic synthesis- Grignard, organo lithium, organo copper, organo zinc and organo cadmium compounds.

2.2 Rearrangements Classification– Wagner-Meerwein rearrangement, Pinacol-Pinacolone, Dienone-Phenol, Baeyer-Villiger, Hoffmann, Curtius, Lossen, Beckmann and Schmidt rearrangements.

2.3 Fries rearrangement, Claisen, Cope and Oxy-Cope rearrangements.

UNIT- III Amino acids and Polypeptides:

3.1 Amino acids – Classification - Essential and Non- Essential amino acids – Acidic, Basic and Neutral Amino Acids – Alpha, Beta and Gamma - Amino acids - Preparation of alpha amino acids – Gabriel's Phthalimide synthesis, Strecker synthesis and Erlenmeyer Azlactone synthesis - Glycine, Alanine and Tryptophan.

3.2 General properties of Amino acids - Reactions of Amino acids due to Amino group and Carboxyl group – Zwitter ions - Isoelectric point.

3.3 Peptides - Synthesis - Bergmann Method - Structural Determination of Polypeptides - End Group Analysis – N-Terminal and C-Terminal Amino Acids Determination.

UNIT- IV Proteins and Nucleic Acids

4.1 Proteins - Definition - Classification based on Physical Properties, Chemical Properties and Physiological Functions - Primary and Secondary Structure of Proteins - Helical and Beta Sheet Structures (Elementary Treatment Only) – Denaturation of Proteins.

4.2 Nucleic acids – Nucleoproteins - Definition - Types of Nucleic Acids – RNA and DNA - Nucleoside, Nucleotide, Degradation of Nucleotide Chain - Components of RNA and DNA.

4.3 Differences between DNA and RNA - Structures of Ribose and 2- Deoxyribose – Double Helical Structure of DNA - Biological functions of Nucleic Acids - Elementary ideas on Replication and Protein Synthesis.

UNIT-V Chemistry of Natural Products

5.1 Carotinoids & Flavonoids: Synthesis and uses of α and β-carotein, Quercetin and Anthocyanidins.

5.2 Alkaloids – Classification – Isolation of alkaloids – General methods of Determination of structure of Alkaloids - Synthesis and Structural Elucidation of Piperine, Coniine and Nicotine.

5.3 Terpenoids – Definition - Classification - Isoprene rule - Synthesis and Structural elucidation of Citral, Menthol and Alpha- pinene.

REFERENCE BOOKS

1. Advanced Organic Chemistry by Arun Bahl and B.S. Bahl, S. Chand and Co. Ltd. (2012).
2. Textbook of Organic Chemistry by P.L. Soni and H.M. Chawla, Sultan Chand & Sons (2007).
3. Modern Organic Chemistry by M.K. Jain & S.C. Sharma, 4th Edition, Vishal Publishing & Co, (2013).
4. Organic Chemistry - I. L. Finar - Volume I and II - London:ELBS, (2002).
5. Organic Chemistry by Morrison and Boyd, 7th Edition, Pearson, (2013).
6. Organic Chemistry by Stanley H Pine, 5th Edition (2008).
7. Advanced Organic Chemistry by Jagadamba Singh & L.D.S. Yadav, (2013).
8. Fundamentals of Organic Chemistry by John McMurry, 7th Edition (2011).
9. March's Advanced Organic Chemistry Reactions, Mechanism and Structure by Michael B Smith and Jerry March, 7th Edition, (2016).
10. Advanced Organic Reaction Mechanism by N. Tewari,(2015).
11. Organic Chemistry of Natural Products - Volume I and II - O. P. Agarwal - Goel Publishing House (2002).
12. Organic Chemistry by T. W. Graham Solomon, C. B. Fryhle – S. A. Dnyder – John Wiley & Sons (2014).
13. Organic Reaction Mechanisms by Ahluwalia V K. Narosa publishing house, New Delhi (2011)
14. A Text Book of Organic Chemistry by Tewari, K.S. and Vishnoi, N. K. 4th edition, Vikas Publishing 2017.

WEB RESOURCES

http://www.organic-chemistry.org/

http://www.chemguide.co.uk/orgmenu.html

http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm

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Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18MCH603 Semester: VI

Major - 10 Title: **PHYSICAL CHEMISTRY - II**

Credits: 5 Max. Marks. 75

Objective	To impart knowledge about Electrochemistry, Surface Chemistry, Photochemistry, Chemical Kinetics and Theories of reaction rates.
Course Outcome: At the end of the course, the students can able to	
CO1	Apply the basics of electrochemistry to construct cell
CO2	Describe the fundamentals of surface chemistry, photochemistry, chemical kinetics and theories of reaction rates

UNIT- I Electrochemistry - III

1.1. Electrochemical cells – Representation of Electrochemical cell - Reversible and Irreversible Cells – EMF of a Cell and its Measurement - Standard Weston Cadmium Cell – Determinations of ΔH, ΔG and ΔS of a cell reaction.

1.2. Derivation of Nernst equation for Electrode Potential and Cell emf –Types of reversible electrodes - Standard Hydrogen Electrode and Calomel Electrode.

1.3. Single electrode potential, signs of electrode potential - Standard Electrode Potential - Electrochemical Series and its Applications.

UNIT- II Electrochemistry - IV

2.1. Concentration cells – Types of Concentration cells – EMF of concentration cells - Liquid Junction Potential – concentration cells with Transference and Without Transference.

2.2. Applications of Concentration cells - Valency of mercurous ion, Solubility Product - Activity Co-efficient of electrolytes - Determination of pH using Hydrogen, Quinhydrone and Glass electrodes.

2.3. Potentiometric titrations – Neutralization, redox and precipitation titrations – Lead storage battery.

UNIT- III Chemical Kinetics

3.1. Rate of the reaction, Rate law – Order and Molecularity – First order reaction - Derivations of rate constant and half-life period - Study of kinetics of acid catalyzed hydrolysis of ester. Second order reaction – Derivation of rate constant and half-life period. Study of alkaline hydrolysis of ester zero order reactions.

3.2. Methods of Determination of order of a reaction. Effect of Temperature on reaction rate - Arrhenius equation – Evaluation of Arrhenius parameters. Bimolecular Collision Theory and its limitations– Lindmann's theory of Unimolecular Reactions.

3.3. ARRT - Thermodynamic treatment of ARRT – Eyring equation - Comparison of Collision Theory and ARRT.

UNIT- IV Surface Chemistry

4.1. Concept of Adsorption – Characteristics of adsorption – Physisorption and Chemisorption –Applications of Adsorption.

4.2. Adsorption of Gases by Solids – Adsorption Isotherms - Freundlich adsorption isotherm - Langmuir theory of adsorption – limitation – BET Isotherm (No Derivation).

4.3. Catalysis –Characteristics - Homogeneous catalysis – mechanism – Enzyme catalysis – Michaelis-Menton Equation – Heterogeneous catalysis – Adsorption theory.

UNIT- V Photochemistry

5.1. Introduction – Difference between thermal and photochemical reaction – Beer-Lamberts - Laws of photochemistry - Grothus-Draper law, Stark-Einstein's law – Primary and Secondary processes – Quantum yield.

5.2. Qualitative description of Fluorescence, Phosphorescence, Chemiluminescence and Photosensitized Reactions.

5.3. Some photochemical reactions – comparison **of** H_2-Cl_2 and H_2-Br_2 reactions with reference to quantum yield (Derivation of rate equations not required).

REFERENCE BOOKS

1. Principles of Physical Chemistry - B. R. Puri, Sharma and Madan S. Pathania, Vishnal Publishing Co., 2017.
2. Text Book of Physical Chemistry - P. L. Soni, O. P. Dharmarha and U. N Dash - Sultan Chand & Co., 2011.
3. Physical Chemistry - Negi and Anand – Eastern Wiley Pvt. Ltd. 2007.
4. Physical Chemistry - Kundu and Jain - S. Chand & Co., 1989.
5. Physical Chemistry - K. L. Kapoor - Macmillan - 5 vol., 2019.
6. Elements of Physical Chemistry - Glasstone and Lewis – Macmillan, .1963
7. Text book of Physical Chemistry - S. Glasstone - Macmillan (India) Ltd., 1948.
8. Fundamentals of Physical Chemistry - Maron and Landor - Collier–Macmillan, 1974.
9. Physical Chemistry - G. W. Castellan - Narosa publishing house, 2004.
10. Physical Chemistry - Walter J. Moore - Orient Longman, 1972.
11. Numerical Problems on Physical Chemistry, Amalendu Ghoshal - Books and Allied (P) Ltd., 2013.

12. Universal General Chemistry, C.N.R. Rao, Laxmi Publications, 2015.
13. Text book of Physical Chemistry – M. V. Sangaranarayanan, V. Mahadevan, Universities Press, 2011.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18ECH601 Semester: VI

Elective - 2 Title: **POLYMER CHEMISTRY (ELECTIVE - II)**

Credits: 3 Max. Marks. 75

Objective	To know about the polymers, polymerization techniques, properties and their applications.
Course Outcome: At the end of the course, the students can able to	
CO1	Classify commercial polymers based on their structure, application and polymerization methods
CO2	Discuss the polymerization techniques, reaction and molecular weights of polymers.
CO3	Describe the about rubbers, commercial and advance polymers.

UNIT-I

1.1. Polymers – Basic Concept, Classification of polymers on the basis of structures and applications. Distinction among plastics, elastomers, and fibers.

1.2. Glass transition temperature (*Tg*) - Definition, factors affecting *Tg*, Relationship between *Tg* and molecular weight.

UNIT-II

2.1. Molecular weight of polymers – Number average, Weight average – Determination – Sedimentation and viscosity - Average molecular weights, Molecular weights and degree of polymerization.

2.2. Polymer Reactions – Hydrolysis, Hydrogenation, Addition, Substitution, Cross linking and Cyclisation.

UNIT-III

3.1. Polymerization – Addition and Condensation – Techniques: Bulk, Solution, Suspension and Emulsion Polymerization.

3.2. Polymer Processing – Molding, Compression and Injection Molding – Calendaring.

UNIT-IV

4.1. Preparation, Properties and Uses of the following – Polyethylene, Polyvinyl chloride, Polytetrafluoroethylene (Teflon), Polystyrene.

4.2. Preparation, Properties and Uses of the following – Nylon, Polyethylene terephthlate, Polyurethane, and Polycarbonates.

UNIT-V

5.1. Rubber – Natural Rubber – Drawbacks of Natural Rubber – Vulcanization – Comparison of Raw and Vulcanized Rubber – Synthetic Rubber – Preparation, Properties and Uses of Styrene Butadiene Rubber (SBR).

5.2. Preparation, Properties and Uses of Conducting polymers – polyacetylene, polyaniline, polypyrrole, polythiophene – Biopolymers and its Applications.

Reference Books:

1. Text Book of Polymer Science, Bill Meyer F.W. Jr. John Wiley & Sons 1984.

2. Polymer Science, Gowarikar. V.R. Viswanathan, N.V. Jayader Sreedhar. Wiley Eastern Ltd., New Delhi, 2005

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

4. Polymer Chemistry. Arora M.G. Vadar M.S. - Anmol publications (P) Ltd., New Delhi 1989.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: Semester: VI

Elective - 2 Title: FUEL CHEMISTRY (ELECTIVE - II)

Credits: 2 Max. Marks. 75

Objective	To impart knowledge about the Fuel Chemistry.
Course Outcome: At the end of the course, the students can able to	
CO1	Discuss about the chemistry of solid, liquid and gaseous fuels.
CO2	Describe the various products of petroleum.

Unit-I Review of energy sources:

Energy sources - renewable and non-renewable, Fuels - Introduction, Classification and their calorific values.

Unit-II Coal:

Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas - composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Unit-III Petroleum and Petrochemical Industry:

Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.

Unit-IV Petrochemicals:

Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Unit-V Lubricants:

Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Reference Books:

1. Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK., 1990.
2. Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi, 2000.
3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut, 1996.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: Semester: VI

Elective - 2 Title: NANO CHEMISTRY (ELECTIVE - II)

Credits: 2 Max. Marks. 75

Objective	To impart knowledge on Nano chemistry and its applications.
Course Outcome: At the end of the course, the students can able to	
CO1	Discuss about the basics of Nano chemistry and its importance.
CO2	Describe the preparation and properties of some useful Nano particles.

UNIT-I Basics of Nanochemistry:

Introduction – definition – length scales – importance of nanoscale and its technology – self assembly of materials – self assembly of molecules – porous solids, nanowires, nanomachines and quantum dots.

UNIT-II Nano Particles:

Introduction – types of nanoparticles – preparation, properties and uses of gold, silicon, silver, zinc oxide, iron oxide, alumina and titania nanoparticles.

UNIT-III Synthetic Techniques:

Techniques to synthesize nanoparticles – top down and bottom up approaches – common growth methods – characterization of nanoparticles – applications and toxic effects of nanomaterials.

UNIT-IV Nano Materials:

Preparation, properties and applications of carbon nanotubes, nanorods, nano fibre and nanoclay.

UNIT-V Instrumental Techniques:

Electron microscopes – scanning electron microscopes (SEM) – transmission electron microscopes (TEM) – scanning probe microscopy – atomic force microscopy (AFM) – scanning tunneling electron microscope (STEM) – basic principles only.

Books for Study:

1. Nanotechnology, S.Shanmugam, MJP Publishers, Chennai (2010).
2. A Handbook on Nanochemistry, Patrick Salomon, Dominant Publishers and Distributers, New Delhi.
3. Nanobiotechnology, S. Balaji, MJP Publishers, Chennai (2010).

Books for Reference:

1. The Chemistry of Nanomaterial: Synthesis, Properties and Applications, Vol. I and II, CNR Rao, Springer (2006).
2. Nanotechnology: Basic Science and Emerging Technologies, Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press (2005).
3. Nanochemistry, G. B. Segreev, Elsevier, Science, New York, (2006).

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18SCH601 Semester: VI

Skilled Based - 4 Title: **AGRICULTURE AND LEATHER CHEMISTRY (SBS - IV)**

Credits: 2 Max. Marks. 75

Objective	To kindle interest in students in learning about soil, fertilizers, manures, fungicides, pesticides and rodenticides. To impart knowledge on leather processing and effluent treatment.
Course Outcome: On successful completion of the course, students will be able to	
CO1	Define the formation of soil and its properties.
CO2	Explain the need and importance of fertilizers and manures for improving soil fertility and productivity.
CO3	Discuss pesticides and its related problems in ecology.
CO4	Express the various steps involved in the manufacture of leather and tannery effluent.

UNIT-I: Soil Chemistry

1.1. Introduction: Formation of Soil.Classification of soil - properties of soil – soil water, soil air, soil temperature, soil minerals, soil texture, soil oil, soil colloids.

1.2. Soil Acidity - Causes of acidity - soil alkalinity. Soil pH -Determination of soil pH - Buffering of soils - Amending the soil - Reclamation of acid soil - Liming agents.

UNIT-II: Soil Fertility and Productivity

2.1. Essential elements for plant growth – macro and micro nutrients for plant growth. Manures – Characteristics of manures – importance of manures. Organic Manures – Several kinds of organic manures - Farmyard Manure - Compost - Oil cakes - Bone meal - Meat meal - Fish meal - Blood meal and green Manures.

2.2. Fertilizers - Classification of fertilizers - Requisites of a good fertilizers - Nitrogenous fertilizers - Phosphatic fertilizers - super Phosphate of lime - Triple super phosphate - NPK fertilizers - ill effects of fertilizers.

UNIT-III: Pesticides

3.1. Introduction to Pesticides – definition - Classification of pesticides–Insecticides and its classification – Stomach poison – Contact poison and fumigants – Organic insecticides – DDT – Gammahexane – Malathion – Parathion.

3.2. Fungicides – Herbicides – Rodenticides – Pesticides in india – Adverse environmental effects of pesticides.

UNIT-IV: Leather Chemistry

4.1. Introduction - Constituents of Animal Skin - Preparing skins and hides - Cleaning and soaking - Liming and degreasing.

4.2. Manufacture of Leather - Leather Tanning - Vegetable Tanning - Chrome Tanning and Mineral Tanning - Dyeing and Fat liquoring - Leather finishing - oil tanning - by products.

UNIT-V:Tannery effluents Treatment

5.1. Tannery effluents - Pollution and its control - Water pollution and Air pollution – Composition of Tannery effluents.

5.2. Treatment – Screening – Primary and Secondary treatment – Filtration, Ultra filtration – RO – Evaporation - Waste management – Effluent waste management.

Reference Books:

1. Industrial Chemistry by B.K. Sharma. Goel Publishing House, Meerut, 2014.
2. Inorganic Chemistry - B.R. Puri, L.R. Sharma and K.C. Kallia - Vallabh Publications (2003).
3. Applied Chemistry by K.Bagavathi - Sundari, MJP Publishers (2006).
4. Fundamental concept of Applied Chemistry by Jayashree Ghosh, S. Chand Company Ltd., (2006)
5. Chemical treatment of hides a leather by J. Partridge Noyes, Park Ridge, N.J.
6. Agricultural Chemistry Vol I &Vol II edited by B.A. Yagodin - New Century books (P) Ltd.,
7. The nature and properties of soils - IX Edition - Nyle.C.Bready - S.Chand Company Ltd.,
8. Soils and soil fertility - Louis M.Thompson - and Frederick. R.Troch– TataMc. Graw hill.
9. Text book of Soil Science - T.D. Biswas and S.K. Mukerijee - II Edition.
10. Fundamental of Leather Science - Wood roffe Publications of CLRI - Chennai.
11. Nature and properties of soils - Harry, O. Buckman.
12. Applied chemistry by Dr. P. N. Sudha, Supra associates – Vellore.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year:	III Year	Subject Code:	U18MCHP61	Semester:	VI
Practical - 3	Title:	**GRAVIMETRIC ESTIMATION**			
Credits:	3			Max. Marks. 75	

1. Estimation of sulphate as barium sulphate.
2. Estimation of barium as barium sulphate.
3. Estimation of barium as barium chromate.
4. Estimation of lead as lead chromate.
5. Estimation of calcium as calcium oxalate monohydrate.
6. Estimation of Nickel as Nickel Dimethyl Glyoxime.

Reference Books for Practicals:

1. Analytical Methods: Interpretation, Identification and Quantification- R. Gopalan and K.S. Viswanathan- Universities Press (2018).
2. Advanced Experimental Inorganic Chemistry- V.K. Ahluwalia and Sunita Dhingra- Manakin Press (2015).
3. Skoog and West's Fundamentals of Analytical Chemistry – P. James Holler and Stanley R. Crouch – Cengage Publishers (2014)

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year:	III Year	Subject Code:	U18MCHP62	Semester:	VI
Practical - 4	Title:	**ORGANIC QUALITATIVE ANALYSIS AND PREPARATIONS**			
Credits:	3			Max. Marks. 75	

Analysis of organic compounds containing one functional group and characterization with a derivative.

Reactions of the following functional groups:

Aldyhyde, ketone, carboxylic acid (mono and di), ester, carbohydrate (reducing and non-reducing), phenol, aromatic primary amine, amide, nitro compound, diamide and anilide.

Organic Preparations:

Acylation

1. Acetylation of salicylic acid or aniline.
2. Benzoylation of aniline or phenol.

Nitration

3. Preparation of m-dinitrobenzene
4. Preparation of p- nitroacetanilide

Halogenation

5. Preparation of p-bromoacetanilide
6. Preparation of 2,4,6-tribromophenol

Diazotisation /coupling

7. Preparation of methyl orange

Oxidation

8. Preparation of benzoic acid from toluene or benzaldehyde.

Hydrolysis

9. Hydrolysis of ethyl benzoate (or) methyl salicylate (or) Benzamide.

Reference Book for Practicals:

1. Vogel's text book of chemical analysis
2. Practical Chemistry - A.O. Thomas - Scientific book center, Cannanore.
3. Practical Chemistry - 3 Volumes -S. Sundaram and others.
4. Vogel's text book of practical organic chemistry – Longman.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Chemistry effective from the year 2020-2021

Year: III Year Subject Code: U18MCHP63 Semester: VI

Practical - 5 Title: **PHYSICAL CHEMISTRY EXPERIMENTS**

Credits: 3 Max. Marks. 75

1. Kinetics

Determination of the order of the following reactions.

a). Acid catalysed hydrolysis of an ester (methyl or ethyl acetate)

b). Iodination of acetone.

2. a) Molecular weight of a solute - Rast's method using naphthalene, or diphenyl as solvents.

b) Determination of Kf of solvent

3. Heterogeneous equilibria:

a) *Phenol-water system – CST

b) Effect of impurity – 2% NaCl or succinic acid solutions on phenol water system - determination of the concentration of the given solution

4. Determination of the transition temperature of the given salt hydrate.

$Na_2S_2O_3.\ 5H_2O$, $CH_3COONa.\ 3H_2O$, $SrCl_2.\ 6H_2O$, and $MnCl_2.\ 4H_2O$

5. Electrochemistry

Conductivity

a) Determination of cell constant and equivalent conductivities of solutions of two different concentrations.

b) Conductometric titration of a strong acid against a strong base.

c) Conductometric titration of a strong acid against a weak base.

6. Potentiometric titration of a strong acid against a strong base.

7. Colorimetry - determination of unknown concentration using Photoelectric colorimeter.

8. Determination of pKa of acetic acid using pH Meter.

*need not be given in examination.

Students must write short procedure / formula with explanation in ten minutes for evaluation during the university practical examination.

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SCHEME OF VALUATION FOR PRACTICAL EXAMINATIONS

CORE PRACTICAL – I
VOLUMETRIC ANALYSIS

Internal assessment: 25 Marks

INTERNAL ASSESSMENT	**Marks**
Two Tests	10
Attendance / Regularity	10
Results accuracy	05
Total	**25**

External assessment: 75 Marks Total: 100 marks

Record : 15 Marks
Procedure : 10 Marks

Error upto

2 %	: 50
2.1 – 3 %	: 40
3.1 – 4 %	: 30
4.1 – 5 %	: 20
>5 %	: 10

For incomplete or wrong calculation deduct 20 % of total marks scored.
For no calculation deduct 40 % of total marks scored.
For each arithmetic error deduct 1 mark.

CORE PRACTICAL – II
INORGANIC QUALITATIVE ANALYSIS AND PREPARATION

Internal assessment: 25 Marks

INTERNAL ASSESSMENT	**Marks**
Two Tests	10
Attendance / Regularity	10
Results accuracy	05
Total	**25**

External assessment: 75 Marks Total: 100 marks

Record : 15 Marks
Preparation : 20 (Quantity- 15 Marks; Quality- 5 marks)
Analysis : 40 Marks.
Each radical with procedure : 10 Marks
(Spotting for each radical - 5 Marks; Fixing the group - 5 Marks)

C. Abdul Hakeem College (Autonomous), Melvisharam.

CORE PRACTICAL – III

GRAVIMETRIC ESTIMATIONS

Internal assessment: 25 Marks

INTERNAL ASSESSMENT	**Marks**
Two Tests	10
Attendance / Regularity	10
Results accuracy	05
Total	**25**

External assessment: 75 Marks Total: 100 marks

Record : 15 Marks

Procedure : 10 Marks

Error upto

2 % : 50

2.1 – 3 % : 40

3.1 – 4 % : 30

4.1 – 5 % : 20

>5 % : 10

a. Among the duplicate results, the value more favorable to the candidate must be taken.

b. When no duplicate result is given deduct 5 marks.

c. If the two results differ by more than 2 % deduct 5 marks.

d. For each independent arithmetical error deduct 1 mark.

e. For incomplete or wrong calculation deduct 20 %.

f. For no calculation deduct 40 %.

g. If the experiment is not completed due to an accident, award 5 marks.

CORE PRACTICAL – IV

ORGANIC ANALYSIS AND PREPARATION

Internal assessment: 25 Marks

INTERNAL ASSESSMENT	**Marks**
Two Tests	10
Attendance / Regularity	10
Results accuracy	05
Total	**25**

External assessment: 75 marks Total: 100 marks

Record : 15 Marks
Preparation : 15 (quantity: 10 & quality: 5)
Analysis : 45
Preliminary reaction : 4
Aliphatic/ Aromatic : 4
Saturated/ Unsaturated : 4
Tests for elements : 9
Functional groups : 10
Confirmatory tests : 10
Derivative/Coloured reaction : 4

CORE PRACTICAL – V
PHYSICAL CHEMISTRY PRACTICALS

Internal assessment: 25 Marks

INTERNAL ASSESSMENT	**Marks**
Two Tests	10
Attendance / Regularity	10
Results accuracy	05
Total	**25**

External assessment: 75 Marks Total: 100 Marks
Record : 15 Marks
Experiment : 45 Marks
Manipulation, Tabulation and Calculation: 15 Marks

1) Kinetics

Graph : 10 Marks
Below a factor of 10 : 35
By a factor of 10 : 25
More than a factor of 10 : 15

2) Molecular weight

Error upto 10 % : 45
20 % : 35
30 % : 25
> 30 %: 15

3) Effect of electrolyte on CST

Graph : 10
Error upto 10 % : 35
20 % : 25
30 % : 15
> 30 : 10

4) Transition temperature

Graph : 10
Error upto 2˚C difference : 35
7˚C difference : 25
> 7˚C difference : 15

5) Conductance

Cell constant : 20 marks

Error Upto 10 % : 20
Upto 15 % : 15
>15 % : 10

Equivalent conductance : 25 marks

Error Upto 10 % : 25
Upto 15 % : 15
>15 % : 10

6) Conductometric titration

Graph : 10

Upto 2 % : 35
2.1 to 3 % : 30
3.1 to 4 % : 25
4.1 to 5 % : 20
> 5% : 15