C. ABDUL HAKEEM COLLEGE (AUTONOMOUS)

(Affiliated to Thiruvalluvar University, Vellore & Re-Accredited by NAAC)

MELVISHARAM – 632 509

PG & Research Department of Chemistry

M. Phil., CHEMISTRY DEGREE COURSE

UNDER CBCS

(with effect from 2018-2019)

The Course of Study and the Scheme of Examinations

S. NO.	Part	Study Components / Course Title		Paper Code	Credit	Title of the Paper	Maximum Marks		
SEMESTER I							**CIA**	**Uni. Exam**	**Total**
1	III	Core Theory	Paper-1	M18MCH101	5	Research Methodology	25	75	100
2	III	Core Theory	Paper-2	M18MCH102	5	Instrumental Methods of Chemical Analysis	25	75	100
3	III	Core Theory	Paper-3	M18MCH103	5	Guide Paper: Polymer Chemistry	25	75	100
4	III	Core Theory	Paper-3	M18MCH104	5	Guide Paper: Reaction Mechanism And Organic Synthesis	25	75	100
5	III	Core Theory	Paper-3	M18MCH105	5	Guide Paper: Schiff Base Complexes And Their Biological Activity	25	75	100
6	III	Core Theory	Paper-3	M18MCH106	5	Guide Paper: Kinetics and Adsorption Studies	25	75	100
7	III	Core Theory	Paper-3	M18MCH107	5	Guide Paper: Molecular coordination chemistry	25	75	100
8	III	Core Theory	Paper-3	M18MCH108	5	Guide Paper: Modernistic approach in Organic Synthesis	25	75	100
9	III	Core Theory	Paper-3	M18MCH109	5	Guide Paper: Polymers For Environmental Protection	25	75	100
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SEMESTER II							**CIA**	**Uni. Exam**	**Total**
1	III	Core Theory	-	M18MCH201	21	Dissertation & Viva	20	80	100

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Syllabus for M.Phil., Chemistry effective from the year 2018-2019

Year: I Year Subject Code: M18MCH101 Semester: I

Core Course I Title: **RESEARCH METHODOLOGY**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To study the importance of research, literature survey, error analysis, statistical treatment and to study about the conventions of writing thesis.
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	Survey of scientific literature using modern tools explained.
CO2	Separation techniques constitute an important aspect of experimental chemistry and the importance & modern techniques are introduced
CO3	Awareness about the causes of uncertainties in the evaluation of data.
CO4	Scientific data are subjected to mathematical and statistical methods. Elementary treatment of these tests are given
CO5	Set up skills required to write the thesis report explained.

UNIT-I: RESEARCH METHODOLOGY

Meaning of research - Objectives of research - motivation of research - Types, approaches and significance - Methods versus methodology - Research in scientific methods - Research process - Criteria for good research - Problem encountered by research in India - Funding agencies.

UNIT-II: RESEARCH DESIGN

Research Problem: Selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem - Research design - Needs and features of good design - Different research design - Basic principles of experimental designs.

UNIT-III: DATA COLLECTION AND DOCUMENTATION

Data collection methods - Data types - Processing and presentation of data - Techniques of ordering data - Meaning of primary and secondary data - The uses of

computers in research - The library and internet - Uses of search engines - virtual libraries - common software for documentation and presentation.

UNIT-IV: DATA AND ERROR ANALYSIS

Statistical analysis of data - Standard deviation - Correlation - Comparison of sets of data - Chi squared analysis for data - Characteristics of probability distribution - Binomial, Poisson and normal distribution - Principle of least square fittings - Curve fitting - Measurement of errors - Types and sources of errors - Determination and control of errors.

UNIT-V: RESEARCH COMMUNICATION

Meaning of research report - Logical format for writing thesis and paper - Essential of scientific report: abstract, introduction, review of literature, materials and methods and discussion - Write up steps in drafting report - Effective illustrations: The use of quotations – footnotes –end notes- tables and figures, referencing – appendices - Reference styles: Harvard and Vancouver systems.

REFERENCE BOOKS:

1. Research Methodology, Methods and Techniques - C.R. Kothari - WishwaPrakasam Publications, II Edition.

2. Research: An introduction - Robert Ross - Harper and Row Publications.

3. Research methodology - P. Saravanavel - KitlabMahal, Sixth Edition.

4. A Hand book of Methodology of Research - Rajammal P.A. Devadass - Vidyalaya Press

5. Introduction to Computers - N. Subramanian

6. Statistical methods - G.W. Snedecor and W. Cocharan - Oxford and IBH, New Delhi.

7. Research Methodology Methods and Statistical Techniques - Santosh Gupta.

8. Statistical Methods - S.P. Gupta

9. Scientific social surveys and research - P. Young - Asia Publishers, Bombay.

10. How to write and publish a scientific paper - R.A. Day - Cambridge University Press.

11. Thesis and Assignment writing - Anderson - Wiley Eastern Ltd.

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Syllabus for M.Phil., Chemistry effective from the year 2018-2019

Year: I Year Subject Code: M18MCH102 Semester: I

Core Course II Title: **INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To study about the Spectroscopy and Analytical techniques.
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	Explain fundamentals of chromatography and electroanalytical methods
CO2	Discuss spectral applications IR and Raman spectroscopy
CO3	Describe about the spectroscopic principles and the applications of UV spectroscopy
CO4	Explain principle and applications of NMR of organic and inorganic compounds
CO5	Gain knowledge related to analytical techniques such as mass spectrometer and electron microscopic instrumentations.

UNIT-I

Instrumental methods of analysis: Principle, instrumentation and applications of Atomic absorption and emission spectroscopy, Chromatography: GC and HPLC, Electro-analytical methods: (polarography, cyclic voltammetry and amperometry).

UNIT-II

IR and Raman Spectroscopy: Symmetry elements; point groups; Principle and applications in the determination of structures of simple organic and inorganic molecules.predicting number of active modes of vibrations. Analysis of representative spectra of metal complexes with various functional groups at the coordination sites; organic functional group identification through IR spectroscopy.

UNIT-III

UV-visible Spectroscopy: Singlet and triplet states; n-π* and π-π* transitions; application to conjugated double bonds and conjugated carbonyls, Change transfer spectra. Optical rotatory dispersion and circular dichroism curves and their application in determining the configuration and conformation of different compounds, conformational analysis. Applications of UV-visible Spectroscopy in the determination of structures of organic and inorganic molecules.

UNIT-IV

NMR spectroscopy: Basic principles; chemical shift and spin-spin interaction and coupling constant. Applications of ^{1}H, ^{13}C, ^{19}F, ^{31}P NMR spectroscopy in the determination of structures of organic and inorganic molecules. Advanced NMR Techniques: Principle and applications of DEPT, COSY, HETCOR and NOESY.

UNIT-V

Mass Spectrometry: Basic principle; Parent peak, base peak, metastable peak, Mc Lafferty rearrangement. Applications of Mass spectrometry in the determination of structures of organic molecules. Electron Microscopy: Principle, instrumentation and applications of SEM, TEM and AFM techniques.

REFERENCE BOOKS:

1. H.A. Strobel, Chemical Instrumentation - Addison - Wesley Publishing Co.
2. R.S. Drago, Physical Methods in Chemistry - W.B.Saunders Company, Philadelphia, London, 1972.
3. G. Barrow, Introduction to Molecular Spectroscopy, McGraw Hill, New York, 1964.
4. W. Kemp, Organic Spectroscopy, Palgrave Publications, 2002.
5. P.S. Kalsi, Spectroscopy of Organic Compounds, New Age International (P) Ltd., 2004.
6. Shriver, D.F., Atkins, P.W., Langford, C.H., Inorganic Chemistry, Oxford University Press, London, 3rd Edition, 2001.
7. E.A.V. Ebsworth, Structural Methods in Inorganic Chemistry ELBS, Great Britain, 3rd Edition, 1987.
8. H.Kaur, Spectroscopy, PragatiPrakashan, Meerut, 2005.

9. JAK Tareen and TRN Kutty, A Basic Course in Crystallography, University Press (India Ltd.),1st Edition, 2001.
10. G.Aruldhas, Molecular Structure and Spectroscopy, Prentice Hall of India Private Limited, New Delhi, 2nd Edition, 2007.
11. K.V.Raman, R.Gopalan, P.S. Raghavan, Molecular Spectroscopy, Vijay Nicole Imprints Private Limited, 2004.
12. Dr. B. K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publishing House, Meerut, 2005.
13. D. A. Skoog, R. J. Holler and T. M. Nieman, Principles of Instrumental Analysis, Harcourt Asia Pvt. Ltd, India,5th Edition, 2001.
14. Willard, Merritt, Dean, Settle, Instrumental Methods of Analysis, CBS Publishers and Distributors, New Delhi, 7th Edition, 1986.
15. RayEgerton, Physical Principles of Electron Microscopy: An Introduction to TEM, SEM and AEM.

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Syllabus for M. Phil., Chemistry effective from the year 2018-2019

Year: I Year Subject Code: M18MCH103 Semester: I

Core Course III (Guide paper)

Title: **POLYMER CHEMISTRY**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To learn fundamentals, kinetics, structure, characterization and applications of polymers.
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	Classification of polymers based on their structure and various techniques of polymerization.
CO2	Understanding the Kinetics and Mechanism of various types of polymerization.
CO3	(a) Study the structure and property relationships of polymers, particularly about glass transition temperature. (b) Study the characterization of polymers using various techniques.
CO4	(i) Study on preparation and application of various Industrial polymers. (ii) Study of application of Bio-Polymers.
CO5	Know about the different type of polymers of specific use.

UNIT- I

Classification – Nomenclature and isomerism – functionality – Molecular forces and chemical bonding in polymers – Molecular weight – Linear, branched and cross linked polymers. Thermoplastic and thermosetting polymers – Elastomers, Fibres and resins. Techniques of polymerization–emulsion, bulk, solution and suspension.

UNIT– II

Kinetics and Mechanism of polymerization – free radical, cationic, anionic and co-ordination polymerization (Ziegler - Natta Catalyst). Copolymerisation – Kinetics (Detailed Study). General Characterization–Kinetic Chain length–degree of polymerization, Chain transfer - initiators – inhibitors – retardars.

UNIT – III

A) Structure and Properties

Structure - property relationship – Mechanical properties, Thermal properties – Glass transition temperature – Factors affecting Glass transition temperature – crystallinity and melting point – related to structure.

B) Polymer characterization and analysis

Crystalline nature – X-Ray diffraction – Differential scanning calorimetry (DSC) – Thermo gravimetric analysis – molecular weight determination – osmometry (membrane), Viscosity, Ultra centrifuge and Gel Permeation Chromatography.

UNIT – IV Industrial and Natural polymers

Important industrial polymers – preparation and application of polyethylene, poly vinyl chloride, poly urethanes, polytetrafluro ethylene (TEFLON), Nafion and ion – exchange resins. Importance of natural polymers – application and structures of starch, cellulose and chitosin derivatives.

UNIT – V Speciality polymers

Bio polymers – biodegradable polymers – biomedical polymers – polyelectrolytes - conducting polymers – high temperature and fire retardant polymers - polymer blend – polymer composites – polymer nanocomposites – IPN inter penetrating network polymers – Electroluminescent polymers.

Text Books:

1. F. W. Bill Meyer. Text book of polymer science 3rd Edition, John Wiley and sons, Newyork.
2. P. J. Flory. Principles of polymer chemistry, Cornell press (recent edition).
3. V. R. Gowarikar, B. Viswanathan, J. Sridhar – polymer science – Wiley eastern, 1986.
4. G. S. Misra – Introduction to polymer chemistry – Wiley Eastern Ltd.,
5. P. Bahadur, N. V. Sastry – Principles of polymer science, Narosa publishing house.
6. G. Odian, principles of polymerization, Mc Graw Hill Book Company, New York, 1973.

Suggested Reference Books:

1. A. Rudin, The Elements of Polymer Science and Engineering. Academic Press, New York, 1973.
2. I. C. E. H. Brawn, The chemistry of High Polymers, Butter worth & Co., London, 1948.
3. G. S. Krishenbaum, Polymer Science study Guide, Gordon Breach Science publishing, New York, 1973.
4. E. A. Coolins, J. Bares and E. W. Billmeyer, Experiments in Polymer Science, Wiley interscience, New York, 1973.

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Syllabus for M.Phil., Chemistry effective from the year 2018-2019

Year: I Year Subject Code: M18MCH104 Semester: I

Core Course III (Guide paper)

Title: **REACTION MECHANISM AND ORGANIC SYNTHESIS**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To learn the mechanism of various reactions, oxidation and reducing reagents, rearrangements, various heterocyclic compounds and their synthetic study
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	Know about the mechanism of Mannich, Stobbe, Darzen, Wittig, Wittig-Horner and Benzoin reactions.
CO2	Learn about the various oxidizing and reducing agents
CO3	Understand about various molecular rearrangements
CO4	Understand about free radicals
CO5	Study about various heterocyclic compounds like imidazole, oxazole, thiazole, flavones, isoflavones, anthocyanins, pyrimidines and purinesand their synthetic study.

UNIT I ADDITION TO C-C AND C-HETERO MULTIPLE BONDS AND ELIMINATION REACTIONS

Mechanism of the following reactions : Hydroboration, Michael addition, 1,3-dipolar additions, Carbenes and their additions to double bonds – Simion Smith reaction, Mannich, Stobbe, Darzen, Wittig, Wittig-Horner and Benzoin reactions.

E1, E2, E1cB mechanism - E1-E2-E1cB spectrum – Orientation of double bond – Hoffman and Saytzeff rules: Competition between elimination and substitution – mechanism of Pyrolytic eliminations, Chugave and Cope eliminations.

UNIT II OXIDATION AND REDUCTION

Mechanism – study of the following oxidation reactions – oxidation of alcohols – use of DMSO in combination with DCC or acetic anhydride in oxidizing alcohols – oxidation of methylene to carbonyl, oxidation of aryl methenes – allylic oxidation of olefins.

Synthetic importance of Clemmenson and Wolf-Kishner reductions – Birch – reduction – MPV Reduction – Reduction with LiAlH4, NaBH4, Tritertiarybutoxyaluminium hydride, sodium cyanoboro hydride, trialkyltin hydride, hydrazins.

UNIT III MOLECULAR REARRANGEMENTS

A detailed study with suitable examples of the mechanism of the following rearrangements – Pinacol-Pinacolone, Wagner-Meerwein, Demjanov, Dienone-Phenol, Favorski, Bayer-Villiger, Wolf, Stevens and Von Ritcher Rearrangements.

UNIT IV FREE RADICALS

Long and Short lived free radicals – Methods of generation of free radicals – a detailed study with suitable mechanism of Sandmeyer reaction – Gomberg reaction – Pschorr reaction – Ulmann reaction – Hansdicker reaction – Detection of free radicals by ESR.

UNIT V HETEROCYCLES

Synthesis and reactions of imidazole, oxazole, thiazole, flavones, isoflavones, anthocyanins, pyrimidines and purines.

Recommended Books

1. Advanced Organic Chemistry, J. March 3rd Edition.
2. Organic Chemistry, Vol II, I.L.Finar, 5th Edition ELBS Publication.
3. Moleular Rearrangements Vol I and Vol II Paul de Mayo.
4. Principle of Organic Synthesis R.O.C.Norman, Chapman and Hall, London, 1980.
5. Some Modern Methods of Organic Synthesis W Carruthers III Edition, Cambridge University Press 1993.

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Year: I Year Subject Code: M18MCH105 Semester: I

Core Course III (Guide paper)

Title: **SCHIFF BASE COMPLEXES AND THEIR BIOLOGICAL ACTIVITY**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To study about the preparation of Schiff base ligands and their complexes, characterization, and biological activities.
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	Learn fundamentals of Schiff base chemistry
CO2	Characterize Schiff base ligands using IR and Raman spectroscopy
CO3	Characterize Schiff base metal complexes using UV and magnetic susceptibility measurements
CO4	Determine stability and structure of Schiff base ligands and their metal complexes using DTA, TGA, NMR, XRD and Mass spectroscopy
CO5	Gain knowledge of biological activities of Schiff base ligands and their metal complexes.

UNIT I

SCHIFF BASES: Introduction – Classification – Synthesis - Mechanism of Schiff reaction – Substrates – Phenols and NH activated aryl substrates – Aliphatic Ketones and activated Alkyl Substrates – Alkene and alkyne substrates – Aromatic heterocyclic substrates – Amines – Aldehydes – Conditions for the reaction – Reactions of Schiff Bases – Spectroscopic properties – ligand properties - Application of Schiff reaction in synthesis' of bioactive molecules – Applications of Schiff bases in the pharmaceutical field - Schiff bases derivatives.

UNIT II

CHARACTERIZATION OF LIGANDS: Infrared spectroscopy – Molecular vibration – Mechanics of Measurement – Application of Infrared, FT-IR, Raman, Absorption of common functional groups.

UNIT III

CHARACTERIZATION OF COMPLEXES: Ultraviolet Spectroscopy - Mechanics of Measurement - Electronic Excitation – Simple Chromophoric groups.

Inter ionic magnetic coupling – spin state cross over – optical activity in complexes – Magnetic circular dichroism – magnetic susceptibility measurements and applications.

UNIT IV

INSTRUMENTATION METHODS: TGA, DTA, Cyclic Voltammetry, reversible, irreversible reduction, ^{1}H NMR, ^{13}C NMR, Chemical shift – applications.

Mass Spectroscopy – Theory, General fragmentation modes – Fragmentation patterns of organic molecules – Exercise on spectroscopy – XRD study of crystals.

UNIT V

STUDY OF BIOLOGICAL ACTIVITY: Pharmacological screening – Drugs for screening – preliminary screening – Anti Convulsant effect – Metrozol Seizure Test – Maximal Electroshock Seizures (MES) Test – Analgestic Studies – Tail Clip Method – Hot Plate Method.

Anti Inflammatory Studies – Antimicrobial activity study – Preparation of antimicrobial compounds – Incorporated media – DNA Studies.

REFERENCES:

1. Advanced Inorganic Chemistry, (VI Edition), F. Albert Cotton and Geoffrey Wilkinson, John Wiley & Sons Inc. (1999).
2. Applications of Absorption Spectroscopy of Organic Compounds, John K. Dyer, Prentice Hall of India Private Ltd. (2011).
3. Organic Chemistry, (VI Edition), I.L. Finar, ELBS – (2002).

4. Theoretical Principles of Inorganic Chemistry, G.S. Manku, Mc Graw Hill Publishing Co (1984).
5. Co-ordination Compounds, SFA Kettle, CBS Edition (1977).

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Year: I Year Subject Code: M18MCH106 Semester: I

Core Course III (Guide paper)

Title: **KINETICS AND ADSORPTION STUDIES**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To learn fundamentals of reaction kinetics, adsorption, green chemistry and hyphenated techniques.
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	define basic laws and methods of studying reactions kinetics
CO2	understand the rates of chemical reaction in solutions.
CO3	explain the need of catalytic reactions and adsorption studies
CO4	discuss the fundamentals of green chemistry
CO5	Describe the principles and applications of hyphenated techniques.

UNIT I: BASIC LAWS AND METHODS OF STUDYING REACTIONS KINETICS

Kinetics terms- zero order kinetics-first order-pseudo-first order-second order-pseudo-second order kinetics- Elovich and intra-particles diffusion kinetics methods. Fractional order of kinetics - methods of determining order of reactions - chemical method-physical methods - techniques for the study of fast reactions.

UNIT II: REACTION IN SOLUTIONS

Rates of chemical reaction in solutions compared to the gas phase – influence of ionic strength of solution on reaction rates – salt effects – effects of pressure on rate of reactions in solution – linear free energy relationship.

UNIT III: CATALYTIC REACTION AND ADSORPTION STUDIES

Catalysis – criteria of catalytic reactions – types of catalysis- enzyme catalyzed reaction – homogeneous and heterogeneous catalysis – adsorption – types of adsorption – Langmuir – Freundlich and Temkin isotherms.

UNIT IV: ENVIRONMENTAL CHEMISTRY AND GREEN CHEMISTRY

Elements of life and bio distribution of elements – essential and trace elements – pollution of environment – concept and scope of environmental chemistry – sources of pollution – chemical toxicology – toxic chemical – effects of toxic substances – water pollution – concept of water pollution – waste water treatment – green technology in waste water management.

UNIT V: HYPHENATED TECHNIQUES

Principle and applications of UV-Visible spectroscopy – atomic absorption spectroscopy – IR spectroscopy - TGA, DSC, XRD, TEM and SEM analysis.

References:

1. Basics chemical kinetics, by G. C. Agarwal, Tata McGraw – Hill Publishing Company Ltd.
2. Environmental chemistry and Green chemistry by Asim K. Das, Books and Allied (p) Ltd.
3. The principles of physical chemistry by Puri and Sharma. Sultan- Chand Publications Ltd.

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Syllabus for M. Phil., Chemistry effective from the year 2018-2019

Year: I Year Subject Code: M18MCH107 Semester: I

Core Course III (Guide paper)

Title: **MOLECULAR COORDINATION CHEMISTRY**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To learn fundamentals of reaction kinetics, adsorption, green chemistry and hyphenated techniques.
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	Summarize structure and different properties of Metal Organic Framework.
CO2	Investigate electronic, magnetic and spectral properties of metal complexes
CO3	Able to identify role of Schiff bases in the biological and physiological systems
CO4	Acquire Conceptual Knowledge Diffraction Methods magnetism

Unit-I

Metal Organic Framework:

Introduction – metal ions – organic linkers – topology, synthesis of MOFs - Hydro/solvothermal method – microwave assisted method – other methods, MOFs for biological applications – recent studies for MOFs as bio materials – toxicity – biodegradability, applications of MOFs – host materials – absorbents for molecular separation – template materials – catalysts – other applications.

Unit-II

Schiff base:

Schiff bases and their chemistry, Schiff base transition metal complexes, biological importance and effect of complexation on biological activity.

Spectral characterisation:

UV: Selection rule for electronic transition, d-d transitions, Charge transfer spectra.

IR: selection rules, applications of IR spectroscopy for the determination of metal complexes.

Unit-III

Diffraction Methods:

Crystal symmetry, symmetry elements and operations, seven crystal systems, unit cells, Bravais lattices, Bragg's law, X-ray diffraction methods: Rotating crystal method and X-ray powder diffraction methods, Applications of diffraction methods in the structural elucidation of metal complexes.

Unit-IV

Molecular magnetism:

Magnetic permeability and susceptibilities, diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism, ferrites, paramagnetism of complex ions, temperature independent paramagnetism, Curie law.

Methods of determining magnetic susceptibility: Gouy and Faraday balances.

Unit-V

EPR: Hyperfine splitting, zero field splitting, applications to copper complexes.

Cyclic Voltammetry and its applications.

Methods to determine antibacterial and anti fungal activities: determination of MIC, Agar diffusion method, Miller Hinton method.

Reference:

1. Physical methods in Inorganic Chemistry, Russel, S. Drago
2. Inorganic chemistry, James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Pearson edition, 2001.
3. Elements of magneto chemistry, Dutta, Syamal,S. Chand and company, 1982.
4. Bio inorganic chemistry - K. Hussain Reddy, 2006.
5. Theoretical principles of Inorganic chemistry - G.S. Manku, TATA McGraw Hill, 2006.
6. Spectroscopy of organic compounds, P.S. Kalsi, New Age International Publishers Ltd., Wiley Eastern Ltd., 1995.
7. Advanced Inorganic chemistry, Cotton and Wilkinson, V edition, Wiley and sons, 1998.

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Year: I Year Subject Code: M18MCH108 Semester: I

Core Course III (Guide paper)

Title: **MODERNISTIC APPROACH IN ORGANIC SYNTHESIS**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To learn the fundamentals of green chemistry, multicomponent reactions and advanced characterization techniques
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	Acquire applicative knowledge of new techniques and concepts in organic synthesis
CO2	Expertise in using Green techniques in organic synthetic reactions
CO3	Able to understand the recent advances in multi component reactions
CO4	Gain knowledge about advance characterisation techniques
CO5	Acquire Conceptual Knowledge of Diffraction Methods

Unit-I

The use of Green Techniques in Organic synthesis - I

Introduction to synthetic organic transformations under microwave.

a) Microwave assisted reactions in water: Hoffmann elimination, hydrolysis, oxidation, saponification reactions. b) Microwave assisted reactions in organic solvents: Esterification reactions, Fries rearrengment, Orthoester Claisen rearrangement, Diels-Alder reaction, decarboxylation. c) Microwave solvent free reactions (Solid state reactions): Deacetylation, deprotaction, saponification of ester, alkylation of reactive methylene compounds, synthesis of nitriles from aldehydes, reductions.

Unit-II

The use of Green Techniques in Organic synthesis - II

Introduction - Types of Sonochemical Reactions- Homogeneous reactions- Heterogeneous liquid-liquid reactions, solid-liquid reactions - Synthetic applications - Esterification – Saponification – Hydrolysis/ Solvolysis – Substitutions –Addition reactions – Alkylation – Oxidation – Reduction – hydroalkylation – Coupling reactions – Dichlorocarbene. Other reactions using Ultrasound method (Bouvault reactions – Strecker synthesis of aminonitriles – The Reformatsky reaction – Barbier reaction of Carbonyl compounds - Carbohydrates). Miscellaneous reactions using Ultrasound method (Ultrsonically dispersed Potassium-Potassium Superoxide – Phenylisocyanate – Sulfur extrusion – Isomerisation of Maleic to Fumaric acid – Spiroketones – Sonolysis of $Fe(CO)_5$ – Oxymercuration of olefins.

Unit-III

Multicomponent Reactions

Recent Advances in the Ugi Multicomponent Reactions - Passerini Multicomponent Reactions - Biginelli Multicomponent Reactions - Bucherer–Bergs And Strecker Multicomponent Reactions - Knoevenagel Reactions in Multicomponent Syntheses - Mcrs under Solvent Free Conditions - Ionic Liquid Promoted Mcrs – Mw Assisted Three Component Reactions.

Unit-IV

Advanced Characterization Techniques

Microscopic Techniques: SEM and TEM: Principle, Instrumentation, Specimen Preparation and Applications. Elemental Analysis with SEM and TEM. STM, AFM, EPMA: principle, Instrumentation and applications. Electron Energy Loss Spectroscopy (EELS), Auger Electron Spectroscopy (AES): Principle, Instrumentation and applications.

Unit-V

Diffraction Methods:

Crystal symmetry, symmetry elements and operations, seven crystal systems, unit cells, Bravais lattices, Bragg's law, X-ray diffraction methods: Rotating crystal method and X-ray powder diffraction methods, Applications of diffraction methods in the structural elucidation of metal complexes.

Methods to determine antibacterial and anti fungal activities: determination of MIC, Agar diffusion method, Miller Hinton method.

Reference:

8. Spectroscopy of organic compounds, P.S. Kalsi, New Age International Publishers Ltd., Wiley Eastern Ltd., 1995.
9. W. Kemp, Organic Spectroscopy, Palgrave Publications, 2002.
10. Organic Synthesis in water, Paul A. Grieco Blackie.
11. Green Chemistry, theory and practice, Paul T. Anastas and John C. Warner.
12. Multicomponent Reactions: Concepts and Applications for Design and Synthesis - Raquel P. Herrera, Eugenia Marqués-López.
13. V. Kumar, An Introduction to Green Chemistry, Vishal Publishing Co., New Delhi, 2007.
14. V.K Ahluwalia, M. Kidwi, New Trends in Green Chemistry, Anamaya Publishers,New Delhi,2nd Edition, 2007.

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Syllabus for M. Phil., Chemistry effective from the year 2018-2019

Year: I Year Subject Code: M18MCH109 Semester: I

Core Course III (Guide paper)

Title: **POLYMERS FOR ENVIRONMENTAL PROTECTION**

Credits: 5 Max. Marks: 75

OBJECTIVES:	To study about the Preparation and Characterization of different types of Polymers and its application in Environmental Protection.
COURSE OUTCOME(S) At the end of the course, the students can be able to	
CO1	Describe the types and Mechanism of Polymerization reactions and methods of Molecular Weight determination.
CO2	Discuss the preparation, properties and applications of various types of polymers.
CO3	Illustrate the methods of Preparation and Characterization of different types of Nano polymers and its Environmental applications.
CO4	Recognize the Significance of Physico – Chemical Parameters of Soil and Water.
CO5	Analyze the Remediation methods of Liquid Wastes and apply it with Langmuir and Freundlich Adsorption Isotherms.

Unit I

STUDY OF MACRO MOLECULES

Types and Mechanism of Polymerization reactions. Step-growth, free radical, addition, ionic, ring opening and group transfer polymerizations. Copolymers, Synthetic and biopolymers.Characterization of polymers.Methods of measurement of molecular weight.

Unit II

CHARACTERISTICS OF POLYMERS

Frictional properties and mechanical properties. Glassy and Rubbery states, Viscoelasticity, Crystallization and melting of polymers. Relation between structure property and performance. Manufacture and applications of polyolefins, thermoplastics, polyamides, polyesters, polyurethanes, epoxides and industrial polymers.Sources and structure of starch, Cellulose, Glycogen and Chitin.

Unit III

POLYMER NANOTECHNOLOGY

Nanoscience Introduction, methods of preparations of nanopolymers (zeolites and biopolymers), devices for characterization, carbon nanotube, nanotechnology for environmental applications.

Unit IV

ENVIRONMENTAL QUALITY

Evaluation of water and soil quality parameters.Methods of estimation of the same. Different standards for normal values of soil and water physico-chemical parameters - USEPA, ISI, WHO.

Unit V

ASSESSING CHEMICAL HAZARDS

Remediation of liquid wastes: coagulation, flocculation, adsorption. Langmuir and Freundlich adsorption isotherms. Chemistry of composting: mechanism involved in the decomposition of organic materials like hemicelluloses, proteins carbohydrates, food materials. Organic insecticides from wastes etc., by aerobic and anaerobic processes.

References:

1. V.R. Gowariker, N.V Viswanathan and JayadevSreedhar Polymer Science New Age International (P) Limited.
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