M. Phil (Chemistry) SYLLABUS
Paper-I
Analytical Chemistry (Common Paper)

Unit-I  Uv-Visible & Infrared Spectroscopy
Theoretical principle, Origin of IR spectra, instrumentation, Methodology and applications

Unit –II  (a) High Performance Chromatography, Scope of HPLC, Column efficiency in liquid Chromatography, equipment, column packing and applications

(b) Principle of gas Chromatography, instrumentation for Gas Liquid Chromatography, columns and stationary phases, parameters, affecting column efficiency, various types of detectors, application of Gas Liquid Chromatography.

Unit –III Principles of Capillary Electrophoresis and Electrochromatography, Instrumentation for Capillary Electrophoresis and applications, Supercritical Fluid Chromatography and its applications.

Unit –IV Thermal Methods
Thermogravimetric methods (TG), instrumentation, applications, Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry-General principles, instrumentation and applications

Rooks recommended:
5. Instrumental Analysis, Skoog and West.
General Spectroscopic Methods of Structure Elucidation:

Unit-I: Nuclear Magnetic Resonance Spectroscopy:

(i) Chemical shifts of some systems
(ii) Applications of spin-spin coupling constant for structure determination.
(iii) The double resonance technique.
(iv) Intermolecular and intramolecular exchange.

Unit-II: Electron Paramagnetic Resonance:

(i) Theory of electron paramagnetic resonance and significance of hyperfine splitting in simple system and its use to interpret the spectra of hypothetical H-α systems and of bis (salicyladimine) Copper (III).
(ii) Factors affecting the magnitude of ‘g’ value, zero field splitting and Kramer’s degeneracy.
(iii) Anisotropy in the hyperfine coupling constant. Nuclear quadrupole interactions of line width in solid state E.P.R.
(iv) Applications of EPR in structure elucidation.

Unit-III- The Visible and Ultraviolet Spectroscopy:

(i) Introduction, Electronic transitions, nomenclatures assignment of transitions. Intensity of electronic transition, charge transfer transition.
(ii) Applications: Finger printing in inorganic system.
(iii) Effects of solvents polarity in charge transfer spectra, Spectra of transition metal complexes.
(iv) Selection rules and intensities of transition.
(v) Structural evidence from electronic spectra.

Unit-IV – Comparison of IR and Raman Spectroscopy:

(i) Applications of IR
(ii) Change in the spectra of donor molecules upon coordination.
(iii) Characteristic group vibrations in oxo-Anions like ClO₄⁻ & NO₃⁻

Unit –V: Magnetic Properties of Coordination Compounds:


Books Recommended:

i) Physical Methods in Chemistry by R.S. Drago
ii) Modern Coordination Chemistry by Lewis and Wilkins
Unit –I: Stereochemistry
Molecular symmetry and chirality, Recemic modifications and thermodynamic properties, configurational nomenclatures, Molecules with two or more chiral centers in aliphatic and alicyclic compounds, axial chirality, planar chirality and helicity, Atropisomerism, mechanism of recemizaition involving carbanion, carbanion ion, free radical and stable symmetrical intermediates, methods of resolution and determination of configuration.

Unit-II: Reaction Mechanism
Determination of mechanism and study of mechanism of the following reactions-substitution, addition, elimination, pericyclic reactions and photochemical reactions.

Unit-III: Preparation, Properties and Applications in Organic Syntheses with Mechanistic Details of
(i) Organometallic compounds of the metals Li, Mg, Hg, Cd, Zn, Cu, Pd, Co, Rh, Cr and Ti.
(ii) Organic compounds containing S, P, Si, B.

Unit-IV: Detailed Studies of the Following Rearrangements/Reactions:


Books Recommended


2. Organic Spectroscopy
   W. Kempt, ELBS

3. Advanced Organic Chemistry
   J. March, Wiley Eastern Ltd.

4. Organic Reaction Mechanisms
   V.K. Ahluwalia and R.K. Parashar Narosa Publishing House

5. Stereochemistry of Organic Compounds
M. Phil (Chemistry) SYLLABUS

Paper-I

Physical Chemistry (Common Paper)

M.M. 100

Unit I  Review of Statistical Thermodynamic functions. Theories of Specific heat of solids.

Unit II  Chemical Bonding: The LCAO – Molecular orbital and the valance bond treatment of hydrogen molecule ion. Huckel electron theory and the expanded Huckel theory and its chemical applications.

Unit III  (a) Theoretical treatment of electronic, rotational & vibrational spectroscopy & diatomic molecule.
          (b) Principles of NMR spectroscopy and its application for structural determination of simple molecules.

Unit IV  (a) Fast reactions: Stopped-flow technique relaxation method, flash photolysis, magnetic resonance method.
          (b) Activities in electrolytic solutions, mean ionic activity coefficients, equilibria in electromechanical cells, Nernst equation.

Unit V   (a) Molecular mechanism of ion transport across membrane ionophores and ferredoxin.
          (b) Semiconductors and their electrical properties.
Annexure – I (x)
B.O.S. 03.10.2011

Department of Chemistry, A.M.U., Aligarh

Syllabus for Ph.D Course (Analytical Chemistry)
Paper – I

Max. Marks: 100

Unit I
Analysis and Presentation Data: Using graphs, presenting data in tables, hints for solving numerical problems, descriptive statistics, choosing and using statistical test, drawing chemical structures, Chemometrics.

Information technology and library resources: The internet and world wide web, internet resources for chemistry, using spreadsheets, word processors, data bases and other packages, finding and citing information.

Communicating information: General aspects of scientific writing, writing essays, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, oral presentations.

Unit II
Research Problems: Meaning of research problems, sources of research problems, criteria/characteristics of a good research problem, and errors in selecting a research problem.
Developing a Research Proposal: Format of research proposal, individual research proposal and institutional proposal.
Research Report: Format of the research report, style of writing the report, references and bibliography.

Unit III
Principle and applications of the following techniques: UV-Visible spectrophotometry, IR, Raman, TG-DTA, Chromatography, GC, GC-MS, HPLC, HPTLC.

Unit IV
Principle and applications of the following techniques: Nuclear analytical techniques, spectrofluorimetry, NMR, AAS, XRD, TEM, SEM.

BIBLIOGRAPHY

Unit – I
Information technology and library resources: The Internet and World Wide Web, internet resources for chemistry, using spreadsheets, word processors, databases and other packages, finding and citing information
Communicating information: General aspects of scientific writing, writing essays, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving oral presentation examinations.

Unit – II
Research problem: meaning of research problems, sources of research problems, criteria/characteristics of a good research problem, errors in selecting a research problem.
Developing a Research Proposal: Format of research proposal, individual research proposal and institutional proposal.
Research Report: Format of the research report, style of writing the report, references and bibliography.

Unit III
General synthetic methods for inorganic molecules: Coordination Biomolecules, macrocyclic, supramolecular and organometallic compounds. Reaction conditions viz; PH, temperature and solvents and their effect on the formation of these compounds. Applications in the field of catalysis, electronics and biology.

Unit IV
Structural elucidation of Coordination, organometallic and bioinorganic compounds employing relevant spectroscopy, viz. NMR, EPR, Mossbauer)
Max. Marks: 100

UNIT – I

Information technology and library resources: The Internet and World Wide Web, internet resources for chemistry, using spreadsheets, word processors, databases and other packages, finding and citing information

Communicating information: General aspects of scientific writing, writing essays, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving oral presentation examinations.

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Developing a Research Proposal: Format of research proposal, individual research proposal and institutional proposal.

Research Report: Format of the research report, style of writing the report, references and bibliography.

UNIT – III
A) Reagents and Reactions:
- Preparation and applications of the following:
  - Pyridinium dichromate (PDC), Pyridinium chlorochromate (PCC), Trifluoromethyl sulphonates (triflates), organoboron compounds organosilicon compounds.
B) Mechanism and uses in organic synthesis of the following:
  - Von Richter aromatic carboxylation, Corey-chaykovsky sulphur ylide reaction, Peterson olefination, Diazoketone (Arndt-Eistert) reaction, Stieglitz Rearrangement, overman Rearrangement, Ireland-Clausen Rearrangement.
C) Organic synthesis Methodology
  - Asymmetric synthesis, Stereo selectivity, 1, 2 & 1, 3-asymmetric induction, Enantioselective hydrogenation, hydroboration, epoxidation and hydroxylation.

UNIT – IV
A) Green Chemistry
  - Basic principles of green chemistry, Application of non conventional techniques in organic synthesis (ultrasonic, microwave and grinding) Synthesis under solvent free conditions.
B) Spectroscopy Practice Problems based on UV, IR, 1HNMR (including 2D) 13CNMR and Mass spectrometry.

Books Recommended:
- Asymmetric synthesis J. D. Morrison Vol 1-5, Academic Press
- Stereochemistry of organic compounds, D. Nasipuri
- Organic Synthesis “The disconnection approach” S. Warren and P. Wyatt
- Designing organic synthesis, S. Warren
- Green chemistry, M. Kidwai and V. K. Ahluwalia
- Modern methods of organic synthesis: W. Carruthers
UNIT – I

Information technology and library resources: The Internet and World Wide Web, internet resources for chemistry, using spreadsheets, word processors, databases and other packages, finding and citing information

Communicating information: General aspects of scientific writing, writing essays, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving oral presentation examinations.

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Developing a Research Proposal: Format of research proposal, individual research proposal and institutional proposal.

Research Report: Format of the research report, style of writing the report, references and bibliography.

UNIT III
A) Kinetics of Electrode Reactions, Mass Transfer by migration and Diffusion Polarography, Potentiometry, Ion-solvent interactions and Born model, Ion-Ion interactions and linearized Poisson – Boltzman equation.

B) Partition functions, Ensembles, Partition functions and Thermodynamic functions, Calculation of equilibrium Constant.

UNIT IV
a) Elements of Symmetry, Point groups, charactertables, X-rays Diffraction methods, Solid state reactions, Defects in solids, thermodynamics of point defects, Solid solutions, phase transitions, ionic conductors and supersonic conductors, Band structure of semiconductors.
b) Theories and Applications of UV, IR, Raman, NMR Spectroscopies.

Books:
1. Electrochemistry - Bockris & A N Reddy
2. Statistical Thermodynamics - N Davidson
3. Solid State Chemistry and its Applications - A R West
5. Fundamentals of Spectroscopy, Banewell