

UNIVERSITY OF GOUR BANGA
(Established under West Bengal Act XXVI of 2007)



DEPARTMENT OF CHEMISTRY

N.H.-34 (Near Rabindra Bhawan), P.O.: Mokdumpur, Dist.: Malda - 732 103.

Research Eligibility Test (RET) Syllabus

Course	Contents	Total Marks
Research Methodology	I: General Research Methodology II: Subject Oriented Research Methodology	50
Chemistry	III: Physical IV: Inorganic V : Organic	50
Total		100

Research Methodology

I: General Research Methodology:

Design: Concept and model: theory building, testing and construction: descriptive and explanatory research: prediction, correlation and causation: deterministic and probabilistic views, pragmatization, social impact.

Methodology: Background, scope, aim and objectives; work elements and milestones; sampling; diagnostic tools; instrumentation – fabrication, interfacing; qualitative, quantitative and admixed methods; controlled trials for facile route(s): deterministic and probabilistic approaches: conjunctive study, parametric statistics: precision and confidence level: synergistic benefit of experiment and theory: connotation: outcome.

II: Subject Oriented Research Methodology: Titrimetric method, gravimetric, chromatographic, potentiometric method of analysis, electrical (electrolysis, coulometry, polarimetry, cyclic voltametry) method of analysis, coulometry, TGA-DTA, and DSC analysis, spectrophotometric analysis, spectral techniques, principles and applications of UV, FT-IR, NMR and Mass spectroscopic techniques including spectrofluorometer. Purification Techniques. Synthetic Methodologies; thermal, photochemical, microwave-irradiation, ultra-sound mediated, room temperature, aqueous media, solvent free techniques, catalytic effects, green methods, material science; solid state synthetic methodologies, physical properties measurements, X-ray Crystallographic Characterization, SEM, TEM, BET surface area. Synthetic polymeric compounds, thermal and spectral analysis of polymeric compounds, molecular wt. determination, commercial polymers, magnetic properties of solid and modern methods of determination, Ball-Milling Technique. Data analysis: Mean, Median and standard deviation, absolute and relative errors; linear regression; covariance and correlation coefficient.

Chemistry**III: Physical Chemistry:**

1. Basic principles and applications of quantum mechanics . Postulates, operator, exactly solvable systems, particle in a box, harmonic oscillator, hydrogen atom, angular momentum, tunneling
2. Variational and perturbational methods.
3. Basics of atomic structure, electronic configuration, shapes of orbitals, hydrogen atom spectra, term symbol
4. Chemical applications of group theory, symmetry elements, point groups, character table, and selection rule.
5. Basic principles and application of spectroscopy – rotational, vibrational, electronic, IR and Raman activity, , selection rule, basic principle of NMR, ESR.
6. Chemical thermodynamics, laws, states and path function and their application; description of various process, Maxwell's relation, spontaneity and equilibria, temperature and pressure dependent thermodynamic quantities. Le- Chatelier principle; thermodynamics of ideal and non-ideal gases and solutions.
7. Statistical thermodynamics, Boltzmann distribution, kinetic theory of gases, partition function and their relation of thermodynamic quantities.
8. Electrochemistry – Nernst equation, electrode kinetics, electrical double layer, Debye-Hückel theory, electrolyte conductance, Kohlrausch's law and its application, ionic equilibria, conductometric and potentiometric titration.
9. Chemical kinetics – empirical rate laws, Arrhenius equation, theories of reaction rates, determination of reaction mechanisms, experimental techniques for fast reactions, enzyme kinetics, salt effect, homogeneous catalysis, photochemical reaction.
10. Solids – crystal structures, Bragg's law and application; bond structure of solid.

IV: Inorganic Chemistry

1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR).
3. Concepts of acids and bases, HSAB, non- aqueous solvents.
4. Chemistry of the main group elements and their compounds. Allotropy, synthesis, bonding and structure.
5. Chemistry of transition elements and coordination compounds – structure, bonding theories, spectral and magnetic properties, reaction mechanisms. Cages and metal clusters.
6. Inner transition elements – spectral and magnetic properties, redox chemistry, applications.
7. Organometallic compounds - synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis.
8. Bioinorganic chemistry – photosystems, porphyrines, metalloenzymes, oxygen transport, electron- transfer reactions, nitrogen fixation.
9. Physical characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer,

- UV-, NQR, MS, electron spectroscopy and microscopic techniques.
10. Nuclear chemistry – nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

V: Organic Chemistry

1. IUPAC nomenclature of organic compounds.
2. Principles of stereochemistry, conformational analysis, isomerism and chirality. Stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction
3. Reactive intermediates and organic reaction mechanisms. Generation, stability, reactivity of carbocation, carbanion, free radicals, carbenes, benzyne and nitrenes.
4. Concepts of aromaticity, benzenoid and non benzenoid compounds-generation and reactions.
5. Pericyclic reactions. Electrocyclisation, cycloaddition, sigma tropic rearrangement and other related concerted reactions. Principles and applications of organic photochemistry
6. Named reactions. Transformations and rearrangements, protecting groups. Asymmetric synthesis. Application in organic synthesis.
7. Oxidation and reduction of functional groups.
8. Common reagents (organic, inorganic and organometallic) in organic synthesis.
9. Chemistry of aromatic and aliphatic heterocyclic compounds.
10. Physical characterisation of organic compounds by IR, UV-, MS, and NMR.