

Ph.D. Written Test Format and Syllabus

Chemistry, Faculty of Science

Ph.D. Admission Test Format

The written test consists of two parts.

1. **Part A:** Research Methodology 25 questions.
2. **Part B:** Chemistry 25 questions

Part A: Research Methodology Syllabus

Research Fundamentals:

Meaning of research; objectives of research; characteristics of good research, Research problem: Identification, selection, and techniques for defining research problem, Research process, Research outcomes, Review of Literature, Hypothesis: Definition and Types

Types of Research:

Types of research, fundamental and applied research, qualitative and quantitative. Research Design: Types of research design – Exploratory, Descriptive, Casual Analytical

Sampling, Data Collection and analysis:

Types and sources of data: Primary and secondary, Methods of collecting data: questionnaire, interview, observation, case study, experiments etc., Sampling and sampling methods, characteristics of good sample, sampling techniques, Statistical Methods for Data Analysis: measures of central tendency and dispersion

Research Report:

Main body of report, abstract and keywords, Referencing styles and bibliography. Journal and author indexing

Ethics in Research:

Biasing: Definition and Types, Plagiarism -Definition and forms, IPR, copyright infringement, AI Generated Content

Part B: Chemistry Syllabus

Chemical Kinetics:

Reaction rate, Rate Law, Order, Molecularity, Methods of determining rate laws, Collision and absolute reaction rate theory, Homogeneous catalysis, Michaelis-Menton kinetics, Heterogeneous catalysis, Salt effect, Complex reactions, Photochemical reactions.

Spectroscopy:

Spectroscopy: Introduction, Principle, Electromagnetic spectrum, quantization of energy, Electronic, vibrational and rotational energy levels, and transitions in atoms and molecules. Absorption and emission spectra. Beer-Lambert's Law and its limitations, Principle, Instrumentation and applications of IR, NMR, UV, Visible and Mass spectroscopy, Gas Chromatography

Metal and Metalloids:

Metal and Metalloids: Main group elements and their compounds- Synthesis, structure, properties and applications, Chemistry of Transition elements and co-ordination compounds- structure, bonding, spectral and magnetic properties, Organometallic compounds, Metal ions in biology, Properties and applications of metalloids.

Water and Water Analysis:

Water and Water Analysis: Sources, Impurities, Hardness & its units, Industrial water characteristics, softening of water by various methods (External & Internal treatment), Boiler trouble- causes, effects & remedies, Characteristics of municipal water & its treatment, Numerical problems based on softening methods. Alkalinity, hardness (Complexometric), Chloride, Free chlorine, DO, BOD and COD determination of water sample, Numerical problems based on above techniques.

Carbon and its compound:

Aromaticity, Chemistry of natural products, Stability and reactivity of carbocations, carbanions and free radicals, Organic reaction mechanism involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species, Selective organic named reactions- Stork enamine reaction, Michael addition, Mannich reaction, Ene reaction, Barton reaction, Baeyer-Villiger reaction, Shapiro reaction.