

Chemistry - 2020-21

THE M.Phil / Ph.D ENTRANCE TEST SYLLABUS .

[As per M.Phil. Ordinance no.13 and Ph.D. Ordinance no.11]

The Test will have the question paper in **two parts A and B.**

The Syllabus for **Part A: Research Methodology [Common to all subjects of faculty of Science (i.e. 1. Physics 2. Mathematics 3. Statistics 4. Chemistry 5. Geology 6. Pharmacy)]**. 50x1=50

Part-A shall consist of **50 objective type** compulsory questions of 1 mark each based on **Research Methodology**. It shall be of generic nature, intended to assess the research aptitude of the candidate. It will primarily be designed to test reasoning ability, data interpretation and quantitative aptitude of the candidate.

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THE M.Phil./Ph.D. ENTRANCE TEST SYLLABUS 2020-21

Syllabus for Part-A: Research Methodology 50×1=50

[Common to all subjects of faculty of Science (i.e.1. Physics 2. Mathematics 3. Statistics 4. Chemistry 5. Geology 6. Pharmacy)].

- Meaning of research, Objective of research, Types of research, Research approaches, Significance of research, Research methods versus research methodology, Research process, Criteria of good research.
- Research Problem, Selecting the problem, Necessity of defining the problem, Technique involved in defining problem.
- Meaning of Research Design, Need for Research Design, Feature of good Design, Important Concepts Relating to Research Design: Dependent and Independent variables, Extraneous Variable, Control, Confounded Relationship, Research Hypothesis, Experimental and Non-Experimental Hypothesis, Experimental and Control Groups, Treatments, Experiment, Experimental unit (s), Research Designs in Case of Exploratory Research Studies, Descriptive and Diagnostic Research Studies.
- Quantitative and Qualitative data, Classification of Measurement Scales: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale. Goodness of Measurement Scale: Validity, Reliability and Practicality.
- Types of data: Primary and Secondary, Methods of Collecting Primary data: Observation method, Interview method, Collection of data through questionnaires, Collection of data through schedules, Difference between questionnaires and schedule, Collection of secondary data.
- Classification of data, Tabulation, Diagrammatic and Graphical representation of data: Bar chart, Pie chart, Box plot, Histogram, Frequency polygon, Frequency Curve, Ogive.

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S. A. B.
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S. A. B.

- Measure of Central Tendencies: Mean, Median, Mode .

Measures of Variability: Range, Quartile Deviation, Standard Deviation and Coefficient of variation.

- Meaning of Correlation, Scatter diagram, Karl Pearson Coefficient of Correlation, Rank Correlation, Regression lines, Regression coefficients, Properties of regression coefficient. Normal Distribution and its Properties
- Testing of Hypothesis and Test of significance: Null and Alternative Hypothesis, Type I and Type II errors, Critical region, Level of significance, One-Tailed and Two- Tailed Tests, Large sample tests: Test of significance for single proportion, Difference of proportions, Single mean and difference of means, Chi -Square test of goodness of fit and independence of attributes. Small sample tests: t-test for single mean, t-test for difference between two sample means, Paired t-test for difference of means, F-test for equality of population variances.
- Analysis of Variance.
- Computer languages and Operating System(OS)-Assembly language, Machine language, MS-DOS and Windows.
- MS-Word and Power point presentation.

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Part B.

**Syllabus for M. Phil. and Ph. D. Chemistry
Entrance Examination (2020-21**

Syllabus will be based on M. Sc. Chemistry and NET Examinations.

Physical Chemistry:

- Basic principles and applications of quantum mechanics – hydrogen atom, angular momentum. Vibrational and perturbational methods.
- Basics of atomic structure, electronic configuration, shapes of orbitals, hydrogen atom spectra.
- Theoretical treatment of atomic structures and chemical bonding.
- Chemical applications of group theory.
- Basic principles and application of spectroscopy – rotational, vibrational, electronic, Raman, ESR, NMR.
- Chemical thermodynamics and Statistical thermodynamics.
- Phase and Chemical equilibria.
- Electrochemistry – Nernst equation, electrode kinetics, electrical double layer, Debye-Hückel theory.
- Chemical kinetics – empirical rate laws, Arrhenius equation, theories of reaction rates, determination of reaction mechanisms, experimental techniques for fast reactions. Concepts of catalysis.
- Polymer chemistry. Molecular weights and their determinations. Kinetics of chain polymerization.
- Solids - structural classification of binary and ternary compounds, diffraction techniques, bonding, thermal, electrical and magnetic properties
- Collids and surface phenomena.

Inorganic Chemistry

- Chemical periodicity and Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules.
- Concepts of acids and bases.
- Chemistry of the main group elements and their compounds. Allotropy, synthesis, bonding and structure.
- Chemistry of transition elements and coordination compounds – bonding theories, spectral and magnetic properties, reaction mechanisms.
- Inner transition elements – spectral and magnetic properties, analytical applications.
- Organometallic compounds - synthesis, bonding and structure and reactivity. Organometallics in homogenous catalysis.
- Bioinorganic chemistry – photosystems, porphyrines, metalloenzymes, oxygen transport, electron- transfer reactions, nitrogen fixation.
- Physical characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-, NQR, MS, electron spectroscopy and microscopic techniques.
- Nuclear chemistry – nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

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Organic Chemistry

- IUPAC nomenclature of organic compounds. Principles of stereochemistry, conformational analysis, isomerism and chirality.
- Reactive intermediates and organic reaction mechanisms. Named reactions. Transformations and rearrangements.
- Concepts of aromaticity.
- Pericyclic reactions.
- Principles and applications of organic photochemistry. Free radical reactions.
- Reactions involving nucleophilic carbon intermediates.
- Oxidation and reduction of functional groups.
- Common reagents (organic, inorganic and organometallic) in organic synthesis.
- Chemistry of natural products such as steroids, alkaloids, terpenes, peptides, carbohydrates, nucleic acids and lipids.
- Selective organic transformations— chemoselectivity, regioselectivity, stereoselectivity, enantioselectivity. Protecting groups.
- Chemistry of aromatic and aliphatic heterocyclic compounds.
- Physical characterisation of organic compounds by IR, UV-, MS, and NMR.

Interdisciplinary topics

- Chemistry in nanoscience and technology.
- Supramolecular chemistry.
- Environmental chemistry.

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