Syllabus for Ph.D. Chemical Sciences

Entrance Examination 2023-24

Research Methodology

Teaching Aptitude: Nature, objectives, characteristics and basic requirements, Learner's characteristics; Factors affecting teaching; Methods of teaching; Teaching aids; Evaluation systems.

Research Aptitude: Research: Meaning, characteristics and types; Steps of research; Methods of research; Research Ethics; Paper, article, workshop, seminar, conference and symposium;

Thesis writing: its characteristics and format.

Communication: Nature, characteristics, types, barriers and effective classroom communication.

Information and Communication Technology (ICT): meaning, advantages, disadvantages and uses; General abbreviations and terminology; Basics of internet and e-mailing.

Structure of the institutions for higher learning and research in India; formal and distance education; professional/technical and general education; value education: governance, policy and administration; concept, institutions and their interactions.

Chemistry

Physical Chemistry: Basic principles and applications of quantum mechanics; basics of atomic structure; Chemical applications of group theory.

Basic principles and application of spectroscopy; chemical thermodynamics. Phase equilibria. Chemical equilibria; Electrochemistry, chemical kinetics; concepts of catalysis. Polymer chemistry. Solid state chemistry.

Inorganic Chemistry: Structure and bonding in homo- and heteronuclear molecules; chemistry of transition elements and coordination compounds; inner transition elements; organometallic compounds. Cages and metal clusters. Bioinorganic chemistry

Analytical chemistry- separation techniques. Spectroscopic electro- and thermos-analytical methods.

Organic Chemistry: Nomenclature and stereochemistry; reactive intermediates and organic reaction mechanisms. Concepts of aromaticity. Pericyclic and photochemistry. Named reactions.

Transformations and rearrangements. Heterocyclic chemistry. Reagents in organic synthesis. Chemistry of natural products. Asymmetric synthesis. Spectroscopic characterization of organic compounds.

Sample Questions:

[1] Which one of the following factors does not affect the chemical shift? a) Inductive effect b) Anisotropic effect c) Concentration d) Hydrogen bonding

[2] Bathochromic shift is also known as a) Hypochromic shift b) Hyperchromic shift c) Red shift d) hypsochromic shift

[3] One of these detectors is not used in gas chromatography a) Flame Ionization b) Thermal conductivity c) Golay d) Electron capture

[4] Silver-silver chloride reference electrode is made up of a) copper wire coated with copper chloride b) Sodium wire coated with sod. chloride c) Mercury with calomel d) Silver wire coated with silver chloride

[5] In polarography any change in diffusion current is denoted by a) Ilkovic equation b) Nernst Equation c) Arrhenius equation d) Stock equation