

**DEPARTMENT OF APPLIED CHEMISTRY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**Syllabus for Ph.D Admissions Test 2020-21**

**SECTION-B**

- 1 **Inorganic Chemistry:** Chemical periodicity; Structure and bonding in molecules including shapes of molecules (VSEPR Theory); Transition elements and coordination compounds: structure, bonding theories; Inner transition elements: spectral and magnetic properties, redox chemistry and analytical applications; Organometallic compounds: bonding and structure, and reactivity.
- 2 **Physical Chemistry:** Laws of thermodynamics; Thermodynamic description of various types of processes; spontaneity and equilibria; Temperature and pressure dependence of thermodynamic quantities, thermodynamics of ideal and non-ideal gases, and solutions; Empirical rate laws of kinetics and temperature dependence, steady state approximation, collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis.
- 3 **Organic Chemistry:** Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes; Organic reaction mechanisms involving addition, elimination and substitution reactions; Common named reactions and rearrangements – applications in organic synthesis. Organic transformations and reagents: Functional group interconversion.
- 4 **Analytical Chemistry and Instrumentation:** Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient; Theory of electronic spectroscopy; Woodward Fieser, Fieser-Kuhn's rules; Frank-Condon Principle, Electronic states and term symbols; Molecular vibrations and modes of vibrations: Fundamental frequencies, overtones, combination bands and hot bands; NMR; Chemical shift; Relaxation processes.
- 5 **Environmental Chemistry:** Air and Water pollutants: classification and properties; Adsorption; Types of adsorption; Factors influencing adsorption of gases and liquids; Adsorption isotherms: Langmuir, Freundlich and BET adsorption isotherms; Adsorption by activated carbon.
- 6 **Polymers:** Classification of polymers; Mechanisms of polymerization; Number, weight and viscosity average molecular weights; Polydispersity and molecular weight distribution; Polymer structure and physical properties.
- 7 **Colloids and surfactants:** Surfactants and their classification; Kraft point; Micelle formation by surfactants; Critical micelle concentration & cmc measurement; Micellar structure and shape, factors affecting cmc; Formation of emulsions, factors determining emulsion stability; Microemulsions.
- 8 **Electrochemistry and Corrosion:** Nernst equation; Electrochemical cells; Debye Huckel theory; Electrolytic conductance, Kohlrausch law and its applications; Definition and importance corrosion; Electrochemical theory of corrosion; Factors affecting corrosion rate; Forms of corrosion; Corrosion prevention by materials selection and design, protective coatings, cathodic protection, anodic protection.