

**Design Innovation Centre
Savitribai Phule Pune University**

Certificate Course in

**Chromatographic Techniques in Designing Forensic and Industrial
Applications**

Syllabus for Entrance Examination

Examination Centre: Department of Chemistry, Savitribai Phule Pune University (Formerly University of Pune), Pune 411007.

Nature of Questions: Objective type, Multiple Choice Questions

Number and names of sections in Question paper: The entrance test will consist of ONE paper having TWO sections.

Total Duration: 120 Minutes (2.0 hours)

Section I: Will consist of 20 multiple choice questions (MCQ) of 1 mark each covering numerical ability, verbal and nonverbal reasoning and English. All questions in this section will be compulsory and no negative marking.

Section II: Will consist of 2 subsections for the subjects as listed below, There will be total 40 questions of 2 marks each and no negative marking.

1. Chemical Science

2. Biological Science

Each candidate is expected to attempt all questions. Subsection I and II will have 20 questions each which are compulsory. All the questions in section II will be multiple choice questions (MCQ). These questions will be based on the syllabi of bachelor's degree level courses of Savitribai Phule Pune University (formerly University of Pune) as mentioned below.

1. Chemical Science

- ✓ Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).
- ✓ Basics of atomic structure: electronic configuration, shapes of orbitals, hydrogen atom spectra.
- ✓ Nuclear chemistry: The atom, nucleus and outer sphere, classification of nuclides, nuclear stability and binding energy, discovery of radioactivity, types of radioactivity, general characteristics of radioactive decay and decay kinetics, measurements radioactivity, gaseous ion collection method, proportional and G.M. counter, applications of radioactivity, radiochemical principles in the use of tracers, typical applications of radioisotopes as a tracer.

- ✓ Chemistry of the main group elements and their compounds: Allotropy, synthesis, bonding and structure.
- ✓ Metals, semiconductors and Super conductors: Metallic bonding, band theory in metals with respect to Na along with $n(E)$ and $N(E)$ diagrams, Electrical conductivity of metals (Na, Mg, Al), valence electrons and conductivity.
- ✓ Analytical chemistry: Separation techniques, spectroscopic electro- and thermoanalytical methods.
- ✓ IUPAC nomenclature of organic compounds.
- ✓ Strength of organic acids and bases: pK_a , origin of acidity, influence of solvent, simple aliphatic saturated and unsaturated acids, substituted aliphatic acid, phenols, aromatic carboxylic acids, pK_a and temperature, pK_b , aliphatic and aromatic bases, heterocyclic bases, acid base catalysis.
- ✓ Spectroscopic methods in structure determination of organic compounds: Different units of measurement of wavelength frequency, different regions of electromagnetic radiations. Interaction of radiation with matter, excitation of molecules with different energy levels, such as rotational, vibrational and electronic level, types of spectroscopy and advantages of spectroscopic methods.
- ✓ Co-ordination chemistry: Coordinate bond, central metal atom or ions, ligand, double salt, complex compound, coordination number, charge on the complex ion, oxidation number of metal ion, first and second coordination sphere, ligands: definition, classification, chelates and chelating agents, formation constant, inert and labile complexes, IUPAC nomenclature of coordination compounds, different geometries of coordination compounds with C.N.= 4 to C.N.=10 and examples of each geometry.

2. Biological Science

- ✓ Amino acid and Proteins: Introduction, biological functions, classification-based on structure, function and composition. Structural organization of proteins- primary, secondary, tertiary and quaternary structures (general overview). Denaturation of Proteins.
- ✓ Introduction of carbohydrates, Introduction and biological significance of proteoglycans, Glycoproteins, Glycolipids, Analysis of carbohydrates, Introduction to lipids, types of lipids, Saponification number, Acid number, Iodine number and their significance. Rancidity of lipids.
- ✓ Biochemical techniques: Principle, working and applications of dialysis, Paper chromatography, TLC, Column chromatography- Gel filtration, Ion exchange, Affinity Chromatography. Electrophoresis- Paper and Gel (Agarose, Native and SDS-PAGE).
- ✓ Cell Biochemistry: Introduction to Cell, Unicellular and Multicellular organisms, Distinguishing features of Prokaryotic and Eukaryotic cell. Structure and function of Cell membrane, Mitochondria, Endoplasmic reticulum, Golgi complex, Lysosomes, Peroxisomes, Plant cell wall and Chloroplast. Concepts of Biomolecules and types of bonds in biomolecules.
- ✓ Vitamins and Coenzymes: Classification- Fat soluble and water soluble vitamins (source, biological functions and deficiency disorders), coenzyme forms of vitamin B complex.

- ✓ Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO₂ fixation-C₃, C₄ and CAM pathways.
- ✓ Plant hormones: Biosynthesis, storage, physiological effects and mechanisms of action.
- ✓ Biophysical methods: Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using X-ray diffraction and NMR; analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.
