RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR SCREENING TEST FOR THE POST OF SENIOR SCIENTIFIC OFFICER- CHEMISTRY DIVISION
(STATE FORENSIC SCIENCE LABORATORY, RAJASTHAN, JAIPUR)

Unit I

Analytical Chemistry : Classification of analytical methods – Classical and Instrumental, volumetric, titrimetric and gravimetric techniques, selection of proper analytical techniques: types and range of determination, accuracy, precision and errors, sample preparation, handling of reagents with safety, density and viscosity measurements.

Statistical Analysis : Mean, Mode, Median, Correlation and Regression analysis, Null Hypothesis, Variance, t-test, Chi-Square test. Type of Data, Measure of central tendency, Dispersion of Data, Correlation, Probability and Proof.

Unit II

Analysis of unknown samples :-

Organic: Physical examination, element detection (N, S, Cl, Br, I, F), Functional Group analysis (-OH, -COOH, $-NO_2$, $-NH_2$, $-CONH_2$, -CO-, -CHO, Hydrocarbons)

Inorganic: Qualitative analysis of cations and anions with special reference to cations i.e. As, Sb, Pb, Ba, Cu, Hg, Zn and Tl and anions i.e.NO_2^-, NO_3^-,S^{2-}, SO_4^{2-}, SO_3^{2-}, halides and cyanides.

Analysis of poisonous gases: CO, H_2S, PH_3, CH_4 and NH_3.

Unit III

Spectroscopic and other techniques :-

Unifying principles : Electromagnetic radiation, interaction of electromagnetic radiation with matter- absorption, emission, transmission, reflection, refraction, dispersion, polarization and scattering.

Basic principles, instrumentation and applications: UV- Visible, FTIR, AAS, Mass, Spectroscopy, Fluorescence and Phosphorescence spectrophotometry, ESR Spectroscopy.

Fundamentals of Acids, Bases and Buffers, pH, pK_a, and pK_b values, principles, instrumentation and applications of pH metry, Potentiometry, Conductometry and Microscopic analysis in forensic Science.

Unit IV

Chromatography and Electrophoresis

General Principles and types of chromatographic techniques: Paper chromatography, column chromatography, Thin layer chromatography, adsorption chromatography, partition chromatography, Gas chromatography, Gas-liquid chromatography, Ion exchange chromatography, Exclusion (permeation) chromatography, affinity chromatography, HPLC, HPTLC, Capillary Chromatography and Electrophoresis.

Unit V

Basic Organic Chemistry: Important preparations and properties of alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, carboxylic acids, aldehydes, ketones, amines and nitro compounds.

Unit VI

Proteins: Classification, Structure and Properties, Molecular weight determination, Isoelectric point, coagulation and denaturation. Carbohydrates: Classification, Structure and Reactions. Fats and Lipids: Classification, Structure and Reactions.
Alkaloids: Classification, Isolation and Identification.

Unit VII

Environmental Pollution - Air, water and soil pollutants, their permissible limits.
Standards of potable water, water analysis, sources of water pollution.
Analysis of agricultural, Industrial, and domestic effluents.
Determination of adulterants in various food commodities. Pesticide analysis in food products. Soaps and detergents: Types and analysis.
Detection of substandard fertilizers by chemical and instrumental techniques.

Unit VIII

Paints, pigments and dyes-

Classification and identification of dyes, analysis of dyes used in Trap cases. Role of dyes in crime investigation.

Paints and pigments: Types and chemical composition, toxic effects on living organisms and identification techniques, authenticity of brands of paints.

Unit IX

Analysis and estimation of illicit liquor including methyl alcohol, ethyl alcohol, denatured spirit, acetone, chloroform, ether and other solvents. Laws pertaining to Excise Act.

Unit X

Metals, alloys and their types. Identification composition and analysis of metals and alloys by chemical methods and instrumental techniques. Hallmarking of precious metals as per BIS.
Trace metal analysis and its forensic importance.

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Pattern of Question Papers:

1. Objective Type Paper
2. Maximum Marks : 100
3. Number of Questions : 100
4. Duration of Paper : Two Hours
5. All Questions carry equal marks
6. There will be Negative Marking

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