

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS OF COMPETITIVE EXAMINATION FOR THE POST OF SENIOR SCIENTIFIC OFFICER TOXICOLOGY DIVISION STATE FORENSIC SCIENCE LABORATORY (HOME DEPARTMENT)

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. Good Laboratory Practices, Standard Operating Procedures, quality assurance and quality control, validation of analytical methods.

Statistical Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test.

UNIT II

Basics of Physical, Inorganic and Organic Chemistry

Properties of alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, carboxylic acids, aldehydes, ketones, amines and nitro compounds.

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.

Sample Preparation Techniques: Liquid-liquid extraction/solvent extraction-partition coefficient, distribution ratio and percent extraction. Solvent extraction of metal ions-ion association complexes and metal chelates, multiple batch extraction, Craig's counter-current distribution. Accelerated and Microwave assisted extraction, protein precipitation and solid phase extraction (SPE).

UNIT III

General Principles of Biological / Biochemical Analysis: pH and Buffers, Physiological solution Centrifugation Techniques, Basic principle of sedimentation, various types of

centrifuges, Density Gradient Centrifugation, Preparative Centrifugation, analysis of sub-cellular fractions, Ultra centrifuge- Refrigerated Centrifuges.

Microscopy: Basic principles of microscopy, Simple and Compound microscope, Study of different types of microscopes: Comparison microscope, Phase contrast microscope, Stereoscopic microscope, Polarizing microscope, Fluorescence microscopy, IR microscopy, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM)

UNIT IV

Electromagnetic radiations: General properties of electromagnetic radiations, Wave and Quantum mechanical properties, Interaction of EMR with matter, electronic spectra and molecular structure, Internal standards and standard addition calibration methods.

Introduction, Theory, Principle, Instrumentation and Applications of Spectroscopic Techniques: Ultraviolet and Visible Spectroscopy, Infrared Spectroscopy, FT-IR, Raman Spectroscopy, FT-Raman spectroscopy, Flame emission spectrometry, Atomic Absorption Spectrometry and Atomic Fluorescence Spectrometry.

UNIT V

Separation Techniques: Introduction to Chromatography: Partition, Adsorption, Ion exchange, Size Exclusion Chromatography.

Introduction, Theory, Principle, Instrumentation and Applications of Thin Layer Chromatography, High Performance Thin Layer Chromatography, Gas Chromatography; Gas-liquid and gas-solid chromatography, High Performance Liquid Chromatography, Gas Chromatography – Head Space: Principle, instrumentation and applications.

Emerging and Hyphenate Techniques: Theory, Instrumentation and Applications Mass Spectroscopy, Inductively Coupled Plasma-Mass Spectroscopy, X-Ray Spectroscopy, Gas Chromatography - Mass Spectroscopy (GC– MS) and GC – MS – MS (Tandem), Liquid Chromatography-Mass Spectroscopy (LC – MS) and LC – MS – MS (Tandem), Capillary Chromatography

Introduction, Theory, Principle, Instrumentation and Applications of Electrophoretic techniques.

UNIT VI

Basics of Forensic Science: Definition, history, principle, scope and development of Forensic science, Forensic Science Laboratories in India, Functions and responsibility of Forensic scientist.

Crime: Definition, types of crimes, Modus Operandi, Law as per Bhartiya Sakshya Adhiniyam, Bhartiya Nagrik Suraksha Sanhita, Bhartiya Nyaya Sanhita.

Court testimony: Admissibility of expert testimony, pre court preparation and court appearance, examination in chief, cross examination and re- examination. Ethics in Forensic Science.

UNIT VII

Crime Scene Investigation: Introduction, types of crime scene, Evaluation and processing of crime scene, Securing and Documenting the crime scene (Note making, Sketching, Photography, videography of crime scene), role of the first arriving officer at the crime scene, Digital Imaging of Crime Scene, 3-D scanning technique, Searching techniques of Crime scene, Processing of physical evidence-discovering, recognizing and examination of physical evidences, Collection, Safety measures for evidence collection, Preservation, Packaging, sealing, labelling and forwarding of physical evidences, Maintaining the chain of custody, Probative value of physical evidences, Reconstruction of scene of crime.

Introduction to evidences, Types, Classification and Role of evidences in Criminal Investigations & Trails, Tele forensic Technology for crime scene investigation, Mobile kits and equipments, their utility on crime scene, Technology innovation in crime scene management, Report writing, Components of reports and report format in respect of crime scene and laboratory findings.

UNIT VIII

Forensic Toxicology: Introduction and concepts of forensic toxicological examination and its significance. Law related to poisons, Introduction to Poisons, form of poisons, classification of Poisons and methods of administration of poison, Mode of action of poison, Diagnosis and management of poisoning cases. Factors affecting the effect of poison, Symptoms of poisoning and antidotes. Types of poisoning cases. Collection and preservation of toxicological exhibits in poisoning cases. Postmortem examination and postmortem changes. Medico-legal aspects in poisoning cases.

Collection and preservation of biological evidences (viscera and /or body fluids) and circumstantial evidences in fatal and survival cases

UNIT IX

Classification of matrices. Isolation and Extraction of poison/ drug by Solvent extraction, distillation/steam distillation, micro diffusion, dialysis, dry ashing and wet digestion.

Method of analysis of Inorganic poisons (metallic, non-metallic and anions). Method of analysis of Neutral poison. Method of analysis of Basic drugs / poisons. Method of analysis of Acidic drugs / poisons. Method of analysis of volatile poisons and noxious gases. Method of analysis of Insects and animal poisons. Method of analysis of Plant poisons, Method of analysis Mechanical poisons.

UNIT X

Toxicological analysis of decomposed materials. Interpretation of toxicological findings and preparation of reports, Forensic pharmacology, Pathways of poison/drug metabolism,

Forensic pharmacological studies, absorption, distribution, pharmacokinetics and metabolism, pathways of drug metabolism, drug toxicity, excretion of drugs and poisons. Detection of poison on the basis of their metabolic studies.

Submission of samples to the laboratory, postmortem examination, specific analysis plan / approach to toxicological examinations of poisoning samples.

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Pattern of Question Papers:

1. Objective Type Paper
2. Maximum Marks: 150
3. Number of Questions: 150
4. Duration of Paper: 2.30 Hours
5. All Questions carry equal marks
6. There will be Negative Marking