

**RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER**  
**SYLLABUS FOR SCREENING TEST FOR THE POST OF**  
**SENIOR SCIENTIFIC OFFICER- BALLISTIC DIVISION**  
**(STATE FORENSIC SCIENCE LABORATORY, RAJASTHAN,**  
**JAIPUR)**

**Unit-I**

Mechanics:- Velocity and acceleration along radial and transverse direction, tangential and normal acceleration, motion under variable forces, motion in a resistive medium, projectile motion.

Newtonian Mechanics of one and many particle systems, conservation laws, work energy theorem, systems with variable mass, frame of reference, inertial and non inertial frames, Central forces, two body Moment and product of inertia of a body, D'Alembert principle, Motion about a fixed axis, Euler's equation for rigid body motion.

Fluid Mechanics:- General introduction of Fluid dynamics. Kinematics of flow fields, conservation of momentum, irrotational motion, equation of continuity, Bernoulli's theorem, viscous fluids, streamline and turbulent flow, Poiseuille's law, Surface tension capillary tube flow, Raynold's number, Stoke's law.

**Unit-II**

Probability-theory, classical definition of probability, basic terms-events, trials, mutually exclusive events, favourable events, exhaustive events etc. Baye's theorem of probability, addition theorem, multiplication theorem, Binomial distribution, normal distribution, hyper geometric distribution, correlated measurements.

Discriminating power-derivation, evaluation of evidence by discriminating power, combination of independent systems, correlated attributes, transfer of evidence, likelihood ratio, probability of guilt, correspondence probabilities, direction of transfer.

Tests of hypothesis-tests of significance of attributes, Z-test of significance and coefficient of correlation, small sample test, T-test, paired test, chi-square test, F-test for equality of variance, large sample test, normal test.

Significant figures, precision indices, statistically reliable differences, rejection of individual readings, probable error.

Applications of statistics in Forensic Ballistics, Statistical evaluation of data regarding Forensic Ballistics obtained by instrumental methods. Mathematical considerations of striation matching etc.

### **Unit – III**

Spectroscopic techniques: Introduction: Properties of light, Interaction of Matter and light, Electro-magnetic radiation & it's application in forensic science UV/Visible Spectrophotometry and it's application in Forensic Science, Molecular Fluorescence, Infrared (IR) Spectroscopy, & it's Application in Forensic Science, Raman Spectroscopy, Mass Spectrometry, Atomic Absorption Spectroscopy and it's applications in Forensic Science.

Separation methods- Thin Layer Chromatography, Gas Chromatography for qualitative and quantitative

### **Unit-IV**

X-ray spectroscopy: X-ray absorption and fluorescence methods, X-rays diffraction, EDX, Auger Emission Spectroscopy (AES),electron spectroscopy for Chemical analysis(ESCA)

Thermal Analysis Methods: Basic principles and theory, differential scanning calorimetry and differential analysis, thermogravimetry.

Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and instrumentation, applications.

Lenses, magnifiers, measuring instruments, Principle and working of Simple - Microscope, Stereo microscope, Zoom stereo microscope, Comparison microscope, light sources- UV, IR, transmitted, oblique light, spotlight.

Principle & working of SEM-EDS, Raman Spectrophotometer, GC- MS, Neutron Activation Analysis.

### **Unit-V**

Firearms and tool marks: Firearms, Types of Firearms, Firearm Barrels, Anatomy of Ammunition, What happens when ammunition is discharged? Tool marks, various types of toolmarks, cartridge cases and bullet comparison, Tool mark comparisons. Collection of fire arms evidence, Safety and operations testing, Firearm Databases and Automated search system, Distance of firing Determination, shot pattern, Gun powder Residues, Primer Residues.

### **Unit -VI**

History and development of firearms, their classification and characteristics, various components of small arms, bore and caliber, relation between bore number of shotguns and internal cross sectional diameter of their barrels, choke-purpose, degrees and types, different automatic mechanisms used in small arms—blow back, retarded blow-back, short-recoil operated, long-recoil operated and gas operated mechanisms; rifling, various class characteristics of rifled bore, purpose of rifling, types of rifling, methods to produce rifling, trigger and firing mechanisms, trigger pull, accidental discharge of firearms, cartridge firing mechanism, Projectile-velocity determination, determination of velocity of shot-charge, techniques of dismantling/assembling of various types of firearms, identification of origin- various marks on firearms, improvised/Country-made/imitative firearms and their constructional features, comparative merits of different bores of shotguns, silencers, Headspace and its importance.

### **Unit -VII**

Types of ammunition, classification and constructional features of different types of cartridges, types of primers and priming compositions.

Propellants and their compositions-black, smokeless and semi- smokeless powders, various additives in propellants like stabilizers, chemicals for reducing flash, non-hygroscopic agents, chemicals for conversion of propellants into progressive burning etc, velocity and pressure characteristics under different conditions.

## **Unit -VIII**

Use of brass/copper for manufacture of cartridge cases, different shapes of cartridge cases and their heads-rimmed, rimless, semi rimmed, belted and rebated.

Various types of bullets and compositional aspects, Jacketed, non- jacketed bullets, round nose, sharp-pointed, boat-tailed, streamlined, soft point, hollow point and other expanding bullets, dum-dum, pencil-point, armour-piercing, tracer and incendiary bullets, latest trends in their manufacture, various types of wads loaded in shot-gun cartridges, shotgun ball ammunition. Identification of origin, head stampmarkings on cartridges, improvised ammunition, safety aspects for handling of fire arms and ammunition

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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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