

GOVERNMENT OF JAMMU AND KASHMIR
JAMMU AND KASHMIR SERVICES SELECTION BOARD
CPO Chowk Kacchi Chawni Jammu/ Zam Zam Building Ram Bagh, Srinagar.
www.jkssb.nic.in

NOTIFICATION

The Jammu and Kashmir Services Selection Board Vide Advertisement Notification NO. 02 of 2022 Dated: 09.02.2022 advertised UT Cadre posts of Assistant Scientific Officers (Home Department).

Accordingly Syllabus to the said posts annexed as **Annexure A** to this notification is notified for information of the candidates.

Sd/=

Riyaz Ahmed Malik (JKAS)

**Controller of Examinations
Jammu and Kashmir Services Selection Board.**

NO :JKSSB-COE0EXAM(UT)/19/2023-03 SERVICE SELECTION BOARD

Dated : 25.04.2023

Copy to

1. Director Information J&K Govt with request to get the said notification published in at least three leading local newspapers of Jammu/Srinagar for at least 03 consecutive days.
2. Secretary J&K Services Selection Board for information.
3. Members (ALL) for information.
4. Pvt. Secretary to Chairman J&K SSB for information of the Chairman.
5. I/C Website.
6. Syllabus File.

ANNEXURE A

Syllabus for the Posts of Assistant Scientific Officers in J&K FSL.

1. Assistant Scientific Officer, Narcotics

- Introduction, Definition, Principles, Scope and branches of Forensic Science.
- Development of Forensic Science in India.
- Crime Scene investigation: Definition of Crime Scene. Classification of Crime Scene, Indoor & Outdoor, Primary & Secondary, Macroscopic & Microscopic Crime scenes, Significance and Ethics of Crime Scenes.
- Physical Evidence: Definition, Classification, Source, Significance and value of Physical evidence. Linkage between Crime Scene victim and Criminal. Study of Crime Scene relating to gas explosion, Fire and Arson, homicide, suicide, murder, mass disaster. Tools and techniques in Crime Scene search. Collection, Preservation, Packaging of the material at Crime Scene. Re-Construction of Crime Scene. Chain Custody and safety measures at the Scene of Crime and in Laboratory.
- Basic Principles of Statistics: Probability, Mean, Median, Mode, Chi square, F-Test, measurement of uncertainty, Systematic and random sampling.
- Expert testimony in court of Law: Admissibility of evidence, Laws and Acts relevant to Forensic Science.
- History of Drug Abuse and related common terminologies, Roots of Administration, actions and symptoms of Narcotic Drugs and Psychotropic Substances, Different methods of extraction of Drugs, Cleanup Procedures, analysis and Field Test, Narcotic Drugs and Psychotropic substances, Introduction and Classification of Control Substances, Precursor Chemicals, Narcotic Raids and Drug Laboratories- Evidence and Forensic Examination, Mandatory Provisions of NDPS Act, NDPS Drugs, Classification of Drugs, Drug Dependence and Drug Tolerance.
- Chemical Periodicity, Main Group of elements and their compounds, concept of acids and bases, Hard Soft acid base concept, Non aqueous solvents.
- Organo-metallic compounds - synthesis bonding and structure and reactivity, characterisation of inorganic compounds.
- Chemistry of natural Products, Carbohydrates, Proteins and peptides, fatty acids, Nucleic acids, Steroids and alkaloids.



- Qualitative Analysis- Sample preparation, dissolution, digestion, and fusion, nature of trace analysis, spot test and spectroscopic methods, Screening test commonly engaged in chemical analysis of Drug samples.
- Quantitative Analysis-Volumetric and gravimetric analysis.
- Solvent Extraction: pH extraction, masking agents, salting out techniques, relation between distribution ratio and distribution coefficient, advantage and application of solvent extraction, quantitative treatment of neutral chelate in extraction system, single extraction versus multiple extraction, solid phase extraction, accelerated solvent extraction, ultrasonic extraction, heat reflux extraction.
- Chromatography: Introduction, Principle, procedure and applications, applications of paper chromatography, thin layer chromatography, High pressure thin layer chromatography, adsorption chromatography, column chromatography, gas-liquid chromatography, ion- exchange chromatography, reverse phase chromatography, High pressure liquid chromatography, Liquid chromatography- Mass spectrometry, Gas chromatography- Mass spectrometry.
- Spectrophotometry: Basic Principles, Beer Lambert's Law, Principles and Bio chemical applications of UV-VIS spectrophotometry, Atomic Absorption, Spectroscopy, Theory and application of IR, Fourier Transform Infrared Spectroscopy (FTIR), Raman Spectroscopy, Mass Spectroscopy.



2. Assistant Scientific Officer, Chemistry & Toxicology

- Introduction, Definition, Principles, Scope and branches of Forensic Science.
- Development of Forensic Science in India.
- Crime Scene investigation: Definition of Crime Scene. Classification of Crime Scene, Indoor & Outdoor, Primary & Secondary , Macroscopic & Microscopic Crime scenes, Significance and Ethics of Crime Scenes.
- Physical Evidence: Definition, Classification, Source, Significance and value of Physical evidence. Linkage between Crime Scene victim and Criminal. Study of Crime Scene relating to gas explosion, Fire and Arson, homicide, suicide, murder, mass disaster. Tools and techniques in Crime Scene search. Collection, Preservation, Packaging of the material at Crime Scene. Re-Construction of Crime Scene. Chain Custody and safety measures at the Scene of Crime and in Laboratory.
- Basic Principles of Statistics: Probability, Mean, Median, Mode, Chi square, F-Test, measurement of uncertainty, Systematic and random sampling
- Expert testimony in court of Law: Admissibility of evidence, Laws and Acts relevant to Forensic Science.
- Narcotic Drugs and Psychotropic substances, Introduction and Classification of Control Substances, Precursor Chemicals, Narcotic Raids and Drug Laboratories- Evidence and Forensic Examination, Mandatory Provisions of NDPS Act, NDPS Drugs, Classification of Drugs, Drug Dependence and Drug Tolerance.
- Explosive Chemistry- Introduction, Assessment, Classification and Chemistry of Explosives, Various Types of IEDs and their reconstruction, Mechanism of Explosion, Kinetics of Explosive reactions, Processing of Explosion Scene of Crimes – Role of Forensic Science, Role of Forensic Scientists in Post Blast Investigation.
- Forensic Drug Chemistry: Introduction to Drugs, Forensic Examination of the Drugs/ Narcotics. Sample Preparation, Extraction Techniques - Chemical colour Test, Microcrystal Techniques and other instrumental techniques.
- Petroleum Chemistry: Paraffins, iso-olefins, Olefin Hydrocarbons, Napthalenes, Cycloparaffins, Aromatic Hydrocarbons, Sulphur Compounds, Nitrogen Compounds, Oxygen Compounds, Organo-Metallic Hydrocarbons, Physical Properties of Petroleum Products, Analytical Techniques: Quantitative and Qualitative Steps in Analysis of Petroleum.



- Fire Chemistry: Fire and Energy, Basic Chemistry, Chemistry and Behaviour of Fire, State of Matter and Behaviour of Gases, Liquids and Solids, Flammable limits.
- Basic Biochemistry: Amino acids, Lipids, Proteins, Carbohydrates.
- Forensic Toxicology Examination- Law relating to Poison, Introduction to Poisons, Forms of Poisons, Classification and methods of administration of poisons, Mode of action of Poisons, Diagnosis and management of Poison Cases, Factors effecting the affect of Poisons and medico legal aspects in Poison cases, Collection and Preservation of Biological evidences and circumstantial evidences in fatal and survival cases, Submission of samples to the laboratory, Specific analysis plan, isolation and extraction of Poison/ Drug by various methods using instrumental techniques.
- Basic Principles of Pharmacology and Forensic Pharmacology.
- Organo-metallic Chemistry.
- Lasers Photochemistry and Spectroscopy.
- Qualitative and Quantative Analysis: Solvent Extraction- Advantage and Applications- pH extraction, masking agents, salting out techniques, relation between distribution ratio and distribution coefficient, advantage and application of solvent extraction, quantitative treatment of neutral chelate in extraction system, single extraction versus multiple extraction, solid phase extraction, accelerated solvent extraction, ultrasonic extraction, heat reflux extraction.
- Chromatography: Introduction, principle procedure and applications, applications of paper chromatography, thin layer chromatography, high pressure thin layer chromatography, gas, liquid chromatography, Ion exchange chromatography, high pressure liquid chromatography, liquid chromatography-mass spectrometry, gas chromatography-mass spectrometry.
- Chemical Periodicity, Main Group of elements and their compounds, concept of acids and bases, Hard Soft acid base concept, Non aqueous solvents.



3. Assistant Scientific Officer, DNA

- Introduction, Definition, Principles, Scope and branches of Forensic Science.
- Development of Forensic Science in India.
- Crime Scene investigation: Definition of Crime Scene. Classification of Crime Scene, Indoor & Outdoor, Primary & Secondary, Macroscopic & Microscopic Crime scenes, Significance and Ethics of Crime Scenes.
- Physical Evidence: Definition, Classification, Source, Significance and value of Physical evidence. Linkage between Crime Scene victim and Criminal. Study of Crime Scene relating to gas explosion, Fire and Arson, homicide, suicide, murder, mass disaster. Tools and techniques in Crime Scene search. Collection, Preservation, Packaging of the material at Crime Scene. Re-Construction of Crime Scene. Chain Custody and safety measures at the Scene of Crime and in Laboratory.
- Basic Principles of Statistics- Probability, Mean, Median, Mode, Chi square , F-Test, measurement of uncertainty, Systematic and random sampling.
- Expert testimony in court of Law- Admissibility of evidence, Laws and Acts relevant to Forensic Science.
- Microscopy, Principles and different types of microscopes and its forensic applications.
- Cell theory, Cell Structure and functions.
- General Characteristics of Skeletal muscle, nervous system in human body and human hair.
- Properties, classifications and functions of Carbohydrates, Proteins, and Lipids.
- Types and Distribution of Body Fluids – Blood, Blood Stains, Semen, seminal stains, urine, (formation, composition, properties), amniotic fluid, sweat (formation, composition, properties), Saliva, vaginal fluid, epithelial cells, their analysis and Forensic significance.
- Nucleic Acid – Structure and functions, physiochemical properties of nucleic acid, methods of isolation of DNA and RNA from various biological sources.
- DNA Amplification – Principal Methodology and components, Types of Polymerase Chain reaction, PCR inhibitors and remedial procedures.
- DNA Quantification by U.V-Visible Spectroscopy, Fluorimetry and real time PCR.
- DNA Profiling – History of DNA finger-printing, Human Genetics, Organisation of Genome, Mitosis, Meiosis, variations and polymorphism,

Genetic Markers of Forensic importance, mutations, population Genetics, Next generation Sequencing Technologies.

➤ Mitochondrial DNA Analysis, and its interpretation for Forensic Investigation.

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4. Assistant Scientific Officer, Biology/Serology

- Introduction, Definition, Principles, Scope and branches of Forensic Science.
- Development of Forensic Science in India.
- Crime Scene investigation: Definition of Crime Scene. Classification of Crime Scene, Indoor & Outdoor, Primary & Secondary, Macroscopic & Microscopic Crime scenes, Significance and Ethics of Crime Scenes.
- Physical Evidence: Definition, Classification, Source, Significance and value of Physical evidence. Linkage between Crime Scene victim and Criminal. Study of Crime Scene relating to gas explosion, Fire and Arson, homicide, suicide, murder, mass disaster. Tools and techniques in Crime Scene search. Collection, Preservation, Packaging of the material at Crime Scene. Re-Construction of Crime Scene. Chain Custody and safety measures at the Scene of Crime and in Laboratory.
- Basic Principles of Statistics: Probability, Mean, Median, Mode, Chi square, F-Test, measurement of uncertainty, Systematic and random sampling
- Expert testimony in court of Law: Admissibility of evidence, Laws and Acts relevant to Forensic Science.
- Composition and Biochemical Functions of Body Fluids - Bio chemical Nature and Forensic Significance.
- Evaluation of Blood and Blood Stain – Visual Examination, Ultraviolet, Infrared Examination, Microscopy, Spectroscopy, Spectrophotometry, Chromatography, Colour and Crystal Test, Luminol Test, Morphology and Composition of Hair and Fibres. Methods used in their elucidation – Applications to Forensic Science.
- Characterisation, Properties, Structure and Functions of Nucleic Acid.
- Semen – Identification of semen, Seminal stains and Spermatozoa – Visual Observation test, Physical Test, Ultra Violet Test, Microscopic Test, Chemical test and Enzymatic Test.
- Saliva and other Body fluids – Forensic importance of Saliva and other body Fluids such as Urine, Sweat, Vomit Stains, vaginal secretion and their identification by chemical test.
- Forensic Serology – Types and properties of antigens and antibodies. Principles, determination of species origin of blood and blood stains, blood grouping Techniques in fresh and dried blood stains, Blood grouping Types and their importance in Forensic analysis. Estimation of age of Blood Stains.
- Various light sources for the detection and locating body fluids and other biological evidences.



- Immuno precipitation, Immuno Diffusion, Immuno Electrophoresis, ELISA for body fluid identification.
- Forensic DNA Examination – Basic Principles of Genetics, Importance of DNA Forensic Analysis, Forensic DNA Techniques including DNA automated Analysis System, Diatom Examination, importance of Diatom examination in Forensic Samples, methods of examination and significance in drown in cases.
- Forensic Odontology, Forensic Anthropology,
- Introduction to wild life forensics, entomology and palynology.

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5. Assistant Scientific Officer, Physics

General Crime Scene Management:

➤ Introduction, Definition, Principles, Scope and branches of Forensic Science, Development of Forensic Science in India.

➤ Crime Scene investigation: Definition of Crime Scene. Classification of Crime Scene, Indoor & Outdoor, Primary & Secondary, Macroscopic & Microscopic Crime scenes, Significance and Ethics of Crime Scenes.

➤ Physical Evidence: Definition, Classification, Source, Significance and value of Physical evidence. Linkage between Crime Scene victim and Criminal. Study of Crime Scene relating to gas explosion, Fire and Arson, homicide, suicide, murder, mass disaster. Tools and techniques in Crime Scene search. Collection, Preservation, Packaging of the material at Crime Scene. Re-Construction of Crime Scene. Chain Custody and safety measures at the Scene of Crime and in Laboratory.

➤ **Basic Principles of Statistics:**

- Probability, Mean, Median, Mode, Chi square, F-Test, measurement of uncertainty, Systematic and random sampling.

- Variance-Co-efficient of Variation, moment, Co-efficient of regression, Correlated measurements.

- Test of hypothesis-Test of Significance of attributes, sample test, t-test, and comparison of data sets, paired test, Chi-Square test, F-test for equality of variance, large sample test, normal test, Pearson's χ^2 test.

➤ Expert testimony in court of Law: Admissibility of evidence, Laws and Acts relevant to Forensic Science.

➤ Metrics System– Units of measurement- SI unit, measuring devices, accuracy, sensitivity and precision of measuring instruments, errors in measurement, significant figures.

➤ Mechanics– Laws of motion, Linear and rotation Motion, Friction, elasticity.

➤ Magnetism and Electricity-Basic properties.

➤ **Pattern Evidence:**

- Glass-Types of Glass and their composition, Glass Fracture, Cone – Fracture, Rib Marks, Hackle Marks, Backward Fragmentation, Colour and Fluorescence, Physical Matching, density comparison, Physical Measurements, Refractive Index by Refractometer, elemental Analysis.

- Impressions: Foot /Footwear/Type Impression, Collection, Tracing, Lifting, Casting of impressions, Gait Pattern and Identification

characteristics, Superimposition of impression on footwear and foot imprints.

- Tool Marks: Types of tool marks: Compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks, photographic examination of tool marks and cut marks on clothes, comparison of tool marks by comparison microscope.

➤ **Forensic Physics:**

- Soil-formation and types of soil, composition and colour of soil, particle size, distribution and turbidity test, microscopic examination, density gradient analysis, ignition loss, differential thermal analysis, elemental analysis.

- Paint – Types of Paint and their composition, macroscopic and microscopic studies, pigment distribution and colorimetry, micro-chemical analysis – solubility test, TLC, Pyrolysis chromatographic techniques, IR absorption spectroscopy of paint samples & X ray diffraction, elemental analysis.

- Fibre– Classification of textile fibres – production, structure and properties, the structure of textiles – an introduction to the basics, ropes and cordage, visible & infrared microscopical examination of fibres, instrumental methods used in Fibre and dye examination.

- Tyre-marks comparison, skid marks, serial numbers restoration.

- Audio: basics of sound, human ear and voice, sound recording and reproduction, forensic significance of voice.

- Cement: Cements and other constituents of building materials and their properties. Identification of adulterated cement and adulterants, sampling of evidence materials, physical and chemical analysis of cement, cement mortar and cement concrete.

- Methods of analysis of different constituents of building materials, steel bars and metal physics.

- Nano science and nano technology, introduction to nano particles, nano tubes, utilization of nano technology in analysis of physical evidences, selectivity of nano particles with compatibility and feasibility, application of nano technology in forensic evidence analysis.

- Basic principles and techniques of black and white and colour photography: Camera and lenses, exposing, development and printing, different kinds of developers and fixers, modern development in

photography: digital photography, working of SLR and DSLR Cameras and basics of digital imaging photography, photomorphing, crime scene photography, laboratory photography, brief about speaker identification and tape authentication techniques and their applications in forensic science, data mining techniques.

- Video graphy: types of video cameras, recording of play back technique of analogue video, basics of video cordec and file formats.
 - Restoration: restoration of erased numbers, methods of marking-cost, punch and engraved methods used for removal of serial numbers, theory behind number restoration, restoration of marks on cast iron, aluminium, brass, wood leather, etc. Chemical methods of restoration (etching), reagents used for various metals, electrolytic methods of restoration-reagents used, ultrasonic cavitation for restoration, magnetic particle method for restoration, other methods of restoration, laser ethched serial numbers and bar codes and their restoration, recording of restored marks.
 - Holography – Importance of Coherence, Principles of Holography and Characteristics , recording and re-construction, Classification of Hologram and application.
- Non Destructive Testing – inline Holograms, off axix Hologram, Fourier Hologram, Image Hologram.
- Laser – Production, Properties of Laser Beam such as intensity, Monochromatocity, coherence, directionality and Brightness. Basic Laser System. Gas Laser, Solid State Laser, Excimer Laser, Laser Beam Propagation.
- **Analytical Instruments and Techniques**
- Microscope, Compound Microscope, Polarized light, Microscopy, Flourescence Microscopy, Comparison Microscope, Stereo-zoom Microscope, Transmission Electron Microscope, Video Zoom Microscope, Scanning Electron Microscope-Energy Dispersive X-Ray, Atomic Force Microscope.
 - Introduction to spectrophotometry, Interaction of electromagnetic radiation with matter; phenomena of absorpion emission, reflection, flourescene, phosphorescence.
 - Detection of radiations: Photographic detectors, thermal detectors, photoelectric detectors,
 - Basic concepts of atomic spectra, energy levels, quantum numbers, designation of states, selection rules, atomic spectra.

- UV and visible spectrophotometry: sampling devices, Lambert and Beers Law, calibration of instruments, Infrared spectrophotometry, High Resolution. Detectors Atomic Absorption, Spectrophotometry, rotational, Vibrational and electronic spectra, spectra of polyatomic molecules.
- Elements of X-ray Spectrometry: Energy Dispersive X-ray Analysis (EDX), Wavelength Dispersive X-ray analysis(WDX), X-ray Diffraction, Auger emission Spectroscopy and applications.
- Radio chemical technique: Basic principles and theory introduction about nuclear reactions and radiations, Neutron sources, Neutron Activation Analysis, Basics of Electrostatic.
- Infrared Spectrophotometry: Basic principle, components, Sample handling, Dispersive and Fourier transform spectrophotometry, (FTIR), Qualitative analysis and interpretation of IR spectra, correlation of infrared spectra with molecular structure and application in forensic chemistry and toxicology.
- Raman Spectroscopy: Basic principles, Instrumentation, Sample handling and illumination, structural analysis, polarization measurements and Dispersive & FT analysis and Applications in Forensic Chemistry and Toxicology. Advantage of Raman over IR and vice versa, Role of microscope.
- Atomic Absorption Spectroscopy (AAS): Instrumentation, interference in AAS, Background correction methods, graphite furnace quantitative analysis and applications. Detection limit and sensitivity.
- Atomic Emission Spectroscopy (AES): Instrumentation and techniques, arc/spark emission, ICP-AES, comparison of ICP vs AAS methods, quantitative analysis, ESCA and applications.
- Fluorescence and Phosphorescence spectroscopy: Types of sources, structural factors, instrumentation, comparison of luminescence and UV visible absorption methods and applications.
- Nuclear Magnetic Resonance Spectroscopy: Basic principles, theory and instrumentation and applications.

6. Assistant Scientific Officer, Ballistics

General Crime Scene Management:

➤ Introduction, Definition, Principles, Scope and branches of Forensic Science, Development of Forensic Science in India.

➤ Crime Scene investigation: Definition of Crime Scene. Classification of Crime Scene, Indoor & Outdoor, Primary & Secondary, Macroscopic & Microscopic Crime scenes, Significance and Ethics of Crime Scenes.

➤ Physical Evidence: Definition, Classification, Source, Significance and value of Physical evidence. Linkage between Crime Scene victim and Criminal. Study of Crime Scene relating to gas explosion, Fire and Arson, homicide, suicide, murder, mass disaster. Tools and techniques in Crime Scene search. Collection, Preservation, Packaging of the material at Crime Scene. Re-Construction of Crime Scene. Chain Custody and safety measures at the Scene of Crime and in Laboratory.

➤ **Basic Principles of Statistics:**

- Probability, Mean, Median, Mode, Chi square, F-Test, measurement of uncertainty, Systematic and random sampling.

- Variance-Co-efficient of Variation, moment, Co-efficient of regression, Correlated measurements.

- Test of hypothesis-Test of Significance of attributes, sample test, t-test, and comparison of data sets, paired test, Chi-Square test, F-test for equality of variance, large sample test, normal test, Pearson's χ^2 test.

➤ Expert testimony in court of Law: Admissibility of evidence, Laws and Acts relevant to Forensic Science.

➤ Metrics System – Units of measurement- SI unit, measuring devices, accuracy, sensitivity and precision of measuring instruments, errors in measurement, significant figures.

➤ Mechanics – Laws of motion, Linear and rotation Motion, Friction, elasticity.

➤ Magnetism and Electricity-Basic properties.

➤ **Pattern Evidence:**

- Glass-Types of Glass and their composition, Glass Fracture, Cone – Fracture, Rib Marks, Hackle Marks, Backward Fragmentation, Colour and Fluorescence, Physical Matching, density comparison, Physical Measurements, Refractive Index by Refractometer, elemental Analysis.

- Impressions: Foot /Footwear/Type Impression, Collection, Tracing, Lifting, Casting of impressions, Gait Pattern and Identification



characteristics, Superimposition of impression on footwear and foot imprints.

- Tool Marks: Types of tool marks: Compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks, photographic examination of tool marks and cut marks on clothes, comparison of tool marks by comparison microscope.

Forensic ballistics:

- Firearms and Ammunition, their classification, details of various small arms used in crime-shotguns, rifles, revolvers, pistols, carbines, improvised firearms. Bore and calibre, choke, automatic mechanisms employed in small arms, rifling-class characteristics of rifled bore, purpose of rifling types of rifling, methods to produce rifling, various locks used in small arms. Head-space. Various types of primers/priming mixtures, propellants, shotgun ball ammunition, various kinds of bullets, head-stamp markings. Various physical, ballistic & functional tests of ammunitions.
- Physical evidence and other clues, handing of evidence, various precautions.
- Internal Ballistics: Ignition and burning of propellants, degressive and progressive powders, rate of burning propellants, factors affecting internal ballistics of projectiles, internal ballistics of 12-bore guns recoil.
- External Ballistics: Equations of motion of projectiles, principal problem of exterior ballistics, vacuum trajectory- calculation of various elements, effects of air resistance on trajectory, points of difference between trajectories in air and vacuum, nature of air resistance phenomena, base-drag, yaw, cross-wind force, overturning moments, stability-fin stabilization and gyroscopic stability, stability factor, nutation and precessional motions of bullets, drift, magnus effect, green hill formula, shape of projectile-form factor, ballistic coefficient, calculation of trajectories of various small arm bullets, calculation of trajectories of shotgun projectile, use of ballistic tables, projectile velocity determination, determination of velocity of shot-charge, Doppler radar method, Automated system of trajectory computation. Falling bullets-limiting velocity, drop, use of lead as bullet material.
- Terminal Ballistics: inter-reaction and penetration of various small arm projectiles in various issues. Thresh hold velocity for penetration of skin, flesh and bones, Thresh hold energy/causality criteria, energy



density, ricochet, various aspects of wound ballistics including wounds of entrance/exit/track of projectile, gunshot injuries caused by different types of fire arm ammunitions. Temporary and permanent cavities, materials simulating human body, gunshot wound as a function of shape of nose of bullet, striking velocity, nature of target trembling of

- Bullet, effect of instability of bullet, effect of intermediate target. Influence of range, identification of gunshot injuries, motion of projectile in dense medium.
- Class and individual characteristics of fired bullets and cartridge cases and their linkage with the suspected fire arms, comparison microscope, photomicrography, source correspondence, linkage of fired shots with shotguns.
- Determination of range of firing in cases of firing by smooth-bore and rifled firearms factors affecting range of firing, stringing of shots, effect of string on pattern, Cart-wheel pattern, balling, Walkers Test, IR Photography.
- Chemical tests for examination and identification of shotgun holes in various targets. Gunshot residue. Identification of shooter.\
- Scientific methods of shooting reconstruction, suicide, murder, accident, self defense and encounter cases-medico legal report, basic ballistic facts, laboratory examination reports, Documentation and evaluation of bullets holes in various materials, ricochet marks, pellet pattern in various targets.
- Instrumentation techniques - AAS, NAA, SEM/EDXA, ICP-MS, ASV and their application in ballistic examination.
- Arms Act and Arms Rule, 2016



7. Assistant Scientific Officer, Documents

- Introduction to Forensic science: Definition and Scope of Forensic Science, History and development of Forensic science, Need and Principle, Police and, Forensic science laboratories/institutions in India and responsibility of Forensic Scientists. Crime scene management techniques, types of crime scenes, crime scene ethics, role of the first arriving officer, crime scene documentation, searching, collection, packaging and forwarding of physical evidences, Maintaining the chain of custody, and Reconstruction of scene of crime.
- Expert testimony in court of law: admissibility of forensic evidence, laws and Acts relevant to forensic science.
- The metric system: Unit of measurement-SI units. Measuring devices, Accuracy, sensitivity and precision of measuring instruments. Errors in measurement, Significant Figures.
- Mechanics: Laws of motion, Linear and rotational motion, Friction, Elasticity, Magnetism and Electricity and its Basic properties, Holography: importance of coherence, Principle of holography and characteristics, recording and reconstruction, classification of hologram and application, non-destructive testing.
- Laser: Production, properties of laser beams such as intensity, monochromaticity, coherence, directionality and brightness. Basic laser systems Gas Lasers: (i) Molecular gas lasers- CO₂ laser & N₂ (ii) ionic gas laser — Ar⁺ laser (iii) gas dynamic laser (iv) high pressure pulsed gas laser Solid State Laser: (i) Nd: YAG laser, (ii) Nd: Glass laser, comparison of performances (iii) Tunable, solid state laser: Ti: sapphire laser; Alexandrite laser Chemical Laser: HF laser, HCl laser, COIL. Excimer laser; Color centre laser; free electron laser; semiconductor diode laser, Laser Beam Propagation: Laser beam propagation, properties of Gaussian beam, resonator, stability, various types of resonators, resonator for high gain and high energy lasers, Gaussian beam focusing.
- Basic concept of Spectroscopy: Atomic, molecular spectroscopy, imaging spectroscopy. Interaction of radiation with matter and its consequences. Reflection, absorption, transmission, scattering, emission, fluorescence, phosphorescence.
- Fluorescence and phosphorescence spectrophotometry: Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods. Infrared spectrophotometry: Dispersive and Fourier transform spectrophotometry (FTIR). Sample handling and preparation, quantitative analysis and interpretation of IR spectra, forensic applications.
- Advanced microscopy: The compound microscope, comparison microscope, stereomicroscope, polarizing microscope, microspectrophotometer, scanning electron microscope. Detectors: photographic detectors, thermal detectors, photoelectric detectors, PMT and semiconductor

detectors.

➤ 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.

➤ Statistics: Statistical evaluation of data obtained by instrumental methods. 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.

➤ Forensic Document Examination: Legal aspects of forensic document examination, 293Crpc, Section 45 evidence act, definition of expert. Indian Penal Code Under sections viz, 29, 463, 405, and 420. Classification of documents, Care, handling, preservation of documents; Preliminary examination of case documents, Principle of handwriting examination; Importance of natural variations, Holographic documents, Comparison of handwriting, principle of fundamental divergence, natural variations in handwriting, nature and types of forgeries, characteristics of genuine and forged signatures, their detection, artificial and natural tremor. basic tools needed for forensic documents examination and their significance.

➤ Alterations in documents: addition, deletion, obliterations, substitutions, overwriting, built up documents, determination of sequence of intersecting strokes, Ink examination, chemical composition of different types of inks, destructive and non-destructive techniques involved in differentiation of ink. Writing instruments, working of fountain pen, ball pen, gel pen, writing inks, Printing inks and printing toners. Viscosity, Surface tension, Capillary rise.

➤ Paper examination: Physical comparison, chemical composition, sizing & loading materials, tensile strength, comparison techniques: destructive & non-destructive, Examination of printed labels, wrappers, rubber seal impressions, Facsimile document, Photocopy and scanned documents: process of scanning. Indented writings, Charred documents: preservation and examination techniques involved.

➤ Printed document examination: Printing technology, examination of type-script, classification of printers: identification of printed matter, different printing technologies, Examination of computer printouts, Concept of e-documents and digital signature.

➤ Examination of security documents: Currency notes, Passport, Visa, Various identity cards, Stamp papers, travel documents. OVI ink, thermal ink, Examination of credit, debit and other plastic cards.

8. Assistant Scientific Officer, Cyber Forensics

(I) Aptitude in Forensic Science

- a) General knowledge, general English, aptitude and reasoning.
- b) Fundamentals of basic sciences as applied to forensic investigation:
 - i. Principles of the forensic science, disciplines of forensic science and their functions. Developments in forensic science in India and abroad. Scope of analysis in forensic science laboratories/institutions. Legendaries and their contributions in the field of forensic science.
 - ii. Types of evidence materials in different-type of crimes, source and significance of evidence material, tools and techniques in crime scene search, sketching, measurement, photography and videography. Identification, collection, preservation, packaging and forwarding of evidence materials. Reconstruction of scenes of crime, lifting, developing and preserving fingerprints, footprints and tyre impressions and pattern evidence, Sampling, Chain of custody, Safety measures at the scene of crime and in laboratory.
- c) Basic Principles of Statistics — Probability, Mean, Median, Mode, F- Test, Chi-square Test, Measurement of uncertainty, Systematic and Random Sampling.
- d) Expert testimony in the Court of law. Admissibility of evidence, Laws, Acts, CrPC and IPC relevant to forensic sciences. Ethics in Forensic Science.

(II) Computer Forensics

- a) Introduction to Computer Hardware- Various Components of a Computer, Motherboard, Processor, Memory, Storage Devices and Networking Components. Understanding Computer Operating Systems (OS), Booting process of computers, Introduction to File Systems and types of File System.
- b) Cyber Crime- Form of Cyber Crime, Internal and External Attacks, Crimes related to social media, ATM and Banking Frauds. Data Privacy issues, Packet sniffing, Spoofing, Web security.
 - i. First responder— role and toolkit. Procedure for search and seizure of digital evidences, Search and Seizure of Volatile and Non-volatile Digital Evidence. Imaging and Hashing Digital Evidence. Analyzing and Recovery of Deleted, Hidden and Altered files.
 - ii. Windows Systems Artifacts: File Systems, Registry, Event logs, Shortcut files, Executables. Alternate Data Streams (ADS), Hidden Files, Slack Space. Linux System and Artifacts: Linux file system: Ownership and Permissions, Hidden Files, User Accounts and Logs, Mac OS X systems and Artifacts: System Startup and Services, Network Configuration, Hidden Directories, System Logs and User Artifacts.
 - iii. Web Browsers: Cookies, Favorites or Bookmarks, Cache, Session Data and Plugins. Email: Types of Email and Protocols, Analysing the Header details and tracking the email, Spoofed Mails. Virtual Machines and Cloud Technology

Forensics .

(III) Network Forensics.

- a) Computer Networking- Digital and Analog Signaling Methods, Network Types and Topologies, Overview of OSI Model and TCP/IP Protocol, Different types of IP Addresses and Classes, Subnet Masks, Subnetting and Supernetting. Network Hardware Devices and Client/Server Computing. Types of Networks — LAN, MAN and WAN. Routers and Routing Protocols.
- b) Network threats and vulnerabilities, Types of network attacks- eavesdropping, spoofing, modification, Cross-site scripting, DNS Spoofing, Routing Table Poisoning, ARP Poisoning, Web Jacking, Attacks on Wireless Networks, Social Engineering Attacks and its types, Packet Sniffing, Types of authentication, Attacks on 'WEP, WPA and WPA-2 Encryption, fake hotspots.
- c) IP security architecture, Security protocols, IPsec, Web Security- Firewalls, IDS, IDPS. Network Security Applications, Authentication Mechanisms: Passwords, Cryptographic authentication protocol, Kerberos, X.509 LDAP Directory. Digital Signatures. Web Security: Secure Socket Layer (SSL) Encryption, Transport Layer Security (TLS), Secure Electronic Transaction (SET) and Virtual Private Networks (VPN).
- d) Monitoring of computer network and activities, Live Packet Capturing and Analysis. Searching and collection of evidences from the network, Network intrusion Detection and Analysis. SQL Injection, Event Log analysis- tools and techniques, Investigating network attacks, Evidence collection from Routers other networking devices.
- e) Cloud Technology and its various components - private, public and hybrid cloud, Cloud types; IaaS, PaaS, SaaS. Role of virtualization in enabling the cloud. Technologies and the processes required when deploying web services. Cloud Security Architecture, Secure Cloud based service, Identity and Access Management, Encryption and Key Management, Cloud Forensic —collection and analysis of evidence.

(IV) Mobile And Wireless Device Forensics

- a) Introduction-to Mobile Technologies: Asynchronous Transfer Mode (ATM), Wireless Application Protocol (WAP). Cellular technologies - Advanced Mobile Phone System (AMPS), i-Mode, Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA) and Global System for Mobile Communications (GSM) and relative strengths, Subscriber Identity Module (SIM), International Mobile Equipment identity (IMEI).
- b) Functions of Bluetooth and security issues. Various Generation of Mobile Phone Technologies. Understanding of the mobile phone operating systems — Android, iOS, Windows. Understanding of SQLite Databases.
- c) Phone Phreaking, Call tampering, Wireless Hack Walkthrough and Man-in-the-Middle-attacks. Overview of WEP attack. Attacks on WEP, WPA and



WPA-2 Encryption, fake hotspots. Wireless Public Key Infrastructure. Securing WLAN, WEP Decryption script.

d) Overview of Mobile Forensics, Seizure and Preservation of mobile phones and PDA, Types of Evidence present in mobile phones - Files present in SIM card, external memory dump, and evidences in memory card. Mobile phone evidence extraction process, Data Acquisition Methods— Physical, File System, Logical and Manual Acquisition, Mobile Forensic Investigation Toolkit. Tracking of mobile phone location.

(V) Social Media Forensics and Cryptography

a) Introduction to Social Media, Security Issues in Social Media, Types of crimes of Social Media ~ Cyber bullying, Online Grooming, Cyber stalking. Social Media and its impact on Business, Politics, Law and Revolutions, Emerging Trends in social media.

b) Sources for social media evidence, Types of Data Available on Social Networking Sites, Different evidence collection methods from social networking sites, Intelligence gathering from Social Media- Tools and technique for intelligence gathering— indirect method, direct method with login, direct method without login.

c) Introduction to Cryptography, Symmetric and Asymmetric Cryptosystem Encryption Techniques— Substitutional Cipher and Trans positional Ciphers. Types of keys — Public Key and Private Key. Advanced Encryption Techniques and Security issues. Various types of attacks including Cipher Text-Only attack, Known-Plaintext Attack, Chosen-Plaintext Attack, Chosen-Cipher text Attack.

d) Symmetric Cryptosystem- AES, DES, RC4, Blowfish. Asymmetric Cryptosystems —RSA, DSA, Elliptic Curve cryptography, Introduction to Cryptanalysis — Differential and Linear Cryptanalysis. Hashing Algorithms — MD5, SHA-1, SHA-2, SHA-3, One- Way Hash, Hash Message Authentication Code.

