

No. A.12038/16/2025-HM(FSL)
GOVERNMENT OF MIZORAM
HOME DEPARTMENT

NOTIFICATION

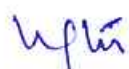
Dated Aizawl, the 17th July, 2025

In pursuance of the approval of DP&AR (GSW) *vide* No. A. 12032/1/2025-MPSC (PRE) dt.17.06.2025, the State Government hereby prescribes the syllabus for direct recruitment to the post of Junior Scientific Officer (Group 'B' Non-Gazetted) under Home (Forensic Science Laboratory) Department, in consultation with the Mizoram Public Service Commission *vide* No. A. 12032/1/2025-MPSC (PRE) dt. 17.06.2025 as outlined in the following pages.

Sd/- VANLALMAWIA
Secretary to the Govt. of Mizoram
Home Department

Memo No. A.12038/16/2025-HM (FSL) : Dated Aizawl, the 17th July, 2025
Copy to:-

1. Secretary to the Governor, Mizoram.
2. Commissioner & Secretary to the Chief Minister, Mizoram.
3. PS to Home Minister, Mizoram.
4. PS to Speaker/Deputy Speaker/Ministers/Ministers of State, Mizoram.
5. Sr. PPS to Chief Secretary, Government of Mizoram.
6. All Administrative Departments, Government of Mizoram.
7. All Heads of Department, Government of Mizoram.
8. Controller, Printing & Stationery with 5 (five) spare copies for publication in the Mizoram Gazette.
9. Director, Forensic Science Laboratory, Aizawl, Mizoram.


(LALNUNMAWIA CHHANGTE)
Under Secretary to the Govt. of Mizoram
Home Department

**APPROVED SYLLABUS FOR RECRUITMENT TO THE POST OF JUNIOR
SCIENTIFIC OFFICER (GROUP-'B' NON-GAZETTED) COVERING DIFFERENT
DIVISIONS UNDER FORENSIC SCIENCE LABORATORY**

- | | | |
|---|---|---------------------|
| 1. PAPER – I : General English | : | 100 Marks (3 hours) |
| (Conventional Type & MCQ with negative marking) | | |
| (Common paper for all divisions) | | |
| 2. PAPER – II : General Knowledge | : | 100 Marks (2 hours) |
| (MCQ with negative marking) | | |
| (Common paper for all divisions) | | |
| 3. PAPER – III : Technical Subject (MCQ) | : | 200 Marks (2 hours) |
| (MCQ with negative marking) | | |
| (Common paper for all divisions) | | |
| 4. PAPER – IV : Technical Subject (MCQ) | : | 200 Marks (2 hours) |
| (MCQ with negative marking) | | |
| (Separate papers for 8 different divisions) | | |
| Total of Written Examination | : | 600 Marks |
| 5. Personal Interview | : | 75 Marks |
| Total | : | 675 Marks |

DETAILED SYLLABUS:

1) General English: 100 Marks (3 hours)

- a) Precis Writing : 10 Marks
- b) Letter Writing : 10 Marks
- c) Comprehension of given passages : 10 Marks
- d) Essay : 10 Marks
- e) Grammar : Parts of Speech
(MCQ with negative marking) : 20 Marks
- f) Correct usage and Vocabularies
(MCQ with negative marking) : 20 Marks
- g) Formation of Sentence (MCQ with negative marking) : 20 Marks

2) General Knowledge (MCQ): 100 Marks (2 hours)

- a) Current events of state, national and international importance : 12 Marks
- b) History of India and Indian National Movement : 12 Marks
- c) Indian and World Geography – Physical, Social, Economic : 12 Marks
- d) Indian Polity and Governance – Constitution, Political
System, Public Policy, Duties & Rights Issues : 12 Marks
- e) Economic and Social Development, Sustainable
Development, Poverty, Inclusive Economy, Demographics,
Social Sector initiatives, and other related issues : 12 Marks
- f) General issues on Environmental Ecology,
Bio-diversity and Climate : 12 Marks
- g) General Science : 12 Marks
- The topics listed above shall cover the State of Mizoram wherever applicable.*
- h) General awareness on Mizo culture,
its heritage and society : 16 Marks

PAPER – III

3) Technical Subject Paper-I (MCQ with negative marking) : 200 Marks (2 hours)

A. GENERAL SCIENCE – 100 MARKS

UNIT I : PHYSICAL SCIENCE

(35 MARKS)

I. Mechanics, Waves And Optics

(15 Marks)

Laws of motion, conservation of energy, linear momentum and angular momentum, gravitational field and potential due to spherical bodies, Kepler's laws; work done by constant force and variable force, work-energy theorem, power elastic and inelastic collisions, rigid body, degrees of freedom, angular velocity, angular momentum, moments of inertia. Simple harmonic motion, damped oscillation, forced oscillation and resonance, wave motion, longitudinal and transverse waves, speed of travelling wave, principle of superposition of waves.

Laws of reflection and refraction; system of two thin lenses; total internal reflection and its applications, magnification, power of a lens, interference of light-Young's experiment; interference by thin films, Fraunhofer diffraction-single slit, diffraction grating, resolving power, Fresnel diffraction, half period zones and zone plates.

II. Thermodynamics And Electrodynamics

(10 Marks)

Laws of thermodynamics, reversible and irreversible processes, entropy; isothermal, adiabatic, isobaric processes and entropy changes; van der Waals equation of state of real gas, critical constants, Maxwell-Boltzmann distribution of molecular velocities.

Coulomb's law, electric field, Gauss' law; electric potential; capacitors, dielectrics and polarization, Ohm's law, Kirchhoff's first and second rules, resistors in series and parallel, potential and field due to a dipole, force and torque on a dipole in an external field, Biot-Savart law, Ampere's law, Faraday's law; Lenz law; self and mutual inductances, DC and AC circuits with R, L and C components.

III. Atomic and Nuclear Physics, Electronics

(10 Marks)

Photoelectric effect, Einstein's photon theory, Bohr's theory of hydrogen atom and quantization, wave nature of matter, de Broglie wavelength, wave particle duality, Heisenberg's uncertainty relationships, Schrodinger equation- eigen values and eigen functions of particle in a box; radioactivity, binding energy of nuclei, nuclear fission and fusion.

Intrinsic semiconductors, electron and holes, doping, impurity states, n and p type semiconductors, conductivity, mobility and Hall effect, p-n junction diode, majority and minority carriers; diode rectification, logic gates.

UNIT - II : CHEMICAL SCIENCE (35 MARKS)

I. Atomic Structure.Periodic Properties And Chemical Bonding (10Marks)

Quantum numbers, shapes of orbitals, Aufbau principle, Pauli's principle, Hund's rule. Properties of elements - atomic radii, ionic radii, ionization energy, electron affinity, electron negativity, oxidation state, covalent character in ionic compounds; Ionic character in covalent compounds. Hybridization; VSEPR theory, valence bond theory, molecular orbital theory, crystal field theory; hydrogen bonding.

II. OrganicCompoundsAndReactionMechanisms (10Marks)

Preparation, properties and interconversions of alkyl and aryl halides, alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, amines, amides and nitriles.

Cleavage of covalent bond, types of reagents, electron displacement mechanisms- Inductive, electromeric, resonance, hyperconjugation, reaction intermediates, SN1 SN2, E1 and E2 mechanisms.

III. Equilibrium, Chemical Kinetics, Electrochemistry and Experimental Analysis (15 Marks)

Characteristics of equilibrium constant and applications, K_p , K_c , Q_p and Q_c , Ionization of acids and bases, K_a , K_b , K_w and K_{sp} , solubility. Concepts of rate, differential and integrated rate expression for zero and first order reactions, order and molecularity of reaction; half life. Variation of conductance for weak and strong electrolytes, Kohlrausch's law, Arrhenius theory of electrolytic dissociation, Ostwald's dilution law, Electrochemical cell, EMF and Nernst equation; Faradays laws of electrolysis. Volumetric titrimetry; primary and secondary standard; expressing concentration of solution, acid base and redox indicators; concept of group separation in qualitative analysis; theories of distillation, fractional distillation, steam distillation, sublimation, zone refining; solvent extraction: principle and efficiency of the technique, chromatography: classification, principles and efficiency of different techniques.

UNIT - III : BIOLOGICAL SCIENCE (30 MARKS)

I. Cell Structure and Function (10Marks)

Structure of prokaryotic and eukaryotic cell; transcription in prokaryotes and eukaryotes; endomembrane system-endoplasmic reticulum, golgi bodies, lysosomes, vacuoles; mitochondria; ribosomes; cytoskeleton, cilia, flagella, centrioles.

Structure and function of proteins, carbohydrates, nucleic acids; classification and nomenclature of enzymes, properties and action; membrane transport; simple, facilitated and active transport.

II. Plant And Human Physiology

(10Marks)

Carbon dioxide fixation in C₃, C₄ and CAM plants, photorespiration and its significance, Growth regulators- auxin, gibberellin, cytokinin, ethylene, abscisic acid, oxidative phosphorylation, glycolysis, TCA cycle, electron transport chain, ATP synthesis.

Neuron and nerves, action potential, synaptic transmission, structure of haemoglobin; composition of blood, blood groups, blood clotting; cardiac cycle, cardiac output, ECG, skeletal muscles, contractile proteins and muscle contraction.

III. Heredity, Reproduction And Ecology

(10Marks)

Mendel's law of inheritance and non-Mendelian inheritance; interaction of genes, linkage and crossing over, incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups; concept of sex determination and sex chromosomes, chromosomal mutations.

Development of male and female gametophyte, double fertilization, development of endosperm and embryo, male and female reproductive systems, anatomy of testis and ovary, gametogenesis-spermatogenesis and oogenesis.

Energyflow,pyramids of number, biomass, energy.

OR

UNIT – III : MATHEMATICS (30 MARKS)

I. Sets, Relations and functions:

(10 Marks)

Sets and their representation; Union, intersection and complement of sets and their algebraic properties; Power set, Relations, type of relations, equivalence relations, functions; one-one, into and onto functions, the composition of functions.

II. Permutations And Combinations:

(10 Marks)

The fundamental principle of counting, permutations and combinations; Meaning of P (n, r) and C(n, r). Simple applications.

III. Statistics And Probability:

(10 Marks)

Measures of dispersion; calculation of mean, median, mode of grouped and ungrouped data, calculation of standard deviation, variance and mean deviation for grouped and ungrouped data. Probability: Probability of an event, addition and multiplication theorems of probability.

B. GENERAL FORENSIC – 100 MARKS

I. Forensic Chemistry (10 Marks)

Narcotic drugs, psychotropic substances and control substances. Corrosive chemicals – hydrochloric acid, sulphuric acid, nitric acid and Alkalis. Chemical separation techniques – Solvent extraction. Solid phase extraction and solid phase microextraction. Legal definition of Arson and motives. Definition of explosives, deflagration and detonation. Characteristics of high and low explosives. Definition and components of improvised explosive device IED.

II. Forensic Fingerprint (10 Marks)

Definition & history of Fingerprint identification, Basis for the science of Fingerprints, Fingerprint as Forensic evidence. Types of fingerprint - visible fingerprints & latent fingerprints and plastic prints. Class and individual characteristics. Automatic Fingerprint Identification system (AFIS), Methods of developing latent fingerprints. Poroscopy and edgeoscopy.

III. Forensic Ballistics (10 Marks)

Definition and scope. Types of evidences associated. Ammunition components. Types of Firearms – Shotgun, revolver, pistol, rifle and country made firearms. Gunshot Residue (GSR) – meaning and importance. Internal and external ballistics. Types of tool marks – class and individual characteristics. Forensic significance of glass and paint. Comparison microscope and its application in Forensic.

IV. Questioned Documents (10 Marks)

Definition and importance of Questioned documents. Forgery and its types & characteristics. Invisible and indented writing. Importance of handwriting examination in forensics. Identifying features of fake and genuine Indian currency notes. Different Types of alterations – erasures, additions, overwritings and obliterations. Difference between photomicrography & microphotography.

V. Forensic DNA/Biology (10 Marks)

Cell- structure and cell organelles. Structure of DNA and RNA. Hereditary, Alleles & mutations. Mendel's law of inheritance. Concept of genetics polymorphism. Antigen and Antibody. Human skeletal system. Forensic significance of Blood, Semen, & Hair. Blood composition and blood groups (ABO, Rh, MN system), Secretor and non-secretor. Morphology of spermatozoa.

VI. Forensic Toxicology (10 Marks)

Forensic Toxicology – introduction, concept and significance. Definition and classification of Poisons. Definition and classification of liquors based on Origin (Indian made Foreign liquor, country made liquor and illicit liquors). Fermented and distilled methods. Characteristics of Beer, Wine and whiskey. Analysis of beverages – alcoholic and non alcoholic. Viscera and its preservation.

VII. Forensic Photography

(10 Marks)

Fundamentals of Photography. Role of Photography in forensic science & photographs as evidence. Use of natural light and portrait photography. Micro and Macro photography. Crime scene and laboratory photography. Advanced Digital Photography Techniques, Infra-red and UV photography and its application in Forensics. Specialized techniques used for Documents, Fingerprints.

VIII. Cyber Forensic

(10 Marks)

Basics of computer, hardware & accessories, operating system & software. Computer forensic – definition, types of computer crimes. Cyber crime & digital evidence. Cyber crime – definition, crimes on internet, hacking, virus, worms, cookies, pornography. Software piracy, intellectual property and computer security. Encryption & decryption.

IX. Crime Scene Investigation

(10 Marks)

Criminalistics – definition, meaning of recognition, collection, identification, individualization and interpretation of physical evidence. Crime Scene - definition, securing the scene, documentation of crime scene (Sketch & photography). Types of Crime Scene – Indoor, Outdoor & Mobile. Secondary Crime Scene. Nature & importance of Crime Scene reconstruction.

X. Forensic Criminology & Laws

(10 Marks)

Important sections of laws pertaining to Forensic Science and Evidence, Technology IT Act, Narcotic Drugs & Psychotropic Substances Act, Arms Act. Difference between a civil case & criminal case. Expert testimony. Importance of chain of custody. Hierarchy of Courts and their powers. Lok Adalat, Lok Ayukta and Juvenile Courts.

PAPER – IV

4) Technical Subject Paper-II (MCQ with negative marking) : 200 Marks (2 hours)

A. FORENSIC TOXICOLOGY– 200 MARKS

Syllabus for Junior Scientific Officer - Toxicology

- I. Forensic Toxicology: Introduction, concept and significance. (40 Marks)
Poisons: Definition, Classification of Poisons, Types of poisoning, sign and symptoms of poisoning, mode of action, factors modifying the action of poisons, Toxicological exhibits in fatal and survival cases, their preservation. Treatment in cases of poisoning, Analysis report. Law relating to Poisons.
- II. Extraction, Isolation and Identification of Poisons: (40 Marks)
Solvent Extraction-Stas Otto method, Ammonium sulphate method, Solid Phase Extraction, Clean-up Procedures, Metallic poisons: Identification and toxicology.
- III. Alcohols: (40 Marks)
The fate of alcohol in the body, alcohol in the circulatory system, breath test instruments, field sobriety testing, Examination of alcoholic beverages; country made liquor, illicit liquor. Analysis of blood and urine for alcohol.
- IV. Pharmacokinetics and Metabolism: (40 Marks)
Types of Metabolic reactions, Drug Metabolism: phase I and II (Analysis, Tranquilizers, Barbiturates and Benzodiazepines), Factors influencing Metabolism. Pesticide intricacies: Organophosphate insecticides, Carbamates, Forensic relevance, Drug Analysis: Screening and detection, Extraction pathways.
- V. General Study and Analysis: (40 Marks)
Barbiturates, Methaqualone, Hydromorphone, Methadone, Mescaline, Amphetamines, LSD, Heroin, Cannabinoids, Phenothiazines. Insecticides: Types, General methods for analysis. Alkaloids: Definition, classification, Isolation and General characterization. Forensic Examination of Metallic Poisons: Arsenic, Mercury, Lead, Methanol, Acetone, Chloroform, Phenol, Snake venoms, Irrespirable gases.

B. FORENSIC DNA - 200 MARKS

Syllabus for Junior Scientific Officer – DNA

I. Forensic Biology: (20 Marks)

Examinations of Hair and Fibre, Diatoms - Importance and Examination. Development of teeth- Dentition, growth of teeth-Milk, Permanent, Forensic Odontology- Basic principles, Applications in criminal investigations- Bite mark analysis, Forensic Odontology limitations.

II. Human Anatomy: (20 Marks)

Axial Skeleton-Skull, Sutures of skull, Cranial Bones, Facial Bones, Skeleton Bones of Upper Limbs, Lower Limbs, Pelvic Girdle etc. Determination of sex- from skull, mandible, pelvis, femur, scapula. Determination of Age- Suture closures, and growth of teeth and appearance of ossification centres, Determination of Stature, Difference between human and animal bones commonly confused with human bones, Facial Reconstruction & Superimposition.

III. Forensic Medicine: (20 Marks)

Pathology, Medical Jurisprudence, Medical evidences- documentations, investigation of scene of death, Role of Anthropologist at the Scene of Crime. Abortion- Infanticide, foeticides, Mechanical Asphyxia- accidental-drowning deaths- Poisoning deaths- Lighting.

IV. Medico-Legal Autopsy: (20 Marks)

Death and its causes- External examination of deceased body, Exhumation process and its importance, Determination of time since death and cause of death- injuries- classification, Post mortem changes- collection of post-mortem samples and preservation, Introduction and Importance of Forensic Entomology- types & developmental stages.

V. Forensic Serology: (50 Marks)

Blood Grouping- History, Biochemistry, Biosynthesis of ABO antigen, Genetics of ABO, RH, MN and other blood group system, Secretors and Non-Secretors, Blood, Semen & Saliva identification - presumptive and confirmatory assays, Methods of ABO Blood grouping from dried blood stains and other body fluids (absorption elution method, absorption inhibition method and mixed agglutination method), Species identification from blood- Double immunodiffusion Assays, Crossed- Over Electrophoresis. Factors influencing immunogenicity. General introduction to vaccines, Types of vaccines, Antigen- antibody reactions and their techniques in serological analysis, Production of Monoclonal and polyclonal antibodies, Autoimmunity and hypersensitivity, Mechanism of enzyme action, Enzymes of forensic significance.

VI. Wildlife Forensic: (10 Marks)

Smuggling, poaching, hunting, Crime scene search, Wildlife Protected and endangered species of animals and plants, Wildlife species commonly traded illegally.

VII. Forensic DNA:

Introduction of human genome:

(10 Marks)

Human chromosomes and karyotype, human nuclear genome, mutation-types and cause, genes and alleles, human genetics and heredity, Mendel's Laws of inheritances, Basic structure, types and properties of DNA and RNA, mt DNA.

Forensic DNA Profiling:

(10 Marks)

History and development of DNA Fingerprinting, Concept of length and sequence variation-VNTRs, STRs, mini STR, SNPs.

Methods of DNA Profiling:

(10 Marks)

Principle, techniques of RFLP, STR Profiling their advantage and limitations. Gender identification: Y-STR and mt-DNA Profiling.

DNA, RNA & Protein Metabolism:

(10 Marks)

Enzymes and accessory proteins involved in DNA replication, Gene transcription, Translation in prokaryotes and eukaryotes, Fundamentals of RFLP and PCR based DNA Typing, Result of STR marker analysis and its interpretation, Single Nucleotide Polymorphism (SNP) and its applications in forensic investigation, Y-STR analysis and its significance in establishing paternal relationships.

DNA sample preparation:

(10 Marks)

Sample sources for DNA, collection and preservation of samples for DNA testing, conventional and recent methods of DNA extraction (for samples blood), tissue, hair, tooth and bones), separation methods, DNA quality check, DNA Quantitation methods, DNA Sequencing, DNA data base-CODIS, STRbase, NGS(New Generation Sequencing Rapid DMNA)

Forensic Issues:

(10 Marks)

Degraded DNA, Contamination, mixes samples and low copy number, Legal standards for admissibility of DNA Profiling.

C. FORENSIC CHEMISTRY– 200 MARKS

Syllabus for Junior Scientific Officer - Chemistry

UNIT – I : CHEMISTRY (100 MARKS)

I. Atomic Structure and Periodic Property: (15 Marks)

Bohr's theory and its limitations; de-Broglie's concept of dual character of matter; Heisenberg's Uncertainty Principle; Schrodinger wave equation (derivation not required); quantum numbers and their significance; radial and angular wave functions (derivations not required) and probability distribution curves; atomic-orbitals; shapes of s, p and d-orbitals. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations. Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. General features of long form of periodic table. Effective Nuclear Charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in the periodic table. Detailed discussions of the following properties of the elements, with reference to s & p- block: (a) Atomic radii and Ionic radii (b) Ionization Energy (c) Electron Affinity (d) Electronegativity.

II. Chemical Bonding: (15 Marks)

Ionic bond, covalent bond and coordinate bond. Bond moment and dipole moment, ionic character from dipole moment and electronegativities. Concept of hybridization, types, orientation of hybrid orbitals; Resonance and resonance energy, Valence shell electron pair repulsion (VSEPR) theory, shapes of simple molecules and ions containing lone pairs and bond pairs of electrons.

III. Evaluation of experimental Data: (15 Marks)

Significant figures, rounding off of numerical expressions, types of errors: correction/minimization of errors, propagation of determinate errors, accuracy and precision, methods of their expression, difference between accuracy and precision, rejection of data, Statistical treatment of analytical data, uncertainties involve in addition, subtraction, multiplication and division, confidence limits and intervals, test of significance (the F-test and t-test).

IV. Chemical Kinetics & Catalysis: (15 Marks)

Concepts of Rate, Order and Molecularity of reaction, Concentration dependence of rates, mathematical characteristics of simple chemical reactions- zero, first order, second order, pseudo order, half-life and mean life. Methods for determination of rate law; Effect of Temperature on Reaction Rate; Temperature Coefficient of a reaction, Arrhenius Equation; Concept of Activation energy, Collision Theory & Absolute Reaction Rate Theory. Types and characteristics of Catalysis, Enzyme catalysis; Michaelis-Menten equation; Turn over number (definition only).

V. Nuclear Chemistry: (15 Marks)

Radioactivity; group displacement law; radioactive disintegration; disintegration constant; half-life and average-life period; radioactive equilibrium; artificial radioactivity; artificial transmutation of

elements; neutron-proton ratio and its implications; packing fraction; mass defect; nuclear binding energy; magic number: fission, fusion, controlled fission reactions and atomic energy.

VI. Green Chemistry:

(15 Marks)

Green Chemistry Definition; Need for Green chemistry, evolution of Green Chemistry, principles of Green Chemistry. Classification of organic reactions under Green chemistry principles: a) Atom economic and non-toxic byproduct reactions: rearrangements, addition reaction, condensations, cascade strategies under catalysis, b) atom uneconomic reactions: substitutions, eliminations, Wittig reactions, degradation reactions. Microwave assisted organic reactions in water: Introduction; synthesis of heterocycles; Amino carbonylation; synthesis of ketones from amines; Williamsons ether synthesis; Nucleophilic aromatic substitution, biochemical (microbial) Oxidations; biochemical (microbial) Reductions.

VII. Safety and hygiene in the Laboratory:

(10 Marks)

Storage and handling of chemicals, incompatible chemicals, personal protective equipments, handling of acids, ethers, toxic and poisonous chemicals, odour threshold and first aid procedure. Heating methods, stirring methods and filtration techniques.

UNIT – II : FORENSIC CHEMISTRY (100 MARKS)

I. Introduction to Forensic Science and Forensic Chemistry:

(30 Marks)

physical evidence; Locard's principle of Exchange, definition of drugs, designer drugs, types of physical evidences, characteristics of drugs (depressant, stimulant, hallucinogens), Narcotic Drugs and Psychotropic substances. Drug precursors. Synthetic antipyretic analgesics and their uses. Antacids and their brief actions; Antihistamines and their side effects. Antibiotics: Classification and their uses. Antibiotic resistance. Drugs addiction and Abuse: Causes, Prevention and Treatment. Arson & Chemistry of Fire.

II. Identification, presumptive test (Colour/spot test) and confirmatory tests, elemental analysis (organic and inorganic), collection and sampling of forensic evidences, chemistry of fire, scientific investigation of clue materials, trap related evidence materials, qualitative and quantitative forensic analysis of organic and inorganic industrial products, chemical fertilizers.

(20 Marks)

III. Advanced Instrumental Techniques:

(30 Marks)

Molecular Spectroscopy (UV-Visible Spectroscopy, Infrared Spectrophotometry, Raman Spectroscopy); Atomic Spectroscopy (Atomic Absorption Spectroscopy, Atomic Emission Spectroscopy, Fluorescence and Phosphorescence Spectroscopy, Nuclear Magnetic Resonance Spectroscopy); Chromatographic Techniques (Thin Layer Chromatography, Adsorption Chromatography, Partition Chromatography, Ion exchange Chromatography, Gas Chromatography, High Performance Liquid Chromatography); Spectrometric Techniques (X-ray Spectrometry, Mass Spectrometry); Microscopic Techniques (Microscope, Compound Microscope, Fluorescence Microscopy, Stereo Microscope, Electron Microscope); Separation and Detection Techniques.

IV. Laws relating to Forensic Chemistry:

(20 Marks)

Assam Drugs Control Act 1950; Drugs & Cosmetics Act 1940; ND&PS Act 1985; The Narcotic Drugs and Psychotropic Substances (Regulation of Controlled Substances) order 2013; Bharatiya Nyaya Sanhita (BNS), BharatiyaNagarik Suraksha Sanhita (BNSS), and BharatiyaSakshyaAdhiniyam (BSA).

D. FINGER PRINT - 200 MARKS

Syllabus for Junior Scientific Officer - Fingerprint

I. History of Fingerprint science and its development (20 Marks)

Anthropometry, the origin of fingerprint science and the stages of its evolution, the pioneering contributions to fingerprint science and its' development through times, Galton, Herschel, Faulds Henry, Aziz-ul-Haque and others

II. Science of Fingerprint identification (20 Marks)

When fingerprint was first conceived as a tool of identification, tracing the origin & circumstances leading to its use. It's Impact on the jurisprudence, policing and homeland security. The chief contributors and their contributions in this sphere - Galton, Faulds, E.R. Henry, Chatterjee and others

III. Application of law of probability to fingerprint science (10 Marks)

Theory of law of probability & use of mathematics for establishing uniqueness or individuality of fingerprints, Chatterjee's calculation based on eight 08 identical ridge characteristics, calculations of probability by other international scientists

IV. Taking fingerprints of living persons and of dead bodies. (20 Marks)

The different procedures of recording fingerprints, the methods of taking fingerprints of living, types of prints-rolled, plain (slap). Precautions in recording of fingerprints, taking fingerprints of dead bodies-fresh, rigor mortis, techniques of recording fingerprints of dead bodies of different stages, viz, immediately after death & after rigor mortis, decomposed & charred bodies. Precautions that are to be taken during the process, need of taking fingerprints of cadavers and its' subsequent use

V. Classification and sub-classification system for recording of fingerprint slips and for conducting search (20 Marks)

Fingerprint Patterns - core & delta, counting & tracing of ridges, evolution of different system of classifications, and their modification till date, their utilities, Henry system and other systems of classification. Classifications of ten-digit fingerprint slip & search, Classification formula, Classification of palm prints.

VI. Comparison of papillary ridges and their counts (20 Marks)

Papillary ridge, methods of comparison of papillary ridges, need of comparison and marking of ridge characteristics in identical prints

VII. Application of fingerprint science in detection of crimes and its other uses (20 Marks)

The significance of fingerprint science in crime detection through the ages, forgery in fingerprints, document case examination & furnishing of expert opinion thereof, Contribution of fingerprint science towards domestic and global security.

VIII. Scene of Crime & methods of developing chance fingerprints & Latest developments in the field (30 Marks)

Crime scene investigations, protecting and isolating the crime scene, Documentation, sketching, field notes and photography. Searching, handling, collection, preservation and transportation of physical evidences. Chain of custody and reconstruction of scene of crime. Report writing. Scene of Crime Prints, types of Chance Prints, composition of sweat various powders-black, grey, universal powder etc, Composition of powders, and various chemical and other modern equipment / techniques used in the lifting/developments of FP on different surfaces/articles.

IX. Photography in Fingerprint Identification (10 Marks)

Different techniques used in photography. Diapositives, Analogue & Digital format, Photography in oblique light, photography of FPs developed with fluorescent powder, Use of camera lens filters while using ALS, Macro and Micro lens, the role of Digital F.P. Photography under the Information & Technology Act.

X. Computerization of 10-digit fingerprint slips (Automated Finger Print Identification System/AFIS) (10 Marks)

History of computerization- use of battley lens & single digit system, need for automation, 40 digit code, evolution of AFIS, AFIS in present form, manual fingerprint and AFIS, the effect of AFIS in modern times, Critical evaluation of AFIS vis-à-vis manual methods, live scanner (FED) and AFIS, a comparison Advantages of AFIS, NAFIS, NIST & WSQ standards, National Automated Fingerprint Identification System (NAFIS)-Concept, Scope and Silent Features of the NAFIS, Stakeholders of the Project, Architecture, Hardware, NAFIS Applications -VPN, MESA, MBIS, Home Page, Slip.

XI. Laws Relating to Fingerprint Evidence & Presenting FP Evidence in the Court of Law (10 Marks)

The Criminal Procedure (Identification) Act, 2022 & its rules, use of necessary means to secure the finger, Resistance or refusal to give FPs, Section 39 in BharatiyaSakshyaAdhiniyam, who is an authorized person to take fingerprints, who can be asked to fingerprints, evidence in court, who is an expert, international standard for furnishing opinion in the court of law and other related matters.

XII. Poroscopy, Edgeoscopy And Forgery Of Finger Prints (10 Marks)

Level Three detail, Poroscopy&Edgeoscopy, definitions, Use of Poroscopy&Edgeoscopy in identification in cases of insufficient ridge details, Dr. Edmond Locards method for identification on the basis of Poroscopy, S.K. Chatterjee's guidelines for using Edgeoscopy for individualization, equipment required for study/research in Poroscopy. How fabrication of FPs is done, how to detect a forged FP, how to check cases of forgery.

E. FORENSIC PHOTOGRAPHY– 200 MARKS

Syllabus for Junior Scientific Officer - Photography

I. Basic principles of Photography: (40 Marks)

Basic principles of Photography; ISO, Aperture, Shutter Speed. Basic parts of camera and their functions; Body, Shutter, Viewfinder.

Lenses: Types of Lenses; single, achromatic, symmetrical and unsymmetrical lenses, telephoto, zoom, macro and fisheye lenses. Focal Length

Focusing; Depth of field, angle of view, Circle of confusion, Single-point AF, Dynamic-area AF, Continuous AF, Manual Focusing.

Exposure modes; meaning of P, S, A, M modes, Shot Bracketing.

Light Metering; Spot metering, Centre weighted, Evaluative or Matrix metering, Partial metering.

Uses of Flash and speedlight, Guide Number, Painting with light.

Different kinds of optical filters and their uses, Filter factor and its compensation.

II. Digital Photography & Videography: (60 Marks)

Key technical concepts – bits, bytes, bit depth, pixels, megapixels and Resolution, DPI, Optical and Digital zoom.

Sensor Noise Pattern; fixed pattern noise (FPN) and the photo-response non-uniformity noise (PRNU), pixel non-uniformity (PNU).

Introduction to digital signals: image and video, Photodiode and image sensors, Digitization process: sampling and quantization, Image Enhancement Techniques: Spatial and frequency domain.

Types of image file formats and their properties, extensions, Digital Negative and RAW formats, lossless and lossy image formats.

Colour Space; (RGB, CMYK, HSV, LAB) and Colour Gamut; Grayscale, sRGB, Adobe RGB.

Digital Watermarking. Exif Metadata. Hashing algorithms; Message digest algorithm (MD5), Secure hash algorithm (SHA1, SHA256).

Post processing of digital photographs; Enhancement of digital image/video, Adobe Photoshop and other photo-editing softwares, Uses of Diapositive or Colour Invert, Rulers and resizing, Colour Channels.

Basics of DVR and NVR, extraction of videos from DVRs, file systems and file format used in DVRs – proprietary file systems. Video compressions, storage methods – HDD, SSD, Cloud etc.

III. Optics: (40 Marks)

Laws of reflection and refraction, reflection and refraction of light at plane and spherical surfaces, mirror formula, nodal planes, system of two thin lenses, chromatic and spherical aberrations; curvature of field, distortion and astigmatism. Deviation and dispersion of light by a prism. Lens formula, Magnification, Power of lenses. Combination of thin lenses in contact. Wavefront and Huygens' principle. Interference, Young's double-slit experiment and expression for fringe width, Coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum. Interference of light-Young's experiment, Newton's rings, interference by thin films; Fraunhofer diffraction-single slit, diffraction grating,

resolving power; Fresnel diffraction: half-period zones and zone plates; Production and detection of linearly and circularly polarized light; Polarisation, plane-polarised light: Brewster's law; Optical activity; Lasers-Einstein A and B coefficients. Spectrum:Wavelength and frequency of light;Hertz and nanometer;Ultraviolet rays, Visible lights, Infrared rays & X-Rays and their bandwidth.

IV. ForensicPhotography.CrimeScenePhotography/Videography&Documentation using Sketch: (40 Marks)

Types of photography employed in Forensic Photography and their application; Fluorescence photography, Infrared photography, X-Ray photography, Photomicrography, Photomacrography, Oblique light photography, Transmitted light photography, Contrast filter photography, Photographic superimposition. Working principle of IR camera and IR filters and its uses in Forensic photography/videography.

Methods of source camera identification. Methods for tampering of digital image/video. Forensic authentication of digital image/video.

Concept of General Crime Scenephotography. Uses of scale for Evidence photography, Importance of Normal angle Lens in Crime Scene photography, Arsonphotography, Evidencephotography, Ballisticphotography, Photography employed in examination of Questioned Documents, Fingerprint Photography. Types of Crime Scene Sketches, Methods for obtaining Measurements.3D image scanning and its uses in crime scene.

V. Photography/Videography and existing Indian Law: (20 Marks)

Importance of hash values of digital photographs & digital videos and their provisions in Indian Laws,InformationTechnologyAct,2000,BSA2023,BNSS 2023.

F. CYBER FORENSIC– 200 MARKS

Syllabus for Junior Scientific Officer – Cyber Forensic

I. Computer Fundamental, Operating System and File System (40 Marks)

Computer Organization and Architecture: Cache memory. Primary and Secondary Storage devices, Number system – binary and hexadecimal, Endianness

Operating System and File System- Operating system- Windows, Linux, Android, iOS; layered architecture/logical structure of operating system, Types of OS, virtual machine, OS services, Process management, Memory management, Virtual Memory. OS service; Process Concept; Principles of concurrency, Process Generation; Process Scheduling; Scheduling criteria; Scheduling algorithms; Deadlocks; Memory Management; Swapping; Paging; Segmentation; File System concepts, naming, attributes, operations, types, structure, file organization & access (Sequential, Direct, Index Sequential) methods, memory mapped files, directory structures, Different files systems; Access methods; Disk management.

II. Database Management Systems (40 Marks)

Database Applications; Evolution of DB & DBMS; Need for data management, Data models & Database Architecture; E-R Diagrams, Relational Model; E-R to Relational Mapping; Constraints, Keys, Dependencies; Normalization – First, Second, Third & Fourth Normal Forms; BCNF; Introduction to SQL; MySQL, SQLite; Unix Timestamp Data Constraints; Triggers; Database Security; Introduction to Transactions, System & Media Recovery, Two phase Commit Protocol.

III. Digital Forensics & Computer Forensics: (40 Marks)

What is Digital Forensics and digital evidence, Principles of Digital Evidence. Sources of digital evidence. Key technical concepts – bits, bytes, numbering scheme, file extensions and file signatures, hashing algorithms, MD5, SHA1, SHA256, importance of hash values in digital forensics, data acquisition and evidence collection - Volatile data collection, Non-volatile data collection, imaging and extraction of storage devices, write-blockers. Memory forensics – memory dump. Deleted file and partitions - concepts and recovery, file carving, metadata, password cracking – brute-force method, dictionary attack, rainbow tables.

Basics of computer forensics, acquisition methods, image format (Raw, DD, SMART, AFF, E01 etc.), disk and file encryption techniques, windows registry analysis, hibernation file (hiberfile.sys), windows event log, artifacts recognition from slack space and unallocated space, Crash Dump Analysis, MFT analysis, metadata analysis. Anti-forensics – data hiding, file extension mismatch, encryption, Steganography, data destruction; Evidence Collection in Linux and Mac Operating system. Computer forensic tools.

IV. Multimedia Forensics: (40 Marks)

Understand the Fundamentals of Multimedia Forensics, including its role in digital forensics. Introduction to digital signals: audio, image and video, Digitization process: sampling and quantization, Image Enhancement Techniques: Spatial and frequency domain. Methods of source camera identification, Methods for tampering of digital image/video, Forensic authentication of digital image/video, Enhancement of digital image/video. Audio forensics - Acoustic Parameters of Sound, Fourier Analysis, Frequency and Time Domain Representation of Speech Signal, Fast Fourier Transform, Methods of tampering for digital audio, Forensic authentication of digital audio, Enhancement of digital audio.

V. Mobile Forensics: (40 Marks)

Types of mobile phones, basics of mobile phones and their components, identification of mobile phones and chipsets. Components Inside Mobile devices, Crimes using mobile phones, SIM Card, SIM Security, Mobile forensic & its challenges, seizure and isolation from network. Mobile phone evidence Extraction process. Operating systems. Android – The Linux kernel layer, Libraries, Dalvik virtual machine. Android security. Android file hierarchy, Android Manifest, XML, Developer options. ADB, fastboot, Rooting, EDL mode, bootloader; iOS – The HFS Plus file system, jailbreaking, iTunes backup, DFU Mode, Plists. Mobile phone acquisition methods – physical, logical, full file system. Chip off and JTAG. Potential evidence stored on mobile phones - Rules of evidence, SQLite examination. Location data. App Analysis. Mobile Forensic Tool

G. QUESTIONED DOCUMENT DIVISION – 200 MARKS

Syllabus for Junior Scientific Officer – Questioned Document

- I. Definition of documents under sec 2 BNS and Section 2(1)(c), 39(1), 41(1) and 72 of BSA and Sections 328 and 329 of BNSS. Scope of forensic document examination, classification of documents, preliminary examination/observation tests, procurement of standard admitted/specimen writings, Care, handling, preservation, marking, packing and forwarding of forensic documents- Dos and Don'ts, maintaining chain of custody at crime scene and in the FSLs. Nature and problems of document examination.
(20 Marks)
- II. Working principles and applications of DocuCenter, ESDA and High Resolution Video Spectral Comparators (VSC). Instrumentation techniques of - Raman spectrophotometer, Comparison microscope, Neutron Activation Analysis (NAA) and Stereo Zoom microscope.
(20 Marks)
- III. Classification of Forensic Documents-disputed/ questioned/ suspected documents, Specimen documents and contemporaneous/ admittedly genuine documents, principle of comparison of "Like with Like," method of procurement of specimen/ contemporaneous writings/signatures, suitability of standards for comparison with disputed documents. Preliminary examination of documents.
(20 Marks)
- IV. Handwriting Examination- Development of handwriting, master pattern, physiology of handwriting, different handwriting systems, matured/ immature writings, Simon New Comb theory of probability. Definition of natural variations and disguise. Various methods adopted for disguise. Importance of natural variation and disguise in handwriting examination.
(10 Marks)
- V. Handwriting/signature examination- principles of handwriting identification, General characteristics and their estimation- line quality, speed slant, shading, rhythm, size, skill, movement, alignment, relative size and proportion, pen lifts, pen pressure, pen position, pen pause, hiatus, commencing and terminal strokes, connecting strokes, individual characteristics of handwriting and their estimation, rare/occasional and accidental features in handwriting, effect of posture, emotion, illness, age and drugs/ alcohol on handwriting, effect of mother tongue on foreign script, examination and inter-se comparison of English alphabets and numerals, procurement of handwriting standards- specimens and contemporaneous writings, process of comparison of like with like, best standards for comparison with disputed documents.
(20 Marks)
- VI. Detection and decipherment of various alterations- obliterations, additions, overwriting, mechanical and chemical erasures and secret writings, simple forgery, traced forgery, simulated forgery, forgery by trickery, forgery by transplantation using scanners and colour printers, inherent signs of forgery. Detection and Decipherment of mechanical impressions - rubber stamp impressions, metallic seal impressions, embossed impressions, indentation marks.
(20 Marks)

- VII. Determination of age of documents by examination of signatures - paper ink and writing/signatures etc., by spectroscopic and chromatographic methods and statistical technique. Examination of sequence of intersecting strokes, Addition of text with ink or typescript, Anachronistic features and their importance. Stabilization of charred documents- Decipherment of charred documents, Reconstruction of torn documents.
(10 Marks)
- VIII. Types of computer printers, working of computer printers- dot matrix printers, ink jet printer, laser jet printers, thermal printers, digital offset printers, identifying features of different computer printouts, methods of identification of toners and inks used in printing. Examination and identification of digitally manipulated documents using computers and printers.
(10 Marks)
- IX. Principle and working of different conventional printing processes- letterpress, offset printing, Intaglio Printing, Flexography printing, Thermography printing, Digital printing and Screen printing, Various type of security printing, Identifying features of the printed matter of various printing processes.
(20 Marks)
- X. Examination of black and white and colour photocopies and their identifying features, process of collection of sample photocopies for the purpose of comparison, examination of fax message, scanned documents, carbon copies and carbonless copies. Difference between Photocopies, Computer Printouts and Scanned copies.
(20 Marks)
- XI. Various types of Indian passports and visa and their security features. History and development of banknotes in India, various types of printing of security documents, printing of currency notes, latest security features of new Indian currency note of Rs 500 & Rs 2000, examination of counterfeit currency notes, passports, visa, stamp papers. Examination of the security features of plastic cards- credit cards, debit card, PAN card, Aadhaar card, smart card and other plastic cards.
(30 Marks)

H. FORENSIC BALLISTICS & TOOLMARKS- 200 MARKS

Syllabus for Junior Scientific Officer – Ballistics & Toolmarks

UNIT – I : FORENSIC BALLISTICS (100 MARKS)

- I. Firearms and Ammunitions, history, their classification, details of various small arms used in crime – shotguns, rifles, revolvers, pistols, carbines, improvised firearms. Bore and caliber, 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. Various types of primers/ priming mixtures, propellants, shotgun ball ammunition, various kinds of bullets/projectiles, head-stamp markings. Various physical, ballistic & functional tests of ammunitions. (10 Marks)

II. Physical evidence and other clues Handling of evidence, various precautions. (5 Marks)

III. 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. (10 Marks)

IV. External Ballistics: Equations of motion of projectiles, principal problem of exterior ballistics, vacuum trajectory – calculation of various elements, effect 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, Greenhill 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. (10 Marks)

V. Terminal Ballistics: Interaction and penetration of various small arm projectiles in various tissues. Threshold velocity for penetration of skin, flesh and bones, threshold energy/ casualty criteria, energy density, ricochet, various aspects of wound ballistics including wounds of entrance/ exit/ track of projectile, gunshot injuries caused by different types of firearm 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, tumbling 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 firearms, comparison microscope, photomicrography, source correspondence, linkage of fired shots with shotguns. (10 Marks)

VI. 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. (10 Marks)

VII. Chemical tests for examination and identification of shotgun holes in various targets. Gunshot residue. Identification of shooter. (5 Marks)

VIII. 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 bullet holes in various materials, ricochet marks, pellet pattern in various targets (10 Marks)

IX. Instrumentation techniques - AAS, NAA, SEM/EDXA, ICP-MS, ASV and their application in ballistic examination. (20 Marks)

UNIT – II : FORENSIC PHYSICS (50 MARKS)

- I. General Guidelines for Physical Evidence: Evidence collection from crime scene, victim & deceased in cases of - Homicide Investigation; Investigation of - Death due to fall from height, sexual offences and sex related homicide, Hanging (suicidal, accidental and homicidal), Paint, Glass, Soil, Fibre, Metals.

Sources of Exhibits, Goals of Evidence Packaging- Protection of Evidence from possible hazards; Elements of Packaging Evidence – Packing Material, Sealing of Evidence; Precautions, General Directions, Directions for Specific type of Exhibits – Weapons and tools, Hair and Fibres, Dust or Soil, Arson Cases and Cases of Burning, Tool Marks. (15 Marks)

II. Pattern Evidence

Tool marks- Types, Class and Individual Characteristics, Comparisons, Impression Marks, Compression Marks, Striated Marks, Combination of Impression and Striated Marks, Repetitive Marks, Materials for making Test Tool Marks, Methods of preparation of Test Tool Marks, Comparison of test and evidence tool marks, Rubber Stamp Impressions, Metallic Seal Impressions, Embossed Impressions and Indentation marks, Mechanical Impressions. Cast, Engraved and Punched Marks – Methods of their restoration.

Glass: types of glass and their composition, and their properties forensic examination of various glass fractures.

Soil- Formation, Types, Composition and physical properties.

Paints- Composition, Types, physical properties of paints.

Fibre- Types, Constituents & their forensic importance.

(15 Marks)

- III. Impression Evidence: Types of Impression Evidence, Significance of Impression Evidence. Tyre Marks Comparison. Skid marks, Serial numbers restoration. (5 Marks)

- IV. Restoration: Restoration of erased numbers, methods of marking-cast, punch and engraved, methods used for removal of serial numbers, theory behind number restoration, restoration of marks on cast iron, Aluminum, 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 etched serial numbers and bar codes and their restoration, recording of restored marks.

(15 Marks)

Explosives

(50 Marks)

- I. Classification, types, firearms database, composition and characteristic of low explosives, primary and secondary high explosive. Black powder, NC, NG, TNT, RDX, PETN, HMX, Dynamite, ANFO, Flexible Sheet Explosives, etc. Detonators, blasting cap, Boosters, Blasting Accessories, explosive train, IEDs and pyrotechniques, explosion process and effects, effects of blast wave on structures and human. Specific approach to scene of explosion, reconstruction of sequence of events, post blast residues, collection, analysis of explosion residues.