SYLLABUS : Junior Scientific Assistant (HRD-QC) in FSL

Fundamentals of Forensic Science and Criminal Justice System

Definition, nature and scope of forensic science; Historical development of forensic science; Fundamental principles of forensic science; Branches of forensic science; Interdisciplinary nature of forensic science; Role of forensic science in the criminal justice system; Organization and structure of forensic science laboratories in India; Duties and responsibilities of forensic scientists; Expert testimony and admissibility of scientific evidence in court of law; Ethical issues and professional conduct in forensic science.

Crime Scene Investigation and Evidence Management

Types of crime scenes; Protection and security of crime scene; Principles of crime scene investigation; Methods of crime scene search; Documentation of crime scene including photography, videography, sketching and note-taking; Recognition and classification of physical evidence; Collection, preservation, packaging and forwarding of evidence; Chain of custody; Reconstruction of crime scene; Report Writing; Safety precautions and legal aspects related to seizure and handling of evidence.

Forensic Biology, Serology and DNA Profiling

Biological evidence- nature, significance and importance; Blood- composition, properties and identification; Semen, saliva and other body fluids- composition, functions and forensic identification; Structure and forensic examination of hair and fibres; Diatoms- structure and forensic significance in drowning cases; Forensic examination of tissues and organs; Bloodstain pattern analysis; Determination of age, sex, stature and ancestry from skeletal remains;

DNA fingerprinting- principles, techniques including extraction methods, quantification, Polymerase Chain Reaction (PCR), Short Tandem Repeat (STR) analysis, mitochondrial DNA (mtDNA) analysis, capillary electrophoresis, interpretation of DNA profiles and forensic applications in criminal investigation, paternity disputes, missing person identification, and disaster victim identification;

Forensic Chemistry and Toxicology

Scope and significance of forensic chemistry; Classification of drugs and poisons; Introduction to drugs of abuse including narcotic drugs and psychotropic substances (NDPS); Inorganic and organic poisons; Metallic poisons and toxic elements; Pesticides and plant poisons- chemical nature and examination; Toxicology of alcohol, drugs and volatile substances; Routes of entry, absorption, distribution, metabolism and elimination of poisons; Collection and preservation of

viscera and toxicological samples; Interpretation of toxicological findings; Examination of petroleum products and arson-related chemicals; Explosives- classification and forensic examination, Good Lab Practices; Chemical and instrumental techniques used in forensic chemical and toxicological analysis

Forensic Physics

Physical principles applied in forensic science; Examination of glass fractures and fracture mechanics; Restoration of obliterated and erased serial numbers; Forensic examination of paint, glass, soil, building materials (cement, concrete, mortar etc.) and fibre evidence; Forensic examination of cut marks; Physical and dimensional analysis of seals, stamps, trademarks and security features; Examination of precious metals such as gold, silver, platinum, etc.; forensic examination of toolmarks, footwear and tyre impressions; Forensic examination of audio recordings; Voice spectrography and speaker identification; Forensic video analysis; Authentication and enhancement of audio and video evidence; Various instrumentation techniques used in forensic physics

Forensic Ballistics

Definition and scope of forensic ballistics; Classification of firearms; Parts and functioning of firearms; Ammunition- components and types; Internal, external and terminal ballistics; Gunshot residue (GSR) examination; Determination of range and direction of firing; Examination and comparison of fired bullets and cartridge cases; Instrumental techniques used in forensic ballistics including comparison microscopy for bullet and cartridge case examination, stereomicroscopy, scanning electron microscopy with energy dispersive X-ray analysis (SEM-EDX) for GSR analysis, and IBIS (Integrated Ballistic Identification System).

Questioned Documents and Fingerprint Science

Scope of questioned document examination; Handwriting characteristics and examination; Natural variation and disguised writing; Genuine and forged signatures; Types of forgeries; Examination of inks and papers; Indented writing and its examination; Detection of alterations, erasures and obliterations; Examination of printed, photocopied and typewritten documents; Security features of currency and valuable documents; Instrumental techniques used in forensic document examination including Video Spectral Comparator (VSC), Electrostatic Detection Apparatus (ESDA), microscopy, chromatography and spectroscopy.

History and development of fingerprint science; Principles of fingerprint identification; Types of fingerprints- latent, patent and plastic; Fingerprint patterns and classification systems; Development of latent fingerprints using physical and chemical methods; Comparison and individualization of fingerprints; Automated Fingerprint Identification System (AFIS); Palm prints and other impression evidence.

Cyber and Digital Forensics

Introduction and scope of cyber and digital forensics; Types of cyber-crimes; Nature and characteristics of digital evidence; Collection, preservation and analysis of digital evidence; Computer forensics; Mobile forensics; Email and network forensics; Basics of data recovery and digital evidence interpretation; Legal provisions related to cyber-crimes cases.

Tools and technologies used in cyber and digital forensics including forensic imaging tools (write blockers, disk imaging software), data recovery tools, mobile forensic extraction tools, forensic software suites (UFED, EnCase, XRY, FTK, Autopsy, etc.), and hash verification techniques (MD5, SHA).

Instrumentation

Principles and applications of various microscopy techniques used in forensic science including compound microscopy, comparison microscopy, polarized light microscopy, fluorescence microscopy, and electron microscopy; Chromatographic techniques including TLC, Gas Chromatography (GC) and High Performance Liquid Chromatography (HPLC); Spectroscopic techniques including UV-Visible spectroscopy, Infrared (IR) spectroscopy, Atomic Emission Spectroscopy (AES) and Atomic Absorption Spectroscopy (AAS);X-ray based techniques including X-ray diffraction (XRD), X-ray fluorescence (XRF); Mass spectrometry and its forensic applications; Capillary electrophoresis and various immunoassay techniques used in forensic science including ELISA and chemiluminescence assays.

Quality Management System and Management Requirements

Quality Management System (QMS) concepts including Quality, Quality Assurance, Quality Control and Quality Management planning; Scope and objectives of a QMS in laboratory operations; accreditation principles with emphasis on NABL and internal standards such as ISO/IEC 17025:2017 including its relevance to competence and accreditation; internal and external audits with planning, implementation and reporting; Calibration and its traceability requirements; Proficiency testing as a competence demonstration tool; Documentation essentials including Quality Manual, Standard Operating Procedures (SOPs) and Master Lists; Corrective and preventive actions (CAPA) for continual improvement within the quality system framework; Laboratory Safety Practices and risk management.