

## B.Sc. (Life Sc. Chemistry, Forensic Sc.)

### Semester I

<b>Paper No.</b>	<b>Code</b>	<b>Credits</b>	<b>Title</b>
I paper Science	FS-401	2(2-0-0)	Introduction in Forensic
II Paper	FS-402	2(2-0-0)	Law

### Semester II

<b>Paper No.</b>	<b>Code</b>	<b>Credits</b>	<b>Title</b>
III paper	FS-421	3(2-0-2)	Crime scene investigation
IV Paper Technique	FS-422	3(3-0-0)	Instrumental and Analytical

### Semester III

<b>Paper No.</b>	<b>Code</b>	<b>Credits</b>	<b>Title</b>
V Paper Examination	FS-431	3(2-0-2)	Fingerprints
VI Paper	FS-432	3(2-0-2)	Document Examination

### Semester IV

<b>Paper No.</b>	<b>Code</b>	<b>Credits</b>	<b>Title</b>
VII paper	FS-441	2(2-0-0)	Ballistics and Photography
VIII Paper	FS-442	2(2-0-0)	Explosive

### Semester V

<b>Paper No.</b>	<b>Code</b>	<b>Credits</b>	<b>Title</b>
IX paper Toxicology	FS-451	3(3-0-0)	Forensic Chemistry &
X Paper Profiling	FS-452	3(3-0-0)	Forensic Serology and DNA

### Semester VI

<b>Paper No.</b>	<b>Code</b>	<b>Credits</b>	<b>Title</b>
XI paper	FS-561	3(3-0-0)	Cyber Forensic
XII Paper Management	FS-562	3(3-0-0)	Quality and Laboratory

## **B.Sc (PCFS&LSCFS)**

### **Semester-I**

#### **Paper -I**

**Code:-FS-401**

**Credits:-2(2-0-0)**

#### **Introduction of Forensic Science**

- UNIT-I**      **Forensic Science:** - Basic Principles & Significance, History & Development of Forensic Science, Organizational Structure of Forensic Science laboratory / Institutions.
- UNIT-II**      Criminalistics; Forensic psychiatry; Coordination of forensic activities and use of court; Legal medicine and jurisprudence; Forensic toxicology; Questioned documents; Bloodstain pattern interpretation; Serology and DNA typing; Forensic odontology; Forensic anthropology; References.
- UNIT-III**      Forensic Statistics Probability; Populations and samples; Weight of evidence and the Bayesian likelihood ratio; Transfer evidence; Application of statistics to particular areas of forensic science; Knowledge based systems; Quality based systems; References.
- UNIT-IV**      Ethics in Forensics Professionalism and ethics: why should professional ethics be important; The importance of professional ethics to science practitioners; Development of a code of conduct and code of ethics for forensic science; Application of codes and ethics; How ethical requirements impact the daily work of a forensic scientist; Ethical dilemmas and their resolution; References.

## Paper -II

Code:-FS-402

Credits:-2(2-0-0)

### Law

**UNIT-I** Criminal Justice System Structure of police, Prosecution & Judicial Organizations

**UNIT-II** Introduction of IPC and Cr. P.C. – Section 291, 292 & 293, Indian Evidence Acts – Introduction and Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137 & 159.

**UNIT-III** Expert Witnessing Introduction; Developing strategies; Fees, contracts and marketing; Discovery; Expert opinions under daubert; The deposition; Daubert challenge; Preparation for trial; Giving testimony at trial; Communication; The engineers nightmare – case studies; The expert as a witness; The lawyer and the verdict; The future of expert witnessing; References.

**UNIT-IV** Drugs and Cosmetic Act, Excise Act, NDPS Act. Arms Act, Explosives Act

## **Semester-II**

### Paper -III

Code:-FS-421

Credits:-3(2-0-2)

## **Crime scene investigation**

**UNIT-I** **Crime:** - Definition & causation, crime scene, types of crime, processing of crime scene, protection and recording of crime scene, search of physical clues, preservation, packing and forwarding of physical clues

**UNIT-II** Blood spattering / Pattern analysis.

**UNIT-III** **Investigative Techniques:** - Criminals, Criminal behavior, modus operandi, criminal profiling, Portrait parley,

#### **UNIT-IV**

Polygraphy, narco analysis, brain fingerprinting, voice stress analysis & speaker profiling.

#### **UNIT-V**

Sketching and Photography of scene of crime. Collecting and Packing of physical clues at the scene of crime. Reconstruction and evaluation of scene of crime. (Hit and run, Arson and shooting cases etc.).

### **Paper -IV**

**Code:-FS-422**

**Credits:-3(3-0-0)**

### **Instrumental and Analytical Technique**

**UNIT- I      Basic Concepts- Atomic Spectroscopy** What is spectroscopy, electromagnetic spectrum, sources of radiation; their utility and limitations – conventional sources for UV visible and infrared rays, sources for shorter wavelength radiations (X-ray tubes) radioactivity  $\gamma$ -rays and  $\beta$ -rays. Laser (He, Ne, Argon ion, dye laser, semi conductor laser) as source of radiation. Interaction of radiation with matter: reflection, absorption, transmission, fluorescence, phosphorescence and their forensic applications, Atomic spectra, energy levels, quantum number and designation of states, selection rules, qualitative discussions of atomic spectra.

**UNIT-II      Basic Concept – Molecular Spectroscopy** Molecular spectra: qualitative discussions of molecular binding, molecular orbital, types of molecular energies, qualitative discussions of rotational, vibrational and electronic spectra, spectra of polyatomic molecules,

**UNIT-III** Ultra violet and visible Spectrophotometry: - Types of sources and stability, wavelength selection, filters-cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection. Fluorescence and phosphorescence Spectrophotometry: - Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods. Atomic absorption spectrometry: - Instrumentation and techniques, interference in AAS, background correction methods, and quantitative analysis.

Atomic emission spectrometry: - Instrumentation and techniques are / spark emission, ICP-AES, comparison of ICP vs AAS methods, quantitative analysis, and applications.

Infrared Spectrophotometry: - Dispersive and Fourier Transform Spectrophotometry, sample handling, quantitative analysis and interpretation of IR spectra.

#### **UNIT – I V**

- Basic Principles, simple and compound microscope, comparison microscope, phase contrast Microscope, Stereoscopy microscope, Polarizing microscope, Fluorescent Microscopy, Infra red Microscopy, Scanning electron Microscope (SEM) & Transmission Electron Microscope (TEM)

**Centrifugation Techniques:** - Basic principles of sedimentation, various types of centrifuges, Density gradient centrifugation, Preparative centrifugation, Analysis of sub-cellular fractions, Ultra- centrifuge-Refrigerated Centrifuges. **Electrophoretic Technique:** - General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis,, Sodium dodecylsulphate (SDS) polyacrylamide gel electrophoresis,, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical electrophoresis.

## **Semester-III**

### **Paper -V**

**Code:-FS-431**

**Credits:-3(2-0-2)**

#### **Fingerprints Examination**

**UNIT-I** History and development of fingerprints, formation of ridges, pattern types, pattern areas, classification of fingerprints – Henry system of classification, single digital classification, extension of Henry system, search of fingerprints, fingerprint bureau.

**UNIT-II** latent & visible fingerprints, plastic fingerprints, composition of sweat, development of latent fingerprints, conventional methods of development of fingerprints – fluorescent method, magnetic powder method, fuming method, chemical method etc.

**UNIT-III** Taking of finger prints preserving and lifting of fingerprints, photography of fingerprints, comparison of fingerprints, basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics,

**UNIT-IV** Introduction of Foot prints:, Tyre mark, Lip prints, Bite marks, Ear prints,

### **Paper -VI**

**Code:-FS-432**

**Credits:-3(2-0-2)**

### **Document Examination**

**UNIT-I** Nature and problems of document:- Classification of documents, procurement of standard admitted / specimen writings, handling and marking of documents, preliminary examination of documents, basic of handwriting identification individuality of handwriting, natural variations, process of comparison, various types of documents genuine and forged documents, various writing features and their estimation, general characteristics of handwriting, individual characteristics of handwriting, basic tools needed for forensic documents examination and their use.

**UNIT-II** Disguised writing and anonymous letters:- Identification of written, examination of signatures characteristics of genuine and forged signatures, examination of alterations, erasers overwriting, additions and obliterations decipherment of secret, indented and charred documents,

**UNIT-III** Examination of Documents:- Xeroxed copies, carbon copies, fax message forgeries and their detection, various types of forgeries and their detection. Examination of built up documents determination of sequence of strokes, physical matching of documents, identification of type writings, identification of typist, identification of printed matter, various types of printing of security documents, printing of currency notes, examination of counterfeit currency notes, passports, visa, stamp papers, postal stamps, etc.

# Semester-IV

## Paper -VII

Code:-FS-441

Credits:-2(2-0-0)

### **Ballistics and Photography**

- UNIT – I** History and background of firearms:- Their classification and characteristics, various component of small arms, smooth bore and class characteristics, purpose of rifling, types of rifling trigger and firing mechanism, improvised / country-made / imitative firearm and their constructional features. Types of ammunition: classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, various types of bullet and compositional aspects,
- UNIT-II** **Internal and External Ballistics:-** Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: Terminal Ballistics Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, Cavitations Temporary and permanent cavities, Ricochet and its effects, stopping power,
- UNIT- III** **Principles and practice of identification** of firearms, ammunition and their components, different types of marks produced during firing process on cartridge- firing pin marks, breech face marks, chamber marks, extractor and ejector marks band on bullet- number/ direction of lands and grooves, striation marks on lands and grooves, identification of various parts of firearms  
Analysis of Gunshot Residues Mechanism of formation of GSR, source and collection, spot test, chemical test, identification of shooter and instrumental methods of GSR Analysis, Arms Act,
- UNIT-IV** Photography, Basic principles and techniques of Black & White and colour photography, cameras and lenses, exposing, development and printing, different kinds of developers and fixtures, modern developments in photography, linkage of cameras and film negatives, digital photography,

## Paper -VIII

Code:-FS-442

Credits:-2(2-0-0)

### **Explosive**

- UNIT-IV** **Explosives:-** Classification, composition and characteristics of explosives, pyrotechnics, IEDs, explosion process and effects, types of hazard, effect of blast wave on structures, human etc. specific approach to scene of explosion, post-blast residue collection,
- UNIT-II**
- UNIT-III** Reconstruction of sequence of events, evaluation and assessment of scene of explosion,
- UNIT-IV** systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques in the laboratory and interpretation of results,
- UNIT-V** Explosives Act.

## **Semester-V**

### Paper -IX

Code:-FS-451

Credits:-3(3-0-0)

### Forensic Chemistry & Toxicology

- UNIT-I** Forensic Chemistry Introduction, types of cases / exhibits, preliminary screening, presumptive test, inorganic analysis, micro-chemical methods of analysis, examination procedures involving standard methods and instrumental techniques,
- UNIT-II** Analysis of beverages: alcoholic and non-alcoholic, country made liquor, illicit liquor and medicinal preparations containing alcohol and drugs as constituents,
- UNIT-III** Drugs of abuse: introduction, classification of drugs of abuse, drug of abuse in sports, narcotics drugs and psychotropic substances, designer drug and their forensic examination, Drugs and Cosmetic Act, Excise Act, NDPS Act.
- UNIT-IV** Quantitative and qualitative forensic analysis of organic and inorganic industrial products, chemical fertilizers, insecticides, metallic and non

metallic products, consumer items such as gold, silver, tobacco, tea, sugar, salts, acids, and alkalis etc.

**UNIT-I** Forensic Toxicology: Introduction and concept of forensic toxicological examination and its significance. Poisons: Classification of poison, types of poisoning, collection and prevention of toxicological exhibits in fatal and survival cases, signs and symptoms of poisoning, mode of action and its effect on vital functions, medico-legal and post mortem examination

**UNIT-II** Extraction, Isolation and Clean up procedure using conventional as well as modern techniques such as solid phase extraction techniques, separation of poisons and drugs using chromatographic and Electrophoretic techniques, identification and estimation of poisons and drug using chromatographic and spectrophotometric and other instrumental methods, ingestion of drugs and their metabolism in the body significance of analytical studies with respect of forensic examination.

### **Paper -X**

**Code:-FS-452**

**Credits:-3(3-0-0)**

## **Forensic Serology and DNA Profiling**

**UNIT-I Serology & Immunology:-** Structure and function of carbohydrates, fats and proteins, serum proteins, cell proteins, Haemoglobin and its variants, Haptoglobins - various types, polymorphic enzymes and their forensic significance. Mendelian genetics, Genotypes, Phenotypes, multiple alleles, genetic variants, biochemical genetics, gene structure frequency determination, gene mapping and gene expression, genetic markers, Immunology Immune system, immune response, innate acquired immune antigens, haptenes and adjuvants, Immunoglobulin –types, physio-chem properties and function, raising of anti-sera, lectins – their significance. Buffer and serological reagents, methods of sterilization employed for serology work.

**UNIT-II Determination of Origin of Species:-** Determination of human and animal origin from bones, hair, nails, skin, body tissue, fluids / stains viz.

blood, menstrual blood, semen, saliva, sweat, pus, vomit, etc., through immuno- diffusion and immuno – electrophoresis

**Serogenetic markers:-** Blood groups – biochemistry and genetics of ABO, Rh, Mn systems, methods of ABO blood grouping from blood stains and other fluids / stains viz. menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail blood specific ABH substances, determination of secretor / non secretor Lewis antigen, Bombay Blood group, Polymorphic enzymes typing- PGM, GLO,ESD, EAP, AK, ADA etc., and their forensic significance, HLA typing, role serogenetic markers in individualization, paternity disputes etc.

**UNIT-III DNA Profiling Structure & Analysis:-** History of DNA fingerprinting, Human genetics – Heredity, Alleles, Mutations & population Genetic, Molecular Biology of DNA, Variations, Polymorphism DNA system – RELP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y-STR, Mitochondrial DNA.

**UNIT-IV Forensic Significance of DNA Profiling:-** Application in disputed paternity cases, child swapping, Missing person's identity – immigration, veterinary & wild life and Agriculture cases,

## **Semester-VI** **Paper -XI**

**Code:-FS-461**

**Credits:-3(3-0-0)**

### **Cyber Forensic**

#### **UNIT-I**

Introduction to Computers Problems and problem solving; General concepts and tools; Arithmetic and logical operators;Developing an algorithm to solve a problem; Modularization; Functions and procedures;Arrays; File processing; Reports and control breaks; Processing the date; Introduction to object-oriented programming.Introduction, Fundamental data types,

#### **UNIT-II**

Cyber Forensic, Fundamentals of computers, hardware and accessories, operating system, software, Cyber Crimes- definition, IT laws – Introduction, internet, hacking, virus, obscenity pornography, programme

manipulation, software piracy, intellectual property and computer security etc. Encryption and Decryption methods.

**UNIT-III** Search and Seizures of Evidence, Investigation of cyber crimes and tools for analysis.

**UNIT-IV** Other Advances, Pattern Recognition & Biometrics – Face, Iris & retinal imaging, speech recognition, finger for palm print, gait pattern, signatures, pattern comparison, Computer simulation, Image processing – Image capturing, Image restoring & enhancement, Image editing, Compression Technique – Proactive Forensic science.

## **Paper -XII**

**Code:-FS-462**

**Credits:-3(3-0-0)**

### **Quality & Laboratory Management**

**UNIT-II** Quality Management (ISO/IEC 17025) General requirements for the competence of testing and calibration laboratories, Introduction, Scope, Management requirements: organization, Quality System, Document Control, , Test and calibration methods and methods validation, Equipment, measurement traceability, Sampling, Handling of test and calibration items, assuring the quality of test calibration results and reporting the results.

**UNIT-II** Laboratory Management, Laboratory information management system, validation and safety equipments.

**UNIT-III** Report Writing and Evidence Evaluation, Components of reports and Report formants in respect of Crime Scene and Laboratory findings. Court Testimony- admissibility of expert testimony, per Court preparations & Court appearance, Examination in chief, cross examination and re-examination, Ethics in Forensic Science.

**UNIT-IV** Cases of Special Importance, Pertaining to forensic examination (Biology, serology, chemistry, toxicology) documents, fingerprints, ballistics, photography and physics, Voice identifications, Tape authentication & Computer frauds pertaining to forensic examination of cases