

# M.Sc. Forensic Science

## I Semester

<b>Paper No.</b>	<b>Code</b>	<b>Credits</b>	<b>Title</b>
Paper I	FS-711	4(2-0-4)	General Forensic- Crime & Investigative Technique
Paper II	FS-712	2(2-0-0)	Law (Cr.P.C. I.P.C, I.E.A)
Paper III	MAS	2(2-0-0)	Forensic Statistics
Paper IV	FS-714	4(2-0-4)	Forensic Ballistics
Paper V	FS-715	3(2-0-2)	Absorption Spectroscopy
Paper VI	FS-716	3(3-0-0)	Emission Spectroscopy
Paper VII	FS-717	3(2-0-2)	Biochemical Techniques
Paper VIII	FS-718	3(2-0-2)	Analytical Chemistry & Technique
Paper IX	FS-719	2(1-0-2)	Forensic Photography
Seminar I	FS-720	1(0-2-0)	Seminar and Tutorials

## II Semester

Paper X	FS-822	4(3-0-2)	Fingerprints & Impressions
Paper XI	FS-823	4(3-0-2)	Questioned Documents
Paper XII	FS-824	3(2-0-2)	Forensic Chemistry
Paper XIII	FS-825	4(3-0-2)	Forensic Toxicology
Paper XIV	FS-826	3(3-0-0)	Forensic Medicine & Pharmacology
Paper XV	FS-827	2(2-0-0)	Explosives
Paper XVI	FS-828	2(1-0-2)	Cyber Forensic
Paper XVII	FS-829	2(2-0-0)	Quality Management
Paper XVIII	LNG-304 Technical	2(2-0-0)	Professional Communication & Writing
Seminar II	FS-830	1(0-2-0)	Seminar and Tutorials

### III Semester

Paper XVIII	FS-832	4(3-0-2)	Forensic Physics
Paper XIX	FS-833	4(2-0-4)	Forensic Biology
Paper XX	FS-834	4(2-0-4)	Forensic Serology
Paper XXI	FS-835	3(2-0-2)	D.N.A. Profiling
Paper XXII	FS-836	2(2-0-0)	Forensic Anthropology & Odontology
Paper XXIII	FS-837	3(2-0-2)	Forensic Botany
Paper XXIV	FS-838	2(2-0-0)	Forensic Entomology
Seminar III	FS-840	1(0-2-0)	Seminar and Tutorials

### IV Semester

Paper XXVI	FS-841	2(2-0-0)	Evidence Evaluation & Report Writing
Paper XXVII	FS-842	2(2-0-0)	Research Methodology in Forensic Science
Paper XXVIII	FS-843	3(3-0-0)	Forensic Psychiatry and Criminal Behavior
Paper XXIX	FS-844	2(2-0-0)	Recent Advances in Forensic Investigation
FS-945		10(0-0-20)	Three months Dissertation/Project work/ Case study/Specialized Training

## **Master of Forensic Science Semester-I**

**Code:-FS-711**

**Credits:-4(2-0-4)**

### **General Forensic – Crime & Investigative Techniques**

- UNIT-I: - Forensic Science:** - Basic Principles & Significance, History & Development of Forensic Science, Organizational Structure of Forensic Science laboratory / Institutions.
- UNIT-II Crime:** - Definition & causation, crime scene, types of crime, protection and recording of crime scene, search of physical clues, preservation, packing and forwarding of physical clues, processing of crime scene, Blood spattering / Pattern analysis.
- UNIT-III Investigative Techniques:** - Criminals, Criminal behavior, modus operandi, criminal profiling, Portrait-Parley, Polygraphy, Narko-analysis, Brain Fingerprinting, voice stress analysis & speaker profiling.
- UNIT-IV Practical Crime Scene**  
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 -II

Code:-FS-712

Credits:-2(2-0-0)

### **Law**

- UNIT-I Criminal Justice System:-** Structure of police, Prosecution & Judicial Organizations, Introduction of IPC and case study
- UNIT-II** IPC various sections related to Homicidal cases and sexual assault, case study
- UNIT-III** Cr. P.C. – Section 291, 292 & 293, case study
- UNIT-IV** Indian Evidence Acts – Introduction and Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137 & 159. , case study
- UNIT-V** Explosive act, Narcotic act NDPS act and Cyber law

## Paper -III

Code:-MAS

Credits:-2(2-0-0)

### **Forensic Statistics**

- UNIT-I:- Forensic Statistics:-** Types of data, Basic concepts of frequency distribution, measure of central values – Mean, media and mode, measures of dispersion, Range, Mean deviation and standard deviation, Correlation and Regression analysis.
- UNIT-II Probability:** Theory, Classical definition of Probability. Basic terms – Events, Trials, Mutually exclusives events, Favorable events, Exhaustive events etc., Baye's Theorems of probability, Addition Theorem, Multiplication Theorem, Conditional Probability & Coincidence Probabilities.
- UNIT-III Variance-** Coefficient of Variation, Moment, Skew-ness and Kurtosis, binomial distribution, normal distribution, hyper geometric distribution, correlated measurements.
- UNIT-IV Discriminating power-** Derivation, evaluation of evidence by discriminating powers, combination of independent systems, correlated attributes, Transfer of evidence- Likelihood ratio, probability of guilt, correspondence probabilities, direction of transfer.
- UNIT-V Tests of hypothesis** – Test of significant 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.

## Paper -IV

Code:-FS-714

Credits:-4(2-0-4)

### **Forensic Ballistics**

- 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 and methods to produce rifling to produce rifling, trigger and firing mechanism, cartridge-firing mechanism, projectile velocity determination, theory of recoil, methods for measurement of recoil, techniques of dismantling / assembling of firearm, identification of origin, improvised / country-made / imitative firearm and their constructional features.
- UNIT – II Types of ammunition:** classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, velocity and pressure characteristics under different conditions, various types of bullet and compositional aspects, latest trends in their manufacturing and design projectile, identification of origin, improvised ammunition and safety aspects for handling firearm and ammunition.
- UNIT-III Internal and External Ballistics:-** Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting, equation of motion of projectile, principal problems of exterior ballistics, vacuum trajectory, effect of air resistance on trajectory, base drag, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Ballistics tables, measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistics data.
- UNIT-IV Terminal Ballistics:-** Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range **Cavitations:-** Temporary and permanent cavities, Ricochet and its effects, stopping power, Wound Ballistics; Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, penetrative in gel block and other targets, nature of wounds of entry, exit, initial with various ranges and velocities with various types of projectiles, explosive wounds, evaluation of injuries caused due to shot-gun, rifle, handguns and country made firearms, methods of measurements of wound ballistics parameters, post-mortem and anti-mortem firearm injuries.
- UNIT- V 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, techniques for obtaining test material from various types of weapons and their linkage with fired ammunition, class and individual characteristics, determination of range of fire- burning, scorching, blackening, tattooing and metal fouling shots dispersion and GSR distribution, time offering different method employed, and their limitations, stereo & comparison microscopy, automatic bullet and cartridge system.

#### **UNIT –VI**

**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, Management an reconstruction of crime scene; suicide, murder and accidental and self defence cases, Arms and Explosive Act, Report writing and court findings.

#### **UNIT-VII**

**Practicals** Examination and Comparison of fired bullets Caliber, rifling characteristics, probable types of firearms. Examination and Comparison of fired Cartridge / cases (Caliber, firing pin, breech face, Extractor / Ejector marks etc.) Determination of shot number from size and weight of shots.. Identification of propellants.. Chemical tests for powder residues (Walker's test) and Barrel wash. Examination of air guns / rifles as per Arms Act 1959.. Determination of Velocity and Energy of Projectiles.

## Paper -V

Code:-FS-715

Credits:-3(2-0-2)

### **Absorption Spectroscopy**

- UNIT-I Basic Concepts- Atomic & Molecular Spectroscopy-I:-**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, radiation filters. Detection of radiations; Photographic detectors, Thermal detectors, Photoelectric detectors. Atomic spectra, energy levels, quantum number and designation of states, selection rules, qualitative discussions of atomic spectra.
- UNIT-II 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.
- UNIT-III Fluorescence and phosphorescence Spectrophotometry:** - Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods.
- UNIT-IV Infrared Spectrophotometry:** - Dispersive and Fourier Transform Spectrophotometry, sample handling, quantitative analysis and interpretation of IR spectra.
- UNIT-V Atomic absorption spectrometry:** - Instrumentation and techniques, interference in AAS, background correction methods, and quantitative analysis.
- UNIT-VI** Experiments on UV absorption of drugs / dyes.. Experiments on IR spectra of paints / drugs.. Experiments on GC Analysis of Arson Exhibits and Volatile substances.. Experiments on GC Analysis of Alcohol. Experiments on Electrophoresis analysis of Biological substances.. Comparison of polythene films by IR spectrophotometry.

## Paper -VI

Code:-FS-716

Credits:-3(3-0-0)

### **Emission Spectroscopy**

- UNIT-I**     **Atomic emission spectrometry:** - Instrumentation and techniques are / spark emission, ICP-AES, comparison of ICP vs AAS methods, quantitative analysis, and applications.
- UNIT-II**     **Raman spectroscopy:-** Instrumentation, sample handling and illumination, structural analysis, polarization measurements and Dispersive & FT analysis.
- UNIT-III**    **X-ray Spectroscopy:-** X-ray absorption and fluorescence methods, X-ray diffraction, Auger mission spectroscopy (AES), electron spectroscopy for chemical analysis (ESCA).
- UNIT-IV**    **Radiochemical techniques:-** Basic principles and theory, introduction about nuclear reactions and radiations, Neutron sources, Neutron Activation Analysis (NAA).
- UNIT-V**     **Thermal Analysis Methods:-** Basic principles and theory, differential scanning colorimetry and differential analysis, thermogravimetry.

## Paper -VII

Code:-FS-717

Credits:-3(2-0-2)

### **Biochemical Techniques**

- UNIT-I**     **General Principles of Biological / Biochemical Analysis:** - pH and buffers  
Physiological solution, Cell and tissue culture, Cell fractionation, Biological variations etc.  
**Centrifugation Techniques:** - Basic principles of sedimentation, various types of centrifuges, Density gradient centrifugation, Preparative centrifugation, Analysis of sub-cellular fractions, Ultra- centrifuge-Refrigerated Centrifuges.  
**Microscopy:** - 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).
- UNIT-II**     **Immuno-chemical Technique:** - General principles, production of antibodies, Precipitin reaction, Gel immuno-diffusion, Immuno-electrophoresis, complement fixation, Radio Immuno Assay (RIA), ELISA, Fluorescence immuno assay.  
**Chromatographic Techniques:** - General Principles, Paper chromatography, column chromatography, TLC, Absorption chromatography, Partition chromatography, Gas chromatography, Gas-liquid chromatography, Ion-exchange chromatography, Exclusion (permeation) chromatography, Affinity chromatography, HPCL, HPTLC, Capillary chromatography, Interfacing GC with IR spectrometry.  
**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.
- UNIT-III**    **Mass Spectrometry:-** Sample flow, Ionization methods, Mass analyzer, Vacuum systems, Data handling, Correlation of mass spectra and molecular structure, Fourier transform mass spectrometry, Tandem mass spectrometry, Inductively coupled plasma MS (ICP-MS), Ion Microprobe Mass Analyzer (IMMA), HR GCMS, LCMS, Secondary Mass Spectroscopy, Laser Mass spectrometry, Fast Atom bombardment and liquid secondary Ion Mass spectrometry, High performance liquid chromatography, Electro spray ionization mass spectrometry.
- UNIT-IV**     **Electrochemical Techniques:** - Principles, Electron transports processes, Ion-selective electrodes (ISE) and gas sensor, Oxidation-reduction (Redox) potentials, Biosensors, Anodic stripping Voltametry.  
**Molecular Biology Techniques:** - Outline of Genetic Manipulations, Enzymes and in genetic manipulation, Cloning procedures, Isolation of specific nucleic acid sequences – complementary DNA, Gene libraries, Colony hybridization, Nick translation, Oligo nucleotide probes, Expression of genes.

## Paper -VIII

**Code:-FS-718**

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

### **Analytical Chemistry and Technique**

- UNIT-I** Basic concepts in analytical methods qualitative and quantitative methods. Errors, Precision, and accuracy. Sampling techniques, processing the samples for analysis.
- UNIT-II** Volumetric- Acid Alkalimetry, oxidation reduction, Precipitation, Complex formation, reactions. Gravimetric, various methods and steps in Gravimetric Analysis, Electrometric, Potentiometric, Chromatographic methods
- UNIT-III** Extraction, Purification of analytes,
- Unit IV** Colorimetric, Spectrophotometric, Spectroscopic techniques

## **Paper- IX**

**Code:-FS-719**

**Credits:-2(1-0-2)**

### **Forensic Photography**

- UNIT-I**      **Photography:-** Basic principles and techniques of Black & White and colour photography, cameras and lenses,
- UNIT-II**      Exposing, development and printing, different kinds of developers and fixtures,
- UNIT- III**    Modern developments in photography, linkage of cameras and film negatives, digital photography, digital water marking and digital imaging, potogrammetry, videography / high speed videography, crime scene and laboratory photography.
- UNIT- IV**    **Practical Photography**  
Photography of objects- Close up, normal, telephoto and processing. Document and finger print photography. Photography in identification of docile and hostile human objects. Systematic photography of crime scene Road accidents, homicide, suicide cases, burglary cases etc.Finger print photography – Multicolor surface, on mirror, revenue stamp. Computerized face re-construction. Matching of facial photography with the skull by super imposition techniques.

### **Seminar-I**

**Code:-FS-720**

**Credits:-1(0-2-0)**

Seminar and Tutorials

## Semester-II

### Paper -X

Code:-FS-822

Credits:-4(3-0-2)

### Fingerprints and Impressions

- 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** **Chance fingerprints**, latent & visible fingerprints, plastic fingerprints, composition of sweat, development of latent fingerprints, conventional methods of development of fingerprints – fluorescent method, magnetic power method, fuming method, chemical method etc. digital imaging and enhancement, application of laser and other radiations to develop latent fingerprints, metal deposition method and development of latent print on skin.
- UNIT-III** **Taking of finger prints** from living and dead persons, preserving and lifting of fingerprints, photography of fingerprints, digital transmission, comparison of fingerprints, basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics, automatic fingerprint identification system.
- UNIT-IV** **Foot prints:** - Importance, gait pattern, casting of footprint in different medium, electrostatic lifting of latent footprints, taking of control sample. **Tyre marks** / prints and skid marks, taking of control samples. **Lip prints**, Natural, location, collection and evaluation. **Bite marks**, Forensic significance, photography, lifting and preservation of bite marks and evaluation. **Ear prints**, Forensic significance, location, collection and evaluation taking of control samples of footprint, lip print and ear print for comparison.
- UNIT-V** **Practicals** Taking plain and rolled inked fingerprints and identify the patterns. Performing the ridge tracing and ridge counting.. Identification of ridge characteristics. Comparison of the finger prints.. Lifting of fingerprints.

## Paper -XI

Code:-FS-823

Credits:-4(3-0-2)

### **Questioned Documents**

- 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, holographic 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, examination of seal impression and other mechanical impressions.
- 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.
- UNIT-IV Determination of age of documents by examination of signature:-** Paper, ink and writing / signatures etc. examination of computer print out, identification of dot-matrix, ink-jet and laser printers, electronic typewriter, credit cards, forensic stylistics, forensic linguistics, e-documents, digital signatures, an introduction to computer forensic opinion writing, reason for opinion.
- UNIT-V** Practicals Identification of handwriting – General characteristics, natural variations, fundamental divergences and individual characteristics. Detection of simulated, traced forgeries and disguised handwritings. Study of the handwriting of person suffering form illness and handwriting written on unusual surface.. Examination of additions, alterations and obliterations in the documents.. Examination of mechanical and chemical use of erasures on the documents. Examination of indented writing.. Identification of writing ink by TLC.. Examination of security documents. Examination of mechanical, electronic and digital typescripts and printed matter. Examination of sequence of intersecting strokes.

## Paper -XII

Code:-FS-824

Credits:-3(2-0-2)

### **Forensic Chemistry**

- 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, analysis of beverages: alcoholic and non-alcoholic, country made liquor, illicit liquor and medicinal preparations containing alcohol and drugs as constituents, 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-II Examination of petroleum products:-** Distillation and fractionation, various fractions and their commercial uses, standard methods of analysis of petroleum products for adulteration, Arson: chemistry of fire, investigation and evaluation of clue material, analysis of arson exhibits by instrumental methods: management of Arson cases, Analysis of trace evidence: cosmetics, dyes, Trap related evidence materials, paints, pigments, fibers, oils, fats, industrial dusts, chemical and plant material.
- UNIT-III 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-IV** Practical, analysis of organic and inorganic industrial products, chemical fertilizers, insecticides, Analysis of alcoholic liquor as per BIS specifications. Analysis of Explosive / explosion residues (Qualitative). Detection determination of Narcotic Drugs and Psychotropic substance e. Opiates, cannabis, Barbiturates, Benzodiazepines and Amphetamine spot colour tests, chromatographic methods. . Systematic extraction & identification of acidic & basic drugs from viscera.

## Paper -XIII

Code:-FS-825

Credits:-4(3-0-2)

### **Forensic Toxicology**

- 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 report finding studies, specific analysis plan / approach to toxicological examination of poisoning samples.
- 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.
- UNIT-III**      **Examination of metallic poisons**, volatile poisons, snake venom, insects bites, and poisons involving animal poisoning cases and their examination, interpretation of toxicological findings and preparation of report, limitations of methods and trouble shooting in toxicological examinations, disposal of analyzed samples, some interesting cases of common and specific poisons and their importance in view of the specific scientific approach in examinations.
- UNIT-IV**      **Practical** Examination volatile poisons, snake venom, insects bites, and poisons involving animal poisoning cases and their examination, 05. Detection of metallic poison (arsenic, bismuth, antimony & mercury) in viscera & foodstuff. Analysis of viscera for organochloro / organophosphorous pesticides by TLC. Identification of vegetable poisons. Identification of methanol mixed in ethanol. Examination of Petroleum such as Petrol, HSD, Kerosene as BIS specifications. Arson residue analysis. Analysis of phenolphthalein in bribe traps cases. Quantitative analysis of drugs by spectrophotometry.

## Paper -XIV

Code:-FS-826

Credits:-3(3-0-0)

### Forensic Medicine & Pharmacology

- UNIT-I**      **Forensic Medicine:-** Medico-legal of death – Asphyxia, starvation, electrocution and accidental and drowning cases, determination of time since death by various methods including histopathological methods, determination of age of living person
- UNIT-II**      **Injuries-** Ante-mortem and post mortem injuries, aging of injury, artificial injury wounds & wound ballistics
- UNIT-III**      **Forensic Pharmacological studies,** absorption, distribution, metabolism, pathway of drug metabolism, drug metabolism and drug toxicity, excretion of drug and poisons, detection of poisons on the basis of their metabolism studies, interpretation of analytical data and forming of opinions.
- UNIT-IV**      Abortion, Infanticide, Sexual offences

## **Paper -XV**

**Code:-FS-827**

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

### **Explosives**

- UNIT-I** Classification, composition and characteristics of explosives, pyrotechnics, IEDs, etc
- UNIT-II** Explosion process and affects, types of hazard, effect of blast wave on structures, human etc. specific approach to scene of explosion, post-blast residue collection,
- 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, Explosives Act.

## **Paper -XVI**

**Code:-FS-828**

**Credits:-2(1-0-2)**

### **Cyber Forensic**

- UNIT-I** 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-II** **Search and Seizures of Evidence:-** Investigation of cyber crimes and tools for analysis.
- UNIT-III** Imaging of hard disc, restoration of deleted files, password cracking and E-mail tracking
- UNIT-IV** **Computer aided Analysis:-** Introduction, Compute organization, Hardware, Circuits for interfacing computers to Instruments, Computer Organization – software, Data representation, The Automated Laboratory

## Paper -XVII

Code:-FS-829

Credits:-2(2-0-0)

### Quality Management

- UNIT-I** (ISO/IEC 17025):- General requirements for the competence of testing and calibration laboratories,
- UNIT-II** Introduction, Scope, Management requirements: organization, Quality System, Document Control, Review of requests, Tenders and contracts, Subcontracting of tests and calibrations, Purchasing services and supplies,
- UNIT-III** Service to the clients, Complaints, Corrective and preventing actions, Control of records, Internal Audits; Technical requirements: General, Personnel, Accommodation and environmental conditions,
- UNIT-IV** 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-V** **Laboratory Management:-** Laboratory information management system, validation and safety equipments.

## **Paper -XVIII**

**Code:-LNG 304**

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

### **Professional Communication and Technical Writing**

#### **Unit I -Language:**

- a. Word enrichment (Antonyms, Synonyms, Homonyms, Homophones, Acronyms)
- b. Tenses
- c. Concord (Subject, Verb Agreement)
- d. Modifiers (adjectives, Adverbs, Participles)
- e. Prepositions (usage)
- f. Inflection (Noun, Verb)
- g. Determiners (Generals, Specific)
- h. Voice

#### **Unit II- Communication:**

- a. Role of Body language in communication
- b. Self Introduction
- c. Conversation in different situations
- d. Group Discussions
- e. Role Plays
- f. Interviews
- g. To cater different types of audience

#### **Unit III- Technical writing:**

- a. Resume
- b. Curriculum vitae
- c. Letters
- d. Memos
- e. Report
- f. Proposals
- g. Usage of Graphics
- h. Different administrative documents (Notices, Circulars, Memos, Agenda, Minutes)

#### **Unit IV- Speech:**

- a. Accent
- b. Intonation
- c. Different types of Speeches
- d. Delivering of different types of speeches.

# **Seminar-II**

**Code:-FS-830**

**Credits:-1(0-2-0)**

**(Seminar and Tutorials)**

## Semester-III

### Paper -XVIII

Code:-FS-832

Credits:-4(3-0-2)

### Forensic Physics

- UNIT-I**      **Glass:** - Types of glass and their composition, forensic examination of glass fractures under different conditions, determination of direction of impact cone- fracture, rib marks hackle marks, backward fragmentation, colour and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis, interpretation of glass evidence.  
**Soil:** Formation and types of soil, composition and colour of soil, piratical size distribution, turbidity test, microscopic examination density gradient analysis, ignition loss, differential thermal analysis, elemental analysis, interpretation of solid evidence, discussion on important case studies of glass & soil.
- UNIT-II**      **Paint:** - Types and their composition, macroscopic & microscopic studies, pigment distribution micro-chemical analysis solubility test, pyrolysis chromatographic techniques, TLC, Colorimetry, IR spectroscopy & X-ray diffraction elemental analysis, interpretation of paint evidence.  
**Miscellaneous clue materials:** - Physical, chemical and instrumental methods of examination of strings / ropes, fiber threads & fabrics, wires / cables, seals, counterfeit coins physical matches of broken objects.
- UNIT-III**      **Building material:** - Types of cement and their composition, determination of adulterants by physical, chemical and instrumental methods, examination of brick, analysis of Bitumen & road materials, analysis of cement mortar and cement concrete & stones, forensic examination of electrical appliances installations.
- UNIT-IV**      **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 and walls etc.**Restoration of erased / obliterated marks:-** method of making cast, punch, engrave, methods of obliteration, method of restoration etching (etching for different metals), magnetic, electrolytic etc., recording of restored marks restoration of marks on wood, leather, polymer etc.  
Density gradient analysis of soil samples.. Comparison of identity of small glass pieces by flotation method.. Restoration of erased identification marks.. Determination of refractive index of glass and liquids.. Comparison of broken Glass bangles.. Physical matching of broken pieces of different object.. Comparison of strings / thread / ropes.. Physical / Chemical analysis of paint samples.. Comparison of Tool marks. Physical analysis of Cement samples.. Imaging of hard disc, restoration of deleted files, password cracking and e-mail tracking

## Paper -XIX

Code:-FS-833

Credits:-4(2-0-4)

### Forensic Biology

- UNIT-I**     **Fundamentals of Biology:-** Scope of Forensic Biology – structure and function of cell, basic concept of anatomy and physiology of digestive, respiratory, skeleton, nervous, excretory and reproductive system etc.  
**Body Fluids / Stains and Tissues:-** Introduction of various types of body fluids & tissues – Morphology, histology, and functions, identification and examination of blood stains – physical, biochemical and spectroscopy methods, identification of seminal stains – physical fluorescence, biochemical and microscopic examination, Morphological structure of spermatozoa of lochial and menstrual stains by microscopic, biochemical and Electrophoretic method, identification and examination of other body fluids / stains-vaginal, saliva, urine, pus, faces, vomit, milk, sweat and tears etc.
- UNIT-II**     **Hair and Fibers:-** Morphology and biochemistry of human and animal hair, and its microscopic examination, determination of origin race, sex, site, types of fiber – forensic aspect of fiber examination- fluorescent, optical properties, refractive index, birefringence, dye analysis etc. identification and comparison of man-made and natural fiber.
- UNIT-III**     **Morphological & Microscopic Examination of hair and fibers.** Microscopic and chemical comparison of paper pulp. Examination of bloodstains: Physical and chemical tests; spectroscopic examination. Menstrual blood and its examination by microscopic and Electrophoretic method Identification of diatoms, Identification of pollen grains and starch granules. Determination of age from skull, teeth, sex from skull pelvic girdle & crystal tests, chemical, biochemical, microscopical and electro-immuno-diffusion test. Examination of saliva and its stains: microscopical and chemical tests. Fecal stains: chemical and microscopical examination, testing of urine and sweat.

## Paper -XX

Code:-FS-834

Credits:-4(2-0-4)

### Forensic Serology

- UNIT-I Serology & Immunology:-** Structure and function of carbohydrates, fats and proteins, serum proteins, cell proteins, Hemoglobin and its variants, Haptoglobins - various types, polymorphic enzymes and their forensic significance.
- UNIT-II Basic concept of Genetics –** Mendelian genetics, Genotypes, Phenotypes, multiple alleles, genetic variants, biochemical genetics, gene structure frequency determination, gene mapping and gene expression, genetic markers their forensic significance.
- UNIT-III Immunology:-** Immune system, immune response, innate acquired immune antigens, haptenes and adjuvant, 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-IV 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, reactivity among closely related species.
- UNIT-V 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-VI**
- Determination of species of origin of blood, semen and saliva. Grouping of blood stains by absorption elution, absorption inhibition and mixed agglutination techniques. Determination of secretor status in saliva by inhibition techniques. Experiments on Electrophoresis of red cell isozymes viz GLO, ESD, EAP and AK. DNA – Isolation from blood – purification and quantifications.. Preparation of Lectins and testing their activities against Body fluids & Tissues.

## Paper – XXI

Code:-FS-835

Credits:-3(2-0-2)

### DNA Profiling

- UNIT-I**      **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-II**      Evaluation of result, Frequency calculations, Interpretation, Allele frequency determination, Match probability – Database, Quality control, Certification and Accreditation.
- UNIT-III**     **Forensic Significance of DNA Profiling:-** Application in disputed paternity cases, child swapping, Missing person's identity – immigration, veterinary & wild life and Agriculture cases,
- UNIT-IV**      Legal perspective – legal standard for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad. New & future technologies – DNA chips, SNPS, DNA cloning, limitations of DNA profiling.
- UNIT-V.**      DNA – Isolation from blood – purification and quantifications. Preparation of Lectins and testing their activities against Body fluids & Tissues.

**Paper – XXII**

**Code:-FS-836**

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

**Forensic Anthropology & Forensic Odontology**

- UNIT-I      Forensic Anthropology:-** Identification of bones- morphological anatomical and chemical characteristics, Determination of age, sex, race, stature etc.,
- UNIT-II**      Forensic anthropometry / osteometry, determination of personal identity, superimposition technique – video image analysis, facial reconstruction, Identification of burnt bones ,recovery and identification of skeletal remains in accident crimes and mass disasters.
- UNIT-III**      **Forensic Odontology:-** Dentition pattern, types and structure to teeth, age determination – identity of person, role in mass disaster, disease of teeth and their significance in personal identification.

## **Paper – XXIII**

**Code:-FS-837**

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

### **Forensic Botany**

#### **UNIT-I**

**Forensic Botany:-** Various types of wood, timber varieties, seeds and leaves their identification and matching. Diatoms – Types morphology, methods of isolation from different tissue and forensic importance of planktons- especially diatom, forensic significance drowning

#### **UNIT-II**

Case study and identification of pollen grains, identification of starch grains, powder and stains of species etc. paper and paper pulp identification

#### **UNIT-III**

Microscopic and biochemical examination of pulp material etc. isolation, classification and identification of microbial organism.

## **Paper -XXIV**

**Code:-FS-838**

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

### **Speaker identification and tape authentication**

- UNIT-I** Speaker identification and tape authentication: Voice production theory vocal anatomy, speech signal processing & pattern recognition basic factor of sound in speech acoustic characteristics of speech signal,
- UNIT-II** Fourier analysis, frequency & time domain representation of speech signal, analogue to digital signal and conversion, fast Fourier transform, quantization, digitization and speech enhancement, analysis of audio & video signal for authenticity,
- UNIT-III** Introduction to the technique of pattern recognition and comparison.

## **Paper -XXV**

**Code:-FS-839**

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

### **Forensic Entomology**

**UNIT-I** General Entomology significance of terrestrial and aquatic insects in forensic investigations and their role in crime detection,

**UNIT-I I** Insect's succession and its relationship to determine time since. Impact of ecological factors on insect's developments.

## **Seminar III**

**Code:-FS-840**

**Credits:-1(0-2-0)**

**( Seminar and Tutorials)**

# Semester-IV

## Paper -XXVI

Code:-FS-841

Credits:-2(2-0-0)

### **Evidence Evaluation and Report Writing**

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

## **Paper -XXVII**

Code:-FS-842

Credits:-2(2-0-0)

### **Research Methodology in Forensic Science**

- Unit-I-** **what is research?** Reflection Science and Research, Reflection, Science, Research, Basic and Applied, Research, Essential Steps in Research.  
**LITERATURE COLLECTION**  
Need for review of literature, Review process and bibliography, Research Reading, Discriminative Reading, Consulting Source Material, Working Bibliography, Index Cards and Reference Cards.
- Unit-II-** **LITERATURE CITATION**  
Introduction, Different Systems of Citing References, Name-year System (s) Mentioned in the Sentence, Author(s) Name(s) not Mentioned in the Sentence, More than one Source/More than one Work of the, Same Author in the same Year and in Different Years, To Cite a Work Cited in Another Work – “use of “Cited in” Use of “&” in the Place of “and”, Name-year System-List of References, Placement of Reference Section, Name-years System- Formal of the Reference Section, Alphabetical and Chronological Arrangement of, Entries in the Reference Section, Citation-Sequence System, Citing References in the Text, Format of the Reference Section, Alphabet-Number System, Reference Section, Alphabet-Number System, Reference-without Article Title, Journal Abbreviations.
- Unit III -** **RESEARCH REPORT**  
Introduction, Components of a Research report, Title, Authors and addresses, Abstract, Summary, Synopsis, key words, Introduction, Materials and Methods, Results, Discussion, Acknowledgements, General Introduction and General Discussion, Summary and Conclusions, Appendixes, References, Plagiarism, Need for Table, Use of “tabular” form, Introduction and Placement of a Table, Format of a Table, Numbering of Tables, Title of the Table, Stub, Box Headings, Units of Measurements, Footnotes.

**Unit IV**      **RESEARCH REPORT-FIGURES**

Introduction, When to use Figures, Introduction and placement of Figures, Numbering of Figures, Caption of Figure, Preparation of Photographs and Microphotographs, Line Diagrams.

**Unit V** -      **RESEARCH REPORT-FORMATTING AND TYPING**

Introduction, Paper, Margins, Paragraphs Indentions, Widow and Orphan Lines, Spacing, Alignment, Hyphenation, Fonts, Pagination, Format of a Thesis, Title Page, Declaration Page, Acknowledgement Page, Table of Contents, Abstract Page, List of Tables, List of Figures, List of Abbreviations and Symbols, Chapters, Quotations, Table, Summary, Appendixes, References, Figures.

**Unit VI**      **EXPERIMENTAL DESIGNS**

Introduction, Observation, Hypothesis and Null-hypothesis, Basic Principles of Experiments, Experiment Unit and Sampling Unit, Experimental Error, Discrimination, Replication, Generalization, Controls, Randomization, Measurement, A few Common Experimental Designs

**Paper -XXVIII**

**Code:-FS-843**

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

**Forensic Psychiatry and Criminal Behavior**

**Unit I**      **Definition, Classification :** Psychosomatic subtle changes, Brain activity, Collection of evidence, case history studies, observation, interviews , interrogation and experimental approach.

**Unit II**      **Psychology in Interrogation:** Psycho-Physiological detection of deceptions, scientific, basis, methods, operational environment, application, utility, limitations and legal status.

**Unit III**      **Insanity:** Definition, Classification, Types, Signs and Symptoms, Legal Status, Differences between true and Feigned Insanity.

**Paper -XXIX**

**Code:-FS-844**

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

**Recent advances in Forensic Investigation**

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

**Three month Dissertation/Project work/Case study/Specialized Training**

**Code:-FS-945**

**Credits:-10(0-0-20)**