

M.Sc. Forensic Science
OUTLINE OF COURSE STRUCTURE

I Semester

Code	Credits	Title
FS-711	3(2-0-2)	General Forensic- Crime & Investigative Technique
FS-712	3(3-0-0)	Law, Evidence Evaluation & Report writing
FS-713	4(3-0-2)	Forensic Ballistics & Photography
FS-714	4(3-0-2)	Instrumental Techniques in Forensic Science
FS-715	4(3-0-2)	Biochemical & Analytical Techniques
FS-716	3(2-0-2)	Forensic Botany & Entomology
FS-717	1(0-2-0)	Seminar I

II Semester

Code	Credits	Title
FS-821	4(3-0-2)	Fingerprints & Impressions
FS-822	4(3-0-2)	Questioned Documents
FS-823	4(3-0-2)	Forensic Chemistry & Explosive
FS-824	4(3-0-2)	Forensic Medicine & Toxicology
FS-825	4(3-0-2)	Cyber Forensic & Quality Management
FS-826	2(2-0-0)	Speaker Identification & Tape Authentication
FS-827	1(0-2-0)	Seminar II

III Semester

Code	Credits	Title
FS-831	4(3-0-2)	Forensic Physics
FS-832	4(2-0-4)	Forensic Biology
FS-833	4(3-0-2)	Forensic Serology & DNA profiling
FS-834	2(2-0-0)	Forensic Anthropology & Odontology
FS-835	3(3-0-0)	Forensic Psychiatry and Criminal Behaviour
FS-836	2(2-0-0)	Research Methodology in Forensic Science
FS-837	1(0-2-0)	Seminar III
FS-838	8(0-0-16)	Dissertation/Project Work/ Case Studies/Specialized Training

IV Semester

Code	Credits	Title
FS-838	22(0-0-44)	Dissertation/Project Work/ Case Studies/Specialized Training

Semester I

Code:-FS-711

Credits:-3(2-0-2)

General Forensic – Crime & Investigative Techniques

- UNIT-I** **Forensic Science – Introduction and definition,** Basic Principles & Significance, History & Development of Forensic Science, Organizational Structure of Forensic Science laboratory.
- UNIT-II** **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, , 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** **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. **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-V** **Variance-** Coefficient of Variation, Moment, Skewness and Kurtosis, binomial distribution, normal distribution, hyper geometric distribution, correlated measurements. Discriminating power- Introduction 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.

Code:-FS-712

Credits:-3(3-0-0)

Law, Evidence Evaluation & Report Writing

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

Forensic 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 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 Ammunition:** Introduction, 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 & Terminal 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. 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, Ricochet and wound ballistics, 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- IV 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, 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.

UNIT-V Introduction definition, basic principles and techniques of photography different type of photography basic concept of cameras and lenses, different type of equipments used for photography. Developmental process exposing, development and printing, different kinds of developers and fixtures, enlargers, different type of enlarger, basic principal and use of enlargers in forensic photography

UNIT- VI Black and white photography, colour photography U.V photography, I.R photography document photography , fingerprint photography, Systematic photography of crime scene close-up photography, zoom photography, use of different type of lenses in forensic photography Modern developments in photography, linkage of cameras and film negatives, digital photography, digital imaging, videography, high speed videography, crime scene and laboratory photography.

Instrumental Techniques in Forensic Science

- UNIT-I Basic Concepts of Spectroscopy:-** Introduction to 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 γ -rays and β -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.
Fluorescence and phosphorescence Spectrophotometry: - Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods.
Infrared & Atomic Absorption Spectrophotometry: - Dispersive and Fourier Transform Spectrophotometry, sample handling, quantitative analysis and interpretation of IR spectra. Instrumentation and techniques, interference in AAS, background correction methods, and quantitative analysis.
- UNIT-III Atomic emission spectrometry: -** Instrumentation and techniques are / spark emission, ICP-AES, comparison of ICP vs AAS methods, quantitative analysis, and applications.
Raman spectroscopy:- Instrumentation, sample handling and illumination, structural analysis, polarization measurements and Dispersive & FT analysis.
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).Thermal Analysis Methods, Basic principles and theory, differential scanning colorimetry and differential analysis, thermogravimetry.

Code:-FS-715

Credits:-4(3-0-2)

Biochemical & Analytical 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, HPLC, HPTLC, Capillary chromatography, Interfacing GC with IR spectrometry.
Electrophoretic Technique: - General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis,, Sodium dodecyl-sulphate (SDS) Polyacrylamide gel electrophoresis,, Iso-electric focusing (IEF), Iso-electrophoresis, Preparative electrophoresis, Horizontal and Vertical electrophoresis.
- UNIT-III** **Mass Spectrometry:**-Introduction, Principle, Instrumentation, Data handling, Correlation of mass spectra and molecular structure, Fourier transform mass spectrometry, Introduction to Tandem mass spectrometry, Inductively coupled plasma MS (ICP-MS), Ion Microprobe Mass Analyzer (IMMA), HR GCMS, LCMS, Secondary Mass Spectroscopy, Laser Mass spectrometry, FAB-LCMS, ESI-MS
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.
- UNIT-IV** **Analytical Techniques:** - Basic concepts in analytical methods qualitative and quantitative methods Volumetric gravimetric electrometric, potentiometric, chromatographic methods Calorimetric, spectrophotometric, spectroscopic techniques

Code:-FS-716

Credits:-3(2-0-2)

Forensic Botany & Entomology

UNIT-I

Forensic Botany:- Introduction, Scope and Significance, Various types of evidences related to forensic botany like wood, timber varieties, seeds and leaves, their examination, identification, analysis and comparison. Source Identification of biological & botanical evidences, documentation of biological & botanical evidences. Evidence recognition and analysis.

UNIT II-

Diatoms: Introduction, Classification, morphology, methods of isolation from water and different types of tissue, its examination, identification, analysis and comparison. Forensic importance of diatom, in drowning cases. Case study. Introduction to Pollen grains their identification, scope and significance in relation with criminal identification, Examination and identification of starch grains and powder.

UNIT-III

Wild Life Forensic:- Introduction and importance of wild life, protected and endangered species of animals and plants, wild life species – Identification and examination of physical evidence by conventional and modern methods, Identification of pug marks of various animals, census of wild life population. Wildlife / environment protection act.

UNIT-IV

Forensic Entomology Introduction, Scope and significance of terrestrial and aquatic insects in forensic investigations and their role in crime detection. Insect's succession and its relationship to determine time since. Impact of ecological factors on insect's developments.

UNIT-V

Identification & Ecology of Forensically Important flies & beetles
Life stages of fly & beetles, the influence of the environment on specific insect species. Succession of insect species on the corpse and its role in post mortem estimation. Statement of witness, council for registration of forensic practitioners, communicating entomological facts in court, physical evidences. Its continuity & integrity.

Semester II

Code:-FS-821

Credits:-4(3-0-2)

Fingerprints and Impressions

- UNIT-I** Introduction , 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, ,ridge tracing and ridge counting, 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.

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.

Code:-FS-823

Credits:-4(3-0-2)

Forensic Chemistry & Explosive

- UNIT-I** **Forensic Chemistry:-** Introduction, definition scope and significance types of cases / exhibits, preliminary screening, presumptive test, examination procedures involving standard methods and instrumental techniques, analysis **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.
- 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 .Quantitative and qualitative analysis of chemical fertilizers, insecticides, metallic and non metallic products, consumer items such as gold, silver, tobacco, tea, sugar, salts, acids, and alkalis etc.
- UNIT-III** **Explosives:** Introduction, general definition, classification, scope, significance different type of explosive, explosive composition, different characteristics of explosives. Dynamite ,its classification and examination, water gel explosive, blasting agents, binary explosive, sheet explosive, plastic explosive, boosters, blasting cap, home made bombs, explosive train, different type of imitating devices, detonators, its different type, different type of bomb .
- UNIT-IV** Explosion phenomena, its process and effects, types of hazard, effect of blast wave on structures, human etc. specific approach to scene of explosion, post-blast residue collection, preservation, packing and forwarding. Reconstruction of sequence of events, evaluation and assessment of scene of explosion,
- UNIT-V** Systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques and interpretation of results, pyrotechnics, IEDs, etc

Code:-FS-824

Credits:-4(3-0-2)

Forensic Medicine & 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** **Forensic Medicine:-** Introduction, General Definition, Scope and Significance, Medico-legal aspects of Death, Asphyxia, Starvation, Electrocutation and Accidental and Drowning cases, Determination of time since death by various methods including histopathological methods, determination of age of living person.
Injuries-ante-mortem injuries, aging of injury, artificial injury wounds.
- UNIT-V** **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. Abortion, Infanticide, Sexual offences

Code:-FS-825

Credits:-4(3-0-2)

Cyber Forensic & Quality Management

- UNIT-I Fundamentals & Concepts:** Fundamentals of computers, hardware and accessories, operating system, software. Introduction to network, LAN, WAN and MAN, and Internet
Cyber Crimes- Definition, motives, and classification of cyber crimes. Modus operandi of cyber crime, types of cyber crimes viz. hacking, virus, obscenity pornography, programme manipulation, software piracy, intellectual property and computer security etc.
- UNIT II Emergence of Computer Crime:** classification of computer crimes, computer virus, different types of virus computer worm, Trojan horse, trap door, super zapping, logic bombs, salami logic, characteristics of computer crime and computer criminals. Common targets of computer criminals.
- UNIT-III Search and Seizures of Evidence:** - Cyber Forensic, Cardinal Rules of Cyber Forensic Investigation of cyber crimes and tools for analysis, Imaging of hard disc, restoration of deleted files, password cracking and E-mail tracking, Encryption and Decryption methods.
- UNIT-IV Quality Management:** Introduction, Definition, Scope and Significance of ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories, Introduction, Scope, Management requirements: organization, Quality System, Document Control, Review of requests, Tenders and contracts, Subcontracting of tests and calibrations, Purchasing services and supplies, Service to the clients, Complaints, Corrective and preventing actions, Control of records, Internal Audits; Technical requirements: General, Personnel, Accommodation and environmental conditions, 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, Laboratory Hazards and safety equipments and Personal protective gears.

Code:-FS-826

Credits:-2(2-0-0)

Speaker Identification and Tape Authentication

- UNIT-I** Introduction ,definition ,scope, significance, , human vocal tract, basic anatomy, human vocal apparatus, vocal cords, supra-laryngeal vocal tract, oral cavity, pharyngeal cavity, nasal cavity, alveolar ridge, epiglottis, glottis soft and hard palate pharynx, larynx,, trachea, bronchi, lungs etc
- UNIT-II** Anatomy of human voice production , Voice production theory ,different type of voice production theory, vocal fold and air flow oscillation graph analysis, mechanism of vocal folds tissue during speech production, Speech signals, speech signal processing & pattern recognition, basic factor of sound in speech, acoustic characteristics of speech, speech signals analysis, voice and voicing ,tone etc
- UNIT-III** Forensic phonetic parameters, acoustic and auditory parameters, traditional and automatic parameters, linguistic and individual variation parameters, quantitative and qualitative parameters, discrete and continuous parameters
- UNIT-IV** Fourier analysis of sound wave, 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-V** Introduction to the technique of pattern recognition and comparison, speaker recognition procedure, method of voice identification, listener method of speaker identification, Instrumental/sound spectrographic method of speaker identification, both classical and computerized approach, analysis of sound spectrogram, sound spectrograph ,its working and principle,

Semester III

Code:-FS-831

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.
- UNIT-II** **Soil:** Formation and types of soil, composition and colour of soil, particle size distribution, turbidity test, microscopic examination density gradient analysis, ignition test, differential thermal analysis, elemental analysis, interpretation of solid evidence, discussion on important case studies of glass & soil.
- UNIT-III** **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.
- UNIT-IV** **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-V** **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.

Code:-FS-832

Credits:-4(2-0-4)

Forensic Biology

- UNIT-I Forensic Biology:** Introduction, General definition, Scope and Significance
Sub Disciplines of Forensic biology, Forensic pathology, forensic Anthropology, Forensic Entomology, Forensic Odontology, History & development of biology, antigen polymorphism, protein polymorphism, DNA polymorphism.
- UNIT-II Identification of semen, saliva and other biological fluids.**
Biological characteristics- Spermatozoa, acid phosphatase, prostate specific antigen, seminal vesicle specific antigen (SVSA), analytical techniques for identification of Semen- presumptive & confirmatory, identification of Saliva, Biological Characteristic of Saliva, other biological fluids and their identification (urine, fecal matter etc).
- UNIT-III Hair & Fibers-**
Morphology and biochemistry of human and animal hair, and its microscopic examination, determination of origin race, sex, site, type 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-IV Mendelian Genetics & protein profiling.**
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. Methods- matrices supporting protein electrophoresis separation by molecular weight, separation by molecular weight, isoelectric point, erythrocytes protein polymorphism, erythrocytes isoenzymes, hemoglobin, serum protein profiling.

Code:-FS-833

Credits:-4(3-0-2)

Forensic Serology & DNA Profiling

- 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.
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-II Determination of Origin of Species:-** Determination of human and animal origin from body fluids / stains viz. blood, menstrual blood, semen, saliva, sweat, pus, vomit, etc., through immuno-diffusion and immuno-electrophoresis, reactivity among closely related species. 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 Human Genetics & DNA:-** Human genetics – Heredity, Alleles, Mutations & population Genetic, History and Molecular Biology of DNA, Variations, Polymorphism DNA system – RELP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y-STR, Mitochondrial DNA,
- UNIT-IV DNA Profiling –** Isolation from blood/Tissues – purification and quantifications. Preparation of Lectins and testing their activities against Body fluids & Tissues. Evaluation of result, Frequency calculations, Interpretation, Allele frequency determination, Match probability – Database, Quality control, Certification and Accreditation.
- UNIT-V Forensic Significance of DNA Profiling & Legal Perspective:-** Application in disputed paternity cases, child swapping, Missing person's identity – immigration, veterinary & wild life and Agriculture cases, Legal perspective and admissibility of DNA – 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.

Code:-FS-834

Credits:-2(2-0-0)

Forensic Anthropology & Odontology

- UNIT-I Forensic Anthropology:** - Introduction, General Definition, Scope and Significance, Anatomy and physiology of major bones like pelvis, limb bones, skull, clavicle and sternum.
- UNIT II Determination of AGE, Race, Sex and Stature from skeletal remains**
Identification of sex, age, race and stature through bones, Skull, Pelvis, morphological anatomical and chemical characteristics, Personal identification through bodily features.
- UNIT-III 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-IV Forensic Odontology:-** Introduction, General Definition, Scope and Significance 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.
- UNIT-V Bite Marks:** Introduction, Scope and Forensic Significance, collection and preservation of bite marks, examination, Identification and comparison and its medico legal importance

Code:-FS-835

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.

Code:-FS-836

Credits:-2(2-0-0)

Research Methodology in Forensic Science

- UNIT-I-** Research definition introduction 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) 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.
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 V** **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.

Code:-FS-838

Semester IV

Credits:-22(0-0-44)

Six month Dissertation/Project work Case study/Specialized Training