## SCHEME OF EXAMINATION- CBCS PATTERN

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SEMESTER I

GENERAL FORENSIC SCIENCE

UNIT I: Introduction to Forensic Science  12 Hours

Forensic Science: Definition, history and development - Scope and need of forensic science in criminal justice system- Development of forensic science in India- Locard’s principle of exchange- Tools and techniques used in forensic science and various disciplines in forensic science- Organization setup of Forensic Science Laboratory: Structure and function of State, Regional and Central Forensic Science Laboratories. Role of Mobile Forensic Science Laboratory in crime scene investigation.

UNIT II: Forensic Organizations  12 Hours


UNIT III: Forensic Science and Criminal Justice System  12 Hours

Criminal Justice System: Law Enforcement Agency, Prosecution & Judicial Organization, Correctional Institutions- Introduction to crime scene investigation, definition and causation of Crime, Modus Operandi and its role in investigation; Crime scene - types and characteristics- Crime scene management: information management, manpower management, technology management, logistics management, protection, documentation, reconstruction, legal consideration at the crime scene.

UNIT IV: Physical Evidences and its significance  12 Hours

Physical Evidence: definition, types, significance, collection, preservation, packing and forwarding of different evidence to the forensic laboratory- Bloodstain Pattern Analysis: terminology, Blood physics, Spatter patterns, Motion and directionality, point of origin and point of convergence, preservation of blood evidence, procedures and precautions.
UNIT V: Forensic Science and Law 12 Hours


REFERENCE BOOKS

- Criminalistics- The Foundation of Forensic Science, Fischer Berry, Tilstone William, Elsevier Publication, UK.
- Crime Scene Investigation, Dutelle, Aric W, Jones and Bartlette Learning, 2014.
- Nanda, B.B. and Tewari, R.K; Forensic Science in India- A vision for the twenty first century, Select Publisher, New Delhi, 2001.
- David L. Shapiro; Forensic Psychology Assessment and Investigative Approach, Allyn and Bacon Publisher, 1991.
- Mario Deva RGAS; the Total Quality Management, NCC Blackwell Pub., 1995.
INTRODUCTION TO PSYCHOLOGY

UNIT I: Understanding Psychology 12 Hours

Psychology: definition, psychology as a discipline, psychology as science and social science, understanding mind and behavior- Evolution of psychology: philosophical and biological origin- Schools of psychology: Structuralism, Functionalism, Behaviorism, Psycho-dynamic and Gestalt psychology- Different branches of psychology: biological psychology, cognitive psychology, social psychology, developmental psychology, clinical psychology, counseling psychology, educational/school psychology, industrial/ organizational psychology, forensic psychology, military psychology and sports psychology- Scope and goals of psychology.

UNIT II: Physiological Psychology 12 Hours


UNIT III: Sensation and Perception 12 Hours


UNIT IV: Altered State of Consciousness 12 Hours

UNIT V: Human Personality

12 Hours

Motivation: model of motivation-need, drive, response and goal- Primary and secondary motives- Learned motives: affiliation, achievement and power motives- Maslow’s theory of hierarchical motives- Human Personality and Assessment of Personality, Personality- categorizing by types, describing by traits. Freud’s Psychoanalytical theory– levels of consciousness, structure of personality-id, ego & superego, psychosexual stages of development and defence mechanisms.

REFERENCE BOOKS

GENERAL CHEMISTRY

UNIT I: Organic chemistry 12 Hours

Basic concepts in organic chemistry- Bond cleavage: homolytic and heterolytic- Types of reagents – electrophilic and nucleophilic reagents- Reactive intermediates - generation and relative stabilities of carbocation, carbanion, carbon free radicals and carbenes – explanation for stability and reactivity based on inductive, resonance and hyper conjugation effects- Types of reactions - addition, substitution and elimination- Concept of isomerism - structural isomerism, stereo isomerism - geometrical and optical isomerism- Aliphatic Hydrocarbons: Alkanes, cyclo - alkanes, alkenes and alkynes- Aromatic compounds: Stability and general features.

UNIT II Stereochemistry 12 Hours


UNIT III Bio molecules 12 Hours


UNIT IV: Organo-metallic compounds 12 Hours

Organo-metallic compounds: Definition and Classification with appropriate examples based on nature of metalcarbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and
properties of mononuclear and polynuclear carboxyls of 3d metals. p - acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).-A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na+, K+ and Mg2+ ions: Na/K pump; Role of Mg2+ ions in energy production and chlorophyll. Role of Ca2+ in blood clotting, stabilization of protein structures and structural role (bones).

UNIT V: Introduction to analytical techniques12 Hours

Errors: Classification, minimization of determinate errors, accuracy and precision.- Significant figures and their computations. -Equivalent weights of acids, bases, salts, oxidising and reducing agents. Methods of expressing concentration of solutions in terms of Normality and Molarity. Numerical problems.-Solvent extraction: Distribution law, Determination of distribution ratio - Batch extraction, continuous extraction, discontinuous extraction, counter current extraction.

REFERENCE BOOKS

SEMESTER II

FORENSIC PSYCHOLOGY

UNIT I: Introduction to Forensic Psychology 12 Hours

Forensic Psychology: definition and sub-specializations of forensic psychology- History of Forensic Psychology, Ethical Issues in forensic psychology, Relationship between psychology and law and Relationship of forensic psychology with criminology and criminal psychology- Scope and future of forensic psychology- Mac Naughten rule- Insanity in Indian penal code (IPC 84) : Legal insanity and medical insanity.

UNIT II: Normality and Abnormality 12 Hours


UNIT III: Psychological Disorder 12 Hours

**Mood disorders:** Mania and depression, Unipolar and bipolar disorders- Causal factors in mood disorders: Biological, Psychological, and Socio-cultural factors- **Anxiety disorders**- Phobic disorders, Panic disorder and agoraphobia, Generalized Anxiety Disorder and Obsessive-Compulsive Disorder- **Personality disorders:** Clinical features of personality disorders- Types ofPersonality disorders- Paranoid, Schizoid, Schizo-typal, Histrionic, Narcissistic, Antisocial, Borderline, Avoidant, Dependent, Obsessive-compulsive, Passive-aggressive and Depressive personality disorder- Causal factors in personality disorders: Biological, Psychological and Socio-cultural- **Schizophrenia and delusional disorder,** The clinical picture in schizophrenia, Subtypes of schizophrenia- Paranoid, Catatonic, Disorganized, Residual and undifferentiated type- Causal factors in schizophrenia- Biological, Psychological, and Socio-cultural factors- The clinical picture in delusional disorder, Causal factors in delusional disorder.
UNIT IV: Psychopathy and Sociopathy  


UNIT V: Criminal Profiling  


REFERENCE BOOKS

INTRODUCTION TO PSYCHOLOGY & FORENSIC PSYCHOLOGY – PRACTICAL

1. Internal –External Locus of control
2. Life Satisfaction Scale
3. Sodhi’s Attitude Scale
4. Self -Concept Questionnaire
5. General Health Questionnaire
6. Guidance Need Inventory
7. Parenting Scale
8. Immediate Memory Span
9. Paired Associate Learning
10. Family Environment scale.
11. Adolescent Problem Checklist.
12. Type A/B Behavioural Pattern Scale.
13. Beck’s Depression Inventory.
15. Buss-Perry Aggression Questionnaire.
16. Barrat Impulsiveness Scale.
17. Suicidal Ideation Scale.
18. Eysenck Personality Questionnaire (EPQ).
20. Demonstration of hypnosis.
FORENSIC CHEMISTRY

UNIT I: BASICS OF CHEMISTRY 12 Hours


UNIT II: PETROLEUM PRODUCTS 12 Hours

Petroleum products: types, by products, uses and importance.-Examination of petroleum products: distillation and fractionation-Commercial uses of petroleum. Standard methods of analysis of petroleum products for adulteration.-Scope, importance and forensic importance of analysis for the adulterants in petroleum products.

UNIT III: ARSON AND FIRE INVESTIGATION 12 Hours

Chemistry of fire, pyrolysis, combustion, fire tetrahedron, flash point and ignition temperature.-Fire categories, burn patterns, finding the igniter.-Investigation of arson cases, functions of a fire investigator, collection preservation and packing of fire evidences.-Lab analysis of the evidence, instrumental techniques used.

UNIT IV: EXPLOSIVES 12 Hours

Introduction, classification, composition and characteristics.-Synthesis and actions of explosives (TNT, PETN and RDX, IED). Explosion process and affect types of explosions, post blast residue collection. Examination of explosion residues in laboratory (chemical and instrumental).

UNIT V: QUANTITATIVE AND QUALITATIVE ANALYSIS 12 Hours

REFERENCE BOOKS

- Advanced inorganic chemistry; B R Puri, L R Sharma and Shoban Lal Nagin; S Chand and Sons 31st edition.
- Mute witness: trace evidence analysis; Houck M M; Academic Press (2001)
- Practical: Fire and arson investigation; redsickerr D R & Cannor J J.
- Criminalistics: an introduction to Forensic Science; Safferstein R; Prentice Hall; 9th edition.
GENERAL CHEMISTRY & FORENSIC CHEMISTRY - PRACTICALS

1. Estimation of potassium permanganate using standard sodium oxalate solution.
2. Estimation of ferrous ammonium sulphate using standard potassium dichromate solution with potassium ferricyanide as an external indicator.
3. Determination of the density using specific gravity bottle and viscosity of a liquid using Ostwald’s viscometer.
4. Preparation of buffers and determination of their pH values using pH meter.
5. Analysis of organic compounds using tests prescribed by DFS.
6. Preparation of standard solution of different compounds in ppm and ppb levels.
7. Analysis of anions (Chloride, Iodide, sulphates) by methods/tests prescribed by DFS.
8. Analysis of anions (Nitrate, Phosphate, Oxalate) by methods/tests prescribed by DFS.
9. Analysis of cations (Arsenic, Copper, Lead) by methods/tests prescribed by DFS.
10. Analysis of cations (Zinc, Barium, Aluminium) by methods/tests prescribed by DFS.
11. Preparation of standard solution of different compounds in ppm and ppb levels.
15. Analysis of anions by methods prescribed by DFS.
16. Analysis of cations by methods prescribed by DFS.
17. Analysis of alcohols.
18. Collection, preservation packaging of evidences in fire and arson cases.
20. Analysis of organic compounds.
Semester III

CRIME SCENE MANAGEMENT

UNIT I: Crime Scene Investigation  12 Hours

Definition of crime and crime scene- Types of crime scenes: Primary, Secondary, Indoor and Outdoor- Concept of evidence- evidence classification: direct, circumstantial, physical, biological, corroborative, conclusive, trace and testimonial- Locard’s principle of exchange- Elements of crime scene: Information from victim, witness, crime scene, suspects, databases and records- Agencies involved in crime scene management: Police, Medico legal experts, Judicial officers- Actions of first responding officer: Objectives, documentation, officer safety, emergency care, secure and control, release scene to appropriate authorities.

UNIT II: Documentation of Crime Scene  12 Hours

Documenting crime scene: Crime scene photography and videography and notes- Search: definition, objectives and search patterns – Strip method, grid method, zone/quadrant method, spiral method (inward and outward), Point to point method, wheel method- Crime scene sketching: Indoor and outdoor, triangulation method, baseline method, polar coordinate method.

UNIT III: Collection of Physical Evidences  12 Hours

Crime scene photography: Location and scene, long-range mid-range and short range photographs- Importance of scale- Use of L scale- Collection, packaging and preservation of physical evidence and general considerations- Evidences: fingerprints, impressions (tyreprints, footprints, lipprints, bitemarks), hair and fiber, trace evidences (glass, soil, paint), firearms and tool marks, biological evidences (blood, bloodstain patterns, body fluids, tissue), explosive materials, questioned documents.

UNIT IV: Arson Investigation  12 Hours

Cases of special consideration: arson, mass disasters- their scene management and evidence- Crime scene reconstruction: Introduction, importance, nature and principles: recognition, identification, individualization and reconstruction- Stages of investigation: data collection, analysis, hypothesis formulation, testing, and theory formation.
UNIT V: Documentation of evidences 12 Hours

Forwarding of evidences: Packing and sealing of evidences, preparation of questionnaire- Chain of custody: Importance and maintenance- Documents to be submitted to FSL along with evidences.

REFERENCE BOOKS

- “An Introduction To Forensic Scientific and Investigative Techniques”, Stuart.H.James and
- “Crime Reconstruction”, W.Jerrychisum and Brent and Turvy, Elsevier Academic Press,
INSTRUMENTATION – I (PHYSICAL)

UNIT I: 12 Hours

- General Physical Concepts: Concept of electromagnetic radiation, Light as wave and particle, type of radiation (classification with frequency and wavelength)
- Interaction between matter and radiation – absorption, emission, reflection, refraction and scattering.
- Fluorescence and phosphorescence – principle and application in Forensic science.
- Density gradient analysis and refractive index in Forensic Science.

UNIT II: 12 Hours

- Spectroscopy: Instrumentation: source, variable (filter) and detector.
- IR Spectroscopy: Principle, instrumentation and application. IR and FTIR
- RAMAN Spectroscopy and their applications in Forensic Science.

UNIT III: 12 Hours

- Atomic Spectroscopy: Atomic absorption Spectroscopy (AAS) and Atomic Emission Spectroscopy- Principle working, application, drawbacks.
- X-Ray Diffraction (XRD): Principles, Working, Application,
- X-Ray Fluorescence (XRF) – Working, Application and Drawbacks.

UNIT IV: 12 Hours

- NMR (Nuclear Magnetic Resonance): Principle, working, instrumentation, application, drawbacks.
- Differential thermal analysis: Working and application.
- Concept of electrochemistry: Polarography and voltammetry.
UNIT V: 12 Hours

- Mass Spectrometry: Principle, Components- Sample inlets- Batch Inlet, probe inlet, direct inlet, chromatographic inlets, Ionization- ionization types and ionization sources-EI, ESI, CI, FAB; vacuum system.
- Detectors- faraday cup, electron multiplier, Scintillation counter.
- Interpretation of Mass spectrograph.
- Applications of mass spectrometry in forensic science.

REFERENCE BOOKS

- Crowle, Immuno Diffusion, 1977
FORENSIC PHYSICS

UNIT I: Glass 12 Hours

Glass: Types of glass and their composition-Forensic examination of glass fractures; Determination of direction of impact: concentric fracture, cone fracture, radial fracture, rib marks, hackle marks, backward fragmentation; Examination of glass: colour, fluorescence, physical matching, density comparison, refractive index, elemental analysis, Interpretation of glass evidence; -Case studies related to glass

UNIT II: Soil 12 Hours

Soil: Formation and types of soil; Composition and colour of soil-Forensic examination of soil: particle size distribution, turbidity test-microscopic examination, density gradient analysis, ignition loss, differential thermal analysis, elemental analysis-Interpretation of soil evidence; Case studies.

UNIT 3: Toll marks 12 Hours

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 tool marks.-Photographic examination of tool marks and cut marks; Forensic examination and comparison of tool marks.-Expert testimony in tool marks.-Comparison microscope and its applications in tool mark analysis.

UNIT IV: Paint 12 Hours

Paints: Types of paint and their composition; Forensic examination of paints: microscopic and macroscopic studies-pigment distribution- micro-chemical analysis, physical matching, solubility test, elemental analysis-pyrolysis, Cyclic voltammetry, AAS. Chromatographic technique- TLC, colorimetry. IR spectroscopy, X-ray diffraction; Interpretation of paint evidence; Case studies.

UNIT V 12 Hours

Restoration of erased or obliterated marks: Method of marking-cast, punch and engrave; Methods of Obliteration; Method of restoration- etching, magnetic, electrolytic; Recording of restored marks on different surfaces. Building Materials: Types of cement and their composition. Determination of adulterants by physical, chemical and instrumental methods. Examination of brick; Analysis of Bitumen and road material.-Analysis of cement mortar, cement concrete and stones.
REFERENCE BOOKS


Skill based subject-I

CRIME SCENE RECONSTRUCTION

30 Hours

UNIT I


UNIT II

Crime scene sketching, rough sketch, measurements, identification of evidences, sketching of 3D crime scene in 2D paper.

UNIT III

Measuring and sketching of various crime scenes, preparation of rough and fare sketch.

UNIT IV

Visit to indoor and outdoor crime scenes, setting up of crime sconces, mock crime scenes, demonstration of crime scene investigation.

UNIT V

Latest trends in crime scene reconstruction, Computer assisted crime scene reconstruction, 3D modeling of crime scene, 3D modeling using Google sketch-up.

Reference books

SEMESTER IV
QUESTIONED DOCUMENT AND FINGERPRINT
EXAMINATION

UNIT I: Introduction to questioned documents 12 Hours

Introduction to questioned documents- History of questioned documents- Classification of questioned documents and various classes of questioned documents- Scope and application of questioned documents- Preservation and handling of questioned documents: Do’s and Don’ts- Tools and techniques used for the examination of questioned documents- Ethics for Questioned Document experts.

UNIT II: Handwriting and Signature examination 12 Hours

Introduction to handwriting and signature examination- Class characteristics and individual characteristics of handwriting- Forgery and types of forgeries- Forensic examination and identification of forgeries- Examination of additions, alterations and obliterations in the documents- Examination of mechanical and chemical erasures on the documents.

UNIT III: Examination of documents 12 Hours

Examination of security documents (Currencies, coins, passports and stamp papers)- Examination of Ink and Paper- Determination of age of documents- Destructive method and non-destructive methods used in examination of ink and paper- Importance of typewriters and printers in forensic document examination- Examination of charred documents and secret writings.

UNIT IV: Introduction to Fingerprints 12 Hours


UNIT V: Classification systems of fingerprints 12 Hours

Classification of fingerprints: Arch, Loop and whorl and its sub-types- Ridge counting and Whorl tracing- Battley’s Single digit Classification and Henry Ten digit classification- Development of latent fingerprints- Physical and chemical methods. Physical methods: Metallic powders, Magnetic powders and Fluorescent powders. Chemical Methods: Ninhydrin method,
Silver nitrate method, Iodine fuming and Cyno-acrylate fuming methods- Photography-Preservation and lifting of fingerprints.

**REFERENCE BOOKS**

- David R. Ashbaugh; *Quantitative and Qualitative Friction Ridge Analysis*, CRC Press, 1999.

**CRIME SCENE MANAGEMENT, QUESTIONED DOCUMENT AND FINGERPRINT- PRACTICALS**

1. To prepare a report on evaluation of crime scene.
2. Seizure of the premises of the crime scene, clothing, accessibility and chronology of investigation.
4. Searching and Listing of evidences at indoor crime scene.
5. Searching and Listing of evidences at outdoor crime scene.
7. Sketching of Crime scene by baseline method.
8. Evidence collection, packaging, sealing and labeling.
10. Analysis of blood stains pattern using photograph.
11. Comparison and examination of handwriting with exemplars.
12. Comparison and examination of signatures with exemplars.
14. Examination of security documents- Currency notes, Indian Passports, Stamp Papers, etc.
15. Examination of alterations: additions, overwriting and obliteration in the documents.
16. To take plain and rolled inked fingerprints in FBI card and to identify patterns.
17. Comparison of fingerprint using ridge characteristic or minutiae from a given fingerprint samples.
18. To perform ridge counting and whorl tracing from a given fingerprint sample.
20. Development of fingerprints from porous/ non-porous surface using powdering method and chemical methods.
GENERAL BIOLOGY

UNIT I: Cytology and micro organisms12 Hours

Cytology: cell wall, protoplasm, mitochondria, chloroplast, endoplasmic reticulum, Golgi complex, lysosomes, endosomes, micro bodies, ribosome’s, centrioles, nucleus, nucleolus-Membrane structure, solute transport techniques: simple diffusion, facilitated diffusion, active transport- Chemical composition of cell.

UNIT II: Bio-molecules12 Hours

Proteins: classification, Properties, and functions- Carbohydrates: classification, structure and configuration. Biological importance of monosaccharide’s (glucose& fructose), di saccharides (Maltose& sucrose) and polysaccharides (Starch and Cellulose) -Lipids: Classification, types and structure with examples.

UNIT III: Micro Organisms12 Hours


UNIT IV: Antigen - Antibody Reaction 12 Hours


UNIT V: Physiology 12 Hours

Physiology: introduction,molecular, cellular and tissue physiology- Systems: control and regulation, support and movement, fluids and transport, environmental exchange and reproductive- Characters, functions and importance of the system.
REFERENCE BOOKS

- The Cell – A Molecular Approach, Geoffery M Cooper, Roberte Houseman, Fourth edition, American Society For Microbiology.
- Advanced immunochemistry, Eugene D Day.
- Handbook of Immunochemistry, Miroslav Ferencik.

GENERAL BIOLOGY- PRACTICALS

1. Safety precautions in laboratory.
2. Introduction to biochemical instrumentation.
3. Examination of plant cell.
4. Examination of animal cell.
5. Examination of micro organisms.
8. Microscopic examination of blood cells.
9. Electrophoresis technique.
10. Culturing of microbes from saliva/blood.
Skill based subject-II

STATISTICS FOR FORENSIC SCIENCE-BASIC

30 HOURS

**Unit I: Introduction to forensic statistics** 06 HOURS


**Unit II: Statistical Presentation** 06 HOURS

Scales of Measurements: Nominal, Ordinal, Interval and Ratio. Tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.

**Unit III: Measures of Central Tendency** 06 HOURS

Mean, Median and Mode – Measures of Dispersion: Range, quartile deviation, mean deviation and standard deviation and coefficient of variations

**Unit IV: Measure of symmetry** 06 HOURS

Kurtosis and skewness, Sheppard’s corrections. Bivariate data: Definition, Scatter diagram, simple, partial and multiple correlations.

**Unit V: Correlation and Regression** 06 HOURS

Definition; types of correlation. Karl Pearson correlation and Spearman Rank Correlation; Regression: definition and Regression analysis. Simple linear regression, principle of least squares and fitting to polynomials and exponential curves.

**Reference**

SEMESTER V

FORENSIC TOXICOLOGY

UNIT I: Introduction to Forensic Toxicology  12 Hours
Forensic toxicology: Introduction, Role of the toxicologist, significance of toxicological findings- Poisons, definition, classification on the basis of their origin, physiological action and chemical nature, types of poisoning- Modes of administration- Signs and symptoms of poisoning, its effect on vital functions- Medico legal and post-mortem findings and report writing.

UNIT II: Drugs and its actions  12 Hours
Drugs: definition, classification and scope and forensic importance- Commonly consumed drugs, their mode of actions, symptoms, street names, methods of consumption- Analysis of drugs: chemical and instrumental. Spot tests and qualitative analysis- Importance of physical and biochemical instrumentation in the field of drug analysis.

UNIT III: Extraction, Collection and Analysis of Toxins  12 Hours
Extraction, isolation and clean up procedures: conventional and modern techniques- Application of chromatography for the separation of poison and drugs- Spectrophotometric techniques for the quantification of poisons and drugs- Examination of metallic poisons, snake venom, insect bites.

UNIT IV: Introduction to Pharmacology  12 hours

UNIT V: Collection of Evidences and Report Writing  12 Hours
Management of Toxicological cases in the hospital: Signs and symptoms of common poisons, antidotes and Stomach washing-Collection and preservation of viscera for various types of poisons: Choice of preservatives, containers and storage- Report writing in toxicological cases.
REFERENCE BOOKS

- S.N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
FORENSIC BALLISTICS

UNIT I: Introduction to Ballistics  12 Hours
Introduction to Ballistics- Scope of forensic ballistics- History of firearms: lock mechanism of various firearms- Firearms: Classification: Based on riffling, action mechanism and loading- Parts of firearms: Butt, chamber, magazine, firing mechanism and barrel- Concept of bore and calibre- Improvised, country made & imitative firearms.

UNIT II: Internal Ballistics  12 Hours
Ammunition – Cartridge case, Primer, Propellant, Bullets, Pellets and Wads. Use of lead as bullet material- Internal Ballistics: Definition, Chemical composition of primer and propellant (black powder, single base, double base, chordite) -Ignition and burning of propellants- Degressive and progressive burning- Pressure developed inside the barrel- Theory of recoil- Intermediate Ballistics: Definition, effects on the motion of projectile by firearm, gas flow field near the muzzle, muzzle flash, muzzle blast and silencers.

UNIT III: External Ballistics  12 Hours
External Ballistics: Definition, vacuum trajectory, Equations of motion of projectile, gyroscopic equilibrium of bullets, vacuum trajectory- calculation, effect of air resistance on trajectory and nature of air-resistance phenomena- Terminal Ballistics: Definition. Physics of shock waves, shock waves within the body; Cavitations-temporary and permanent cavities- Behaviour of various types of bullets on hitting the target, Ricochet and its forensic aspects- Arms Act, 1959 (Important sections), Examination and reporting of cases under Arms Act. Various court ruling relevant to forensic ballistics.

UNIT IV: Wound Ballistics  12 Hours
Preparation of gelatine gel block and its use in wound ballistics studies- Calculation of trigger pull- Test for the possibility of accidental discharge of firearm- Determination of range of firing for shotguns: Burning, scorching, blackening and Tattooing- characteristics of contact shots, Walker’s test- Effective, killing and extreme ranges.

UNIT V: Examination of Gun Shot Residues  12 Hours
Evidentiary clues: Types, occurrence, collection and packing- Matching of crime & test Bullets and cartridge cases in regular firearms & improvised firearms- Framing of opinion in ballistics cases and the challenges of it- Comparison microscope, Identification of bullets and their comparison- Factors affecting the formation of striations- Gun Shot Residues (GSR): Formation
of GSR, composition of GSR, Positioning of GSR, collection, chemical methods of analysis and instrumental methods of analysis.

**REFERENCE BOOKS**

- M. Johari; Identification of Firearms Ammunition and Firearms Injuries, BPR&D New Delhi, 1980.
INSTRUMENTATION – II (BIO-CHEMICAL)

UNIT I: Basic principles of sampling 12 Hours

- Sample preparation: Stock solution, standard solution and serial dilution- Qualitative and quantitative estimation. General Principles of Biological and Biochemical analysis: pH and Buffers, pH Meter, Physiological Solution. Centrifugation: Basic principles of centrifugation, Svedberg’s unit, density gradient centrifugation, types of centrifuges - (based on size, type of rotors and usage), ultra-centrifugation, refrigerated centrifuges, - safety maintenance of centrifuge.

UNIT II: Microscopy 12 Hours

- Microscopy: Lens systems and it’s working. Principle of microscopy, Abbe equation- Principle, ray diagrams, working, sample preparation and applications of following in Forensic Science-Simple microscope and Compound microscope, Stereo microscope, Comparison microscope, Phase contrast microscope,

UNIT III: Advanced microscopy 12 Hours

Principle, ray diagrams, working, sample preparation and applications of following in Forensic Science: Polarized light microscope, Fluorescent microscope, Infrared microscope, Scanning electron microscope (SEM), Transmission electron microscope (TEM) - Atomic force microscope (AFM)

UNIT IV: Chromatography 12 Hours

Chromatography: General principles of chromatography, classification-Paper chromatography, Column chromatography, Thin Layer Chromatography (TLC), High Performance Thin Layer Chromatography (HPTLC)-Concept of mutual miscibility and preparation of mobile phase. Liquid Chromatography (LC), High Performance Liquid Chromatography (HPLC), Liquid Chromatography- Mass Spectrometry (LC-MS), Gas Chromatography (GC), Gas Chromatography- Mass Spectrometry (GC-MS),

UNIT V: Immuno-chemical techniques 12 Hours

Immuno-chemical Techniques and electrophoresis: General principles and introduction to antigen and antibody, Antigen-antibody reaction, precipitin reaction, production of antibodies. - Enzyme Assay Techniques: Visible and UV spectrophotometry methods, ELISA, Automated enzyme analysis, Immobilized Enzymes, Fluorescence Immuno-assay. Electrophoresis- General
Principle, factors affecting electrophoresis, Horizontal and vertical electrophoresis, SDS, PAGE, cross over electrophoresis, capillary electrophoresi

**REFERENCE BOOKS**

- Curry, Analytical Methods of Human Toxicology, 1986.
- Gilbert, GC-MS guide to ignitable liquids, 1997.
- Brown, P.R., Advance in Chromatography, 2004
- Howard, Forensic Analysis by Gas Chromatography, 2012
FORENSIC BIOLOGY

UNIT I: Introduction to Forensic Biology  12 Hours


UNIT II: Hair and Fibers  12 Hours

Hair – structure of human hair: Inner and Outer morphology, biochemistry of hair and growth stages- Comparison of human and animal hair: medulla, Medullary index calculation, Cuticle examination- Fibre – Classification: Natural, semi-synthetic and synthetic fibres and their properties- Structure analysis for different types of fibers and their Forensic significance.

UNIT III: Forensic Botany  12 Hours


UNIT IV: Forensic Entomology  12 Hours

Entomology: Introduction, areas and importance- General anatomy of arthropod- Insects of Forensic significance: Order- dipteral, Coleoptera, collembola etc- Estimation of time since death and insect succession- Collection, packing and preservation of entomological evidence.

UNIT V: Wildlife Forensics  12 Hours

REFERENCE BOOKS

- Forensic Biology, S. Chowdhuri, BPRD, New Delhi (1971).
- Criminalistics and Scientific Investigation, Peter B Piazza, Frederick Cunliffe.
- Forensic Science in Wildlife Investigation, Taylor & Francis (2009)
- Forensic Science in Crime Investigation, B S Nabar.
Skill based subject -III

STATISTICS FOR FORENSIC SCIENCE-ADVANCED

30 HOURS

UNIT I: Uncertainty in forensic science 06 hours
Probability: Introduction, standard for uncertainty, events, subjective probability, dependent events, law of total probabilities, updating of probabilities.

UNIT II: Variations 06 hours
Populations, samples and estimates, counts-binomial distribution, multinomial distribution, hyper geometric distribution, Poisson distribution, beta binomial distribution.

UNIT III: Transfer of evidence 06 hours
Likelihood ratio: Probability of guilt, justification, combination of evidences, correspondence probabilities, Direction of transfer-from criminal to scene and from scene to criminal. Transfer probabilities, presence of non matching evidences.

UNIT IV: Evaluation of evidences 06 hours
Complimentary events and examples. Bayes’ theorem and examples. Errors in interpretation-fallacy of transposed conditional, source probability error, false positive fallacy, empirical errors in interpretation.

UNIT V: Value of evidence 06 hours

References:

SEMESTER VI

FORENSIC SEROLOGY

UNIT I: Biological Evidences 12 Hours

Biological evidence: location, importance, collection, preservation, packing and identification- Hair: identification, analysis, medullary index calculation and importance of root and individualisation from root bulb- Fibres: classification, identification, structure, importance and forensic significance- Identification forensic significance of pollen and seeds.

UNIT II: Antigen Antibody and Its Reactions 12 Hours

Human Blood groups: General Principles, theory of their inheritance, Blood group determination from fresh blood, titer, raulax formation and Bombay blood group- Definition of antigen and antibody, Various Antigen-antibody reactions- Difference between precipitation, agglutination and flocculation- Immunochemical techniques: principle, function and forensic significance.

UNIT III: Blood and Its Functions 12 Hours

Blood: composition, functions. Collection, packaging and preserving techniques for different types of cases- Analysis of blood: identification, confirmatory for fresh blood stains- Takayama and Teichmann test for dried blood stains- Identification of blood group from stain of blood, Semen, saliva and sweat: absorption elution, absorption inhibition and mixed agglutination.

UNIT IV: Identification of Other Body Fluids 12 Hours

Semen: location, collection, packing, evaluation and tests for identification and forensic significance- Urine: location, collection, packaging, preservation, evaluation and tests for identification and forensic significance- Forensic significance of other body fluids like sweat, saliva, milk and it’s collection and identification.

UNIT V: Enzymatic Reactions and Paternity Disputes 12 Hours

DNA: definition, characteristics, polymorphism- Polymorphic enzymes: Forensic significance, identification from fresh blood and stains- Paternity disputes: Causes, Various serological and biochemical methods, calculation of paternity index and probability for paternity and maternity- Case studies: paternity and maternity disputes.
REFERENCE BOOKS

FORENSIC BIOLOGY & FORENSIC SEROLOGY -

PRACTICALS

1. Safety precautions in lab.
2. Introduction to Microscope.
3. Collection, preservation, packaging of samples.
4. Microscopic examination of human hair.
5. Comparison of human and non human hair.
6. Analysis of fiber.
7. Microscopic examination of structure of wood.
8. Microscopic examination of structure of leaves.
9. Analysis of pollen grains
10. Analysis of diatoms.
11. Analysis and comparison of human and animal hair.
13. Presumptive test for blood stains.
14. Microcrystal tests for dried blood stains.
16. Analysis of urine samples.
17. Analysis of salivary stains.
18. Separation and analysis of macromolecules using gel electrophoresis.
20. Collection preservation and packaging of serological samples.
FORENSIC BALLISTICS & FORENSIC TOXICOLOGY -
PRACTICALS

1. Identification of parts of firearms.
2. Preliminary examination of various characteristics of fired bullets and shots.
3. Preliminary examination of various characteristics of fired cartridge cases.
4. Chemical tests for powder residues and barrel wash.
5. Examination and comparison of fired and test bullets and shots.
6. Examination and comparison of fired and test cartridge cases.
7. Collection and packing of Gun Shot Residues.
8. Identification of bullet using holes physical and chemical examination.
10. Reconstruction of sequence of events in shooting incidents.
15. Thin layer analysis for ink analysis.
16. Collection, preservation and packaging of toxicological evidences.
17. Report writing in toxicological cases.
18. Analysis of alcoholic poisons.
20. Analysis of vegetable poisons.
Skill based subject-IV

GOOD LABORATORY PRACTICES

30 Hours

UNIT I

06 hours

Definition of good laboratory practices (GLP), History and purpose of GLP, Compliance with GLP regulations, objectives of GLP and its principles.

UNIT II

06 hours

Components of GLP: Test facility management, quality assurance programs, meeting the requirements of the test facilities-equipments, personals. Handling, sampling and storage of analytes, standard operational protocols.

UNIT III

06 hours

Performance of the study- Reagents and solutions, test and control articles, study implementation and method validation, data recording

UNIT IV

06 hours

Reporting of study results, archiving of records and materials, enforcement of GLP-audits, non-compliance and consequences, facility disqualification and reinstatement.

UNIT V

06 hours

National accreditation board for testing and calibration laboratories (NABL): requirement for accreditation, benefits, scope and proficiency testing.

Reference books

ELECTIVE I

CRIMINOLOGY AND CRIMINAL JUSTICE ADMINISTRATION

UNIT I: Introduction to Crime and Criminology 12 Hours

UNIT II: Juvenile Delinquency 12 Hours

UNIT III: Penology and Correctional Administration 12 Hours

UNIT IV: Prevention of Crime 12 Hours
Crime Prevention: Definition of concepts – History of crime prevention – Primary, secondary and tertiary crime prevention- Concept of Recidivism, Fear of crime and Dark Figure- Methods of crime prevention: punitive methods, defenceMethods, intervention method, mechanical method, mass method, clinical method and group relations methods- Crime prevention by police: community policing, patrolling and beats Intelligence collection and Surveillance- Crime prevention strategies in urban and rural areas.

UNIT V: Victimology 12 Hours
Victimology: Definition, Origin, development and scope- Dimensions of victimization- Typology of victims and concept of Victim precipitation, Victim facilitation, Victim provocation and indirect victimization- Retributive justice and Restorative justice- Victim assistance and victim service organizations in India.
REFERENCE BOOKS

FORENSIC AUDIO-VIDEO ANALYSIS AND SPEAKER IDENTIFICATION

UNIT I: Basic Circuits 12 Hours

UNIT II: Introduction to video technology 12 Hours

UNIT III: Forensic audio and video analysis 12 Hours

UNIT IV: Basics of speaker identification 12 Hours
and Supra segmental, Prosodic features- Stress, Intonation, Duration, Syllables, Nasalization, and Accent features.

UNIT V: Forensic speaker identification 12 Hours


REFERENCE BOOKS

- A Simplified Guide to Forensic Audio and Video Analysis (PDF Notes).
- Audio video analysis by B.R. Sharma, Universal Publishers, Luck now.
FORENSIC MEDICINE

UNIT I: Introduction to Forensic Medicine 12 Hours


UNIT II: Death and Its Causes 12 Hours

Death: Definition, types, brain death- Suspended animation- Modes of death: coma, syncope and asphyxia, determination of time since death- Identification: methods to identify living person for gender, race, and age- Bite marks: scope and forensic significance.

UNIT III: Infanticide and Foetal Age 12 Hours

Infanticide: definition, foeticide and still birth- Signs of intrauterine death, signs of live birth, viability of foetus, age determination of foetus, demonstration of ossification centres, precipitate labour, haase’s rule, hydrostatic test, maceration, sudden infant death syndrome- Foetal age determination, identification of criminals, unknown persons, dead bodies from the remains hairs, fibers, teeth etc.

UNIT IV: Medico Legal Autopsy 12 Hours

Autopsy: introduction, legal requirements to conduct autopsy, preparation of autopsy report- Examination of dead body: types and methods- Examination of bones- Exhumation- Signs of death: Immediate, Early and Late. Rigor mortis, algor mortis, post mortem hyptosis, muscle changes, putrefaction, saponification and mummification.

UNIT V: Injuries 12 Hours

establishment of identity- Electrical injuries: factors influencing, effects, properties, Post mortem appearances- Lightning stroke: types of burns, Post mortem appearances, radioactive substances, action on an individual.

**REFERENCE BOOKS**

- Internet: Journal of Indian Congress of Forensic Medicine and Toxicology.
ELECTIVE II

POLICE ADMINISTRATION

UNIT I: History of Indian Police 12 Hours

History of Indian Police: Ancient period, Medieval period and British period- Modern policing- Community policing- Police Act, 1861- Police Commission Reforms and Recommendations- National Police Commission recommendations (NPC), 1979

UNIT II: Police Organization and Structure 12 Hours

State police organization and structure – Urban and rural policing- Hierarchy in city police, district police and police battalion- Functioning of State Police: Law and Order, Intelligence and Special Unit- Central police organizations: RAW, IB, NIA, CBI, CISF, CRPF, RPF- Police research and Crime Statistics Organizations: BPR&D, NCRB.

UNIT III: Criminal Investigation 12 Hours

Crime prevention: Patrolling, beat, surveillance, traffic regulation and maintenance of law & order- Collection of intelligence and its use- Use of scientific methods to tackle crime- Examination of crime scene and investigation- Methods of Investigation: Information, Modus Operandi and Interrogation, Recording of FIR, Case Diary, NC register, Collection of Evidence, Examination of Witnesses and Suspects, Confession of the accused and filing of charge Sheet.

UNIT IV: Records Maintained in police Stations 12 Hours


UNIT V: Public Image on Police 12 Hours

Public perception of police – Measures to improve police image in urban and rural areas- Measurements to improve police-public relationship through community policing- Measures to tackle corruption – Treatment of victims and offender by the police- Campaign to prevent drug abuse and to ensure safety of women in cities.
REFERENCE BOOKS

GENERAL PHYSICS

UNIT – I: Waves 12 Hours

Wave Motion, General Equation of Wave Motion and Plane Progressive Harmonic Wave- Energy Density for a Plane Progressive Wave, Intensity of a Wave. Transverse Waves in Stretched Strings, Modes of Transverse Vibrations of Strings and Longitudinal Waves in Rods and Gases, Fourier’s Theorem, Wave Velocity and Group Velocity

UNIT-II: Sound 12 Hours


UNIT-III: Wave dynamics12 Hours

Waves in one dimension, the wave equation and sinusoidal waves. Boundary conditions: reflection and transmission and Polarization. Electromagnetic waves in vacuum, Wave equation for E and B, monochromatic plane waves in vacuum, energy and momentum of Electromagnetic waves. Pointing vector - Electromagnetic waves in matter, Propagation through linear media, reflection and transmission at normal incidence.

UNIT-IV: Electronics 12 Hours

UNIT- V: Quantum Mechanics 12 Hours


UNIT-VI: Elasticity 12 Hours


REFERENCE BOOKS

FORENSIC ANTHROPOLOGY AND ODONTOLOGY

UNIT I: Introduction to Forensic Anthropology 12 Hours


UNIT II: Ossification and Its Importance 12 Hours


UNIT III: Chemistry of Bones 12 Hours

Chemistry of bones: Biochemical aspects, chemical constituents in ligaments - Field and laboratory management of skeletal remains - Collection, preservation and packaging of osteological evidence - Biological profiling of skeletal remains: Demography, sex, age, stature and race estimation.

UNIT IV: Application in Investigation 12 Hours

Facial reconstruction: two and three dimensional methods, facial anatomy of humans - Estimation of facial tissue thickness with MRI and other methods - Facial superimposition: Comparison and analysis of facial features of human skull and the ante-mortem photograph - Superimposition: photographic and computerized methods.

UNIT V: Forensic Odontology 12 Hours

REFERENCE BOOKS

- Forensic Anthropology: Current Methods and Practice.
- The human bone manual, Tim D White, Peiter A Folkens.
- Forensic anthropology training maznual, Karen Ramey Burns.
- Atlas of Human Anatomy by Mark Nielsen; Shawn D. Miller.
- Anatomy at a Glance by Omar Faiz; Moffat David.
ELECTIVE III

CRIMINAL LAW

UNIT I: Indian Constitution 12 Hours


UNIT II: Origin of Criminal Law 12 Hours


UNIT III: Introduction to Criminal Justice System 12 Hours


UNIT IV: IPC Offences 12 Hours


UNIT V: Indian Evidence Act 12 Hours

Evidence - Meaning, principles and concept of relevancy and admissibility- Confessions and Dying Declaration- Presumption of fact and law- Burden of proof- Examination in Chief, Cross Examination and Re- examination- Special and Local Laws – Need and Objectives of special and local laws – Special laws vs. local laws – Conventional laws vs. Special and local laws.
REFERENCE BOOKS

RESEARCH METHODOLOGY AND STATISTICS

UNIT I: Introduction to Research 12 Hours

Research: Definitions, Characteristics and Objective of research- Epistemology and ontology of research- Types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Qualitative vs. Quantitative, Conceptual vs. Empirical, and other kinds of research- Research methods vs. Research Methodology - Inductive and deductive research- Ethics in Criminal Justice Research.

UNIT II: Research Problem 12 Hours

Formulation of the research problem– Research process – Overview of the stages in research (hypothesis formation to analysis and report writing) -Research design: Meaning of research design – Need for research design- Hypothesis: Definition – Types of hypothesis.

UNIT III: Data Collection 12 Hours

Data collection – Types of Data’s- Modes of collection of primary data: Observation, Interviews, interview schedules, Questionnaires – Modes of collection of secondary data- Population and unit of analysis - Sampling Techniques: Definition – Criteria for selecting a sampling design- Types of sampling: Probability sampling and non-probability sampling – Types of probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling, area sampling and multi-stage sampling – Types of non-probability sampling: purposive sampling, convenience sampling, judgment sampling and snowball sampling. - Advantages of sampling – Requirements of a good sample.

UNIT IV: Introduction to Statistics 12 Hours

Variables – Discrete and Continuous - Independent and Dependent- Scales of measurement- Nominal, ordinal, Interval and ratio- Frequency for grouped and ungrouped data- Class Interval and Class width - Continuous and discontinuous data- Graphical representation of data- bar chart, pie-chart and histogram- Significance of statistics in forensic science.

UNIT V: Measures of Central Tendency 12 Hours

Measures of Central Tendency: Mean, Median and Mode- Measures of Dispersion: Range, quartile deviation, mean deviation and standard deviation and coefficient of variations- Measure
of symmetry: Kurtosis and skewness- Introduction to Statistical Package for Social Science Research (SPSS).

**REFERENCE BOOKS**

DNA TYPING

UNIT I: Introduction to Human Genetics 12 Hours

History: discovery, development in the findings. Definition, structure, properties and forensic importance- Human genetics- definition and explanations for Heredity, alleles, mutations and population genetics- Molecular biology of DNA, variations in DNA, Biochemical aspects- Genomics and medical genetics.

UNIT II: DNA Profiling 12 Hours

Mitochondrial DNA- definition, structure, biochemical activity-DNA Profiling: Introduction, definition, history and importance in the field of forensic science- Types of samples used for DNA analysis- Collection, packaging and preservation of blood, saliva, semen, sweat and hair- Paternity and maternity index: equation, derivation and calculation.

UNIT III: DNA typing Systems 12 Hours

DNA typing systems- Polymorphism, RFLP analysis, PCR amplifications, sequence polymorphism- Analysis and functioning of SNP and Y- STR- Evaluation of results, frequency estimate calculations, allele frequency determination- Interpretations of results. Match probability- database, quality control, certification and accreditation.

UNIT IV: Application of DNA Profiling 12 Hours

Forensic Significance of DNA profiling: Applications in disputed paternity cases, child swapping- Missing person’s identity- civil immigration, job disputes- Application in veterinary, wildlife and agriculture cases- Case studies related to paternity and maternity disputes and child swapping.
UNIT V: Legal Perspective of DNA Profiling  12 Hours


REFERENCE BOOKS

- DNA Profiling and DNA fingerprinting; Edited by Jorg T. Epplen and Thomas Lubjuhn; Birkhauser Verlag, Switzerland, 1999.
- DNA Technology in Forensic Science by committe on DNA Technology in Forensic Science, Board on Biology, Commission on Life Sciences, National Research council; National Academy Press, Washington, D.C. 1992
- Keith In man and Norah Rudin; An Introduction to Forensic DNA Analysis, CRC Press; Ny. 1997.
- Kirby: DNA Fingerprinting Technology.