

BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI 620 024

B.Sc. Forensic Science Programme – Course Structure under CBCS

(Applicable to the candidates admitted from the academic year 2019 -2020 onwards)

Sem	Part	Course	Ins.Hrs	Credit	Exam Hours	Marks		Total	
						Int.	Ext.		
I	I	Language Course – I (LC) –Tamil*/Other Languages +#	6	3	3	25	75	100	
	II	English Language Course - I (ELC)	6	3	3	25	75	100	
	III	Core Course – I (CC)General Forensic Science and Crime Scene Management		5	5	3	25	75	100
		Core Course – II (CC)Crime and Criminal Justice System		4	4	3	25	75	100
		First Allied Course –I (AC) Physics		4	4	3	25	75	100
		First Allied Course – II (AC) (Practical)		3	---	---	---	---	---
		Value Education		2	2	3	25	75	100
	TOTAL			30	21				600
II	I	Language Course – II (LC) - Tamil*/Other Languages +#	6	3	3	25	75	100	
	II	English Language Course – II (ELC)	6	3	3	25	75	100	
	III	Core Course – III (CC) Basic Forensic Psychology		5	5	3	25	75	100
		Core Practical -I Crime Scene Management Lab		4	3	3	40	60	100
		First Allied Course – II (AC) (Practical) Physics and Biology Lab		3	3	3	40	60	100
		First Allied Course – III (AC) Biology		4	2	2	25	75	100
		Environmental Studies		2	2	3	25	75	100
	TOTAL			30	21				700

III	I	Language Course – III (LC) Tamil*/Other Languages +#	6	3	3	25	75	100
	II	English Language Course - III (ELC)	6	3	3	25	75	100
	III	Core Course – IV (CC) Fingerprints and questioned Documents	5	5	3	25	75	100
		Core Course – V (CC) Forensic Physics and Ballistics	4	4	3	25	75	100
		Second Allied Course – I (AC) Chemistry	4	3	3	25	75	100
		Second Allied Course – II (AC) Basic Chemistry Lab	3	---	---	---	---	---
	IV	Non Major Elective I – for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto 10 th +2 but opt for other languages in degree programme c) Criminalities (or) Questioned Document Analysis (or) Fingerprint Science	2	2	3	25	75	100
TOTAL			30	20			600	
IV	I	Language Course –IV (LC) Tamil*/Other Languages +#	6	3	3	25	75	100
	II	English Language Course – IV (ELC)	6	3	3	25	75	100
	III	Core Course – VI (CC) – Instrumentation	4	4	3	25	75	100
		Core Practical – II Fingerprints and Questioned Documents Lab	4	4	3	40	60	100
		Second Allied Course – II (AC) (Practical) Basic Chemistry Lab	2	3	3	40	60	100
		Second Allied Course – III Basics of Computer	4	2	3	25	75	100
	IV	Non Major Elective II – for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto 10 th +2 but opt for other languages in degree programme c) Handwriting Analysis (or) Investigation of Scene of Occurrence (or) Digital Forensics	2	2	3	25	75	100
	V	Skill Based Elective I	2	2	3	25	75	100
TOTAL			30	23			800	

V	III	Core Course – VII (CC) – Forensic Biology and Serology	5	5	3	25	75	100
		Core Practical III – Forensic Biology and Serology Lab	5	5	3	40	60	100
		Core Course –VIII (CC) – Cyber Crime and Cyber Law	5	5	3	25	75	100
		Core Practical – IV (CC) – Cyber Forensics Lab	4	3	3	40	60	100
		Major Based Elective – I Forensic Anthropology (or) DNA Forensics (or) Accident Investigation	5	5	3	15 + 10	45 + 30	100
	V	Skill Based Elective – II	2	2	3	25	75	100
	V	Skill Based Elective – III	2	2	3	25	75	100
		Soft Skills Development	2	2	3	25	75	100
	TOTAL			30	29			800
	VI	III	Core Course –I X (CC) – Forensic Medicine and Toxicology	6	5	3	25	75
Core Course – X (CC) – Advanced Forensic Psychology			6	5	3	25	75	100
Core Practical – V (CC) - Forensic Medicine and Toxicology Lab			5	3	3	40	60	100
Major Based Elective II Economic Offences (or) Theory + Practical Fire and Explosives Investigations (or) “ Wildlife Forensics (Theory)			6	5	3	25	75	100
Major Based Elective III Mini Project (or) Digital and Cyber Forensics Lab (or) DNA Analysis Lab			6	5	3	25	75	100
V		Extension Activities	-	1	-	-	-	-
		Gender Studies	1	1	3	25	75	100

	TOTAL	30	26			600
	GRAND TOTAL	180	140	-	-	4100

Program Objective:

- 1. To provide the basic knowledge and principles of Forensic Science.**
- 2. To develop problem-solving skills in a stepwise fashion.**
- 3. To inculcate diverse skills and abilities involved in various fields of Forensic Science.**
- 4. To develop laboratory skills.**
- 5. To develop conceptual understanding of Criminal Justice System and Legal System.**
- 6. To produce ethical and skillful graduates, who can articulate the professional standards.**

Program Outcome:

- 1. Demonstrate knowledge and understanding of some basic principles and concepts of Forensic Science.**
- 2. Ability to apply knowledge and understanding of various scientific principles to solve crime cases.**
- 3. Possess high awareness of major issues and development of research areas in Forensic Science.**
- 4. Understand various aspects of Indian Law and related sections.**
- 5. Posses laboratory skills to exacting standards of precision and care.**
- 6. Acquire professional ethics and act in a non-biased manner.**

SEMESTER-I

CORE COURSE I

General Forensic Science & Crime Scene

Management Learning Objectives:

- a. The significance of Forensic science to human society.
- b. The fundamental principles and functions of Forensic science.
- c. The divisions in a Forensic science laboratory.
- d. The methods of securing, searching and documenting crime scenes.

- e. The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.
- f. The legal importance of chain of custody.

Unit 1:

Introduction to Forensic Science. Need and functions of Forensic science. Historical aspects of Forensic science. Development of Forensic Science Laboratories.

Definitions and concepts in Forensic science. Basic principles of Forensic science. Scope of Forensic science. Forensic Science in Indian scenario. Admissibility in Indian Courts. Frye standard and Daubert standard. Legal and Scientific problems.

Unit 2:

Branches of Forensic science and their importance. Hierarchical set up of various Government Forensic Science Laboratories. Basic services of crime laboratories. Qualifications of Forensic scientists. Duties of Forensic scientists. Code of conduct for Forensic scientists. Data depiction.

Unit 3:

Crime Scene. Types of crime scenes. Safety measures at crime scenes. Role of First Responding Officer. Coordination between police personnel and Forensic scientists at crime scenes. The evaluation of 5Ws (who? what? when? where? why?) and 1H (how?).

Unit 4:

Documentation of crime scenes – photography, videography, sketching- Baseline method, Triangulation method, coordinate method, extended coordinate method. Crime scene notes.

Search – Definition, Objectives, Patterns- Strip/Lane method, Grid method, Zone method, Spiral method, Wheel method.

Classification of crime scene evidence – physical and trace evidence. General collection, labeling, sealing and transportation of evidence. Hazardous evidence. Preservation of evidence. Chain of custody- objectives and importance.

Unit 5:

Definition, importance, nature and principles, stages: Data collection, Hypothesis formation, Testing, Theory formation.

Management of scenes of mass disasters. Important evidences for human identification.

Suggested Readings

1. **W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).**
2. **S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).**
3. **M. S. Dahiya, Principles and Practices in Contemporary Forensic Sciences, Shanti Prakashan (2015).**
4. **Robert. C. Shaler, Crime Scene Forensics: A Scientific Method Approach, CRC Press (2011)**
5. **M. S. Maloney, Crime Scene Investigation: Procedural Guide, CRC Press (2014)**
6. **B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).**
7. **R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).**
8. **M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001).**
9. **T.J. Gardener and T.M. Anderson, Criminal Evidence, 4th Ed., Wadsworth, Belmont (2001).**

Course Outcomes:

1. **Basic understanding of the Scientific method and the use of the problem-solving in the field of the Forensic science.**
2. **Identify the role of the Forensic scientist and physical evidence within the criminal justice system.**
3. **Understand various branches of Forensic science and their functions.**
4. **Identify and examine current and emerging concepts and practices within the Forensic science field.**
5. **Gain basic knowledge of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.**

CORE COURSE II - Crime and Criminal Justice System

Learning Objectives:

- a. The elements of crime.
- b. The causes and consequences of criminal behavior.
- c. The various agencies involved in crime detection and prevention.
- d. The elements of criminal justice system.
- e. Acts and provisions of the Constitution of India related to Forensic science.
- f. Elements of IEA, CrPC and IPC related to Forensic science.
- g. Acts governing socio-economic crimes and environmental crimes.

Unit 1:

Elements and definition of crime. Mens rea, Actus reus and Corpus delicti. Caveat Emptor. Nature, causes and consequences of crime. Types - Hate crimes, property crimes, organized crimes and public disorder, domestic violence and workplace violence.

White collar crimes, Blue collar crimes, Green collar crimes.
Broad components of criminal justice system. Prosecution and Judicial Organizations. Constitution and hierarchy of courts in India, Jurisdiction of courts in criminal cases. Classification – civil, criminal cases, Cognizable and non-cognizable offences, Bailable and non-bailable offences. Inquests and its types. Summons and its types. FIR.

Unit 2:

Police Administration: Introduction. Structure and Functioning of State and Central Police Organization. International Organizations. Victimology.

Unit 3:

Constitution of India:

Preamble, Fundamental Rights, Directive Principles of State Policy. – Articles 14, 15, 20, 21, 22, 51A.

Indian Evidence Act: 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141, 159.

Criminal Procedure code:53,53A, 54, 291, 292, 293.311A

Unit 4:

Indian Penal Code:

Offences against person: 299, 300, 302, 312, 304A, 304B, 306, 319, 320, 326, 339, 340, 351, 359, 362, 375, 376, 377.

Offences against property: section 378, 383, 390, 391, 405, 415, 420, 441, 463, 471, 499, 503, and 511.

Unit 5:

Narcotic, Drugs and Psychotropic Substances Act. Drugs and Cosmetics Act. Explosive Substances Act. Arms Act. Dowry Prohibition Act. Prevention of Food Adulteration Act. Prevention of Corruption Act. Wildlife Protection Act. Environment Protection Act. Untouchability Offences Act. Mental Health Act. I.T. Act. Prevention of damage to public property Act. Enactments for women and children.

Suggested Readings

1. Dr. V. Krishnamachari, Law of Evidence, 7th Edition, S. Gogia & Company (2017)
2. (Chief Justice) M. Monir, Law of Evidence, 6th Edition, Universal Law Publishing Co. Pvt. Ltd., New Delhi (2002).
3. M. P Jain, Indian Constitutional Law, 8th Edition.
4. Takwani, Criminal Procedure, 3rd Edition (2011).
5. K D Gaur, Text Book on Indian Penal Code, 5th Edition (2015).
6. D. D Basu, Introduction to the Constitution of India, PHI

Course Outcomes:

1. Gain knowledge about crime and its elements.
2. Identify the various agencies involved in crime detection and prevention.
3. Understand the structure of courts in India.
4. Summarize process of Judicial Review.
5. Understand the various sections and laws pertaining to Forensic science.

ALLIED COURSE I Physics:

Learning Objective:

- a) To provide knowledge and concepts of Physics related laws.
- b) To give simple and basic ideas for better revelation of student.
- c) To understand the basic principles in physics.
- d) To have basic idea about acoustics and EMR.
- e) To understand LCR circuits.

Unit 1: Mechanics and Thermal Physics

Mechanics: Force, conservative and non-conservative force, rotational motion of inertia, expression of M.I. of regular shaped bodies. Acceleration due to gravity. Simple Harmonic motion and compound pendulum.

Thermal Physics: concept of temperature, ideal gas, reversible and irreversible process, Zeroth law, first, second and third law of thermodynamics. Carnot's cycle.

Unit 2: Optics

Optics: Cardinal Points, thin lens and its combinations, Aberration and its types, Newton's rings. Fresnel's diffraction – Diffraction at a (1) circular aperture (2) Straight edge (3) narrow wire. Lasers.

Unit 3: Acoustics

Acoustics: The generation of sound, Properties, Velocity of sound, noise and sound intensity measurement, echo, propagation of sound waves, standing waves, modes of vibration. Sound and its perception. Principle of microphone and loudspeaker.

Unit 4: Electronics

Electronics: Electric current, resistance, Ohm's Law, Resistivity, Capacitance, Voltage, Transistors, Basic LCR circuits, Growth and decay of current containing resistance and inductance, Transformers and Amplifiers. Working of electric meter.

Unit 5: Electromagnetic Radiation

Introduction, Electromagnetic spectrum, Interaction between matter and radiation, Scattering, Raman and Rayleigh scattering.

Suggested Readings

1. R. Murugesan, Properties of matter, S. Chand & Co. Pvt. Ltd., Revised edition, 2012.

2.M. Narayanamurthi and N. Nagarathinam, Dynamics, The National Publishing Company 2005, Chennai.

3.Brijlaland Subramaniam, Heat and Thermodynamics & Statistical physics, S. Chand & Co. 2015.

4.M. Narayanamurthi and N. Nagarathinam, Statics, Hydrostatics and Hydrodynamics - The National Publishing Company 2005, Chennai.

5.Dr. N. Subramaniam, Brijlal and Dr.M.N. Avathanulu, Optics, S. Chand & Co. Pvt. Ltd.-9th revised edition, New Delhi ,2014.

6. R.L. Saihgal, A Text Book of Sound, S. Chand & Co. Pvt. Ltd, New Delhi, 1979.

Course outcome:

- 1. Demonstrate knowledge of selective topics of Mechanical and Thermal Physics.**
- 2. To apply the knowledge to analyze broad range of physical phenomena.**
- 3. Recognizing universal physical laws relevant to the problems.**

ALLIED COURSE II - Physics and Biology lab:

Learning Objective:

- a) To provide knowledge and concepts of Physics related laws.
- b) To understand the working of basic instruments.
- c) To determine Refractive Index and focal length.
- d) To calculate the specific gravity of glass.

LIST OF PRACTICALS:

1. Standard operating procedures for using Vernier Caliper, Micrometer Screw Gauge, Travelling Microscope.
2. Spectrometer: determination of angle of prism and the refractive index for a glass prism for sodium light.
3. Combination of lenses- Focal length of convex and concave lenses.
4. Newton's rings.
5. Basic LCR Circuits
6. Waves – Verification of laws- sonometer.
7. Specific gravity of glass.

Course outcome:

1. Use various basic instruments in physics.
2. Take measurements in Physics lab and analyze them to draw valid conclusions.
3. Use experimental, and theoretical methods to solve complex problems.

SEMESTER-II
CORE COURSE III

Basic Forensic Psychology:

Learning Objectives:

- a. The basic concepts of Psychology and its scope.
- b. The various perspectives of Psychology.
- c. The elements of brain and nervous system.
- d. The basics of cognitive processes.

Unit 1:

Definition, goals and scope of Psychology. Role of psychologist in society. Perspectives- Biological, Psychodynamic, Behaviouristic, Humanistic, Evolutionary and Cognitive. Subfields of Psychology.

Scope of Forensic Psychology. Duties and responsibilities of Forensic Psychologist.

Unit 2:

Nervous system- Introduction, Classification. Structure of brain and its parts. Significance of left and right brain. Structure and psychological importance in thought and language. Neurons- Structure, Neural impulse-generation and transmission, neurotransmitters and their function.

Unit 3:

Introduction to cognition. Sensation- Processes in sensation, types- receptors involved in each of the sensory modalities i.e., visual, auditory, gustatory, olfactory, tactile and others. Sensory adaptation. Sensory threshold, Absolute threshold, Weber's Law.

Unit 4:

Attention- Introduction, definition, characteristics, selective and divided attention. Perception- Introduction, definition, Gestalt laws. Process of perception- Depth

perception, constancy, movement. Correlated of perception- Awareness, motives, needs, illusion, subliminal perception and extra sensory perception.

Unit 5:

Thinking- Introduction, definition, theories- information processing theory, S-R theory, cognitive theory, simulation models. **Types-** free association, imaginal thought, reasoning, problem solving, decision making, creative thinking, concept formation, language. **Intelligence-** Introduction, definition, theories- factor theories, cognitive models of intelligence. **Intelligence tests-** characteristics and types. **External and internal influences.**

Suggested readings

- 1. Robert A. Baron, Psychology, Prentice Hall.**
- 2. Feldman R.S, Understanding Psychology, McGraw Hill.**
- 3. Wayne Weiten, Psychology – Themes and variations, Brooke/Cole Publishing Co.**

Course outcomes:

- 1. Describe key concepts, principles and overarching themes in Psychology**
- 2. Develop a working knowledge of Psychology's content domains**
- 3. Describe applications of Psychology.**
- 4. Understand the basic concepts of brain and its components.**

Core Practical I - Crime Scene Management Lab

Learning Objectives:

- a. **To secure, search and document various types of crime scenes.**
- b. **To prepare a report on Crime scenes**
- c. **The right method of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.**
- d. **Reconstruction of Crime scenes.**

Practical

1. **Securing the scene of crime and following safety measures.**
2. **Documentation of crime scene with sketching and listing of evidences.**
3. **Photography of a scene of crime and individual evidences.**
4. **Collection, preservation, packaging, sealing and labelling of physical evidences.**
5. **Collection, preservation, packaging, sealing and labelling of biological evidences.**
6. **To prepare a report on evaluation of indoor crime scene.**
7. **To prepare a report on evaluation of outdoor crime scene.**
8. **Demonstration of reconstruction of crime scene.**
9. **A case study on the importance of crime scene management.**
10. **A visit to the police station to discuss about the present scenario of crime scene management and suggest improvements.**

Course Outcomes:

1. **Basic understanding of securing, searching and documenting various types of crime scenes.**
2. **Gain basic knowledge of collecting, packaging and preserving different types of physical evidences.**
3. **Asses the importance of evidences found at a crime scene.**
4. **Effective report writing.**
5. **Gain skills required for reconstruction of crime scene.**

ALLIED COURSE III - Biology:

Objective:

- a) To provide knowledge about various fields of biology.
- b) To provide basic concepts of biology.

Unit 1: Basics of cell

Introduction, Eukaryote and Prokaryote cell, Plant and Animal cell. Various cell organelles-Endoplasmic Reticulum, Golgi complex, Mitochondria, Chloroplast and Lysosomes - structure and function.

Unit 2: Immunology

General concepts of Immune system. Innate and Adaptive immunity. Various cells of the immune system.

Antigen: Structure, Properties, factors influencing antigenicity. Antigenicity and immunogenicity.

Antibody: Structure, Properties, Function and Types. Antigenic determinants. Production of monoclonal and polyclonal antibodies.

Immunological principles: Ag-Ab interactions. Affinity and Avidity. Cross-reactivity, precipitation and agglutination reactions. Immunodiffusion, immune-electrophoresis. ELISA-types.

Unit 3: Microbiology

History and development. Classification and identification of microbes. Microbial role in diseases- Koch's postulates. Preventive medicines: Vaccines- History and Types. The control and growth of microbes. Culturing techniques – Aerobic and Anaerobic. Batch and continuous culture. Types of media.

Unit 4: Bio molecules

Amino acids – structure and functional group properties. Proteins and peptides – Composition of proteins – Primary, Secondary and Tertiary structure of protein. Enzymes and its functioning.

Carbohydrates - Definition, biological importance and classification.

Monosaccharides - Isomerism, anomerism. Sugar derivatives, Monosaccharides, Disaccharides, Polysaccharides. Structures of starch, glycogen and glycosaminoglycans.

Lipids - Definition, Biological importance and classification, Fats and fatty acids, Introduction to compound lipids, Hydrophobic and hydrophilic groups, Cholesterol, Bile salts, Micelle. Bimolecular leaflet, Lipoproteins.

Unit 5: Nucleic acids

DNA and RNA- Chemical Structure, types and function. Replication, Transcription and Translation.

Suggested readings

- 1. Lehninger, Principles of Biochemistry, 7th Edition.**
- 2. Lydyard, A Whelan and M W Fanger, Instant notes in immunology**
- 3. J m butler, Fundamentals of Forensic DNA typing**

Course Outcomes:

- 1. Explain basic concepts of Biology.**
- 2. Required skills to function as a Biologist.**
- 3. Ability to demonstrate and evaluate Biological issues in context.**

SECOND YEAR
SEMESTER-III
CORE COURSE V

Fingerprints and Questioned Documents

Learning Objectives:

- a. The fundamental principles on which the science of fingerprinting is based.
- b. The physical and chemical techniques of developing fingerprints on crime scene evidence.
- c. The significance of foot, palm, ear and lip prints.
- d. The importance of examining questioned documents in crime cases.
- e. The tools required for examination of questioned documents.
- f. The significance of comparing hand writing samples.

Unit 1:

Introduction. History and development of fingerprinting.

Histology and formation of ridges. Fundamental principles of fingerprinting. Types of fingerprints. Fingerprint patterns. Fingerprint characters/minutiae.

Classification – Henry’s classification and cataloguing of fingerprint record. Automated Fingerprint Identification System.

Unit 2:

Constituents of sweat residue. Locating latent fingerprints and development by physical and chemical techniques and its mechanism.

Preservation of developed fingerprints. Digital imaging for fingerprint enhancement.

Recording of fingerprints of living and deceased. Plain and rolled fingerprints.

Unit 3:

Footprints- Introduction, types, development, collection and comparison.

Footwear impressions- Introduction, types, location, collection, comparison and significance.

Collection of standards. Gait pattern analysis.

Palm prints- Introduction, examination and significance.

Lip prints – Introduction, nature, classification, location, collection and examination of lip prints.

Ear prints- classification, examination and their significance.

Unit 4:

Questioned Documents- Introduction, Definition, History and development of questioned document examination. **Forgery-** Definition, types and Sections involved. **Alterations in documents,** including erasures, additions, over-writings and obliterations. **Charred documents.**

Characteristic features of Indian currency notes and coins, passports, visas and stamp papers and their examination. Tools required- VSC, ESDA, UV-IR, Comparison Microscope.

Handwriting- Introduction and development of individuality. Characteristics of handwriting-Class and individual characteristics. Factors influencing handwriting. **Forgery and its types.**

Standards for comparison of handwriting.

Unit 5:

Printer: Introduction, parts of a printer, types of printers and their working principle

Typewriter: Introduction, working principle, parts of a typewriter.

Examination and comparison of printed, typed and xeroxed documents- toner analysis, grabber marks, individual characteristics and defect marks.

Suggested Readings

1. **C. Champod, C. Lennard, P. Margot and M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).**
2. **Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).**
3. **M. P. Caligiuri, The Neuroscience of Handwriting: Application for Forensic Document Examination, 1st Edition, (2012).**
4. **J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983).**
5. **Albert S. Osborn, Questioned Documents, 2nd Edition.**
6. **Wilson Harrison, Suspected Documents, Rowman & Littlefield, (1958)**
7. **O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (1982).**
8. **A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, Foundation Press, New York (1995).**
9. **R.N. Morris, Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2000).**
10. **E. David, The Scientific Examination of Documents – Methods and Techniques, 2nd Edition, Taylor & Francis, Hants (1997).**

Course Outcome:

1. **Understand the importance of fingerprints in Forensic Science.**
2. **Know the importance of document examination.**
3. **Learn about various components which help in determination of the Document.**
4. **Acquire skill required for handling questioned documents.**
5. **Basic understanding of handwriting analysis.**

CORE COURSE V

Forensic Physics and Ballistics:

Learning Objectives:

- a. The classification of firearms and their firing mechanisms.**
- b. The methods of identifying firearms.**
- c. The characteristics of ammunition.**
- d. The importance of firearm evidence.**
- e. The nature of firearm injuries.**
- f. The methods for characterization of gunshot residue.**

- g. Analysis of other physical evidences.**

Unit 1:

History and development of firearms. Classification of firearms. Weapon types and their operation. Firing mechanisms of different firearms.

Ammunition – classification and constructional features of different types of cartridge cases and bullets. Different types of marks produced during firing process – firing pin marks, breech face marks, chamber marks, extractor and ejector marks.

Unit 2:

Internal ballistics – Definition, ignition of propellants, shape and size of propellants, manner of burning, and various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting.

External Ballistics – Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistic data.

Unit 3:

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. Ricochet and its effects, stopping power. Wound Ballistics.

Unit 4:

Matching of bullets and cartridge cases in regular firearms. Identification of bullets, pellets and wads fired from improvised, country made firearms. Automated method of bullet and cartridge case comparison. Determination of range of fire and time of fire.

Mechanisms of formation of gunshot residues. Methods of analysis of gunshot residues from shooting hands and targets, with special reference to clothing.

Identification and nature of firearms injuries. Reconstruction with respect to accident, suicide, murder and self-defense.

Unit 5:

Glass – Composition, types, collection, packaging and examination of glass samples, glass fracture.

Soil – Composition, types, collection, packaging and examination of soil samples.

Paint – Composition, types, collection, packaging and examination of paint samples.

Fiber – Composition, types, collection, Packaging and examination of fiber samples.

Tampering of electric meters.

Suggested Readings

- 1. Vincent Di Maio, Gunshot wounds, 3rd Edition, CRC Press, Washington DC.**
- 2. J. S. Wallace, Chemical Analysis of Firearms, Ammunition & Gun Shot Residue, 2nd Edition, (2018).**
- 3. B. R. Sharma, Firearms in Criminal Investigation & Trial, (2017).**
- 4. T. Warlow, Firearms, the Law, & Forensic Ballistics, 3rd Edition, CRC Press, (2011)**

5. **W.F. Rowe, Firearms identification, Forensic Science Handbook, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).**
6. **A.J. Schwoeble and D.L. Exline, Current Methods in Forensic Gunshot Residue Analysis, CRC Press, Boca Raton (2000).**
7. **E. Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).**
8. **B.J. Heard, Handbook of Firearms and Ballistics, Wiley and Sons, Chichester (1997).**
9. **R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).**

Course Outcomes:

1. **Know in detail regarding the field of Forensic ballistics including history of firearms, about ammunitions and how firearms are classified.**
2. **Learn about the various types of mechanism of firing and also on what principles the identification and comparison of firearms, bullets and cartridge cases is based upon.**
3. **Comprehend and get an in-depth knowledge of internal, external and terminal ballistics.**
4. **Understand about what are gunshot residues, and how can they be analysed using chemical and instrumental techniques.**
5. **Understand the importance of various physical evidences and their analysis.**

Second ALLIED COURSE I

Chemistry:

Objective:

- a) To provide knowledge about various fields of chemistry.
- b) To understand the basic principles in chemistry.
- c) To understand the importance of Chromatographic and Spectroscopic techniques.
- d) To understand about various concepts of Industrial and Pharmaceutical Chemistry.

UNIT: I

Introduction to inorganic chemistry: Atomic structure -de Broglie matter wave, Heisenberg uncertainty Principle, atomic orbitals, quantum numbers, Aufbau and Pauli Exclusion Principle, Hund's multiplicity rule.

Study of periodic table: Modern periodic table and periodic properties, electronic configuration, atomic and ionic radii, ionization potential, electron affinity, electro negativity, metallic, non metallic characters and magnetic properties. Comparative study of s and p block elements. Introduction to Noble gases, Lanthanide and Actinide series.

UNIT: II

Introduction to organic chemistry: Empirical and Molecular formula, Classification of Aliphatic and Aromatic compounds, IUPAC Nomenclature of alkanes, alkenes, haloalkanes, alcohols, aldehydes, ketones, ethers, carboxylic acids and nitro compounds.

Introduction to chemical compounds: Aromatic hydrocarbons, Amines, Diazonium salts, Phenyl hydrazine, Sulphonic acids, Aromatic Alcohols, Phenols, quinones and also aromatic cyclic compounds - Naphthalene, Anthracene, Phenanthracene and its carcinogenicity.

UNIT: III

Dyes: Introduction and classification synthesis and use of Congo red malachite green alizarin and indigo

Food Chemistry: Organic food preservatives and food additive. Detection of food adulterants.

Textile Chemistry: Manufacture of synthetic fibers – Viscos rayon, acetate silk or rayon – properties and uses.

Petrochemicals: Raw materials, production of petrochemicals from olefin and acetylene, alkanes and cycloalkanes, aromatic hydrocarbons. Synthetic petrol – Berguis process, petroleum products – ISS of Gasoline and kerosene.

Pharmaceutical chemistry: Organic Pharmaceutical aids – preservatives, antioxidant, emulsifiers, stabilizing and suspending agents, ointments bases and related agents. Relationship between chemical structure and pharmacological activity – effect of unsaturation, chain length, isomerism, halogens, amine group, aldehydes and ketones group on structure property relations.

UNIT: IV

Spectroscopic Techniques: Introduction: Properties of light, Interaction of Electromagnetic radiation

with Matter, application in forensic science, Spectroscopy and its application in Forensic science : UV

/ Visible Spectrophotometry , Molecular Fluorescence, IR spectroscopy, Raman Spectroscopy , Atomic Absorption Spectroscopy

Chromatographic Techniques: General Principles, Paper, Column, TLC, Adsorption chromatography, Partition Chromatography, gas -liquid and gas chromatography, ion -exchange chromatography, HPLC and HPTLC techniques.

Physical methods of analysis: X-ray spectroscopy: X-ray absorption and fluorescence methods, X-ray diffraction, EDX, AES (Auger Emission Spectroscopy) ESCA (electron spectroscopy for chemical analysis

UNIT: V

Radioactivity. Fission, Fusion reactions. Half-Life Period. Alpha, Beta and Gamma emissions.

Penetration of Matter. Nuclear reactors. Applications. Geiger counters. Scintillation detectors.

Hazards of radioactivity.

Text Books:

1. R.D. Madan, “Modern Inorganic Chemistry”, 2nd edition, S. Chand & Company Ltd., 200

2. J. E. Huheey, Inorganic Chemistry; 4th Ed., Harper and Row Publishers, Singapore, 2006.
3. Bahl, B.S. and Bahl, A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010).
4. Finar I.L., Organic Chemistry, Vol 1&2, (6th edition) England, Addison Wesley Longman Ltd. (1996).
5. C. N. Banwell, Fundamentals of Molecular Spectroscopy; 4th Ed., McGraw Hill Education, Noida, 1994.
6. V. K. Srivastava and K. K. Srivastava, Introduction to Chromatography; 2nd Ed., Holden Day, New York, 1985.
7. Gurdeep.R.Chatwal and Sham K.Anand , Instrumental Methods of Chemical Analysis, Himalaya publish house
8. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6th Edition, Saunders College Publishing, Fort Worth (1992).
9. Max Houck Forensic Chemistry, 1st edition Academic press 2015, Elsevier.
10. Tewari.S.N: Liquor and Narcotic drugs.
11. Egon Stahl, Thin Layer Chromatography-A Laboratory Manual.

Reference Books:

1. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993).
2. J.D. Lee, „Concise Inorganic Chemistry“, 20th revised edition, Sultan Chand & Sons, 2000.
3. Carey.F.A. and Sundberg.R.J., Advanced organic chemistry, part A and B, 5th Springer Germany.
4. Silverstein.R.M., Webster,F.X., Spectroscopic identification of organic compounds 6th edition John Wiley, sons Inc (1997).
5. G. H Stout and L. H. Jensen, X-ray Structure Determination: A Practical Guide; John Wiley and Son.

6. R. Gopalan, P.S. Subramanian, K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand and Sons, New Delhi, 1997, New York, 1992.
7. F.A. Settle : Hand book of instrumental techniques for Analytical Chemistry, Prentice Hall 1997
8. Sharma. J and Fried. B., Handbook of TLC.
9. J.D. DeHaan, Kirk's Fire Investigation, 3rd Edition, Prentice Hall, New Jersey (1991).
10. F.G. Hofmann, A Handbook on Drug and Alcohol Abuse, 2nd Edition, Oxford University Press, New York (1983).
11. Clark. E.G.C: Isolation and Identification of drugs, Vol I & II academic press.
12. Zweig. G., Analytical Methods of Pesticides, academic press.

Course outcomes:

1. Firm foundation in the fundamentals of chemistry.
2. Application of current chemical and scientific theories.
3. Explore various branches of chemistry.

SECOND ALLIED COURSE II

Basic Chemistry lab:

Learning Objective:

- a) To have basic knowledge about various tests for explosives.
 - b) To understand the basic principles in chemistry.
 - c) To identify organic, inorganic and metallic salts.
 - d) To perform volumetric analysis.
1. Preliminary tests for explosives.
 2. Determination of melting, boiling and flash points determination.
 3. TLC separation of Drugs.
 4. Detection of adulterants from common food samples.
 5. Volumetric analysis using Iodoform.
 6. Volumetric analysis using Potassium Permanganate.
 7. Tests for detection of Alcohols.
 8. Identification of Organic compounds
 9. Identification of Inorganic compounds.
 10. Identification of Metallic salts.

Course outcomes:

1. To design and carry out scientific experiments.
2. Accurately record and analyze the results of experiments.
3. Explore various applications of chemistry.

SEMESTER III

NON-MAJOR ELECTIVE I

Criminalities

Learning Objectives:

- a. The methods of securing, searching and documenting crime scenes.
- b. The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.
- c. The legal importance of chain of custody.
- d. The importance of reconstruction of crime scene.

Unit 1: Functions of Forensic Science Definitions and concepts in forensic science.

Scope of forensic science. Need of forensic science. Basic principles of forensic science. Tools and techniques in forensic science. Branches of forensic science. Data depiction. Forensic science in India: Organizational set up of forensic science laboratories.

Unit 2: Criminology

Definition, Aim and Scope. Theories of criminal behavior. Criminal profiling. Elements, nature, causes and consequences of crime. Deviant behavior. Social change and crime. Understanding modus operandi. Investigative strategy. Police's power of investigation. Filing of criminal charges. Correctional measures and rehabilitation of offenders.

Unit 3: Crime Scene Management

Crime scene investigations. Protecting and isolating the crime scene. Crime scene search methods. Documentation of crime scene by photography, sketching and field notes. Types, significance and classification of physical and trace evidence. Submission of evidence. Chain of custody. Reconstruction of crime scene.

Suggested Readings

- 1. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).**
- 2. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).**
- 3. M. S. Dahiya, Principles and Practices in Contemporary Forensic Sciences, Shanti Prakashan (2015).**
- 4. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).**

Course Outcomes:

- 1. Basic understanding of the Scientific method and the use of the problem-solving in the field of the Forensic science.**
- 2. Identify the role of the Forensic scientist and physical evidence within the criminal justice system.**
- 3. Understand various branches of Forensic science and their functions.**
- 4. Identify and classify various types of evidences.**
- 5. Importance of chain of custody.**

NON MAJOR ELECTIVE - Questioned Document Analysis

Learning Objectives:

- a. To understand the history and development of Questioned Document Examination.
- b. The importance of examining questioned documents in crime cases.
- b. The tools required for examination of questioned documents.
- c. The importance of detecting frauds and forgeries by analyzing questioned documents.

Unit 1: Nature and Scope of Questioned Documents

Introduction, Definition and History and development of questioned documents.

Qualifications, duties and responsibilities of
Questioned document examiner.

Government Examiner of Questioned Document.

Basic tools- ESDA, VSC. Stages of Document examination.

Unit 2: Forgery

Definition, types and Sections involved. Alterations in documents, including erasures, additions, over-writings and obliterations. Charred documents.

Characteristic features of Indian currency notes, passports, visas and stamp papers and their examination.

Seal examination. Paper and Ink examination.

Unit 3: Other documents

Printer: Introduction, parts of a printer, types of printers and their working principle.

Typewriter: Introduction, working principle, parts of a typewriter.

Examination and comparison of printed, typed and xeroxed documents- toner analysis, grabber marks, individual characteristics and defect marks.

Suggested Readings

- 1. Albert S. Osborn, Questioned Documents, 2nd Edition.**
- 2. Wilson Harrison, Suspected Documents, Rowman & Littlefield, (1958)**
- 3. O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (1982).**

Course Outcome:

- 1. Know the importance of document examination.**
- 2. Learn about various components which help in analysis of the Document.**
- 3. Various tools and techniques involved.**
- 4. Acquire skill required for handling questioned documents.**

NON MAJOR ELECTIVE - Fingerprint Science

Learning Objectives:

- a) The fundamental principles on which the science of fingerprinting is based.
- b) The method of classifying criminal record by fingerprints.
- c) The physical and chemical techniques of developing fingerprints on crime scene evidence.
- d) The significance of foot, palm, ear and lip prints.

Unit 1: Basics of Fingerprinting

Introduction. History and development of fingerprinting.

Histology and formation of ridges. Fundamental principles of fingerprinting. Types of fingerprints. Fingerprint patterns. Fingerprint characters/minutiae.

Henry's classification and cataloguing of fingerprint record. Automated Fingerprint Identification System.

Unit 2: Development of Fingerprints

Latent prints. Constituents of sweat residue. Latent fingerprints' detection by physical and chemical techniques. Mechanism of detection of fingerprints by different developing reagents. Application of light sources in fingerprint detection

Unit 3: Other Impressions

Importance of footprints. Casting of foot prints, Electrostatic lifting of latent foot prints. Lip prints - Nature, location, collection and examination of lip prints. Ear prints and their significance. Palm prints and their historical importance.

Suggested Readings

1. C. Champod, C. Lennard, P. Margot and M. Stoilovic, *Fingerprints and other Ridge Skin Impressions*, CRC Press, Boca Raton (2004).
2. Lee and Gaensleen's, *Advances in Fingerprint Technology*, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

Course Outcome:

1. Understand the importance of fingerprints in Forensic Science.
2. Identify and classify fingerprints.
3. Understand the principle behind development of latent fingerprints.
4. Gain knowledge on various other types of impressions.

SEMESTER IV

CORE COURSE VI

Instrumentation

Learning Objectives:

- a. The general concepts of instrumentation.
- b. The significance of microscopy in visualizing trace evidence and comparing it with control samples.
- c. The importance of Chromatographic and Spectroscopic techniques in processing crime scene evidence.
- d. The utility of Colorimetry, Electrophoresis and Neutron activation analysis in identifying chemical and biological materials.

Unit 1:

General Physical and Biological concepts- Mass, Density, range of electromagnetic radiation, interaction between matter and radiation, fluorescence, phosphorescence. pH and buffers. Significance of instrumentation in Forensic Science. Centrifuge- Principles, types and Forensic applications.

Unit 2:

Principles, ray diagrams, parts and working, sample preparation and Forensic applications of-Simple microscope, Compound microscope, Stereo microscope, Polarized light microscope, Dark-field microscope, Comparison microscope, Fluorescent microscope, Electron microscope.

Unit 3:

Principles of spectroscopy- Beer Lambert's Law, ray diagram, parts and working and Forensic applications of- UV-Visible spectroscopy and IR spectroscopy. FTIR.

Principles and Forensic applications of- Atomic Absorption and Emission Spectroscopy, Raman spectroscopy, X-Ray spectroscopy.

Principle, working and applications of Mass Spectroscopy.

Unit 4:

Principles, working and Forensic applications of Paper chromatography, Column chromatography, and TLC. Principles and applications of LC, HPLC and GC. GC-MS. LC-MS.

Unit 5:

General principles, factors affecting, Types- Horizontal and Vertical, SDS PAGE, AGE, Crossed over electrophoresis and Capillary electrophoresis, Genetic Analyzer. Forensic applications.

Principles and working and Forensic applications of Autoclave, Laminar Air Flow-HEPA filters, Incubators, CO₂ incubators.

Suggested Readings

1. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6th Edition, Saunders College Publishing, Fort Worth (1992).
2. W. Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, Hampshire (1991).
3. J.W. Robinson, Undergraduate Instrumental Analysis, 5th Edition, Marcel Dekker, Inc., New York (1995).
4. J.C.Giddings, Dynamics of Chromatography, Marcel Dekker, New York.

Course Outcomes:

1. Understand various principles involved in instrumentation.
2. Apply various techniques to visualize trace evidences.
3. Significance of various techniques involved in identifying various Chemical and Biological materials.
4. Understand the working of various instruments.

CORE PRACTICAL II

Fingerprints and Questioned Documents Lab

Learning Objectives:

- a. To record fingerprints.
- b. To classify fingerprints.
- c. To develop latent prints.
- d. To prepare a cast.
- e. To analyze handwriting.
- f. To identify forgery and alterations.

Practical

1. To record plain and rolled fingerprints.
2. To identify different fingerprint patterns.
3. To carry out ridge tracing and ridge counting.
4. To carry out ten-digit classification of fingerprint.
5. To develop latent fingerprints using physical and chemical methods.
6. To prepare cast of foot prints.
7. To identify handwriting characters and detect forgery.
8. To examine the security features of currency notes and passports.
9. A case study on the fingerprints / questioned documents.

Course outcomes:

1. Record and classify fingerprints.
2. Attain the ability to development latent fingerprints.
3. Gain skills to collect footprints by preparing a cast.
4. Identify features of currency notes.
5. Attain the ability to detect forgery.

SECOND ALLIED COURSE III

Basics of Computer:

Objective:

- a) To impart knowledge about the fundamental concepts of computers in a logical and informative manner.
- b) To provide knowledge about different parts of computer.
- c) To understand the basic of operating system.
- d) To understand the importance of Internet.

UNIT-I

Introduction: Characteristics of Computers – The Evolution of Computers – The Computer Generations. Basic Computer Organization: Input Unit – Output Unit - Storage Unit – Arithmetic Logic Unit – Control Unit – The Central Processing Unit. Processor and Memory: The Main Memory.

UNIT-II

Secondary Storage Devices: Sequential and Direct Access Devices – Magnetic Disk -

Optical Disk – CD-ROM. Input-Output Devices: Input Devices: Keyboard – Point-and-Draw

Devices – Data Scanning Devices – Electronic-card Reader. Output Devices: Monitors –

Printers – Plotters. Various storage devices. Computer Software: Types of Software.

UNIT-III

Operating Systems: Main Functions of an Operating System. Business Data Processing: Data Processing – Data Storage Hierarchy – Standard Methods of Organizing Data – File Management System: File Types – File Organizations – Database Management System: Database Models.

UNIT-IV

The Internet: Definition- Basic Services: Electronic Mail – File Transfer Protocol – Telnet - The World Wide Web. WWW Browsers – Uses of the Internet. Multimedia: Multimedia Computer System – Multimedia Components – Multimedia Applications.

UNIT-V

Computer Networks- Introduction, Network topology. Working of LAN, MAN, WAN.

TEXT BOOK:

- 1. Pradeep K. Sinha and Priti Sinha, Computer Fundamentals, BPB Publications, Third Edition.**
- 2. Comdex DTP Course Kit - Vikas Gupta**
- 3. Introduction to Computers – Alexis Leon, Vikas Publication.**

Course Outcomes:

- 1. Apply knowledge of computer programs to various disciplines.**
- 2. Identify and define computing requirements appropriately to solve problems.**
- 3. Design, implement and evaluate computer-based systems.**
- 4. Ability to use current techniques, skills and tools necessary for computing practice.**

SEMESTER IV

NON-MAJOR ELECTIVE II **Handwriting Analysis**

Learning Objectives:

- a. The basic elements of handwriting.
- b. The individuality of handwriting.
- c. The significance of comparing hand writing samples.
- d. The importance of detecting signature forgeries by analyzing questioned documents.

Unit 1: Handwriting

Handwriting- Introduction and development of individuality. Characteristics of handwriting- Class and individual characteristics. Natural variation. Factors influencing handwriting.

Unit 2: Comparison of Handwriting

Process of comparison. Standards for comparison of handwriting. Exemplars – types and merits and demerits. Forgeries and its types, detection of forgeries in handwriting. Signature forgery- detection.

Unit 3: Other analysis

Disguised writing and anonymous letters- identification of writer, secret writings-indentured and invisible writings. Examination of alterations- erased writing, overwritings, additions, substitutions and obliterations. Charred writings. Built up documents, determination of sequence of strokes, physical matching of documents.

Suggested Readings

1. M. P. Caligiuri, **The Neuroscience of Handwriting: Application for Forensic Document Examination, 1st Edition, (2012).**
2. R.N. Morris, **Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2000).**

Course Outcome:

1. **Basic understanding of handwriting analysis.**
2. **Identifying various class and individual characteristics.**
3. **Significance of Handwriting analysis.**
4. **Various tools and techniques involved in handwriting analysis.**

NON MAJOR ELECTIVE II - Investigation of Scene of Occurrence

Learning Objectives:

- a. Basics of crime and crime scene.
- b. The methods of securing, searching and documenting crime scenes.
- c. The art of collecting evidences at various crime scenes.
- d. The legal importance of chain of custody.

Unit 1: Introduction

Crime- definition, causes, types.

Scene of crime- Introduction, definition, types- Indoor and outdoor, primary, secondary and tertiary, macroscopic and microscopic evidence, accidental, suicidal and homicidal.

Various personnel involved and their role at the scene of crime.

Unit 2: Crime Scene Management

Role of first responding officer. Steps to be followed at a crime scene.

Documentation- Photography, Videography, Sketching.

Crime scene search- Definition, objective, Patterns- Strip/Lane method, Grid method, Zone method, Spiral method, Wheel method. Chain of Custody.

Unit 3: Specific Crime Scenes

Management and important evidences and their collection and significance in- Blast crime scene, Arson crime scene, Airplane crash crime scene, Motor Vehicle and Train accidents.

Suggested Readings

1. **W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).**
2. **S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).**
3. **M. S. Dahiya, Principles and Practices in Contemporary Forensic Sciences, Shanti Prakashan (2015).**

Course Outcomes:

1. **Basic understanding of the Scientific method and the use of the problem-solving in the field of the Forensic science.**
2. **Identify the role of the Forensic scientist and physical evidence within the criminal justice system.**
3. **Understand various branches of Forensic science and their functions.**
4. **Handle and examine different types of crimes scenes.**

NON MAJOR ELECTIVE II - Digital Forensics

Learning Objectives:

- a. The basics of Digital forensics.**
- b. The cases which fall under the purview of Digital crimes.**
- c. The types of Digital crimes.**
- d. The elements involved in investigation of Digital crimes**

Unit 1: Fundamentals and Concepts Fundamentals of computers

Hardware and accessories –Development of hard disk, physical construction, CHS and LBA addressing, encoding methods and formats. Memory and processor. Methods of storing data. Operating system. Software. Introduction to network, LAN, WAN and MAN.

Unit 2: Computer Crimes Definition and types of computer crimes. Distinction between computer crimes and conventional crimes. Reasons for commission of computer crimes. Breaching security and operation of digital systems. Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs. Types of computer crimes – computer stalking, pornography, hacking, crimes related to intellectual property rights, computer terrorism, hate speech, private and national security in cyber space. An overview of hacking, spamming, phishing and stalking.

Unit 3: Computer Forensics Investigations

Seizure of suspected computer. Preparation required prior to seizure. Protocol to be taken at the scene. Extraction of information from the hard disk. Treatment of exhibits. Creating bitstream of the original media. Collection and seizure of magnetic media. Legal and privacy issues. Examining forensically sterile media. Restoration of deleted files. Password cracking and E-mail tracking. Encryption and decryption methods. Tracking users.

Suggested Readings

- 1. Dejey, Murugan, Cyber Forensics, Oxford University Press, New Delhi (2018)**
- 2. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, Computer Crimes and Computer Forensics, Select Publishers, New Delhi (2003).**
- 3. C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey (1997).**
- 4. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).**
- 5. E. Casey, Digital Evidence and Computer Crime, Academic Press, London (2000).**

Course Outcome:

- 1. Conduct digital investigations that conform to accepted professional standards.**
- 2. The investigative process: identification, preservation, examination, analysis and reporting.**
- 3. Cite and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy.**
- 4. Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy and/or societal standards.**
- 5. Knowledge of various types of digital crime and its detection.**

**THIRD YEAR
SEMESTER V
CORE COURSE VII**

Forensic Biology and Serology:

Learning Objectives:

- a. The significance of biological and serological evidence.
- b. The Forensic importance of hair evidence.
- c. Collection and Packaging of biological evidences.

- d. The importance of biological fluids – blood, saliva, semen, sweat, urine, fecal stains and milk – in crime investigations.
- e. How Forensic entomology assists in death investigations.
- f. How wildlife Forensics aid in conserving natural resources.

Unit 1:

Nature and importance of biological evidence. Collection and preservation of common biological evidences.

Significance and origin of hair evidence. Transfer, persistence and recovery of hair evidence. Structure of human hair. Comparison of hair samples. Morphology and biochemistry of human hair. Comparison of human and animal hair.

Importance of pollen grains, wood and diatoms in Forensic science.

Unit 2:

Common body fluids. Composition and functions of blood. Collection and preservation of blood evidence. Distinction between human and non-human blood- Origin determination. Determination of blood groups.

Forensic characterization of bloodstains. Typing of dried stains. Blood enzymes and proteins. Semen. Forensic significance of semen. Composition, functions and morphology of spermatozoa. Collection, evaluation and tests for identification of semen. Individualization on the basis of semen examination.

Composition, functions and Forensic significance of saliva, sweat, urine, fecal stains, milk and vomit. Tests for their identifications.

Unit 3:

Bloodstain characteristics. Impact bloodstain patterns. Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails. Bloodstain drying times. Documentation of bloodstain pattern evidence. Crime scene reconstruction with the aid of bloodstain pattern analysis.

Unit 4:

**Basics of Forensic entomology. Insects of Forensic importance.
Collection of entomological evidence during death investigations.**

Unit 5:

**Significance of Wildlife Forensics. Organizations involved. IUCN Red List-
Conservation Status- Extinct, Extinct in Wild, Critically Endangered,
Endangered, Vulnerable, Near Threatened, Least Concern. List of protected
species in India. Illegal trading of wildlife**

items. Identification of Physical evidences pertaining to wildlife crime.

Suggested Readings

1. J. M. Butler, *Advanced Topics in Forensic DNA Typing*, Academic Press, (2014).
2. Alan Gunn, *Essential Forensic Biology*, 2nd Edition, Wiley (2009)
3. L. Stryer, *Biochemistry*, 3rd Edition, W.H. Freeman and Company, New York (1988).
4. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, *Harper's Biochemistry*, APPLETON & Lange, Norwalk (1993).
5. S. Chowdhuri, *Forensic Biology*, BPRD, New Delhi (1971).
6. R. Saferstein, *Forensic Science Handbook*, Vol. III, Prentice Hall, New Jersey (1993).
7. G.T. Duncan and M.I. Tracey, *Serology and DNA typing in, Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
8. W.G. Eckert and S.H. James, *Interpretation of Bloodstain Evidence at Crime Scenes*, CRC Press, Boca Raton (1989).
9. G.T. Duncan and M.I. Tracey in *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
10. T. Bevel and R.M. Gardner, *Bloodstain Pattern Analysis*, 3rd Edition, CRC Press, Boca Raton (2008).

Course Outcomes:

1. Understand the general concepts and definitions used in Forensic Biology and serology.
2. Understand the role of Forensic biologists in crime scene investigation.
3. Locate and collect various types of biological evidences and also about the laboratory handling procedures of such evidence.
4. Importance of Forensic Entomology and Wildlife Forensics.

CORE PRACTICAL III

Forensic Biology and Serology Lab:

Learning Objectives:

- a. To identify hair specimen.
- b. To examine and compare pollen grains and diatoms.
- c. To conduct tests for blood and other serological fluids.
- d. To analyze bloodstain patterns.

Practical:

- 1.To examine hair morphology and identify species.
- 2.To carry out microscopic examination of pollen grains.
- 3.To carry out microscopic examination of diatoms.
4. To carry out preliminary and confirmatory tests for blood.
5. To determine the blood group from fresh and dried blood stains.
- 6.To identify the given stain as saliva.
- 7.To identify the given stain as urine.
- 8.To identify various bloodstain patterns in a crime scene.
- 9.To prepare a case report on Wildlife Forensics.
- 10.To prepare a case report on Forensic Entomology.

Course Outcomes:

1. Identify and examine hair and other biological evidences.
2. Perform various tests to identify various biological samples.
3. Gain skills to carry-out serological tests.
4. Gain knowledge on the science of bloodstain pattern analysis.

CORE COURSE VIII

Cyber Crime and Cyber Law:

Learning Objectives:

- a. Various types of computer and cybercrimes.
- b. The types of file systems.
- c. The basics of computer Forensic tools.
- d. The process of retrieving deleted data.
- e. The role of first responding officer.
- f. The elements of cyber law and I.T Act.

Unit 1:

Cyber Crimes, Types of Cybercrime and Financial Crimes, Hacking, Cyberspace, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Cyber Laws and Ethics, Law Enforcement Roles and Responses, Incident response, First Responder.

Unit 2:

Digital investigation, Digital crime scene evaluation process, Search & Seizure, Digital Forensic Lab Setup, Dead v/s Live Forensics, Types of Digital Evidences, Chain of Custody, Standard Operating Procedures of cyber Forensics, Investigation Guidelines, overview of tools, Slack Space, Virtual paging.

Unit 3:

Evidence collection from different devices, Write Protect, Write Blockers, Disk Imaging, Data Recovery, Volatile and Non-Volatile Data Acquisition and Analysis, File Systems and Signatures, Registry Forensics, Email analysis and IP, Stenography, Cryptography, Card crimes.

Unit 4:

Metadata Analysis, Browser Forensics, History Extraction, Integrity, Hash Value, Data tampering, File Signature Analysis, Overview of Mobile Forensics, Network Forensics, Cloud Forensics and Malware Analysis.

Unit 5:

Introduction to IT Act 2000, Basic terms and elements of the act. Amendments made in IT Act. Electronic Governance, Certifying Authorities, Digital Signature and Electronic Signature Certificates, Case Study.

Legal Procedure to gather information from Outside India.

Suggested Readings

- 1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, Computer Crimes and Computer Forensics, Select Publishers, New Delhi (2003).**
- 2. C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey (1997).**
- 3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).**
- 4. E. Casey, Digital Evidence and Computer Crime, Academic Press. London (2000).**

Course outcome:

- 1. Understand the different theoretical and cross-disciplinary approaches (criminological, political, legal and information security/management) to the study of cyber-security and the regulation of the Internet and the Internet of Things.**
- 2. Investigate assumptions about the behavior and role of offenders and victims in cyberspace, and use basic web-tools to explore behavior on-line.**
- 3. Analyze and assess the impact of cybercrime on government, businesses, individuals and society.**
- 4. Evaluate the effectiveness of cyber-security, cyber-laws (e.g. the Budapest Convention) and other countermeasures against cybercrime and cyber warfare.**

CORE PRACTICAL IV

Cyber Crime and Cyber Law Lab:

Learning Objectives:

- a. How to respond to a cybercrime scene.**
- b. Various tools and techniques to analyze digital evidences.**
- c. To trace e-mails.**
- d. How to prepare a formal report.**

Practical:

- 1. To identify, seize and preserve digital evidence from crime scenes.**
- 2. To write protect a system.**
- 3. To carry out copying and imaging of pen drives and hard disks.**
- 4. To identify encrypted and hidden files.**
- 5. Analysis of metadata of files.**
- 6. Analysis of graphic files - steganography.**
- 7. Analysis of file systems and system registry.**
- 8. To trace routes followed by e-mails and identify the IP address of the sender.**
- 9. Case studies on digital/cybercrime – Reported Nationally and Internationally**

Course outcome:

- 1. Respond to a cybercrime scene.**
- 2. Gain the ability to perform various analysis on digital evidences.**
- 3. Trace e-mails to the sender.**
- 4. Prepare a report on Cybercrime case.**

SEMESTER V

MAJOR BASED ELECTIVE I

1. Forensic Anthropology (Theory + Practical)

Learning Objectives:

- a. Importance of Forensic anthropology in identification of persons.**
- b. Different techniques of facial reconstruction and their Forensic importance.**
- c. Significance of Superimposition technique and its admissibility in court of law**
- d. Significance of Somatoscopy and Somatometry.**
- e. Significance of Forensic Odontology.**

Unit 1: Significance of Forensic Anthropology

Scope of Forensic anthropology. Study of human skeleton. Nature, formation, and identification of human bones. Determination of age, differentiation of sex, estimation of stature from skeletal remains.

Unit 2: Personal Identification – Somatoscopy and Somatometry

Somatoscopy – observation of hair on head, forehead, eyes, root of nose, nasal bridge, nasal tip, chin, Darwin’s tubercle, ear lobes, supra-orbital ridges, physiognomic ear breadth, circumference of head. Scar marks and occupational marks.

Somatometry – measurements of head, face, nose, cheek, ear, hand and foot, body weight, height. Indices - Cephalic index, nasal index, Cranial index, upper facial index.

Facial reconstruction- Introduction, Steps and Importance. Case study.

Unit 3: Forensic Odontology

Definition and scope of odontology. Teeth- primary and secondary. Estimation of age from teeth. Dental charting.

Bite marks. Forensic significance of bite marks. Collection, preservation, photography and comparison of bite marks evidence. Legal aspects of bite marks.

Practicals

- 1. To study identification and description of bones and their measurements.**
- 2. To determine of age from skull and teeth.**
- 3. To differentiate sex from skull.**
- 4. To differentiate sex from pelvis.**
- 5. To investigate the differences between animal and human bones.**
- 6. To perform somatometric measurements on living subjects.**
- 7. To carry out craniometric measurements of human skull.**
- 8. To estimate stature from long bone length.**

Suggested Readings

- 1. Narayan Reddy, The Essentials of Forensic Medicine and Toxicology, 34th Edition (2017)**
- 2. C.K Parikh, Textbook of Medical Jurisprudence and Forensic Toxicology, 6th Edition, (2007).**
- 3. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).**
- 4. British Pharmacopeia**
- 5. Indian Pharmacopeia**
- 6. Warren, The Forensic anthropology laboratory, CRC Press (2008).**
- 7. Henry gray, Gray's anatomy for students.**
- 8. Pickrin and Bachman, Use of Forensic anthropology.**

Course Outcomes:

- 1. Reconstruct a basic biological profile from a set of human skeletal remains.**
- 2. Recover Forensic evidence using archaeological methods as part of a mock excavation in the field.**
- 3. Describe, explain, and critically evaluate methods used in Forensic Anthropology.**
- 4. Discuss and construct an academic argument around an issue/issues in Forensic Anthropology and Archaeology case(s).**
- 5. Understand the importance of bite-mark evidences.**

2. DNA Forensics (Theory + Practical)

Learning Objectives:

- a. The basic principle of DNA analysis.**
- b. The Forensic significance of DNA typing.**
- c. The importance of Short Tandem Repeats and Restriction Fragment Length Polymorphism in DNA technique.**
- d. Role of DNA typing in disputed paternity and maternity testing, child swapping, kidnapping, murder, rape cases and immigration cases.**

Unit 1: Basic Principles DNA as biological blueprint of life.

Extraction, amplification and identification of STR alleles using Genetic analyzer.

Unit 2: Forensic DNA Typing Collection of specimens.

Polymerase chain reaction – historical perspective, sequence polymorphisms, individualization of evidence. Restriction Fragment Length Polymorphism (RFLP), Short Tandem Repeats (STR) – role of fluorescent dyes, nature of STR loci, genetic markers, typing procedure and interpretation of results. Touch DNA.

Unit 3: Parentage Testing, Principles of heredity and Individual Identification. Genetics of paternity. DNA testing in disputed paternity. Mendelian laws of parentage testing. Mathematical basis of parentage identification. Missing body cases. Reference populations and databases. Allele frequency determination. Hardy-Weinberg law. Probability determination in a population database.

Practical:

- 1. To carry out extraction of DNA from various body fluids.**
- 2. Preparation of gel plates for electrophoresis.**
- 3. To discuss case studies on the role of DNA typing in solving paternity and maternity disputes.**
- 4. Case studies on role of DNA typing in identifying unrecognizable bodies.**
- 5. Case studies on Touch DNA.**

Suggested Readings

- 1. J m butler, Advanced topics in forenics DNA typing - Methodology**
- 2. J m butler, Fundamentals of Forensic DNA typing**
- 3. J m butler, Forensic DNA typing - biology, technology and genetics of STR markings**
- 4. J m butler, Advanced topics in forenics DNA typing – Interpretation**
- 5. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).**

Course Outcomes:

- 1. Explain the key concepts in population, evolutionary and quantitative genetics including: the basis of genetic variation; heritability; Hardy-Weinberg Equilibrium; roles of migration, mutation.**
- 2. Understand the range of molecular laboratory techniques used routinely in human Forensic analysis and population genetic analysis including sex typing, DNA profiling, Single Nucleotide Polymorphism (SNP) detection and DNA sequencing.**
- 3. Perform by hand, calculator and computer software the statistical analysis of genetic data relevant to Forensic, conservation, quantitative and evolutionary genetics, and summarize and interpret the outcomes.**
- 4. Understand the importance of DNA based evidences in various types of crimes.**

3. Accident Investigation (Theory + Practical)

Learning Objectives:

- a. The basic principle of motor vehicle accidents.**
- b. The Forensic significance of tyre marks, skid marks and scuff marks.**
- c. The various types of injuries resulting from accidents.**
- d. The importance of Tachographs.**

Unit 1: Motor Vehicle Accidents Accident scene.

**Sources of Forensic information. Eyewitness accounts, Locard's principle
Extent of vehicle damage. Examination of vehicular lights, Visibility conditions.
Photographs of accident site. Estimation of speed. Tyre marks, skid marks, scuff
marks. Maintenance of vehicles.**

Abandoned vehicles. Importance of air bags. Railway accidents.

Unit 2: Accident Analysis

**Pre-crash movement. Post-crash movement. Collision model. Gauging driver's
reaction – Breathe analyzer, Occupant's kinematics. Types of injuries resulting
from accident – Fake or real for clamming insurance. Hit and run investigations.
Trace evidence at accident sites.**

Unit 3: Tachographs: Forensic significance.

**Tachograph charts. Principles of chart analysis. Accuracy of speed record. Tyre slip
effects.**

Falsification and diagnostic signals. Route tracing.

Practical:

- 1. To lift tyre marks.**
- 2. To study the pattern of skid marks.**
- 3. To study the pattern of scuff marks.**
- 4. To estimate the speed of the vehicle from skid marks.**
- 5. Popular case study.**

Suggested Readings

- 1. T.S. Ferry, Modern Accident Investigation and Analysis, Wiley, New York (1988).**
- 2. D. Lowe, The Tachograph, 2nd Edition, Kogan Page, London (1989).**
- 3. T.L. Bohan and A.C. Damask, Forensic Accident Investigation: Motor Vehicles, Michie Butterworth, Charlottesville (1995).**
- 4. S.C. Batterman and S.D. Batterman in Encyclopedia of Forensic Sciences, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).**

Course Outcomes:

- 1. Differentiate between an accident and incident;**
- 2. Apply an understanding of the different steps of an investigation process;**
- 3. Describe the roles and responsibilities of an investigator;**
- 4. Detail the responsibilities of operators and other authorities within investigations;**
- 5. Apply appropriate methods and protocols by which to collect and analyse evidence within an investigation;**

SEMESTER VI
CORE COURSE IX

Forensic Medicine and Toxicology:

Learning Objectives:

- a. The duties of the first responding officer who receives a call on homicide or suicide case.
- b. The steps involved in processing the death scene.
- c. The importance of ascertaining whether the crime was staged to appear as suicide or accident.
- d. The stages of decomposition.
- e. The importance of autopsy.
- f. The significance of toxicological studies in Forensic science.
- g. The classification of poisons and their modes of actions.
- h. The absorption of poisons in body fluids.

Unit 1:

Definition, History and scope of Forensic Medicine. Role of first responding officer. Approaching a crime scene of death. Documenting the death scene. Medical Jurisprudence. Post Mortem Changes- Rigor Mortis, Cadaveric Spasm, Putrefaction, Mummification, Adipocere formation.

Handling buried body cases- search for buried bodies, methods of exhumation. Identification of various bones. Personal identification.

Medical certification and medico-legal reports. IPC sections relating to Forensic Medicine.

Unit 2:

Death- Definition, types- natural and unnatural deaths. Suspended animation. Modes of death – Coma, Syncope and Asphyxia. Manner of death and Cause of death.

Medico-legal aspects and Forensic significance of asphyxia death, drowning, death due to starvation, electrocution, heat and cold. Asphyxia – Types and classification. Medico-legal aspects

Infanticide and foeticide. Signs of live birth, Determination of age of foetus.

Unit 3:

Injuries- Types and classification. Antemortem and post mortem injuries. Aging of injuries.

Artificial injuries. Burns and scalds.

Unit 4:

Poisons: Definition, Classification of poisons. Physico-chemical characteristics and mode of action of poisons, route of administration. Elaboration on Accidental, suicidal and homicidal poisonings. Insecticides and Pesticides. NPIC. Poisoning cases in India.

Signs and symptoms of common poisoning and management of poisoning cases. Collection and preservation of viscera, blood and urine for various poison cases.

Beverages: Types of alcoholic and non-alcoholic, Illicit liquors. Symptoms, analysis and tests of alcohol. Estimation of ethyl alcohol in blood and urine.

Drugs of abuse-Introduction, Classification. Symptoms and Antidotes. NDPS Act.

Radioactive poisoning, Anthrax poisoning. Date-rape drugs.

Unit 5:

Toxicology- Introduction, definition, characteristics of exposure, spectrum of toxic effects. Basic steps of analytical Toxicology. Significance of toxicological findings. Techniques used in Toxicology. Human performance Toxicology. Extraction from visceral samples. Stass-Otto Method. Basic tests for identification of common poisons. Post Mortem findings in poisoning cases.

Pharmacology- Introduction, Definition, Scope of Forensic Pharmacological studies, Absorption, Distribution, Metabolism and Excretion (ADME) of drugs. Pharmacokinetics and Pharmacodynamics. Dose-response relationship. Lethal dose 50 and effective dose 50.

Suggested Readings

1. Narayan Reddy, The Essentials of Forensic Medicine and Toxicology, 34th Edition (2017)
2. C.K Parikh, Textbook of Medical Jurisprudence and Forensic Toxicology, 6th Edition, (2007).
3. K. Smyth, The Cause of Death, Van Nostrand and Company, New York (1982).
4. Casserats and Doulls
5. Dictionary of Forensic
6. J. Singh. Modi
7. Paul Krik, Crime Investigation
8. M. Bernstein, Forensic odontology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
9. J. Dix, Handbook for Death Scene Investigations, CRC Press, Boca Raton (1999).

Course outcome:

1. Gain knowledge on various aspects of Forensic Medicine.
2. Understand the basis of presumptive and confirmation testing, and compare and evaluate the use of a variety of biological matrices in toxicological analysis
3. Discuss the pharmacological characteristics and analytical considerations of several major drugs classes commonly encountered in Forensic Toxicology
4. Explain how pharmacokinetic/ pharmacodynamic parameters can be used to interpret toxicological findings
5. Summarize the role of Forensic Toxicology in areas such as sports drug testing and drug-facilitated sexual assault cases.

CORE COURSE X

Advanced Forensic Psychology:

Learning Objectives:

- a. The overview of Forensic Psychology and its applications.
- b. The legal aspects of Forensic Psychology.
- c. The significance of criminal profiling.
- d. The importance of psychological assessment in gauging criminal behavior.
- e. The tools and techniques required for detection of deception.

- f. The critical assessment of advanced Forensic techniques like Polygraph, Narco analysis and brain electrical oscillation signatures

- g. The elements of substance abuse disorders, delusional disorders and personality disorders.

Unit 1:

The relationship between Forensic Psychology and Law. Development of Forensic Psychology. Ethical issues in Forensic Psychology. Importance of assessments in civil and criminal cases. Mental disorders and Forensic Psychology. Psychology of evidence- Witness testimony, Confession and Statement verification.

Unit 2:

Crime and Psychopathology. Biological factors and crime – social learning theories, psycho-social factors, abuse. Juvenile delinquency – theories of offending (social cognition, moral reasoning), Child abuse (physical, sexual, emotional), juvenile sex offenders, legal controversies. POCSO Act.

Delusional disorders. Meaning, Symptoms, Treatment and Outcome.

Personality disorders- Cluster A, B and C.

Unit 3:

Introduction, Definition, History, Types of profiling – Inductive and Deductive, its advantages and disadvantages. Steps and approaches to Offender profiling. Geographical profiling. Salient features of Serial murderers. Case study.

Profiling of sexual offenders. Paraphilias.

Assessments- Introduction, Classification, Hypothesis formulation, Data gathering- Interview, psychometric assessment, Data analysis -Reliability, Validity, Specificity, Sensitivity. Importance in Forensic Scenario.

Unit 4:

Tools for detection of deception – interviews, non-verbal detection, statement analysis, voice stress analyzer, hypnosis.

Polygraph – operational and question formulation techniques, ethical and legal aspects, the guilty knowledge test.

Narco analysis and brain electrical oscillation signatures – principle and theory, ethical and legal issues. A critical review of Supreme Court on Polygraph and Narco analysis.

BEOSP- brain electrical oscillation signatures

Unit 5:

Alcohol Abuse and Dependence- Clinical picture, Causes, Treatment and Prevention.

Drug Abuse and Dependence- Types: Narcotics, Sedatives, Stimulants, Hallucinogens.

Clinical picture, Causes, Treatment and Prevention.

Suggested Readings

- 1. David A. Crighton and Graham J. Towl, Forensic Psychology, 2nd Edition, Wiley (2010).**
- 2. Scott-Snyder, Introduction to Forensic Psychology: Essentials for Law Enforcement, (2016).**
- 3. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).**
- 4. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).**
- 5. J.C. DeLadurantey and D.R. Sullivan, Criminal Investigation Standards, Harper & Row, New York (1980).**
- 6. J. Niehaus, Investigative Forensic Hypnosis, CRC Press, Boca Raton (1999).**
- 7. E. Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).**
- 8. J. Singh Modi**
- 9. Crime investigation, Paul Krik**

Course outcome:

- 1. Describe the contribution of Psychology at all levels of the criminal justice system (i.e., from interviewing witnesses and suspects of crime, to jury decision making, to the incarceration and rehabilitation of offenders, to lie detection etc.)**
- 2. Demonstrate an awareness of basic theory, research findings and methods of investigation used in Forensic Psychology**
- 3. Evaluate current knowledge of psychological motivation towards violent and sexual behaviour.**
- 4. Gain in-depth knowledge of Criminal Profiling.**

CORE PRACTICAL V

Forensic Medicine and Toxicology Lab:

Learning Objectives:

- a. To know the various stages of decomposition.
 - b. To differentiate and identify various types of injuries.
 - c. To perform tests to identify various poisons.
 - d. Basic chemical tests to identify various types of drugs and poisons.
- Practical:**

1. To identify different stages of decomposition.
2. Case studies reported on infanticide / foeticide.
3. To identify and report on the different types of injuries.
4. To identify ethyl alcohol.
5. To identify methyl alcohol.
6. To identify metallic poisons from food samples.
7. To identify organic poisons from food samples.
8. To perform color tests for acidic and basic drugs.
9. Case studies on metallic poisons.
10. To perform color tests for pesticides.
11. To discuss case studies on methanol poisoning.

Course outcome:

1. Gain knowledge and the ability to identify various stages of decomposition.
2. Ability to differentiate between various types of injuries.
3. Perform various color tests for different types of drugs and poisons.
4. Identify the presence of pesticides.

SEMESTER VI

MAJOR BASED ELECTIVE II

Economic Offences (Theory + Practical)

Learning Objectives:

- a. Basic Economic and financial terminology.**
- b. Economic crimes in India are linked to several other crimes.**
- c. Economic crimes often have a bearing on national security.**
- d. Types of common Economic offences and their consequences.**
- e. Steps involved in mitigating Economic crimes.**

Unit 1: Taxonomy of Economic Offences/Criminogenic Factors

Fundamentals of Economics in Economic offences. Tax evasion. Excise duty evasion. Fraudulent bankruptcy. White collar crime. Economic exclusion. Black money. Corruption and bribery of public servants. Money laundering and hawala transactions. Insurance frauds. Corporate frauds. Bank frauds. Ponzi scheme. Pyramid scheme. Illicit trafficking in contraband goods. Illicit trafficking in arms. Illicit trafficking in explosives. Illicit drug trafficking. Trafficking in humans and organs. Cultural objects trafficking. Role of NCRB, NCRB crime rates in India. Racketeering in employment. Racketeering in false travel documents.

Unit 2: Applied Economics in Processing Evidence

Basics of Forensic accountancy and Forensic auditing. Valuation of Economic losses.

Violation of Intellectual Property Rights.

Unit 3: Prevention of Economic Offences, Legislations to deal with different forms of Economic offences.

RBI Act. SEBI Act. Competition Commission of India Act. Credit card frauds.

Enforcement agencies to deal with different forms of Economic offences.

International perspectives – measures adopted by FBI and INTERPOL. Cases related to Economic offences.

Practical

- 1. To prepare a draft on fraudulent bankruptcy.**
- 2. To cite a case of money laundering and hawala transactions in India and prepare a note on it.**
- 3. To cite a case involving bank fraud and suggest measures to prevent such crimes.**
- 4. To study a case involving illicit drug trafficking and trace the route by which the item was being smuggled.**
- 5. To prepare a report on trafficking of heritage artefacts, including religious deities in India.**
- 6. To study the applications of accounting software.**
- 7. To study the applications of TALLY software.**
- 8. To review the legislative measures to deal with a particular Economic offence, identifying the loopholes and suggesting ways to plug the loopholes.**
- 9. To prepare a Schedule of National agencies involved in curbing Economic offences. Outline their specific duties.**

Suggested Readings

1. R.V. Clarke, Situational Crime Prevention: Successful Case Studies, 2nd Edition, Criminal Justice Press, New York (1997).

2. S.P. Green, Lying, Cheating and Stealing: A Moral Theory of White Collar Crime, Oxford University Press, Oxford (2006).

3. G. Geis, R. Meier, L. Salinger (Eds.), White-Collar Crime: Classic & Contemporary Views, Free Press, New York (1995).

4. J. Reiman, The Rich get Richer and the Poor get Prison, Allyn & Bacon, Boston (1998).

5. Indian Audit and Accounts department, Audit of Fraud, Fraud Detection and Forensic Audit, 2007.

6. State Crime Branch, Haryana, Investigation of Economic Offences.

Course Outcomes:

- 1. Understand Economic and financial terminologies.**
- 2. Gain knowledge on various types of Economic offences and their consequence.**
- 3. Prevention of Economic crimes.**
- 4. Identify crimes linked with Economic crimes in India.**

Fire and Explosives Investigation (Theory + Practical)

Learning Objectives:

- a. The methods of analyzing trace amounts of petroleum products in crime scene evidence.
- b. The method of searching, collecting, preserving and analyzing arson evidence.
- c. The classification of explosives, including the synthesis and characterization of representative analogy.
- d. The significance of bomb scene management.
- e. The techniques of locating hidden explosives

Unit 1: Fire and Arson

Chemistry of fire. Conditions for fire. Fire scene patterns. Location of point of ignition.

Recognition of type of fire. Searching the fire scene. Collection and preservation of arson evidence.

Analysis of fire debris. Analysis of ignitable liquid residue. Post -flashover burning. Scientific investigation and evaluation of clue materials. Information from smoke staining.

Insurance claim cases.

Unit 2: Petroleum and other Accelerants

Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions.

Analysis of petroleum products. Adulteration. Cases reported.

Other commonly used accelerants and their properties.

Unit 3: Explosives Substances

Classification of explosives – low explosives and high explosives. Homemade explosives.

Military explosives. Blasting agents.

Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Blast waves. Bomb scene management. Searching the scene of explosion. Mechanism of explosion. Post blast residue collection and analysis.

Blast injuries. Detection of hidden explosives,

Practical:

- 1. To carry out analysis of gasoline.**
- 2. To carry out analysis of diesel.**
- 3. To carry out analysis of kerosene oil.**
- 4. To analyze arson accelerators.**
- 5. To perform color tests for explosives.**
- 6. A case study report on arson case.**
- 7. Analyze the difference between arson and fire cases.**
- 8. A case study report on bomb blast.**

Suggested Readings:

- 1. Jean Ford, Explosives & Arson Investigation.**
- 2. James B. Crippin, Explosives and Arson.**
- 3. Alexander Beveridge, Forensic Investigation of Explosions, 2nd Edition**
- 4. Textbook of Quantitative analysis**
- 5. Kirk's fire investigation**
- 6. Crime investigation, Paul L Kirk**
- 7. J. S Modi**

Course Outcomes:

- 1. Understand the applicable codes and standards related to Forensic investigations**
- 2. Understand the legal frameworks in which Forensic investigations take place**
- 3. Understand notable fire events**
- 4. Have an ability to apply fire dynamics to Forensic investigations**
- 5. Understand the basic terminology and techniques involved in Forensic investigations**
- 6. Understand the role of the scientific method in Forensic investigations**

Wildlife Forensics (Theory)

Learning Objectives:

- a. Importance of wildlife.
- b. The list of animals facing threat due to wildlife crimes.
- c. To know the various agencies involved in conservation of wildlife.
- d. Elements of Wildlife Protection Act.
- e. How wildlife Forensics aid in conserving natural resources.

Unit 1: Introduction

Introduction to wildlife. Common terms related to wildlife. Importance of wildlife. Concept of wildlife crime. The current scenario of illegal wildlife trade in India and the world. The steps involved- from capturing wildlife to the selling of the goods in black markets.

Unit 2: Agencies and Law

The list of agencies involved and their function in combating wildlife crime- IUCN, CITES,

TRAFFIC, WTI, Wildlife crime Control Bureau, WII, ZSI, CCMB, Institute of wood science

and technology, FSL.

Wildlife Protection Act.

Unit 3: Wildlife Crime Scene

Search and seizure, documentation, types of evidences found, crime scene sketch, collection and packaging, chain of custody. Forensic Significance. Wildlife investigation team and role of each member.

Unit 4: Genetics and Wildlife conservation

Introduction to genetics. Species identification, Mitochondrial DNA. Importance of genetics in wildlife protection and conservation. Case elaboration.

Suggested Readings:

- 1. Linacre & Tob, Wildlife dna analysis: applications in Forensic science.**
- 2. Jane E. Huffman, John R. Wallace, Wildlife Forensics: Methods and Applications, 1st Edition.**

Course Outcomes:

- 1. Understand the historical context of the development of wildlife conservation, and an understanding of what constitutes wildlife crime.**
- 2. Understand the significance of international trade in wildlife and a knowledge of the main provisions of CITES.**
- 3. Have a knowledge of what types of activities are incorporated under the term "poaching", and of the legislation which exists to combat it.**
- 4. Be aware of the law relating to the cruelty and persecution of animals and to habitat protection.**
- 5. Understand environmental crimes and the impact these may have on wildlife.**

MAJOR BASED ELECTIVE III

8. Dissertation

The dissertation will be based on a research topic in Forensic Science/Criminology. The topic will be assigned in consultation with police, giving due consideration to the problem areas faced by these institutions. The students will be expected to undertake extensive field work.

Lab:

The students will undertake certain projects pertaining to Digital and Cyber Forensics and DNA Analysis. The projects will be assigned in consultation with respective departments experts.