

Program Structure for 2-year Postgraduate Programs with Exit Option

1st Year of PG curricular structure for 2-year PG Programmes (3+2)

1 st Year								
SEMESTER I								
S.No	Type of Course	Code	Title of the Course	Contact Hours Per Week				Remarks
				L	T	P	C	
1	CC	FRS450	Introduction to Forensic Science and Criminal Justice System	4	0	0	4	
2	CC	FRS451	Digital and Cyber Forensics	3	0	1	4	
3	CC	FRS452	Scene of Crime Investigation	4	0	0	4	
4	DSE	FRS453/ FRS454/ FRS455	Discipline Specific Elective Bucket:					
			Explosives and Post Blast Investigation/	3	0	1	4	
			Forensic Anthropology and Odontology/	3	0	1	4	
			Forensic Psychology	4	0	0	4	
			SWAYAM MOOC courses (Any courses aligning with the themes of specified DSE courses, subject to availability in the portal within the stipulated time frame)					
F5	RM	FRS456	Discipline Specific Research Methodology Research Methodology in Science	4	0	0	4	
6	SEC (Hands on Training)	FRS457	Entrepreneurship Course/ Skill-based course/ workshop/ Specialised laboratory/ Hands on Learning/ Field Project/ Research Project/ Internship/ On Job Training Scene of Crime Investigation Lab	0	0	2	2	

7	AEC		Foreign Language	2	0	0	2	
8	SEC		Career Development Course I (Soft Skill / Soft Skill and Aptitude Course)	1	0	0	1	
Semester Credits							25	
SEMESTER II								
S.No	Type of Course	Code	Title of the Course	Contact Hours Per Week				Remarks
				L	T	P	C	
1	CC	FRS458	Questioned Documents and Fingerprint Examination	3	0	1	4	
2	CC	FRS459	Forensic Chemistry	4	0	0	4	
3	CC	FRS460	Instrumental Techniques in Forensic Science	4	0	0	4	
4	DSE	FRS461/ FRS462/ FRS463	Discipline Specific Elective Bucket:					
			Disk and Memory Forensics/	4	0	0	4	
			Quality Management/	4	0	0	4	
			Forensic Entomology	4	0	0	4	
SWAYAM MOOC courses (Any courses aligning with the themes of specified DSE courses, subject to availability in the portal within the stipulated time frame)								
5	MDE	FRS464	To be chosen from pool of discipline specific elective courses/ elective courses of other disciplines/ SWAYAM MOOC courses approved by the department Artificial Intelligence and Machine Learning in Forensic Science	4	0	0	4	
6	SEC (Hands on Training)	FRS465	Entrepreneurship Course/ Skill-based course/ workshop/ Specialised laboratory/ Hands on	0	0	2	2	

			Learning/ Field Project/ Research Project/ Internship/ On Job Training Forensic Chemistry Lab					
7	AEC		Foreign Language	2	0	0	2	
8	SEC		Career Development Course I (Soft Skill / Soft Skill and Aptitude Course)	1	0	0	1	
Semester Credits							25	
Exit option with Post-Graduate Diploma after the first year or two semesters with the completion of courses equivalent to 50 credits								

2nd Year of PG curricular structure for 2-year PG Programmes

One-year PG Programme after completion of Four-Year UG Programme (4+1)

PG Curricular Structure with Coursework and Research

2 nd Year								
SEMESTER III								
Sr. No	Type of Course	Code	Title of the Course	Contact Hours Per Week				Remarks
				L	T	P	C	
1	CC	FRS500	Forensic Toxicology	3	0	1	4	
2	CC	FRS501	Forensic Biology and DNA Profiling	3	0	1	4	
3	CC	FRS502	Forensic Medicine	2	0	0	2	
4	DSE	FRS503/ FRS504/ FRS505	Discipline Specific Elective Bucket:					
			Wildlife Forensics/	3	0	1	4	
			Network Forensics/	3	0	1	4	
			Forensic Photography	3	0	1	4	
			SWAYAM MOOC courses (Any courses aligning with the themes of specified DSE courses, subject to availability in					

			the portal within the stipulated time frame)					
5	INT	FRS506	Entrepreneurship Course/ Skill-based course/ workshop/ Specialised laboratory/ Hands on Learning/ Field Project/ Research Project/ Internship/ On Job Training Internship				2	-
6	Project	FRS507	Term paper leading to Dissertation				6	
7	SEC		Career Development Course I (Soft Skill / Soft Skill and Aptitude Course)	1	0	0	1	
Semester Credits							23	
SEMESTER IV								
1	CC	FRS508	Forensic Physics and Ballistics	3	0	1	4	
2		FRS509/ FRS510/ FRS511	Discipline Specific Elective Bucket: Mobile Forensics / Forensic Biotechnology/ Forensic Archaeology	4	0	0	4	
				3	0	1	4	
				4	0	0	4	
	DSE		SWAYAM MOOC courses (Any courses aligning with the themes of specified DSE courses, subject to availability in the portal within the stipulated time frame)					
4	ED	FRS512	Entrepreneurship Course				2	
5	Project	FRS513	Dissertation				12	
							22	
Total Credits							45	

Total credit for 2-year M.Sc. (Forensic Science) = 95

*The following **four** outcomes must be achieved by the end of III Semester

- 1) Research Problem identification
- 2) Review of literature
- 3) Research design formulation
- 4) **Phase I** of research (for e.g. Initial phase of research experimentation, completion of pilot project etc.)

*The following **three** outcomes must be achieved by the end of IV Semester

- 1) **Phase II** of research - Final phase of experimentation/ fieldwork
- 2) Dissertation/ project report submission
- 3) Attain **at least one** of the following outcomes:

- i) Developed a prototype or product which meets the **Technology Readiness Level 3/4** (TRL-3 or TRL-4) as defined by CSIR
- ii) Publication in Scopus indexed journals #
- iii) Patent
- iv) Any other scholastic work as recommended by the University R&D Cell and approved by the Academic Council
- v) Publication of a book by a reputed publisher (National/International) as recommended by the R&D Cell and approved by the Academic Council.

Publication must be in Scopus indexed journals and the authors have to be the student concerned and his/her supervisor(s). All PG dissertation should comply with the guidelines set by R&D Cell and duly approved by the Academic Council.

Course curriculum

SEMESTER III

Course Code	Course Name	L	T	P	C
FRS503	Wildlife Forensics	3	0	1	4

Course Objectives:

1. Introduce the basics and scope of wildlife forensics.
2. Explain types of wildlife crimes and related laws.
3. Teach wildlife crime scene management and evidence handling.
4. Train in analysis of biological and botanical evidence.
5. Develop skills in case simulation, report writing, and presentation.

Course Outcomes:

1. Understand wildlife forensics and legal frameworks.
2. Identify types of wildlife crimes and forensic applications.
3. Manage wildlife crime scenes and preserve evidence.
4. Analyse wildlife-related physical and biological evidence.
5. Prepare reports and present forensic case findings effectively.

Mapping of CO and PO:

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	3	1	1	1	1	2	3	1
CO2	3	2	2	3	2	1	2	1	2	3	2
CO3	2	3	3	3	1	2	2	2	2	2	2
CO4	3	3	2	2	2	1	1	2	2	2	2
CO5	2	2	2	3	1	3	2	1	2	2	2

Unit I: Introduction to Wildlife Forensics and Legal Framework (12 lecture hours)

Introduction to Wildlife Forensics- Definition, scope and interdisciplinary nature of the field. Wildlife Crime Overview- Types of wildlife crimes: poaching, illegal trade, trafficking, and habitat destruction. Wildlife Conservation and Legal Frameworks-Indian Wildlife (Protection) Act, 1972, Forest Conservation Act, 1980, CITES (Convention on International Trade in Endangered Species), Biodiversity Act, 2002, Protected and Endangered Species-Schedule species of India, Red List species (IUCN). Role of Wildlife Forensics in Conservation and Enforcement.

Unit II: Wildlife Crime Scene Investigation (10 lecture hours)

Crime Scene Management in Wildlife Cases, Search techniques, Securing the scene. Evidence Recognition and Recovery-Biological: tissue, blood, hair, feathers, bones, scat. Physical: traps, weapons, snares, vehicles. Collection, Packaging, and Preservation of Wildlife Evidence. Chain of Custody and Documentation. Safety and Biohazard Considerations in the Field.

Unit III: Biological Evidence Analysis (8 lecture hours)

Hair and Fiber Examination: Differentiating between human and animal hair, Analysis of textile fibers. Botanical Evidence: Identification of plant materials like wood, leaves, and pollen in wildlife crimes. Entomological Evidence: Use of insect activity to estimate time of death and other forensic applications.

Unit IV: Practical (30 lecture hours)

- **Microscopic Hair Examination-** Study medullary index and scale patterns, Compare hair from different mammalian species.
- **Feather Identification-**Examine types of feathers under microscope. Identify features useful in species-level identification.
- **Identification of Wildlife Products-** Visual comparison of wildlife derivatives: ivory, tiger claw, snake skin, pangolin scales.
- **Simulated Wildlife Crime Scene Investigation-** Create a mock wildlife crime scene, evidence search, collection, labeling, and sketching.

- **Report Writing and Case Presentation-** Prepare a forensic case report from mock investigation.

References:

- **Huffman, J. E., & Wallace, J. R. (2012).** *Wildlife Forensics: Methods and Applications* – A core book covering forensic methods in wildlife crime.
- **Shivani Bhardwaj.** *Introduction to Wildlife Law in India* – Focused on Indian legal frameworks like the Wildlife (Protection) Act and Biodiversity Act.
- **Divan, S., & Rosencranz, A. (2001).** *Environmental Law and Policy in India* – Offers insight into India's conservation laws and their enforcement.
- **Robertson, J., & Roux, C. (2017).** *Forensic Examination of Hair* – Detailed microscopic analysis techniques for hair and fibers.
- **Hall, D. W., & Byrd, J. H. (2012).** *Forensic Botany: A Practical Guide* – Identification of plant evidence in forensic cases.
- **Greenberg, B., & Kunich, J. C. (2002).** *Entomology and the Law: Flies as Forensic Indicators* – Application of insects in wildlife forensics.
- **Wildlife Crime Control Bureau (WCCB), India.** *Field Manuals & Guidelines* – Official procedures for wildlife crime scene management and species identification (freely available online).

course curriculum

Course Code Course Name L T P C

FRS452 Scene of Crime 4 0 0 4
Investigation

Course objective:

1. To introduce the students to forensic science and its role in the investigative system
2. To introduce the different sections of IPC, CrPC and Indian Evidence Act
3. To train the students in crime scene management process
4. To introduce students to different crime scene investigation methods.
5. To introduce the different types of physical evidence and their handling.

Course outcome: After completion of this course students will be able to

- CO1: Build knowledge about forensic science and its role in the investigative system
CO2: Develop knowledge of various techniques to investigate a scene of crime
CO3: Appraise their knowledge about criminal justice system and different sections of IPC, CrPC and IEA.
CO4: Execute handling and analysis of different physical evidence at crime scene
CO5: Perceive an idea of criminal justice system.

CO–PO Mapping Table

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	1	2	1	1
CO2	2	3	2	3	2	2	2
CO3	3	2	3	1	2	1	2
CO4	2	3	1	3	3	2	3
CO5	3	2	3	2	2	1	2

Course contents:

Module I: Introduction to Crime Scene Investigation (15 hrs.).

definition and types of crime scene, principles of Forensic Science, experts team composition, role of first responding officer, physical evidence. Introduction, definition, types and their collection, preservation, packaging, transporting and forwarding, various techniques used for handling, physical and trace evidence, crime scene tool kits and equipment's etc. Ethics in crime scene investigation.

Module II: Criminal Justice System (15 hrs.).

Structure of police organizations, Introduction to IPC, CrPC (section 291, 292, and 293). Indian Evidence Acts – Introduction and sections (32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, and 159). FIR, Cognizable and non-cognizable offences, investigation of cognizable offences- burglary, theft, murder, hit and run cases, and rape.

Module III: Crime Scene Management (15 hrs.).

Crime terminology, types of crime scene, protection and recording of crime scene, searching of physical evidence, crime scene survey, photography, recording, documentation and presentation in the court, processing and reconstruction of the crime scene

Module IV: Physical evidence and Investigative techniques (15 hrs.).

Definition, types and importance of physical evidence, collection, preservation, packing and forwarding of different types of evidence to the laboratories. Blood splattering analysis. Investigative techniques: portrait parley, polygraphy, narcoanalysis, brain fingerprinting.

Text & References:

- Bodziak, W., Footwear Impression Evidence (2nd Edn.) CRC Press, Boca Raton, Florida, 2000.
- DeForest, P., Gaensslen, R., and Lee, H., Forensic Science - An Introduction to Criminilastics, McGraw Hill, New York, 1983.
- Fisher, B., Techniques of Crime Scene Investigation (6th Edn.) CRC Press, Boca Raton, Florida, 2000.
- James, S., and Eskerc, W., Interpretaion of Blood Stain Evidence at Crime Scenes, (2nd Edn) CRC Press, Boca Raton, Florida, 1999.
- James, S.H., and Nordby, J.J., (Eds), Forensic Science; An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
- The Indian Evidence Act (1872), Amendment Act (2002), Universal Law Pub. Co. (2003)
- The Code of Criminal Procedure (1973) Amendment Act, (2001), Universal Law Pub. Co. (2002)
- Rattan Lal & Dhiraj Lal; The Indian Penal Code, 28th Ed. Wadhwa & Co. Nagpur (2002)
- Nanda, B.B. and Tewari, R.K; Forensic Science in India- A vision for the twenty first century, Select Publisher, New Delhi (2001) • Saferstein: Criminalistics – An Introduction to Forensic Science, Prentice Hall Inc. USA (1995)

Course objective:

1. 2. 3. 4. 5. To introduce the different Crime Scene Sketching methods.
- To introduce the collection, packaging and forwarding of different evidence.
- To introduce the Crime Scene management and reconstruction process of hit and run cases.
- To introduce Blood stain spatter analysis.
- To introduce crime scene photography.

Course outcome:

- CO1: Apply different sketching methods in outdoor and indoor Crime Scenes.
 CO2: Choose different Collection, packaging and forwarding of different evidence.
 CO3: Perform photography of crime scene.
 CO4: Analyze different blood stain splatters.
 CO5: Reconstruct the hit and run cases

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	2	2	1
CO2	2	3	2	3	2	1
CO3	1	2	3	2	2	2
CO4	2	3	1	2	3	1
CO5	2	3	2	3	3	2

Course contents:

Practical's will be done in the Forensic Science laboratory of the department. The student is expected to complete all the experiments in the lab under the guidance of the faculty member. He/she will be required to write details of the practical conducted by him or her in a practical notebook. The write-up of each practical should contain the title of the practical, the conduction of the practical, the tools required and used, the conduction procedure, the results obtained and interpretation. Where needed, diagrams should be presented in the practical notebook should also be presented and were photographs are available the same should be pasted.

1. Investigation and sketching of the indoor crime scene (10 hrs.).
2. Investigation and sketching of the outdoor crime scene (10 hrs.).
3. Collection, packaging and forwarding of different physical evidence (10 hrs.).
4. Crime scene management and reconstruction in hit and run cases (10 hrs.).
5. Blood splatter analysis (10 hrs.).
6. Photography of the scene of crime (10 hrs.).

Course Objectives: The course aims to provide the students with

1. Historical Development of Forensic Psychology
2. Legal Aspects of Forensic Psychology.
3. Assessment & evaluation in forensic psychology
4. Impact of crimes on victims

Course Outcomes: After studying this course, the students will

- CO1. Be able to understand overview of Forensic Psychology
 CO 2. Be able to understand Ethical Issues in practice
 CO 3. Be able know concept of victimization
 CO 4. understand tools and techniques for detecting deception and their ethical/legal aspects.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	1	1
CO2	2	2	3	1	2	2
CO3	2	1	2	1	2	3
CO4	2	3	3	3	2	2

UNIT I Introduction to Forensic Psychology (12 hrs.).

Introduction and overview of forensic psychology, Nature, definition, scope, and history of Forensic Psychology. Professional training and education in forensic psychology, Forensic Psychology in India.

UNIT 2 Victimization and Impact of Crime (09hrs).

The victim, Victimization, Impact of crimes on victims, Factors affecting for victimization coping with victimization.

UNIT 3 Ethics, Mental Disorders, and Psychology of Evidence (12 hrs.).

The Psychologists as an expert witness. Ethical issues in forensic psychology, Mental disorders and forensic psychology. Psychology of evidence—eyewitness testimony, confession evidence, Criminal profiling. Section 84 IPC

UNIT 4 Crime Scene Psychology and Investigative Interviewing (12 hrs.).

Crime scene and investigation, Investigative interviewing: Interviewing vulnerable witnesses, Interviewing suspects. Neurobiological Forensic testing and investigation.

UNIT 5 Deception Detection Techniques and Legal/Ethical Considerations (15 hrs.).

Tools for detection of deception – interviews, non-verbal detection, statement analysis, voice stress analyzer, hypnosis. Polygraphy – operational and question formulation techniques, ethical and legal aspects, the guilty knowledge test. Narcos analysis and brain electrical oscillation signatures – principle and theory, ethical and legal issues.

Suggested Readings

1. Bharti A. Studies on Criminological Psychology. G.S. Rawat for Ceber Tech Publications. New Delhi- 110 002
2. Gregory, R.J. (2005). Psychological Testing (4th ed.). Delhi: Pearson education Pte.Ltd.
3. Suryanarayana, N.V.S, HimabinduGoteti, Neelima V. (2011). Cyber Psychology. Sonali Publications, New Delhi- 110 002
4. Thou Teisi (2011) Forensic Psychology. ABD Publishers, Jaipur-302018
5. Veereshwar, P. (2002). Indian systems of psychotherapy. Delhi: Kalpaz publications
6. Verma, L. (1990). The management of children with emotional and behavioral difficulties. London: Routledge.

Course objective:

1. To introduce legal procedures followed in a medical profession.
2. To introduce about the cause manner and mechanism of death and the types of asphyxia deaths.
3. 5. To introduce the different patterns of injuries
4. To introduce different types of sexual offences, infanticide and Abortion.
5. To introduce different types of psychological disorders prevalent within an offender leading to causation of crime.

Course outcome:

CO1: Define legal procedures followed in a medical profession.

CO2: Infer cause and mode of death and prepare autopsy report.

CO3: Distinguish the type and degree of injuries present on a victim.

CO4: Point out Sexual offence cases, infanticide and abortion cases.

CO5: Conclude psychological disorders in human beings that lead to violent criminal behavior.

CO–PO Mapping Table

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	1	2	1	2
CO2	3	3	2	3	2	1	2
CO3	3	3	2	3	2	2	2
CO4	2	2	3	2	2	3	3
CO5	2	3	2	2	2	3	3

Course contents:**Module I: Medical jurisprudence, Medico legal autopsy & death (07 hrs.)**

Introduction and legal procedure, law and medicine, law in relation to the medical profession, definition of autopsy, objectives, requirements, precautions, external examination, internal examination, collection and preservation of different viscera for analysis, Postmortem report, Death: Definition, cause, manner and mechanism of death, determination of time since death, medico legal aspects of death investigation

Module II: Asphyxia (08 hrs.)

Definition, asphyxia deaths- hanging, ligature strangulation, throttling, suffocation, drowning, death from starvation, cold and heat, anaphylactic deaths.

Module III: Injuries (08 hrs.)

Mechanism of injury, types of injuries: abrasions, bruises, lacerations, incised wounds, stab wounds, firearm injuries, defense wounds, self-inflicted wounds, injury patterns, medico legal aspects of injuries, ante-mortem and post-mortem injuries, aging of injury, artificial injury; thermal injuries- burns, dowry deaths, scalds, electricity, lightning, explosions

Module IV: Sexual Offences & Infanticides (07 hrs.)

Natural sexual offences-rape, incest, examination of the victim, examination of the accused. Unnatural sexual offences- sodomy, buccal coitus, tribadism, bestiality. Sexual perversions.

Infanticide: definition, still born and dead born child, Postmortem examinations, causes of death in the newborn.

Text & references:

- Sharma, B.R., Forensic Science in Criminal Investigation and Trials (3rd Edn.) Universal Law Publishing Co. Ltd. New Delhi
- Modi, Jaishring P, Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Pub. 2001.
- Parikh, Textbook of Medical Jurisprudence & Toxicology, 2001.
- Knight's Forensic Pathology (5th Ed., 2021), Simpson's Forensic Medicine (14th Ed., 2022), Essentials of Forensic Medicine and Toxicology by Reddy & Murty (35th Ed., 2023), The Essentials of Forensic Medicine by Anil Aggrawal (2023), Forensic Medicine and Toxicology by Gautam Biswas (5th Ed., 2022), Textbook of Forensic Medicine and Toxicology by Krishan Vij (9th Ed., 2023)

COURSE CURRICULUM

FIRST SEMESTER

Course code	Course name	L	T	P	C
FRS450	Introduction to Forensic Science and Criminal Justice System	4	0	0	4

Course Objective:

1. To Introduce the students to the basic concepts and theories of Criminology and Forensic science.
2. To Introduce students with different organizations related to investigation of crime.
3. To Introduce students to different Laws associated with Crime.
4. To Introduce students Criminal Justic System in India.

Course outcome: After completion of this course students will be able to

CO1: Define the basic concepts of forensic science.

CO2: Develop knowledge about criminal justice system.

CO3: Maximize knowledge about criminal laws.

CO4: Build knowledge about the role and responsibilities of the Investigating agencies.

CO5: Illustrate different organizations related to investigation of crime.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	2	2	1	2	2	1
CO2	2	2	2	3	1	2	2	1	2	2	1
CO3	2	1	2	3	1	2	2	1	2	2	1
CO4	2	2	3	3	2	2	3	1	2	2	2
CO5	2	1	2	2	1	2	3	1	2	2	2

Course contents:

Module I: Forensic science:

(Lecture hours : 15 hours)

Introduction to forensic science. Definition and Scope of Forensic Science, History and development of Forensic science, Law and Principles of Forensic science: Law of Exchange, Principle of Individuality, Law of Comparison, Principle of Linkage, Law of Probability, Law of Progressive change. Organizational structure and function of Forensic science laboratories / institutions in India.

Module II: Introduction to Crime and Criminology

(Lecture hours : 15 hours)

Definition and scope of crime and criminology, theories of causation of crime and criminology, types of crime (economic offences, organized crime, white collar crime, occupational crime, crime against women), cause of crime. Victimology: definition of victim and victimization, types of victimization, characteristics of criminals. prevention of crime, Psychology and investigative techniques: Polygraph (Lie-detection), Narco-analysis, Brain mapping, Forensic psychiatry – human behavior and relationship between human behavior and legal proceeding in both civil and criminal cases

Module III: Law

(Lecture hours : 15 hours)

Bhartiya Sakshya Adhiniyam, 2023: S.2(1)e – Definition of Evidence, Ss.3-14- Relevancy of Facts, Ss. 15-27- Admission and Confession, S.39- Opinion of Experts, S.57- Primary Evidence, S.58- Secondary Evidence, S.61- Electronic Digital Records, S.63- Admissibility of Electronic Records, S.136- Exclusion from witness upon production of documents, S.140-144- Examination and Cross Examination, S.158- Impeaching credit of witness, S. 165- Production of Documents.

Bharatiya Nagrik Suraksha Sanhita, 2023: FIR, Zero FIR, S.6- Courts, S.197-Inquiry and Trial, Ss.105/185- Videographer of Search and Seizure, S.176- Procedure for Investigation S.178- Power to hold investigation, S.180- Examination of witness by police, S.184-Medical examination of victims of rape, S.193/194- Police report, S.329- report of Government Scientific experts etc.

Bhartiya Nyaya Sanhita, 2023: S.3- General Explanations, Mens Rea, Actus Reus, S. Sections 45-62- Abetment/Criminal Conspiracy/Attempt, S.63- Sexual Offences, S.101- Murder, S.178- Counterfeiting, S.317- Receiving stolen property etc

Module IV: Criminal Justice System

(Lecture hours : 15 hours)

Introduction to criminal justice system, Role of investigating agencies associated in the Criminal Justice System: Commission of crime, Police investigation and crime scene management, Role of doctors, Role of Forensic Laboratory/Forensic experts, Court Proceedings, Judgement and conviction, Restrictive application of Forensic Science in Criminal Justice System in India. Report writing and evidence evaluation: Components of reports and report format in respect of crime scene Post Mortem and laboratory findings. Court testimony: Admissibility of expert testimony, pre court preparation and court appearance, competence requirements for deposition in the court, cross-examination and re- examination

Text & References:

- B. Caddy, Forensic Examination of glass and paints analysis and interpretation, ISBN 078405749 2001.
- Bengold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons, USA, 1999.
- C.E. O 'Hara and J.W. Osterburg, An Introduction to Criminalistic, Indiana University Press, Blomington, 1972.

- Denis Shaw, Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17, 1976.
- Carper, K. (ed.), Forensic Engineering, 2ndEdn. CRC Press, Boca Raton, Florida, 2001.
- Field, J., and Carper, K., Construction Failure, 2ndEdn. John Wiley and Sons, New York, 1996.
- James, S.H. and Nordby, J.J. Eds., Forensic Science An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
- Nickolls, L.C., Scientific Investigation of Crime, Butterworths, London, 1956.
- Philip Rose, Forensic Speaker Identification, Taylor & Francis Forensic Science series, London 2001.
- R. Saferstein, Forensic Science Handbook, Vols. I, II, (Ed), Prentice Hall, Eaglewood Cliffs, NJ; 1988.
- Raymond C Murray and John C.F Tendrew, Forensic Geology, Prentice Hall, New Jersey, 1991.
Working Procedure Manual: Physics BPR&D Publication, 20

Course code	Course name	L	T	P	C
FRS453	Explosives and Post Blast Investigation	3	0	1	4

Course Objective

1. To introduce explosives and its classification
2. To introduce mechanism of explosion
3. To introduce the chemistry of fire and arson
4. To introduce Processing of scene of crime of explosion
5. To introduce Analysis and management of explosives
6. To introduce the Law related to explosive

Course Outcomes

CO1: Define explosives and its classification

CO2: Explain mechanism of explosion

CO3: Apply their knowledge in Processing of scene of crime of explosion,
Fire and Arson

CO4: Appraise their knowledge about Analysis and management of
explosive scene of crime

CO5: Appraise their knowledge about Laws related to Forensic interest

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	2	1	1	2	2	1
CO2	3	2	3	2	1	2	1	1	2	2	1
CO3	3	3	3	2	2	2	3	2	2	2	3
CO4	3	3	3	2	2	3	2	2	2	2	3
CO5	2	1	2	3	1	2	1	2	2	3	2

Module I: Introduction to explosive material and post blast investigation: (Lecture hours : 10 hours)

Introduction to explosive materials, Nature of explosives, Uses of explosives, Categories of explosives, Characteristics of chemical explosives, Classification of explosives, Characteristics of high and low Explosives, Detail study of high, low explosive and mixed explosive like Mercury Fulminate, Lead Azide, Lead Styphnate, Picric acid, TNT, Tetryl, PETN, RDX, Nitroglycerine, Black powder, Smokeless

powder, Post blast investigation. Systematic examination of explosive and explosion residues (organic and inorganic) by colour test and other instrumental techniques.

Module II

(Lecture hours : 10 hours)

Initiating devices Safety fuse, Pyrotechnic compositions, Improvised Explosive Devices (IED) and their categories: Common Improvised Explosive Containers, Main charge, Initiation device, Projectile & Missiles. Laws related to Explosive and Explosion. Law related to explosive, Case studies.

Module III Fires & Arson

(Lecture hours : 10 hours)

- Chemistry of Fire, Investigation and Evaluation of the clue materials Analysis of Arson exhibits by instrumental methods (Gas Chromatography)
- Management of Arson Case Examination of Petroleum products and Fractional Distillation (Petrol, Kerosene, Deisel etc) and their commercial use
- Std. methods of analysis of petroleum products for Adulteration. Case study.

Module III: Management of Scene of Explosion

(Lecture hours : 10 hours)

Collection, preservation, and documentation of explosive evidences. Analysis of pre blast or unexploded material – bulk analysis, Analysis of post blast or exploded material – Trace analysis. Extraction of Explosive material, Detection of Inorganic explosives including pyrotechnic composition: Chemical analysis of anions-Chloride, Sulphate, Nitrite, Nitrate, Chlorate, Perchlorate, Sulphite, Phosphate. Chemical analysis of cations-Sodium ion, Potassium ion, Calcium ion, Barium ion, Gutzeit method for Arsenic and Reinsch's test for Heavy metals. Organic explosive: Identification of Picric acid, TNT, Tetryl, PETN, RDX, Nitro Glycerin using TLC, HPLC, GC-MS, IR

Module IV: Practical

(Lecture hours : 30 hours)

1. Detection of low explosives by chemical/colour test

2. Detection of high explosives by color test and TLC.

3. Examinations of petroleum products as per BIS specifications.

Text Books & References:

- Alexander Beveridge. Forensic Investigation of Explosives, CRC Press, 2nd edition, 2011
- Explosive Substances Act, 1908
- J. Akhavan. The Chemistry of explosives, RSC Publishing, 2015
- J. Yinon, S. Zitrin. Modern Methods and Applications in Analysis of Explosives, Wiley Publishers 1996
- Working Procedure Manual-Explosives

Course code	Course name	L	T	P	C
FRS456	Research methodology in science	4	0	0	4

Course objective:

1. To introduce the nature and classification of research design and the types of research
2. To introduce the history of research, types of research
3. To introduce how to apply research methods in forensic science
4. To introduce sample analysis and hypothesis testing.
5. To introduce the evaluation of data and its uses.

Course outcome:

CO1: Remember the nature and classification of research design and the types of research

CO2: Understand history of research, types of research

CO3: Apply research methods in forensic science.

CO4: Analyze sampling concept and concepts of testing hypothesis such as chi square, ANOVA, factorial design and learn to apply it

CO5: Evaluate the data - uses, advantages, disadvantages, types and sources and types of measurement scales and create skilful research reports

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	1	1	1	1	2	3	2	2
CO2	3	1	2	2	1	1	1	2	3	2	2
CO3	3	2	3	2	2	2	2	3	3	2	3
CO4	3	2	3	2	2	2	2	3	3	2	3
CO5	3	2	3	2	2	3	2	3	3	3	3

UNIT-I: Types of Research and Research Design:

(Lecture hours : 15 hours)

Meaning of research, research objectives, motivation in research, Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature Review, and Development of Hypothesis. Research design and methods, developing a research plan—Exploration, Description, Diagnosis, and Experimentation, and determining experimental and sample designs.

UNIT-II: Data Collection, analysis and Interpretation of Findings:

(Lecture hours : 15 hours)

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central tendencies – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, t test, U test, Z score, Correlation, Regression, ANOVA, SPSS. Types of Errors and Interpretation of Findings.

UNIT-III : Ethical Usage of AI in Research

(Lecture hours : 15 hours)

principles of research ethics, data privacy and protection, informed consent in AI-assisted studies, algorithmic transparency, bias and fairness in AI models, accountability and responsibility in AI research, intellectual property rights, dual-use concerns of AI technologies, ethical implications of AI-generated content, regulatory frameworks and compliance (e.g., GDPR, IEEE, UNESCO guidelines), human oversight in automated systems, and the role of institutional review boards (IRBs) in AI-related research. Responsible use of AI writing tools, authorship and attribution ethics, avoiding plagiarism and data fabrication, maintaining academic integrity with AI-generated content, transparency in the use of AI assistance, citation of AI tools, bias detection in AI-generated reports, ethical editing and paraphrasing, data confidentiality and security, adherence to publication ethics, accountability in collaborative AI use, and compliance with institutional and journal guidelines on AI in scholarly writing.

Module IV: Technical requirements

(Lecture hours : 15 hours)

Introduction to Technical Requirements, Facilities and environmental conditions, Equipments and its calibration, concept of RM and CRM, evaluation of measurement uncertainty, metrological traceability, Selection, verification and validation of methods, Statistical approach for the validation of laboratory developed methods, ensuring the validity

of test and calibration results.

Module V: Quality Management

(Lecture hours : 15 hours)

Introduction to Laboratory Management System, Concept about Quality, Quality Assurance, Quality Control, Quality system, Definition of Accreditation, Pre requests, of accreditation in Forensic science laboratories (NABL) and educational institutes(NAAC), Process of accreditation, Assessment methodology , Advantages of accreditation, International Laboratory Accreditation Co-operation (ILAC), Asia Pacific Laboratory Accreditation Cooperation (APLAC).Pacific Accreditation Co-operation(PAC), , Proficiency testing, Audit-1st, 2nd, 3rd party, internal audit/external audit, Management Review Meeting(MRM), Training and conferences, corrective and preventive action, management system documentation and their control.

SECOND SEMESTER

Course code	Course name	L	T	P	C
FRS459	Forensic Chemistry	4	0	0	4

Course objective:

1. To introduce different methods to investigate the case of arson and explosives.
2. To introduce forensic chemistry and quality management ..
3. To introduce Drug of abuse, commonly abused substances, their sign and symptoms.
4. To introduce about different types of explosives.
5. To introduce about Selection, verification and validation of methods

Course outcome:

CO1: Develop knowledge about different NDPS drugs and their use

CO2 Develop knowledge on chemistry of arson and fire

CO3: Develop knowledge on Analysis of Beverages and Food Chemistry

CO3: Identify Drug of abuse, commonly abused substances, their sign and symptoms

CO4: Develop Laboratory Management System.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	3	1	2	2	1	2	2	2
CO2	3	2	2	2	1	2	2	1	2	2	2
CO3	3	2	2	2	1	2	2	1	2	2	2
CO4	3	2	3	2	1	2	2	1	2	2	2
CO5	2	3	2	3	1	3	2	2	2	2	3

Course contents:

Module-I: NDPS and drugs in sports:

(Lecture hours : 15 hours)

Introduction, classification of drugs of abuse and its effect on human body, drug overdose and its detection, sedatives, hypnotics, analgesics, antipyretics drugs and forensic significances, drugs of abuse in sports and doping, narcotics drugs and psychotropic substances, designer's drugs and their forensic examination
Acts: Drugs and Cosmetic act, Excise act, NDPS act.

Module-I1: Arson and Explosive:**(Lecture hours : 15 hours)**

Arson: chemistry of fire, investigation and evaluation of the clue material, analysis of arson exhibits by instrumental methods: . Examination of petroleum products: distillation and fractionation, various fractions and their commercial uses, standard methods of analysis of petroleum products for adulteration.

Explosive: Classification, composition and characteristics of explosives, pyrotechnics, IEDs, explosion process and affects, types of hazard, effect of blast wave on structures, human etc., specific approach to scene of explosion, Collection, preservation, identification and quantification of explosives and explosion residues in the laboratory using chemical and instrumental techniques in the laboratory and interpretation of results.

Alcoholic and non-alcoholic beverages and their composition, Analysis of alcoholic beverages as per BIS and PFA Act, Detection and determination of ethanol, methanol, furfural, organic acids and inorganic acids, aldehydes, chloral hydrate, and ethylene glycol in liquors by color tests, TLC, GC, and GC-MS methods, Distinction between licit and illicit liquors.

Bribe Trap: Examination of Phenolphthalein used in Bribe trap cases by UV-VIS and colour test. Case studies

Module-111: Analysis of Beverages and Food Chemistry:**(Lecture hours : 15 hours)**

Alcoholic and non-alcoholic beverages and their composition, Analysis of alcoholic beverages as per BIS and PFA Act, Detection and determination of ethanol, methanol, furfural, organic acids and inorganic acids, aldehydes, chloral hydrate, and ethylene glycol in liquors by color tests, TLC, GC, and GC-MS methods, Distinction between licit and illicit liquors.

Food Chemistry: Study of common food adulterants, Analysis of Lipids and fats: Physical examination of lipids, Chemical examination of lipids (Acid value, Saponification value, Ester value, Acetyl value, Iodine value), Test for hydrogenated oils and fats, Detection and Determination of rancidity, Analysis of butter and butter fats, Analysis of adulterated and non-adulterated oils. Analysis of dairy products: Milk and its products for adulteration. Food poisoning, causes and detection.

Module IV: Laboratory Management System:**(Lecture hours : 15 hours)**

Introduction to Laboratory Management System, Concept about Quality, Quality Assurance, Quality Control, Quality system, Definition of Accreditation, Pre requests, of accreditation in Forensic science laboratories, Process of accreditation, Assessment methodology , Advantages of accreditation, International Laboratory Accreditation Co-operation (ILAC), Asia Pacific Laboratory Accreditation Cooperation (APLAC).Pacific Accreditation Co-operation(PAC), , Proficiency testing, Audit-1st, 2nd, 3rd party, internal audit/External audit, Management Review Meeting(MRM), Training and conferences.

Text & References:

- A Burger; Medicinal Chemistry, Vol. II, Wiley Interscience, New York; (1970)
- A.I Vogel; Textbook of Practical Organic Chemistry including Qualitative Organic Analysis; ELBS, Essex (1971)
- Boudreau, JE et al – Arson & Arson Investigation, Surevey& Assessment National Institute of Law Enforcement, U.S Deppt of Justice, US Govt. Printing Press (1977)
- D.A. Skoog, D.M. West and F.J. Holler; Analytical Chemistry: An Introductin; SaundersCollege Publishing, Philadephia, USA, (1994)
- Dettean, J D; Kirk's Fire Investigation, 5thed, Prentice Hall, Eaglewood Cliffs, N.J (2002)
- F. Waltch; Principles and Methods of Chemical Analysis, 2nd Ed.; Prentice Hall; (1966)
- I.L. Finar; Organic Chemistry Vol. II; Longmans, Essex; (2003)
- J. Bassett, et.al; Vogel's Textbook of Quantitative Inorganic Analysis, 4thed: Longman, Exxex; (1978)
- R.T. Morrison and R.N. Boyd; Organic Chemistry, (3rd Ed.); Prentice Hall, New Delhi; (1977)
- Working Procedure Manual: Chemistry, Explosives and Narcotics, BPR&D Pub (2000)
- Y. Lyalikov; Physiochemical Analysis; Mir, Moscow, USSR, (1968)

COURSE CODE	COURSE NAME	L	T	P	C
FRS460	Instrumental Techniques in Forensic Science	4	0	0	4

Course objective:

1. To introduce various instruments and their calibration used in the analysis of different substances encountered during a criminal investigation.
2. To introduce various methods used in forensic sample analysis
3. To introduce different types of detectors used for detecting the various substances
4. To introduce different spectrophotometric, chromatographic and microscopic techniques

Course outcome:

CO1: Build knowledge of the various instruments used in the analysis of different substances encountered during criminal investigation.

CO2: Develop knowledge of various types of instrumentation, their application, calibration used for forensic sample analysis.

CO3: Apply different spectrophotometric, chromatographic, and microscopic techniques in sample analysis.

CO4: Choose most suitable type of detectors used for detecting the various substances in various techniques.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	2	2	2	2	2	2
CO2	3	3	3	2	2	2	2	2	2	2	2
CO3	3	3	3	2	3	2	2	2	2	2	3
CO4	3	3	3	2	3	2	2	2	2	2	3

Course contents:

Module I: Introduction to Instrumentation

(Lecture hours : 15 hours)

Electromagnetic Spectrum: Electromagnetic radiations, Absorption & Emission Spectra, General properties of electromagnetic radiations: Atomic & molecular spectra, Theoretical Concepts of Separation and Extraction techniques: Adsorption, Absorption & Partition, Solvent extraction, Solid Phase extraction, Methods: Definition of method, Selection, verification and validation of methods, Detail about standard, non-standard and laboratory developed method, selection criteria of method, validation of method using statistical parameters-Precision, accuracy. Linearity, standard deviation, relative standard deviation, Robustness, bias, LOD, LOQ,

Reproducibility, repeatability, Equipment maintenance and calibration, Reference materials (RM) and certified reference materials (CRM). Concept of measurement uncertainty and metrological traceability.

Module II: Spectroscopic Techniques:

Introduction to absorption and emission spectroscopy. Ultraviolet and Visible Spectroscopy: Theory, Transitions of electrons in different orbitals, the chromophore concept, Instrumentation, Applications and Calibration. Infrared Spectroscopy: Theory of IR absorption, Molecular vibrations (Stretching and Bending vibration), Instrumentation and Applications. Raman Spectroscopy: Theory of Raman Spectroscopy, Instrumentation, Applications. Atomic Absorption Spectroscopy: Theory, Instrumentation and Applications. Mass Spectroscopy: Theory, Instrumentation and Applications. Proton NMR: Theory and principle, Instrumentation and Applications.

Module I11: Chromatographic Techniques:

Chromatography Techniques: Introduction to Chromatography: Theory of separation techniques, Types of chromatography and their Forensic Applications; Paper chromatography, Column Chromatography, Thin layer chromatography; High Performance Liquid Chromatography: Principle, instrumentation and applications. Gas Chromatography: Principle, instrumentation and applications. Plate theory and concept of theoretical plates with respect to peak width and peak intensity, Concept of Retention factor and Retention time, selection of column packing materials of different chromatography process.

Module 1V : Microscopy Techniques:

Mirrors & Lenses, Basic principles of microscopy, Simple and Compound microscope, Study of different types of microscopes: Light Microscope & Electron Microscope: Comparison microscope, Phase contrast microscope, Stereoscopic microscope, Polarizing microscope, Fluorescence microscopy, IR microscopy, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM).

Text & References:

- Jacobson, B.H.E., Ray, Sidney, Attridge G. G., The Manual of Photography; Focal Press, London, 1988.
- Baker, D.R., Capillary – Electrophoresis, New York, 1995.
- Chapmen, J.R., Practical Organic Mass spectrometry, A Guide for Chemical and Biochemical Analysis, Wiley, New York, 1993.
- Lide, D.R., Handbook of Chemistry & Physics C.R.C. 75th ed. CRC Press WashingtonD.C., 1994.
- Dollisth, F.R., Fateley, W. G. & Bentley, F. F., Characteristic Roman frequencies of organic compounds, Wiley, New York, 1974.
- Friebolin, H. Berik, One- & Two-Dimensional NMR spectroscopy; WeinheimGermany, VCH

1991.

- Stout G.H., & Jensten, L.H., X-ray Structure Determination – A practical Guide, 2nd Ed., Wiley, New York, 1989.
- Gchristian, Gray D and Fredric J. Feldman, Atomic Absorption Spectroscopy; Wiley-Interscience, London, 1970.
- Willard, H.H. et al, Instrumental Methods of Analysis, CBS Publishers and Distributors, Delhi 1986.
- Henry Horeustein, Colour Photography A working Manual, Little Brown Company, Boston, 1995.

- Bassett, J., et al, Vogel's Text Book of Quantitative Inorganic Analysis including Elementary Instrumental Analysis (Fourth Ed.), Long man Essex, 1978.
- Sneddon, J., Advances in Atomic Spectroscopy, Vol. I & II, JNI Press 1992 & 1994.
- Jahne B., Digital Image Processing, Heidelberg Springer, 1996.
- Jarris, K.E., Gray, A.L., & Hock, R.S., EDS, Handbook of Inductively Coupled Plasma Mass Spectrometry, Glasgow Blockie, 1992.
- Azaroff, L.V., Elements of X-Ray Crystallography, McGraw Hill, New York, 1968.
- Lin – Vien, D & Other – Infrared & Raman Characteristics frequencies of organic molecules; San Diego Acad, Press 1991.

COURSE CODE	COURSE NAME	L	T	P	C
FRS462	Quality Management	4	0	0	4

Course Objectives

1. To introduce the principles and practices of quality control and assurance in forensic laboratories.
2. To familiarize students with national and international accreditation bodies and procedures.
3. To provide knowledge about structural, resource, and personnel requirements in forensic institutions.
4. To equip students with an understanding of method validation and statistical tools in laboratory processes.
5. To develop skills for implementing and evaluating management system documentation, audits, and reviews.

Course Outcomes

1. Explain the concepts of quality, quality assurance, and quality control in a forensic context.
2. Identify the roles of accreditation bodies (ILAC, APLAC, ASCLD) and describe the accreditation process.
3. Analyze structural and personnel requirements necessary for establishing a quality forensic laboratory.
4. Apply method validation techniques and statistical tools to assess reliability and accuracy in test results.
5. Perform internal audits, handle documentation, and participate in management system reviews and improvements.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	1	1	1	2	3	2
CO2	3	2	1	2	1	2	2	2	2	3	2
CO3	3	3	2	2	2	1	3	2	2	2	2
CO4	3	3	2	2	3	2	2	3	2	2	2
CO5	2	2	3	3	2	2	2	2	3	3	3

Module 1 : Quality management:

(Lecture hours : 15 hours)

Introduction to Quality, Quality Assurance, Quality control, Definition of Accreditation, History and development of ISO, Importance of accreditation in Forensic science laboratories, Process of accreditation, Quality system, International Laboratory Accreditation Co-operation (ILAC), Asia Pacific Laboratory Accreditation Co-operation (APLAC). American Society of Crime Laboratory Directors (ASCLD), Proficiency testing, internal audit/External audit, MRM, Training and conferences

Module 11 : General, structural and resource requirements

(Lecture hours : 15 hours)

Impartiality and confidentiality, legal entity, range of laboratory/ educational Institute activities for conformation/recognition, organization and management structure, defined role and responsibility of all employees, Personnel: competence requirements, selection of personnel, training of personnel, monitoring competence of personnel, facilities and environmental conditions, equipment sans its calibration, reference

and certified reference materials, metrological traceability.

Module 111: Process requirements:

(Lecture hours : 15 hours)

Definition of method, different types of methods, Selection, verification and validation of methods, validation of laboratory developed method using statistical parameters (SD , RSD, linearity, bias, precision, robustness, reproducibility, repeatability, LOD. LOQ), sampling and handling of test and calibration items, technical records, measurement of uncertainty, ensuring the validity of results, Proficiency testing.

Module 1V : Management System requirements:

(Lecture hours : 15 hours)

Introduction to management system documentation, control of these documents, technical and management records, improvement, corrective and preventive action, complaint and feedback, Audit-1st, 2nd, 3rd party, internal audit/External audit, management review meeting (MRM), Training and conferences.

REFERENCES:

1. Doyle, S. (2019). *Quality management in forensic science*. Academic Press.
2. Houck, M. M., & Siegel, J. A. (2015). *Fundamentals of forensic science* (3rd ed.). Academic Press.
3. International Organization for Standardization. (2017). *ISO/IEC 17025:2017 – General requirements for the competence of testing and calibration laboratories*. ISO.
4. American Society of Crime Laboratory Directors. (n.d.). *Guidelines and standards*. Retrieved from ASCLD official website
5. Caruana, R. (2017). *Quality management in forensic disciplines*. *Journal of Forensic Sciences & Criminal Investigation*. Juniper Publishers.

COURSE CODE	COURSE NAME	L	T	P	C
FRS465	Forensic Chemistry Lab	0	0	2	2

Course objective:

1. To teach detection and determination of insecticides and pesticides, narcotics and psychotropic substances by spot colour tests, chromatographic methods
2. To teach Analysis of illicit liquor alcohol
3. To teach analysis of volatile, non-volatile poisons and vegetable poisons
4. To teach Instrumental analysis of drugs or toxic substances using uv-visible spectrophotometer and colorimeter
5. To teach Examination of petroleum products such as petrol, kerosene, diesel
6. To teach Analysis of phenolphthalein (qualitative) in bribe trap cases.

Course outcome

CO2: Perform detection and determination of insecticides and pesticides, narcotics and psychotropic substances by spot colour tests, chromatographic methods

CO3: Perform Analysis of illicit liquor alcohol

CO4: Analyse volatile, non-volatile poisons and vegetable poisons

CO5: Apply different Instrumental analysis method of drugs or toxic substances using UV-visible spectrophotometer and colorimeter

CO6: Examine petroleum products such as petrol, kerosene, diesel

CO7: Investigate bribe trap cases by phenolphthalein method.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO2	3	3	3	2	3	2	2	2	2	2	3
CO3	3	3	3	2	3	2	2	2	2	2	3
CO4	3	3	3	2	3	2	2	2	2	2	3
CO5	3	3	3	2	3	2	2	2	2	2	3
CO6	3	3	3	2	2	2	2	2	2	2	3
CO7	3	3	3	3	2	3	2	2	2	2	3

Course contents:

- 1 Detection and determination of methyl and ethyl alcohol in their mixture
2. Spot test of chloride, nitrates, nitrites, carbonates, sulphates, sulphites in water and their salts.
3. Examination of petroleum products such as petrol, kerosene, diesel as per BIS specifications
- 4.Colour test for the identification of Narcotic drugs.
5. Separation and identification of Psychotropic substance by TLC.
6. Separation and identification of Cannabis TLC, UV,
7. Separation of Opium by TLC, UV,
8. Analysis of high explosives by TLC, UV,
9. Analysis of NDPS drugs and explosives by instrumental techniques.
10. Identification of methanol and ethanol in illicit liquor

SEMESTER III

COURSE CODE	COURSE NAME	L	T	P	C
FRS500	FORENSIC TOXICOLOGY	3	0	1	4

Course objective:

1. To introduce basic concepts and terminologies of toxicology.
2. To introduce various types of drugs and toxic substances encountered in investigation.
3. To introduce different poisons and toxins
4. To introduce the various techniques by which these toxic substances can be isolated and analyzed.

Course outcome:

CO1: Develop knowledge of toxicology and toxins

CO2: Build knowledge about the various drugs and toxic substances encountered in an investigation.

CO3: Appraise their knowledge about different poisons, toxins and their medicolegal aspects

CO4: Choose various techniques by which these toxic substances can be isolated and then analysed to determine their type.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1:	3	2	2	2	2	1	1	2	2	2	2
CO2:	3	3	2	2	2	2	1	3	2	2	2
CO3:	3	2	1	3	2	2	2	2	1	2	1
CO4:	3	3	3	2	3	2	2	3	2	2	2

Course contents:

Module I: Introduction to Toxicology and Toxins

Introduction to Toxicology classification of poisons (according to mode of action), medico legal classification of poisons, action of poisons and factors modifying its action, LD 50, LC 50, modes of administration of poisons, routes of elimination of poisons. Poisoning by drugs (barbiturates, amphetamine, LSD, cocaine, benzodiazepines, Insecticides (organochloride, organophosphorus, and carbamates)

Module II: Isolation techniques of toxins

Basics of Forensic Toxicology, History, Scope and Significance, Crime scene involving poisons, medico legal aspects of poisoning, Poisons and classification of poisons, mode of action, types of poisoning, factors affecting poisoning, nature of forensic toxicological examinations, Roles and Responsibilities of forensic toxicologists, Format of autopsy report and laboratory report, expert witness testimony . Collection and Preservation Biological and non-biological samples, National and International guidelines of toxicological sample collection and preservation

Module III: Heavy metal poisoning and corrosive poisons

Extraction, purification and Examination of Poisons: Extraction of poisons from biological and nonbiological samples, Methods of Extraction, Liquid-Liquid extraction, extraction methods for acidic, basic and neutral poisons, extraction of volatile and non-volatile poisons, extraction of plant poisons, purification of toxins using chromatography methods, common methods of poison detection (Volatile & non-volatile, metallic, plant poisons, insect and snake bites), chemical tests and Instrumental methods (Chromatographic & Spectroscopic),

Module IV: general study and analysis of vegetable and animal poison

Corrosive poisons: mineral acids (nitric acid, hydrochloric acid, sulphuric acid) strong base (potassium hydroxide, sodium hydroxide)

Vegetable and animal poison: Introduction to poisoning by vegetable poisons (Datura, Nux Vomica, Oleander, Aconite, Castor)

Introduction to poisoning by animal poisons (snake venom, cantharides, scorpions),

Module V : Practical

1. Detection of metallic poisons such as Arsenic (As), Lead (Pb), mercury (Hg)
2. Detection of organophosphorus pesticides and zinc & aluminium phosphides by spot colour tests, UV-Vis Spectroscopy and chromatographic method (TLC).
3. Identification of Narcotic drugs by colour test and TLC
4. Analysis of illicit liquor alcohol (Ethyl alcohol, methyl alcohol, organic acid (acetic acid) aldehyde (acetaldehyde) Furfural, ketone
5. Identification of organo chloro and carbamates pesticide by UV and TLC

Text & References:

- Albert's, B. Bray, D, Lewis, J, Roberts K & Watson, J. D., Molecular Biology of Cell, 2nd Ed Garland Pub., New York, 1989.
- Pandey, B. P., Plant Anatomy; S. Chand, New Delhi, 1998.
- Simon, Ball, Environment Law – The Law and policy relating to protection of environment, Universal Law Pub Co, Delhi, 1991.
- Biology Methods manual, Metropolitan Police Forensic Science Laboratory, London, 1978.
- Byrd, J. H. & Castner, J. L., Forensic Entomology, The Utility of Arthropods in legal Investigation, CRC Press, USA, 2000

- Morrison, Robert D; Environmental Forensics Principles and Applications, CRC Press, Boca Raton, New York, (2000)
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- P. L. Williams and R. Warwick; Gray's anatomy; Churchill Livingstone, London; (1980)
- Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice – Hall, Englewood Cliff, New jersey; (1982)
- Smith; DGV; A manual of Forensic Entomology Ithaca New York Camstock Univ. Press, USA, (1986)

Course curriculum

SEMESTER III

Course Code	Course Name	L	T	P	C
FRS505	Forensic Photography	3	0	1	4

Course Objectives:

- Introduce the fundamental principles of photography and its historical evolution with emphasis on forensic applications.
- Develop technical knowledge about cameras, lenses, light sources, and photographic materials used in both conventional and digital photography.
- Train students in various photographic techniques applicable to crime scenes, documents, and microscopic evidence.
- Familiarize students with image processing and enhancement tools including digital editing and forensic image analysis using software like Photoshop.
- Impart legal and ethical knowledge for admissibility of photographic evidence in court, including documentation and report writing.

Course Outcomes:

CO1 Explain the working principles of cameras and optical systems used in forensic photography.

CO2 Demonstrate proficiency in capturing and processing forensic images, including crime scenes and evidence documentation.

CO3 Apply digital techniques and software tools to manipulate and enhance forensic photographs while maintaining evidentiary integrity.

CO4 Perform advanced photographic techniques such as photomicrography, IR/UV imaging, and macro photography in a forensic context.

CO5 Prepare legally admissible photographic reports and effectively present photographic evidence in court while maintaining the chain of custody.

CO- PO MAPPING

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11
CO1: Explain working principles of Forensic camera	3	2	2	2	3	1	1	2	1	2	2
CO2: Demonstrate crime scene and evidence photography	3	3	2	3	3	2	1	2	2	3	2
CO3: Apply digital tools for image enhancement	3	3	2	3	3	2	1	2	2	2	3
CO4: Perform advanced photographic techniques	3	3	3	3	3	2	1	2	2	2	3
CO5: Prepare admissible reports and maintain chain of custody	3	2	2	3	2	3	1	3	2	3	3

Unit I: Introduction to Forensic Photography (12 hours)

Definition of photography, History, Cameras and its working, attachments Of camera, photographic instruments: light sources, types of camera and lenses, Optical filters, fundamentals of light and vision, Basic principles and techniques of Black & White And colour photography, Spectral sensitivity of photographic materials, Concepts of coloured Photography, Camera exposure determination.

Unit II: Photographic Processing and image development (12 hours)

Linkage of cameras and film negatives, Modern developments in photography: digital photography, Image sensors, photo shop-development- digital images processing and manipulation- forensic Application.

Unit III: Crime Scene Photography and Modern Techniques (12 hours)

Crime scene photography, photomicrography, macro photography, photography of fingerprints and Documents, IR and UV photography, photogrammetry, crime scene videography / high speed Videography, and laboratory photography.

Unit IV: Legal Aspects and Report writing (09 hours)

Court representation and admissibility in judicial system , chain of custody and preparing photographic reports. Case study.

Unit V: Practicals (30 hours)

- Photography of objects-close up, normal, telephoto and processing.
- Document and Finger print photography.
- Crime scene photography-long shot, medium and close up shots
- Developing of black and white Photographic prints
- Photomicrography and Macro photography
- Photography with different filters for developing contrasts

References:

1. E. M. Robinson, Crime Scene Photography, 3rd ed. Burlington, MA, USA: Elsevier Academic Press, 2016.
2. C. D. Duncan, Advanced Crime Scene Photography, 2nd ed. Boca Raton, FL, USA: CRC Press, 2014.
3. N. Marsh, Forensic Photography: Importance of Accuracy, London, UK: CRC Press, 2020.
4. P. Jones, Practical Forensic Digital Imaging: Applications and Techniques, Boca Raton, FL, USA: CRC Press, 2010.
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7. K. Mancini and J. Sidoriak, Manual of Crime Scene Photography, Burlington, MA, USA: Jones & Bartlett Learning, 2010.
8. B. R. Sharma, Forensic Science in Criminal Investigation and Trials, 6th ed. Lucknow, India: Universal Law Publishing, 2019.

Course code	Course name	L	T	P	C
FRS508	FORENSIC PHYSICS & BALLISTICS	3	0	1	4

Course objective:

1. To introduce students to the fundamental principles and forensic significance of trace evidence including glass, soil, and paint.
2. To develop an understanding of the types, characteristics, and forensic value of tool marks and tyre impressions.
3. To provide a comprehensive overview of firearms, ammunition, and the legal framework governing their use.
4. To explain the scientific principles behind internal, external, and terminal ballistics and their application in forensic investigations.
5. To equip students with hands-on skills for practical forensic examinations and interpretation of various types of physical evidence.

Course outcome:

CO1:Analyze and interpret glass, soil, and paint evidence using physical, chemical, and instrumental techniques.

CO2:Identify and compare tool marks and tyre impressions, and apply appropriate collection and preservation methods.

CO3:Classify firearms and ammunition, understand firing mechanisms, and analyze ballistic markings for firearm identification.

CO4: Apply concepts of internal, external, and terminal ballistics to determine trajectories, impact, and wound patterns in forensic contexts.

CO5: Perform practical forensic procedures including GSR analysis, bullet and cartridge identification, and restoration of obliterated marks.

CO-PO Mapping Table

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	-	2	1	2
CO2	2	3	3	1	2	1	2
CO3	3	2	2	3	2	1	2
CO4	3	2	-	2	3	1	2
CO5	2	3	3	1	2	1	3

Course contents:

Module I: Glass ,Soil & Paint (13 Hours)

Types of glass and their composition, forensic examination of glass fractures under different conditions, determination of direction of impact: cone – fracture, rib marks, hackle marks, backward fragmentation, color and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis, interpretation of glass evidence. Case studies.

Introduction, Formation and types of soil, composition and color of soil, Classification of soil, Collection and preservation of soil as evidence, analysis of soil samples: Physical, chemical and instrumental interpretation of soil evidence, (particle size distribution, turbidity test, microscopic examination, density gradient analysis, ignition loss), Case Studies.

Introduction, Composition, Manufacture of Paint, Types of paint, Forensic Examination of Paints and Coatings: Collection and Preservation of paint samples, macroscopic and microscopic studies, pigment distribution, micro-chemical analysis- solubility test, chemical and instrumental examination of paint and case studies.

Module II: Tool marks & Tyre impressions (12 Hours)

Types of tool marks: compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, Collection and Preservation of tool marks: Tracing and lifting of tool marks, method of marking-cast. Forensic examination of tool marks, Case Studies.

Restoration of erased/obliterated marks: Principle of restoration of erased marks, Techniques involved for alteration of individual markings, Restoration of erased and obliterated marks on various

surfaces, Photography and Forensic assessment of methods for restoration of obliterated marks, case studies.

Tyre Impressions : Introduction to tire impressions, Collection and Preservation of the tire impression evidence, Forensic Significance of skid marks, Forensic Examination for identification and comparison, Case Studies.

Module III: Introduction to Ballistics & identification of firearm and ammunition (10 Hours)

Definition, history and background of firearms, classification characteristics and firing mechanism of smooth bored firearms and rifled firearms, country-made firearms. Ammunition: classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, various types of bullets and compositional aspects, Arms and explosives act (1959), Safety aspects for handling firearms and ammunition.

Principles and practice of identification of firearms, different types of marks produced during firing process on cartridge-firing pin marks, breech face marks, chamber marks, extractor and ejector marks, Different types of marks produced during firing process on bullet-number/direction of lands and grooves, striation marks on lands and grooves, Analysis of GSR –Composition of GSR, Location & Collection, Mechanism of formation, Chemical & Instrumental techniques involved in analysis.

Module IV: Internal, External & Terminal ballistics (10 Hours)

Internal ballistics: definition, General principles of internal ballistics - ignition of propellants, shape and size of propellants, manner of burning etc.

External ballistics: definition, vacuum trajectory, effect of air resistance on trajectory, base drag, yaw, shape of projectile and stability, coefficient of reduction and sectional density, recoil velocity, Ricochet and heat problem encountered, determination of range of fire & its related phenomena.

Definition, interaction and penetration of various types of projectiles in various tissues, factor affecting wound ballistics, Various aspects of wound ballistics, nature of wounds of entry & exit, Evaluation of firearm injuries caused due to shot-gun, and rifle firearms handguns and country made firearms, postmortem and anti-mortem firearm injuries.

Module V: Practical (30 Hours)

- Examination of paint
- Restoration of obliterated marks
- Examination of glass fragments
Examination of soil samples
- Identification of fired cartridge cases.
- Identification of fired bullet
- Collection and preservation of GSR
- Chemical & Instrumental Examination Analysis of GSR

Text & References:

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- Ray D. Kent and Charles Read; Acoustic analysis of speech
- **Brain** J. Heard; Hand book of Firearms and Ballistics; John Willey, England; (1997)
- I.V. Hogg; The Cartridges Guide — A small arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, PA (1982)
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Course Code	Course Name	L	T	P	C
FRS463	FORENSIC ENTOMOLOGY	4	0	0	4

Course objective:

1. Introduce the concept, history, and forensic relevance of entomology in legal investigations.
2. Explain the biology, life cycles, and classification of forensically important insects.
3. Train students in techniques for collection, preservation, and documentation of entomological evidence.
4. Teach methods for estimating postmortem interval (PMI) using insect development and case data.
5. Explore advanced topics like entomotoxicology, insect DNA analysis, and ethical/legal considerations.

Course Outcomes (COs):

CO1. Explain the principles of forensic entomology and its significance in legal investigations.

CO2. Identify and describe the life cycles of insects commonly found in forensic contexts.

CO3. Apply entomological techniques to estimate the postmortem interval (PMI).

CO4. Analyze and interpret entomological data to assist in forensic casework.

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	3	2	1	2	0	2	3	2
CO2	3	3	2	2	2	0	2	0	1	2	2
CO3	3	3	3	3	3	2	2	0	2	3	3
CO4	3	3	2	3	3	2	2	0	2	3	3

Unit I: Introduction to Forensic Entomology

(10 LECTURE HOURS)

Definition, historical perspective, significance in forensic science, advances in forensic science. Forensic importance of insects and arthropods, basic principles of entomology and the role of insects in legal investigation. Interdisciplinary nature of forensic entomology and its applications.

Unit II: Insect Biology and Life Cycles

(10 LECTURE HOURS)

Morphology, physiology and behaviour of forensically important insects, insect taxonomy, anatomy and ecological roles, life cycles of insects, Life cycles of Diptera (e.g., blowflies, flesh flies) and Coleoptera, Factors affecting insect development: temperature, humidity, drugs including egg, larval, pupal and adult stages, identification and classification of insects.

Unit III: Collection and Preservation of Entomological Evidence

(10 LECTURE HOURS)

Techniques for documenting, collecting, preserving entomological evidence, proper handling and storage of insect specimens, methods for collecting different types of entomological evidence, including insects, larvae, pupae and eggs, CSI protocols and evidence handling procedures, legal considerations and chain of custody for entomological evidence.

Unit V: Entomotoxicology and Advanced Applications

(10 LECTURE HOURS)

Effect of toxins and drugs on insect development, Insect DNA for species identification (COI barcoding), stored product, and environmental forensics applications, Ethical, legal, and ecological concerns

Unit IV: Estimation of Postmortem Interval(PMI) and Case Studies

(10 LECTURE HOURS)

Methods of estimating the time since death, factors influencing insect development and their impact on PMI estimation, calculation of accumulated degree days and use of insect development models, case studies and real world scenario, Role of forensic entomologists as expert witness.

References:

1. Byrd, J. H., & Castner, J. L.; "Forensic Entomology: The Utility of Arthropods in Legal Investigations", CRC Press, 2010.
2. Smith, K. G. V.; "A Manual of Forensic Entomology", British Museum (Natural History), 1986.
3. Gennard, D. E.; "Forensic Entomology: An Introduction", Wiley-Blackwell, 2007.
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5. Singh, K. P.; "Forensic Entomology: Principles and Practice", Indian Publishers, 2015.
6. Sharma, B. R., & Goswami, P. K. (Editors); "Forensic Science: An Indian Perspective", PHI Learning, 2018.
7. Goyal, R. K.; "Forensic Entomology: A Handbook for India", Indian Forensic Publishers, 2016.
8. Kapoor, A. K., & Bhattacharya, S. K. (Editors); "Forensic Science in India: A Review", Indian Science Publishers, 2019.

Course Code	Course Name	L	T	P	C
FRS501	FORENSIC BIOLOGY & DNA PROFILING	3	0	1	4

Course objective :

Understand different types of biological evidence and their forensic importance.

Learn molecular techniques used in forensic biology.

Identify and analyze body fluids using serological methods.

Understand DNA profiling and its forensic applications.

Study basic molecular biology concepts relevant to forensics.

Perform practical techniques like DNA extraction and bloodstain analysis.

Course Outcome (COs):

1. **CO1 :** Demonstrate understanding of various biological evidences, including blood, hair, fibres, and diatoms, along with their forensic relevance, collection, and examination techniques
2. **CO2 :** Apply molecular and serological techniques such as ELISA, PCR, STR, and MPS for identification, quantification, and comparison of DNA and body fluids.
3. **CO3:** Differentiate and analyze forensic samples using microscopic, biochemical, and immunological techniques for blood, semen, saliva, and other biological fluids.
4. **CO4:** Differentiate and analyze forensic samples using microscopic, biochemical, and immunological techniques for blood, semen, saliva, and other biological fluids.
5. **CO5:** Perform practical techniques including DNA extraction from biological samples, electrophoresis, serological identification, and bloodstain pattern analysis for forensic casework.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	2	2	2	1	2	2	2
CO2	3	3	2	2	3	2	2	3	3	2	3
CO3	3	3	2	2	2	2	2	2	2	2	2
CO4	3	3	2	3	3	3	3	3	3	2	3
CO5	3	3	3	3	3	3	2	2	2	2	3

Module 1: Introduction to Forensic Biology and Biological evidences: (10 LECTURE HOURS)

What are biological samples, different types of biological evidences, Importance in forensic investigation, Sample collection, Preservation, Packing, Sealing and Forwarding of biological samples.

Hair examination –

morphology and biochemistry of human and animal hair, and its microscopic examination, determination of origin, race, and sex.

Fibre examination-

Fibre types, forensic aspects of fibre examination- fluorescent, optical properties, refractive index, birefringence, dye analysis etc., identification and comparison of man-made and natural fibre.

Diatom Analysis-

Definition and types, structure, Forensic significance of diatoms in drowning cases and their isolation and examination.

Module 2: Molecular Techniques in Forensic Biology: (10 LECTURE HOURS)

Rapid DNA Technologies: Implementation of automated DNA profiling systems for swift analysis. Automated DNA Extraction, Quantitation, Amplification, Sequencing. MiniSTRs, Multiplex STRs, Amplicons.

Massively Parallel Sequencing (MPS): Application of NGS for detailed DNA analysis, enabling differentiation between closely related individuals. Pyrosequencing, Illumina Sequencing, Ion-torrent sequencing. It's Principles and Applications.

Module 3: Body Fluids & Serological Examination

(10 LECTURE HOURS)

Blood: identification, species determination, confirmatory tests, Seminal, vaginal, saliva, sweat, and urine stains: identification and forensic relevance, Microscopy and biochemical tests for body fluids.

Module 4: DNA Profiling

(10 LECTURE HOURS)

History of DNA fingerprinting, DNA polymorphism, Genes and DNA markers in forensic DNA analysis, Introduction to mitochondrial DNA and its forensic importance, Important case studies of DNA fingerprinting. Short Tandem Repeat (STR) Analysis: Enhanced methods for analysing genetic markers. Nomenclature of the genetic markers. Mitochondrial DNA Analysis: Techniques for examining maternal lineage and degraded samples. Techniques and equipment for DNA extraction and purification, Different methods of DNA quantitation, DNA separation and detection techniques, and Polymerase Chain Reaction (PCR). Y-STR analysis and its forensic significance using advanced molecular techniques. DNA databases using advanced bioinformatics tools.

Module 5 : Molecular Cell Biology in Forensics:

(10 LECTURE HOURS)

Central Dogma: Organization of genome in prokaryotes and eukaryotes, Chemical structure of DNA and RNA, DNA replication: Enzymes and accessory proteins, Mechanism of DNA replication in prokaryotes and eukaryotes. Transcription: RNA polymerases, features of prokaryotic and eukaryotic transcription, transport of RNA within eukaryotic cells. Translation: Structure and role of t-RNA in protein synthesis, ribosome structure, genetic code and their properties; translation (initiation, elongation and termination and post translational modifications).

Module 6 : Practical

(30 LECTURE HOURS)

- To determine blood group from blood samples
- to carry out the crystal test on a blood sample.
- To identify blood samples by chemical tests.
- To carry out cross-over electrophoresis.
- To study the correlation between impact angle and shape of bloodstain.
- To identify the point of convergence from the bloodstain patterns.
- Organic extraction of DNA from blood
- Extraction of DNA from saliva.
- Extraction of DNA from other body fluid
- Isolation of DNA from hairs.
- Quantification of DNA

References:

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2. Pandey, B. P., Plant Anatomy; S. Chand, New Delhi, 1998.
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8. Kimball, John W; Biology; Arvind Publishing Co. New Delhi (1974)
9. Lewis, B Gene IV, Oxford University Press, England (1980)
10. Morrison, Robert D; Environmental Forensics Principles and Applications, CRC Press, Boca Raton, New York, (2000)
11. Oates, D W, Brown, C W & Weigel, D L; Blood and tissue identification of selected birds and mammals; JPR study Projects Lincoln NE Nebraska Gome and Perks Commission (1974)
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13. Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice - Hall, Englewood Cliff, New jersey; (1982)
14. Smith; DGV; A manual of Forensic Entomology Ithaca New York Camstock Univ. Press, USA, (1986)
15. Jorg T. Epplen Thomas Lubjumhin, DNA Profiling and DNA Fingerprinting; Birkhauser Verlag, Basel, 1995.
16. Simon, Easteal, DNA profiling, Principles, pitfalls and potential, Harwood Acad. Publishers, 1992.

Course Code	Course Name	L	T	P	C
FRS510	FORENSIC BIOTECHNOLOGY	3	0	1	4

Course objective

Understand basics of forensic genomics and DNA markers.
 Learn how to use biological databases and tools like BLAST.
 Know how recombinant DNA technology works.
 Study population genetics and genetic variation.
 Use genetic tools for phylogenetic and forensic analysis.

Course outcome(COs):

CO1: Recognize and explain real-time PCR-based DNA quantification methods and interpret forensic genetic results accurately.

CO2: Design and conduct forensic genetic experiments and apply appropriate statistical tools for data analysis and evaluation.

CO3: Critically assess different DNA markers and sequencing technologies used in forensic and population genetics.

CO4: Demonstrate understanding of bioinformatics tools and techniques, including sequence alignment, database retrieval, and genomic analysis relevant to forensic applications.

CO5: Explain the principles of recombinant DNA technology, gene expression systems, and their applications in forensic investigations.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	2	1	2	2	1	1
CO2	3	3	2	2	3	2	2	1	2	1	2
CO3	3	3	2	2	3	1	1	2	2	1	2
CO4	3	3	2	2	2	2	2	3	2	1	2
CO5	3	3	1	2	3	2	2	2	2	1	3

UNIT I: Forensic Genomics:

(10 LECTURE HOURS)

Identity, Phenotypic and ancestry-informing markers, Molecular autopsy and tissue identification by DNA and RNA and Various guidelines for DNA forensics workflow.

UNIT II: Basics of Biocomputing

(10 LECTURE HOURS)

Biological Data: The form of biological information, Databases – Format and Annotation: Conventions for database indexing and specification of search terms, common sequence file formats, annotated sequence databases - primary sequence databases, organism specific databases, Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, Submission of (new and revised) data, data submission tools, Sequence Similarity Searches: Local v/s global, Distance metrics. FASTA, BLAST and other variants of BLAST, Multiple Sequence Alignment and Whole genome analysis

UNIT III: rDNA Technology:

(10 LECTURE HOURS)

General introduction and concept of recombinant DNA technology. Vectors: Types of vectors and choice of vectors- Plasmids, cosmids, Lambda phagevectors, shuttle vectors, BACs and YACs, Choice of hosts, Expression systems in Eukaryotic cells, Yeast, Bacteria, Insect cell lines, Gene-screening; methods for transferring recombinant DNA to host cells (transformation and transfection).

UNIT IV: Population and Conservation Genetics:

(10 LECTURE HOURS)

Basic Concepts in Population Genetics, HardyWeinberg Principle and Linkage disequilibrium, Causes of evolution- admixture, selection, mutation, drift. Genetic Diversity and variations; Haplotype analysis, Various tools for phylogenetic analysis.

UNIT V: Practical

(30 LECTURE HOURS)

1. Online platforms like **HirisPlex** or **Snipper** to predict traits from genetic data.
2. DNA/RNA/protein sequence search, alignment (BLAST).
3. 3D structure of proteins

REFERENCES:

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2. D. Male, J. Brostoff, D. Roth, I. Roitt, (2012) Immunology (8th Edition), Saunders, Elsevier, USA.
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5. W. Miller, An Introduction to Bioinformatics Algorithms, J. Am. Stat. Assoc. 101 (2006) 855–855. <https://doi.org/10.1198/jasa.2006.s110>.
6. P. Romero, Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, 2004. <https://doi.org/10.1093/bib/5.4.393-a>.
7. F.H. Stephenson, Calculations for Molecular Biology and Biotechnology, Elsevier, 2003. <https://doi.org/10.1016/B978-0-12-665751-7.X5041-0>.
8. T. Warnow, Bioinformatics and Phylogenetics: Seminal Contributions of Bernard Moret, 2019. <https://doi.org/10.1007/978-3-030-10837-3>.
9. Supratim Choudhuri, Michael Kotewicz, Bioinformatics for beginners: genes, genomes, molecular evolution, databases and analytical tools, 2014, 1st ed., Academic Press, ISBN 13:9780124104716

COURSE CODE	COURSE NAME	L	T	P	C
FRS456	Research Methodology in Science	4	0	0	4

Course Objectives (COs):

CO1: To introduce students to the fundamentals of research, including types, objectives, research formulation, hypothesis development, and research design, with an emphasis on both qualitative and quantitative approaches.

CO2: To develop analytical skills for data collection, processing, and statistical analysis using tools such as SPSS and statistical tests like chi-square, t-test, ANOVA, correlation, and regression to interpret research findings effectively.

CO3: To foster an understanding of ethical research practices with a focus on AI-assisted studies, covering data privacy, algorithmic transparency, bias mitigation, informed consent, and responsible use of AI writing and analytical tools.

CO4: To inculcate awareness of academic and publication ethics in the context of AI, including responsible authorship, proper citation of AI tools, avoidance of plagiarism, data fabrication, and maintenance of academic integrity.

CO5: To provide comprehensive knowledge of quality management systems applicable to forensic and analytical laboratories, including ISO requirements, document control, audits, and corrective and preventive actions.

CO6: To impart practical understanding of technical quality assurance in laboratory settings through test and calibration methods, traceability, equipment handling, result validation, safety protocols, and use of Laboratory Information Management Systems (LIMS).

Course Outcomes (CO):

CO1: Explain the meaning, objectives, and types of research, including formulation of hypotheses, literature review, and development of research plans.

CO2: Apply appropriate methods of data collection, analysis, and interpretation using statistical tools such as probability, hypothesis testing, and software like SPSS.

CO3: Evaluate ethical considerations in AI-assisted research, including data privacy, bias, fairness, transparency, and responsible use of AI tools.

CO4: Analyze quality management requirements, including competence of laboratories, quality systems, internal audits, and corrective actions.

CO5: Demonstrate knowledge of technical requirements, including test and calibration methods, measurement traceability, and validation.

CO6: Integrate knowledge of research design, data analysis, AI ethics, and quality management to design and implement ethical, high-quality research studies.

CO-PO Mapping:

Course Outcomes (COs)	Unit(s)	PO1	PO2	PO3	PO4	PO5	PO6
CO1: Explain the meaning, objectives, and types of research, including research formulation and design.	Unit I	1				2	3
CO2: Apply appropriate methods of data collection, analysis, and interpretation using statistical tools.	Unit II	1	2			3	
CO3: Evaluate ethical considerations in AI-assisted research, including bias, transparency, and responsible use of AI tools.	Unit III			1		2	3
CO4: Analyze quality management requirements, including competence of labs, quality systems, internal audits, and corrective actions.	Module IV				1	2	3
CO5: Demonstrate knowledge of technical requirements, including test and calibration methods, measurement traceability, and validation.	Module V				1	2	3
CO6: Integrate knowledge of research design, data analysis, AI ethics, and quality management to design and implement ethical, high-quality research studies.	Units I–V	1	2	3	4	5	6

UNIT-I :Types of Research and Research Design:

(10 lecture hours)

Meaning of research, research objectives, motivation in research, Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature Review, and Development of Hypothesis. Research design and methods, developing a research plan—Exploration, Description, Diagnosis, and Experimentation, and determining experimental and sample designs.

UNIT-II: Data Collection, analysis and Interpretation of Findings:

(20 lecture hours)

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central tendencies – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, t test, U test, Z score, Correlation, Regression, ANOVA, SPSS. Types of Errors and Interpretation of Findings.

UNIT-III : Ethical Usage of AI in Research

(10 lecture hours)

principles of research ethics, data privacy and protection, informed consent in AI-assisted studies, algorithmic transparency, bias and fairness in AI models, accountability and responsibility in AI research, intellectual property rights, dual-use concerns of AI technologies, ethical implications of AI-generated content, regulatory frameworks and compliance (e.g., GDPR, IEEE, UNESCO guidelines), human oversight in automated systems, and the role of institutional review boards (IRBs) in AI-related research. Responsible use of AI writing tools, authorship and attribution ethics, avoiding plagiarism and data fabrication, maintaining academic integrity with AI-generated content, transparency in the use of AI assistance, citation of AI tools, bias detection in AI-generated reports, ethical editing and paraphrasing, data confidentiality and security, adherence to publication ethics, accountability in collaborative AI use, and compliance with institutional and journal guidelines on AI in scholarly writing.

Module IV: Quality Management

(10 lecture hours)

Management requirements- General requirements for the competence of testing and calibration laboratories, quality system, document control, internal audit, corrective and preventive actions.

Module V: Technical requirements

(10 lecture hours)

Test and calibration methods, equipment, measurement traceability, sampling and handling of test and calibration items, assuring the quality of tests and calibration results, reporting of results, LIMS, validation and safety equipment.

Text books and references:

- Andersen, J. C., & Toombs, A. (2023). Authorship in the Age of Generative AI: Ethical Considerations for Human-AI Collaboration. *Communications of the ACM*, 66(9), 34–37. <https://doi.org/10.1145/3608590>
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- Smith, Jonathan, A. (Ed.), Qualitative Psychology: A Practical Guide to Research Methods, Sage Publications, 2003.
- UNESCO. (2021). *Recommendation on the Ethics of Artificial Intelligence*. <https://unesdoc.unesco.org/ark:/48223/pf0000380455>
- Woodworth and Schlosberg, Experimental Psychology, Methuen and co. ltd, London, 1971.

COURSE CODE	COURSE NAME	L	T	P	C
	FORENSIC ARCHAEOLOGY	4	0	0	4

Course Objectives (COs):

CO1: To introduce students to the definition, scope, and evolution of forensic archaeology, highlighting its distinctions from traditional archaeology and its role in medico-legal investigations.

CO2: To develop understanding of archaeological survey and excavation techniques—including remote sensing, stratigraphy, and dating methods—and their application in forensic contexts such as grave recovery and disaster victim identification.

CO3: To familiarize students with burial taphonomy and post-mortem changes, including decomposition patterns, soil interaction, and the identification of clandestine or disturbed graves.

CO4: To train students in standardized recovery protocols, field documentation, and the maintenance of chain of custody during forensic archaeological investigations, in accordance with international standards like INTERPOL DVI guidelines.

CO5: To enable students to accurately interpret burial evidence, distinguish between archaeological and forensic contexts, and understand how such evidence contributes to legal processes and human rights inquiries.

CO6: To build competency in writing forensic archaeological reports, providing expert testimony, addressing ethical considerations, and participating in repatriation and human rights-focused investigations.

Course Outcomes (CO):

CO1: Define and explain the scope, history, and multidisciplinary nature of forensic archaeology, including its role in medico-legal investigations.

CO2: Demonstrate knowledge of archaeological methods applicable in forensic contexts, including survey techniques, excavation strategies, dating methods, and recovery protocols.

CO3: Analyze burial taphonomy and post-mortem processes, considering different burial types and taphonomic factors influencing decomposition and preservation.

CO4: Evaluate and differentiate archaeological versus forensic sites and interpret burial evidence with respect to contextual integrity and contamination.

CO5: Prepare forensic archaeological reports and communicate findings effectively in legal contexts, including expert testimony and courtroom presentation.

CO6: Critically assess ethical issues in forensic archaeology, including repatriation, human rights investigations, and adherence to international standards.

CO-PO Mapping:

Course Outcomes (COs)	Module(s)	PO1	PO2	PO3	PO4	PO5	PO6
CO1: Define and explain the scope, history, and multidisciplinary nature of forensic archaeology.	Module I	1				2	3
CO2: Demonstrate knowledge of archaeological methods including survey, excavation, dating, and recovery protocols.	Module II	1	2				3
CO3: Analyze burial taphonomy and post-mortem processes in various burial contexts.	Module III	1		2			3
CO4: Evaluate archaeological vs. forensic sites and interpret burial evidence.	Module IV	1		2	3	4	5
CO5: Prepare forensic archaeological reports and present expert testimony in legal contexts.	Module IV	1			2	3	
CO6: Critically assess ethical issues in forensic archaeology, including human rights and international protocols.	Module IV	1			2	3	4

Module I: Introduction to Forensic Archaeology

(20 lecture hours)

Definition, scope, and history of forensic archaeology, Distinction between traditional and forensic archaeology, Role of forensic archaeologists in medico-legal investigations, Multidisciplinary approach: collaboration with forensic anthropologists, pathologists, law enforcement, International protocols and standards (e.g., INTERPOL DVI guidelines)

Module II: Archaeological Methods in Forensic Contexts

(20 lecture hours)

Survey techniques: remote sensing, GPR, aerial photography, GIS. Excavation strategies: grid system, stratigraphy. Dating methods include C14, TL, dendrochronology, and K-Ar dating. Recovery protocols: photography, mapping, context sheets, field notes. Evidence recovery and chain of custody. Mass grave excavation and disaster victim recovery.

Module III: Burial Taphonomy and Post-Mortem Processes

(20 lecture hours)

Types of graves: primary vs. secondary, clandestine graves, Decomposition and skeletonization in different burial environments, Taphonomic factors: soil chemistry, fauna, climate, Disturbance analysis and soil stratigraphy, Contextual integrity and contamination assessment

Module IV: Interpretation, Reporting, and Legal Aspects

(20 lecture hours)

Contextual interpretation of burial evidence, Differentiating archaeological vs. forensic sites, Writing forensic archaeological reports, Expert witness testimony and courtroom presentation, Ethical issues, repatriation, and human rights investigations.

Suggested Reading:

1. Hunter, J., & Cox, M. (2005). *Forensic Archaeology: Advances in Theory and Practice*. Routledge.
2. Blau, S., & Ubelaker, D. H. (Eds.). (2016). *Handbook of Forensic Anthropology and Archaeology*. Routledge.
3. Dirkmaat, D. C. (Ed.). (2012). *A Companion to Forensic Anthropology*. Wiley-Blackwell.
4. Skinner, M., & Sterenberg, J. (2005). *Guidelines for International Forensic Bio-archaeology Investigations*. ICRC.
5. Cox, M., & Mays, S. (2000). *Human Osteology in Archaeology and Forensic Science*. Cambridge University Press.

Course code	Course name	L	T	P	C
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FRS21033	FORENSIC ANTHROPOLOGY& ODONTOLOGY	3	0	1	4
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Course Objectives (COs):

CO1: To develop a foundational understanding of forensic anthropology, including the identification, classification, and comparative analysis of human and non-human skeletal remains, and to explore techniques such as forensic anthropometry, osteometry, and advanced imaging for human identification.

CO2: To equip students with the skills to estimate skeletal age, biological sex, race, and stature using both complete and fragmentary skeletal remains, emphasizing differences due to population variability and anatomical characteristics of key bones.

CO3: To introduce and enhance knowledge of personal identification techniques including somatometry, somatoscopy, portrait parle, facial reconstruction, craniofacial superimposition, and analysis of congenital and genetic anomalies relevant in forensic contexts.

CO4: To provide a thorough understanding of forensic odontology, including the structure and classification of teeth, age estimation methods, bite mark analysis, dental anomalies, and digital techniques like CBCT, OPG, and 3D scanning in identification.

CO5: To train students in disaster victim identification (DVI), focusing on the examination and identification of fragmented or burnt skeletal remains and the integration of forensic odontology and anthropology in mass fatality scenarios.

CO6: To develop hands-on practical skills in anthropometric, osteometric, craniometric, and odontometric measurements and indices, and to familiarize students with standardized protocols for handling, analyzing, and documenting forensic skeletal and dental evidence while maintaining chain of custody.

Course Outcomes (CO):

CO1: Explain the scope and applications of forensic anthropology, including human skeletal anatomy and its role in identification.

CO2: Determine skeletal age, sex, and race using osteometric and anthropometric methods and interpret their forensic significance.

CO3: Apply personal identification techniques, including somatometry, somatoscopy, facial reconstruction, and superimposition, in forensic casework.

CO4: Analyze dental evidence, including dentition, dental anomalies, age estimation techniques, bite mark analysis, and digital imaging in forensic odontology.

CO5: Evaluate methods for disaster victim identification, including fragmented and burnt skeletal remains, and the role of forensic odontology in mass disaster scenarios.

CO6: Demonstrate practical skills in anthropometry, osteometry, craniometry, odontometry, and proper evidence handling protocols relevant to forensic anthropology investigations.

CO-PO Mapping:

Course Outcomes (COs)	Module(s)	PO1	PO2	PO3	PO4	PO5	PO6
CO1: Explain the scope and applications of forensic anthropology.	Module I	1				2	3
CO2: Determine skeletal age, sex, and race using osteometric and anthropometric methods.	Module II	1	2				3
CO3: Apply personal identification techniques in forensic casework.	Module III	1	2		3	4	5
CO4: Analyze dental evidence and digital imaging techniques in forensic odontology.	Module IV	1		2	3	4	5
CO5: Evaluate methods for disaster victim identification, including fragmented and burnt skeletal remains.	Module V	1	2	3	4	5	6
CO6: Demonstrate practical skills in anthropometry, osteometry, odontometry, and proper evidence handling.	Practical sessions	1	2	3	4	5	6

Module I: Forensic Anthropology

(5 lecture hours)

Definition, scope, and problems, human skeleton, comparative skeletal anatomy of human and non-human. Bones- identification, classification, and determination of site, morphological, and anatomical characteristics. Skeletal age, sex, and race. Forensic Anthropometry, Osteometry, Identification of individuals (living), Identity of missing person by superimposition techniques, Facial reconstruction method, Advanced Imaging Techniques, and Musculoskeletal Reconstruction.

Module II: Skeletal age, sex, and race

(10 lecture hours)

skeletal age (earlier years): prenatal ossification. Postnatal appearance and union of centre ossification. Differences due to race. Skeleton age (later years): cranial suture closure, pubic

symphysis. Sexing skeleton remains - general considerations and age factors. Sex differences in skull, pelvis, orbit, scapula, mandible, and long bones. Calculation of stature of long bones: studies on stature reconstruction in various population groups. Use of fragmentary long bones in stature reconstruction. Racial differences in human skeleton.

Module III: Personal identification techniques

(10 lecture hours)

Introduction and forensic importance; personal identification of living & dead- identification through Somatometry and somatoscopy observation, nails, occupation marks, scars, tattoo marks and deformities. Portrait parle/Bertillon system, facial reconstruction, super imposition technique. Craniofacial super imposition technique – photographic super imposition, videoperimposition, Roentgenographic superimposition. Use of somatoscopic and craniometric methods in reconstruction. Importance of tissue depth in facial reconstruction. Genetic and congenital anomalies – causes, types, identification and their forensic significance.

Module IV: Forensic odontology

(10 lecture hours)

Definition and Scope of Forensic Odontology, Types of dentitions, Basic structure of human teeth, types of teeth & their morphology, and determination of age from teeth using various methods, dental anomalies and their role in Personal Identification. Age Estimation Techniques: Demirjian's Method (Digital Enhancements), Cameriere's Method, and Kvaal's Method with CBCT. Digital Dental Radiography and Imaging: Cone Beam Computed Tomography (CBCT), Digital Orthopantomogram (OPG), and Intraoral Imaging, Computer-Aided Design and Manufacturing (CAD/CAM), and 3D Printing and Scanning. **Bite marks:** Types & forensic importance; collection and preservation of samples, analysis of bite marks, presentation of bite mark evidences in court of law

Module V: Disaster Victim Identification:

(10 lecture hours)

Examination and identification of dead bodies in mass disasters; mutilated bodies; fragmentary skeletal remains and bones; Determination of age, sex, race, and species origin from bones and assessment of stature; Identification of burnt bones, skeletal remains in accidents, crimes, and mass disasters. Role of forensic odontology in mass disaster victim identification, dental charting, and comparison of ante-mortem and post-mortem dental records.

Practical:

(30 lecture hours)

Anthropometry for sex identification: stature, body weight, maximum cranial length, maximum cranial breadth, bizygomatic breadth, nasal height, nasal breadth, upper facial

height, bigonial breadth, mandibular length, gonial angle, biacromial breadth, chest breadth, pelvic breadth, hand length, hand breadth, foot length, foot breadth, femur length, humerus length, radial length, ulnar length, tibial length, and fibular length.

Osteometry: Side and site determination from long bones. Osteometric measurements and indices of the femur, humerus, ulna, and radius include maximum length, physiological length, vertical diameter of head, transverse diameter of femur head, bicondylar width, epicondylar width, midshaft diameter, and pilastric index, pelvic measurements and indices include conjugate diameter, transverse diameter, pubic length, ischial length, subpubic angle, and ischio-pubic index; orbital measurements and indices include orbital height, orbital breadth, biorbital breadth, and orbital index; skull measurements and indices include maximum cranial length, maximum cranial breadth, cranial height, bizygomatic breadth, nasal height, nasal breadth, upper facial height, cranial index, cephalic index, facial index, and nasal index.

Craniometry (Craniogram): maximum cranial length, maximum cranial breadth, cranial height, frontal breadth, bizygomatic breadth, nasal height, nasal breadth, orbital breadth, orbital height, biorbital breadth, and upper facial height.

Stature estimation from bones. Sex determination from various bones- Skull bones, orbit, mandible, Age determination from Skull.

Odontometry: Age estimation from teeth. Mesiodistal width, buccolingual (or labiolingual) width, crown height, root length, total tooth length, incisal-cervical height, cusp height, intercuspal distance, intercanine width, intermolar width, and occlusogingival height. Bite mark analysis(cast preparation).

Protocol of handling different bone sample and maintaining their chain of custody

Text & References:

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- D. Ubelaker and H. Scammell, Bones, M. Evans & Co., New York (2000).
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- El Najjar and Mcwilliams (1978) : Forensic Anthropology
- Comas, J.A. (1960): A Manual of Physical Anthropology, Charles C. Thomas U.S.A.

- Whitaker, D.K. and MacDonald, D.U. (1989): Forensic Dentistry, Wolfe Medical Publications Ltd. Robert A. Jensen: Mass fatality and Casualty incidents: A field guide
- Taylor (2000) : Forensic Art and Illustrations CRC Press.
- Singh, I.P. and Bhasin M. K. (1968): Anthropometry, Kamla-Raj Publications, Delhi
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- . Nath, S. (1987): An Introduction to Forensic Anthropology. Gian Publishing House, New Delhi.
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- Blau, S., & Ubelaker, D. H. (2016). *Handbook of Forensic Anthropology and Archaeology*. Routledge.
- Ubelaker, D. H. (2008). *Forensic Science: Current Issues, Future Directions*. Wiley-Blackwell.
- Bass, W. M. (2005). *Human osteology: A laboratory and field manual* (5th ed.). Missouri Archaeological Society.
- Buikstra, J. E., & Ubelaker, D. H. (1994). *Standards for data collection from human skeletal remains*. Arkansas Archaeological Survey.
- Byers, S. N. (2016). *Introduction to forensic anthropology: A textbook* (5th ed.). Routledge.
- Clement, J. G., & Ranson, D. L. (1998). Age determination in forensic odontology. In *Forensic pathology reviews* (pp. 245–269). Humana Press.
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- Krogman, W. M., & İşcan, M. Y. (1986). *The human skeleton in forensic medicine* (2nd ed.). Charles C Thomas Publisher.
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- Singh, I. P., & Bhasin, M. K. (2004). *A manual of physical anthropology* (2nd ed.). Delhi: Kamla-Raj Enterprises.
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- Wilder, H. H. (1920). *Anthropometry: A textbook of body measurements for sports and health education*. Philadelphia: W. B. Saunders Company.

Course curriculum

SEMESTER II

Course Code	Course Name	L	T	P	C
FRS458	QUESTIONED DOCUMENT AND FINGERPRINT EXAMINATION	3	0	1	4

Course Objectives:

- To introduce students to the historical evolution and scientific foundation of fingerprint examination and classification systems.
- To equip students with knowledge and practical skills in fingerprint development, identification, and comparison methods.
- To familiarize students with the principles of questioned document examination, including handwriting analysis and forgery detection.
- To train students in modern techniques for analysing alterations, secret writings, counterfeit documents, and mechanical impressions.
- To enhance students' practical proficiency in forensic examination techniques through hands-on exercises and real-world case applications.

Course Outcomes:

CO1 Explain the history, classification, and development of fingerprint science, including various classification systems such as Henry Classification and AFIS.

CO2 Apply different physical and chemical methods to develop latent fingerprints and utilize fingerprint comparison techniques.

CO3 Conduct a thorough examination of questioned documents using handwriting analysis, forgery detection, and classification methods.

CO4 Identify and analyze alterations, erasures, overwriting, and secret writings in various types of documents.

CO5 Utilize practical forensic tools and techniques for the examination of counterfeit currency, passports, and other questioned documents.

Mapping of CO and PO:

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1: History, classification and development of fingerprint including Henry classification, AFIS	3	2	1	2	1	2	1	1	2	2	1
CO2: Physical and chemical methods for development of fingerprints and utilisation of Fingerprint comparison techniques	2	3	3	2	3	1	2	1	2	3	2
CO3: Examination of QDs using handwriting	2	2	3	2	2	2	1	2	3	2	2

analysis, forgery detection and classification method											
CO4: Identification of alterations, erasures, overwriting and secret writing .	2	2	3	2	2	2	1	2	2	3	2
CO5: Utilisation of forensic tools and techniques for examination of counterfeit currency, passport and other QDs.	1	3	3	3	3	2	1	1	3	3	-

Unit I: Introduction, History and Classification of Fingerprints

(09 hours)

History of Fingerprint Science, main functions of FPB, development of fingerprint science, composition of sweat, pattern types and ridge characteristics, ridge tracing, ridge counting, various

systems of fingerprint classification, Henry Classification system, NCIC Classification, AFIS Classification

Unit II: Development and Examination of Fingerprints (12 hours)

Development, Identification and Presentation of Fingerprints, known prints and rolled impressions, direct or inked prints, Developments of latent prints and lifting techniques, various physical methods and chemical methods, processing of post developed prints, fingerprint comparison and identification, Introduction to AFIS

Unit III: Introduction to Questioned Documents (12 hours)

Definition of Questioned Documents, nature and problems in document examination, types of cases encountered, care and handling of documents, classification of documents, procurements of standards, admitted/specimen writings, preliminary examination of documents, class and individual characteristics of handwriting, principles of handwriting & signature identification, forgeries and its types and their detection

Unit IV: Examination of Questioned Documents (12 hours)

Examination of alterations, erasures, overwriting, addition, and obliteration. Decipherment of secret writing, indented writing and charred documents. Photography of questioned documents. Examination of counterfeit currency notes, passport, credit cards, visa, seal, and other mechanical impressions. Basic tools and instrumental techniques used for questioned documents.

Unit V: Practical (30 hours)

- To take plain and rolled fingerprints and identify the patterns.
- To develop latent fingerprints with powder methods.
- To develop latent fingerprints with different chemical methods.
- Identification of class and individual characteristics of handwritings.
- Examination and identification of signature forgeries.
- Examination of secret writings.
- To study the natural variation in handwritings written in different circumstances.

References:

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press
2. E. Roland Menzel; Fingerprint Detection, with Lasers, Second edition; Marcel, Dekker, Inc. USA.
3. James F. Cowger; Friction Ridge skin CRC Press London.
4. Mehta, M.K: Identification of Thumb Impression & Cross Examination of Finger Prints, N .M. Tripathi (P) Ltd, Bombay
5. Moenssens: Finger Prints Techniques, Chitton Book Co. Philadelphia, New York.
6. Chatterjee S.K., Speculation in Finger print identification, Jantralekha, Printing Works, Kolkata.
7. Cowger, James F: Friction ridge skin: Comparison and Identification of Fingerprints; CRC Press, Boca Raton, New York.
8. J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press
9. Albert S. Osborn; Questioned Documents, Second Ed.; Universal Law Publishing, Delhi;
10. Albert S. Osborn; The Problem of Proof~ Second Ed.; Universal Law Publishing, Delhi;
11. Charles C. Thomas, Typewriting Identification I.S.Q.D.; Billy Prior Bates; Springfield, Illinois, USA
12. Charles C. Thomas, I.S.Q.D. Identification System for Questioned Documents; Billy Prior Bates Springfield, Illinois, USA
13. Wilson R. Harrison; Suspect Documents -Their Scientific Examination; Universal Law Publishing, Delhi
14. Hard less, H.R: Disputed Documents, handwriting and thumbs-print identification: profusely illustrated, Low Book Co., Allahabad

Course curriculum

SEMESTER III

Course Code	Course Name	L	T	P	C
FRS503	Wildlife Forensics	3	0	1	4

Course Objectives:

1. Introduce the basics and scope of wildlife forensics.
2. Explain types of wildlife crimes and related laws.
3. Teach wildlife crime scene management and evidence handling.
4. Train in analysis of biological and botanical evidence.
5. Develop skills in case simulation, report writing, and presentation.

Course Outcomes:

1. Understand wildlife forensics and legal frameworks.
2. Identify types of wildlife crimes and forensic applications.
3. Manage wildlife crime scenes and preserve evidence.
4. Analyse wildlife-related physical and biological evidence.
5. Prepare reports and present forensic case findings effectively.

Mapping of CO and PO:

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	3	1	1	1	1	2	3	1
CO2	3	2	2	3	2	1	2	1	2	3	2
CO3	2	3	3	3	1	2	2	2	2	2	2
CO4	3	3	2	2	2	1	1	2	2	2	2
CO5	2	2	2	3	1	3	2	1	2	2	2

Unit I: Introduction to Wildlife Forensics and Legal Framework (12 lecture hours)

Introduction to Wildlife Forensics- Definition, scope and interdisciplinary nature of the field. Wildlife Crime Overview- Types of wildlife crimes: poaching, illegal trade, trafficking, and habitat destruction. Wildlife Conservation and Legal Frameworks-Indian Wildlife (Protection) Act, 1972, Forest Conservation Act, 1980, CITES (Convention on International Trade in Endangered Species), Biodiversity Act, 2002, Protected and Endangered Species-Schedule species of India, Red List species (IUCN). Role of Wildlife Forensics in Conservation and Enforcement.

Unit II: Wildlife Crime Scene Investigation (10 lecture hours)

Crime Scene Management in Wildlife Cases, Search techniques, Securing the scene. Evidence Recognition and Recovery-Biological: tissue, blood, hair, feathers, bones, scat. Physical: traps, weapons, snares, vehicles. Collection, Packaging, and Preservation of Wildlife Evidence. Chain of Custody and Documentation. Safety and Biohazard Considerations in the Field.

Unit III: Biological Evidence Analysis (8 lecture hours)

Hair and Fiber Examination: Differentiating between human and animal hair, Analysis of textile fibers. Botanical Evidence: Identification of plant materials like wood, leaves, and pollen in wildlife crimes. Entomological Evidence: Use of insect activity to estimate time of death and other forensic applications.

Unit IV: Practical (30 lecture hours)

- **Microscopic Hair Examination-** Study medullary index and scale patterns, Compare hair from different mammalian species.
- **Feather Identification-**Examine types of feathers under microscope. Identify features useful in species-level identification.
- **Identification of Wildlife Products-** Visual comparison of wildlife derivatives: ivory, tiger claw, snake skin, pangolin scales.
- **Simulated Wildlife Crime Scene Investigation-** Create a mock wildlife crime scene, evidence search, collection, labeling, and sketching.

- **Report Writing and Case Presentation-** Prepare a forensic case report from mock investigation.

References:

- **Huffman, J. E., & Wallace, J. R. (2012).** *Wildlife Forensics: Methods and Applications* – A core book covering forensic methods in wildlife crime.
- **Shivani Bhardwaj.** *Introduction to Wildlife Law in India* – Focused on Indian legal frameworks like the Wildlife (Protection) Act and Biodiversity Act.
- **Divan, S., & Rosencranz, A. (2001).** *Environmental Law and Policy in India* – Offers insight into India's conservation laws and their enforcement.
- **Robertson, J., & Roux, C. (2017).** *Forensic Examination of Hair* – Detailed microscopic analysis techniques for hair and fibers.
- **Hall, D. W., & Byrd, J. H. (2012).** *Forensic Botany: A Practical Guide* – Identification of plant evidence in forensic cases.
- **Greenberg, B., & Kunich, J. C. (2002).** *Entomology and the Law: Flies as Forensic Indicators* – Application of insects in wildlife forensics.
- **Wildlife Crime Control Bureau (WCCB), India.** *Field Manuals & Guidelines* – Official procedures for wildlife crime scene management and species identification (freely available online).