



SCHOOL OF EXCELLENCE IN LAW

LL.M. CBCS PATTERN

SYLLABUS

FROM ACADEMIC YEAR 2024-2025

DEPARTMENT OF CRIME AND FORENSIC LAW

DEPARTMENT OF CRIME AND FORENSIC LAW

The Department of Crime and Forensic Law of the Tamil Nadu Dr. Ambedkar Law University was established in the Academic Year 2024. The study of Crime and Forensic Law occupies a central position in the modern legal and criminal justice framework. In an era marked by rapid technological advancement, transnational crimes, and complex evidentiary challenges, the intersection of law and forensic science has become indispensable for ensuring effective and ethical justice delivery.

The importance of studying this discipline lies in its interdisciplinary approach, which combines the analytical rigor of legal reasoning with the precision of scientific inquiry. It empowers legal professionals, investigators, and policymakers to comprehend the scientific underpinnings of evidence, thereby strengthening the credibility and reliability of judicial outcomes. A sound understanding of forensic methodologies—such as DNA analysis, fingerprint examination, digital forensics, toxicology, and ballistic studies—enables law graduates to interpret and challenge scientific evidence with accuracy and confidence. This integration enhances the efficiency of criminal investigations, the fairness of trials, and the overall administration of justice.

Furthermore, the study of Crime and Forensic Law promotes critical thinking, ethical awareness, and practical competence, equipping students to address emerging challenges such as cybercrime, terrorism, organized crime, and environmental violations. It also encourages the application of scientific truth-seeking principles within the framework of human rights and due process, ensuring that justice is not only achieved but seen to be achieved.

In academia and practice alike, Crime and Forensic Law fosters research innovation, policy development, and international collaboration. It contributes to a deeper understanding of crime causation, offender behavior, and evidence-based legal reform. As forensic technologies continue to evolve, legal professionals with expertise in this field are increasingly vital in bridging the gap between scientific discovery and judicial integrity. In essence, the study of Crime and Forensic Law cultivates professionals who are ethically grounded, scientifically informed, and legally proficient—capable of upholding the principles of truth, fairness, and justice in the service of society.

At the advent of new Criminal Law regime, introduction of three new Criminals Laws mandates the understanding of Forensic Science Analysis on Crime and Criminal Justice System. Under the Bharatiya Nagarik Suraksha Sanhita, 2023, u/s. 176(3), the Procedural Law included the Forensic Experts as a functionary of the Law. Introduction of this department opens the contemporary approaches of Criminal Law and activate the students to apply the Criminal Law practically with advanced Science and Technology. This is achieved through a combination of substantive law, judicial precedents and doctrines, customary law and practices, and practical approaches envisaged in 6 Specialized Core Papers, 3 Discipline Specific Elective Papers and 2 Generic Elective Papers which will be studied over 4 Semesters in 2 Years (CBCS System).

THE TAMIL NADU DR.AMBEDKAR LAW UNIVERSITY

BRANCH – XIII

DEPARTMENT OF CRIME AND FORENSIC LAW

LL.M SYLLABUS

SPECIALIZED CORE PAPERS - 06

1. Introduction to Forensic Science, Law
2. Forensic Anthropology & Forensic Medicine
3. Forensic Biology, Serology & DNA Technology
4. Forensic Toxicology & Forensic Pharmacology
5. Questioned Documents & Fingerprint
6. Digital and Multimedia Forensics

Discipline specific (3)

7. Forensic Ballistics and Explosives Analysis
8. Forensic Analysis of Tool Marks and Track Evidence
9. Sports Law and Forensic Investigations

Generic elective (2)

10. Forensic Psychology and Criminal Psychology
11. Environmental Forensic Investigation

SUBJECTS IN SEMESTERS

FIRST SEMESTER	1. Judicial Process (Common Paper – I) 2. Legal Education and Research Methodology (Common Paper – II) 3. Introduction to Forensic Science Law (Specialized Core Course – I) Forensic Anthropology & Forensic Medicine (Specialized Core Course – II) Forensic Psychology & Criminal Psychology (Generic Elective Course – I)
SECOND SEMESTER	1. Constitutional Law: The New Challenges (Common Paper – III) 2. Law and Social Transformation in India (Common Paper – IV) 3. Forensic Biology, Serology & DNA Technology (Specialized Core Course – III) 4. Forensic Ballistics and Explosives Analysis

	(Discipline Specific Elective Course – I) 5. Applied Research Methodology
THIRD SEMESTER	1. Forensic Toxicology & Forensic Pharmacology (Specialized Core Course – IV) 2. Questioned Documents & Fingerprints (Specialized Core Course – V) 3. Forensic Analysis of Tools Marks and Track Evidence (Discipline Specific Elective Course – II) 4. Environmental Forensic Investigation (Generic Elective Course – II)
FOURTH SEMESTER	1. Digital and Multimedia Forensic (Specialized Core Course – VI) 2. Sports Law and Forensic Investigation (Discipline Specific Elective Course – III) 3. Skill Enhancement Course (SEC) 4. Dissertation

SYLLABUS

PAPER -I

INTRODUCTION TO FORENSIC SCIENCE AND LAW

(Specialized Core Paper)

Objective of the Course

The course "Introduction to Forensic Science and Law" aims to provide students with a comprehensive understanding of forensic science principles, methodologies, and applications within the legal system. Students will explore the interdisciplinary nature of forensic science through theoretical study and practical exercises, covering historical development, foundational principles, and ethical considerations. The course will integrate scientific knowledge with legal frameworks, focusing on crime scene investigation, evidence collection, forensic analysis methods, and the application of forensic science in legal contexts. Emphasis will be placed on the admissibility of scientific evidence in court, including the Frye and Daubert standards, and the role of expert testimony. By the end of the course, students will appreciate the role of forensic science in justice, understand ethical responsibilities, and engage with contemporary issues in forensic science and law.

After undergoing the study, the student will be able to understand the following:

- The foundational principles and practices of forensic science.
- The integration of forensic evidence in legal proceedings.
- The importance of ethical considerations and standards in forensic investigations.
- The role and responsibilities of various agencies involved in crime detection and investigation.

COURSE OUTLINE

Module 1: Nature and Scope of Forensic Science

- a) Definition and Scope of Forensic Science
- b) Historical Development of Forensic Science
- c) Basic Principles and Laws of Forensic Science
- d) Introduction to Crime Scene Examination

Module 2: Tools and Techniques in Forensic Science

- a) Methods of Evidence Collection and Preservation
- b) Analytical Techniques in Forensic Laboratories
- c) Introduction to DNA Analysis and Serology
- d) Physical and Trace Evidence Analysis

Module 3: Legal Frameworks and Standards

- a) Introduction to Legal Systems and Forensic Evidence

- b) The Frye Standard and Admissibility of Scientific Evidence
- c) The Federal Rules of Evidence (Rule 702) and Daubert Standard
- d) Expert Testimony and Cross-Examination

Module 4: Crime Scene Investigation and Management

- a) Crime Scene Management and Initial Response
- b) Methods of Evidence Documentation and Collection
- c) Analysis of Crime Scene Reconstruction Techniques
- d) Introduction to Crime Typologies and Modus Operandi

Module 5: Agencies for Crime Detection and Society

- a) Role and Functions of Law Enforcement Agencies
- b) Introduction to Criminal Investigations and Techniques
- c) Ethical and Legal Issues in Forensic Science
- d) Public Perception and Social Impact of Forensic Evidence

Recommended reading

Books

1. Harris, Howard A., and Henry C. Lee. Introduction to forensic science and criminalistics. CRC Press, 2019.
2. Lawless, Christopher. Forensic science: A sociological introduction. Routledge, 2022.
3. Bell, Suzanne. Forensic science: an introduction to scientific and investigative techniques. CRC press, 2019.
4. Rodrigues, Caio Henrique Pinke, Maria Eduarda Azambuja Amaral, Lívia Salviano Mariotto, Jade Simões Castro, Marina Enriquetto Mascarelli, Jesus Antônio Velho, and Aline Thais Bruni. "Forensic Science or Forensic Sciences? Conceptual analysis." Seven Editora (2023).
5. Willis, Sheila. "The professionalism of forensic science." Wiley Interdisciplinary Reviews: Forensic Science 5, no. 3 (2023): e1478.
6. Weyermann, Céline, Sheila Willis, Pierre Margot, and Claude Roux. "Towards more relevance in forensic science research and development." Forensic Science International 348 (2023): 111592.
7. Neuteboom, Wim, Alastair Ross, Lyndal Bugeja, Sheila Willis, Claude Roux, and Kevin Lothridge. "Quality Management in forensic science: A closer inspection." Forensic Science International 358 (2024): 111779.
8. Koehler, Jonathan J., Jennifer L. Mnookin, and Michael J. Saks. "The scientific reinvention of forensic science." Proceedings of the National Academy of Sciences 120, no. 41 (2023): e2301840120.
9. Kothari, Prapti. "Exploring the Role of Forensic Science in Indian Criminal Justice System." Available at SSRN 4565177 (2023).
10. Fraser, Jim. Forensic science: a very short introduction. Oxford University Press, 2020.

Articles

1. V.R.Dinkar. "Forensic scientific evidence: problems and pitfalls in India." (2015): 79-84. <https://doi.org/10.19070/2332-287X-1500020>.
2. Walsh, Simon J. "Forensic science in the criminal justice system: the good, the bad and the academy." *Australian Journal of Forensic Sciences* 55, no. 3 (2023): 285-294.
3. Kapoor, Neeti, Pradnya Sulke, Pooja Pardeshi, Rasika Kakad, and Ashish Badiye. "Introduction to Forensic Science." In *Textbook of Forensic Science*, pp. 41-66. Singapore: Springer Nature Singapore, 2023.
4. Willis, Sheila. "The professionalism of forensic science." *Wiley Interdisciplinary Reviews: Forensic Science* 5, no. 3 (2023): e1478.
5. Bhardwaj, Durga. "Evolution of the Forensic Science and Law." *Issue 2 Int'l JL Mgmt. & Human.* 6 (2023): 1888.
6. Shepitko, Valery Yu, and Mykhaylo V. Shepitko. "The role of forensic science and forensic examination in international cooperation in the investigation of crimes." *Journal of the National Academy of Legal Sciences of Ukraine* 28, no. 1 (2021): 179-186.
7. Weyermann, Céline, and Claude Roux. "A different perspective on the forensic science crisis." *Forensic Science International* 323 (2021): 110779.
8. Banerji, Bidisha, K. V. Kumar, and Avneet Kaur. "Review of forensic science in India." *International Journal of Medical Toxicology & Legal Medicine* 26, no. 1and2 (2023): 192-197.
9. PANDEY, SWATI. "Aspect of Forensic Science in Criminal Investigation: Admissibility in the Indian legal System." (2022).
10. Basu, Saumitra. "Hundred years of forensic science in India (1849–1947): A historical perspective." *Indian J Hist Sci* 55, no. 1 (2020): 80.

Learning Outcomes

- Understand the fundamental principles and historical development of forensic science.
 - Apply analytical techniques and methods in forensic investigations.
 - Analyse the admissibility of forensic evidence under legal standards like the Frye and Daubert criteria.
 - Evaluate crime scenes, document evidence, and reconstruct scenarios for investigative purposes.
 - Discuss the societal and ethical implications of forensic science practices and evidence use.
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PAPER - II

FORENSIC ANTHROPOLOGY & FORENSIC MEDICINE

(Specialised Core Paper)

Objective of the Course:

The course in Forensic Anthropology & Forensic Medicine aims to equip students with a profound understanding of human biological characteristics and medical principles crucial to forensic investigations. Through a blend of theoretical knowledge and practical skills, the course seeks to train future professionals in the analysis of skeletal remains, determination of cause and manner of death, and identification of individuals in medico-legal contexts. Emphasizing ethical standards and legal responsibilities, the program prepares students to contribute effectively to forensic sciences, addressing challenges such as trauma analysis, mass disaster responses, and the integration of advanced technologies in forensic identification. Students will emerge with the expertise to conduct meticulous forensic examinations, present findings accurately, and uphold the highest standards of integrity in forensic practice.

After undergoing the study, the student will be able to understand the following:

- Techniques for analyzing and identifying human skeletal remains.
- Methods for determining cause and manner of death through forensic pathology.
- Ethical and legal considerations in forensic investigations.
- Utilization of advanced technologies in forensic anthropology and medicine.

COURSE OUTLINE

Module 1: Introduction to Forensic Anthropology

- a) Fundamentals of Forensic Anthropology - Introduction to human osteology - Methods of skeletal analysis - Role of forensic anthropology in legal investigations
- b) Identification Techniques - Age estimation methods (e.g., dental development, skeletal age indicators) - Sex determination from skeletal remains - Ancestry assessment using skeletal features
- c) Forensic Taphonomy - Processes of decomposition and their effects on skeletal remains - Understanding post-mortem changes and their implications
- d) Legal and Ethical Issues - Ethical considerations in handling human remains - Legal aspects of forensic anthropology - Expert witness roles and responsibilities

Module 2: Forensic Pathology and Medicolegal Investigation

- a) Introduction to Forensic Pathology - Role of forensic pathologists in death investigation - Principles of post-mortem examination - Autopsy techniques and procedures
- b) Mechanisms of Death - Differentiating between manner and cause of death- Types of injury and their forensic significance

c) Forensic Toxicology- Introduction to forensic toxicology and its importance- Detection and interpretation of drugs and poisons in post-mortem samples - Analytical techniques in forensic toxicology

d) Forensic Odontology - Role of forensic dentistry in identification and bite mark analysis - Dental records and their importance in forensic investigations

Module 3: Human Identification Methods

a) Biological Profile Construction - Methods for constructing biological profiles from skeletal remains- Age, sex, ancestry, and stature estimation techniques

b) DNA Analysis in Forensic Identification - Basics of DNA analysis and its forensic applications - Techniques for DNA extraction and profiling - Chain of custody and quality assurance in DNA analysis

c) Mass Disaster Management - Procedures for handling mass fatality incidents- Techniques for victim identification in mass disasters

d) Digital Forensics in Identification - Use of digital tools in forensic identification (e.g., facial recognition software) - Integrating digital and traditional methods in identification - Legal and ethical considerations in digital forensics

Module 4: Anthropological and Medical Aspects of Trauma Analysis

a) Understanding Trauma - Types of skeletal trauma and their forensic interpretation- Blunt force, sharp force, and projectile trauma analysis - Interpretation of trauma patterns

b) Child Abuse and Neglect - Signs of child abuse and neglect in skeletal remains - Role of forensic anthropology in child death investigations - Legal considerations and reporting obligations

c) Sexual Assault Examination - Forensic aspects of sexual assault examination - Role of forensic anthropology in sexual violence cases - Techniques for identifying evidence of sexual assault

d) Forensic Age Estimation - Methods for estimating age from skeletal remains - Challenges and advancements in age estimation techniques

Module 5: Special Topics in Forensic Anthropology and Medicine

a) Forensic Anthropology in Archaeological Contexts- Role of forensic anthropology in archaeological excavations - Techniques for excavating and analysing human remains - Preservation and conservation of skeletal materials

b) Psychological Autopsy - Procedures and techniques in psychological autopsy - Role of forensic anthropology in psychological autopsy

c) Forensic Entomology - Introduction to forensic entomology and its applications - Use of insect evidence in estimating time since death

d) Forensic Anthropology and Disaster Victim Identification (DVI) - Principles and protocols of disaster victim identification - Role of forensic anthropology in DVI operations - Interdisciplinary approaches to DVI

Recommended reading

Books

1. Jain, B. Guide to Forensic Medicine & Toxicology. B. Jain Publishers, 2023.
2. Fahmy, Khaled. In quest of justice: Islamic law and forensic medicine in modern Egypt. Univ of California Press, 2023.
3. Shrivastava, Pankaj, Jose Antonio Lorente, Ankit Srivastava, Ashish Badiye, and Neeti Kapoor, eds. Textbook of Forensic Science. Springer, 2023.
4. Chand, Suresh. Essentials of Forensic Medicine & Toxicology With Complimentary Workbook-E-Book. Elsevier Health Sciences, 2023.
5. Atkinson, Stanley B. Golden rules of medical evidence. Good Press, 2023.
6. Stojanowski, Christopher M., and Andrew C. Seidel. Forensic anthropology: an introductory lab manual. University Press of Florida, 2023.
7. Parra, Roberto C., and Douglas H. Ubelaker, eds. Anthropology of violent death: theoretical foundations for forensic humanitarian action. John Wiley & Sons, 2023.
8. Larsen, Clark Spencer, ed. A companion to biological anthropology. John Wiley & Sons, 2023.
9. Hillson, Simon. Dental anthropology. Cambridge University Press, 2023.
10. Hagerty, Alexa. Still Life with Bones: Genocide, Forensics, and What Remains:'I defy you not to be moved'-Sue Black. Hachette UK, 2023.

Articles

1. Vodanović, Marin, Marko Subašić, Denis Milošević, Ivan Galić, and Hrvoje Brkić. "Artificial intelligence in forensic medicine and forensic dentistry." The Journal of Forensic Odontostomatology 41, no. 2 (2023): 30.
2. Muitdinovna, Khatamova Sarvinoz, and Ochilov Komil Rakhimovich. "Forensic Medical Assessment and Statistical Analysis of Mechanical Asphyxia." International Journal of Integrative and Modern Medicine 1, no. 3 (2023): 21-24.
3. Indiaminov, Sayit I., Iskandar B. Shopulatov, and Iskandar Shopulatov. "Forensic medical characteristics of bone fractures of the hand." Russian Journal of Forensic Medicine 9, no. 1 (2023): 5-17.
4. Nteziryayo, Damascene, and Liu Xinshe. "Development of forensic medicine in Rwanda-past, present, and future perspectives." Journal of Forensic and Legal Medicine (2023): 102573.
5. Cioffi, Andrea, and Camilla Cecanecchia. "Role of forensic medicine in addressing the war crimes: Perspective from Russia-Ukraine conflict during the COVID-19 pandemic." Medicine, Science and the Law 63, no. 2 (2023): 168-173.
6. Gunas, Valery, Volodymyr Mishalov, Olexandr Mykhaylenko, Kostyantyn Voroshilov, Olexandra Hrynchyshina, and Oksana Makarenko. "Forensic-medical characteristics of penetrating wounds as manifestations of explosive trauma in the case of decomposed bodies examination." Legal Medicine 67 (2024): 102373.
7. Levina, Irina L., and Leonid N. Korol. "THE HISTORICAL PATH OF FORENSIC MEDICINE: FROM LAW TO MEDICINE, FROM MEDICINE TO HIGH TECHNOLOGY." Russian Studies in Law and Politics 7, no. 1 (2023): 74-87.
8. Nagieb, M. M., G. A. El-Gallad, S. S. Ghaleb, and A. R. Saleh. "Medico legal aspects of medical malpractice dead cases in Cairo and Giza governorates from 2014–2015." Egyptian Journal of Forensic Sciences 13, no. 1 (2023): 30.

9. Hughes, Cris, An-Di Yim, Chelsey Juarez, John Servello, Richard Thomas, Nicholas Passalacqua, and Angela Soler. "Investigating identification disparities in forensic anthropology casework." Plos one 18, no. 11 (2023): e0290302.
10. Yim, An-Di, and Nicholas V. Passalacqua. "A Systematic Review and Meta-Analysis of the Effects of Race in the Criminal Justice System with Respect to Forensic Science Decision Making: Implications for Forensic Anthropology." Humans 3, no. 3 (2023): 203-218.

Learning outcomes:

- Accurately analyse and identify human skeletal remains.
- Determine the cause and manner of death through forensic pathology techniques.
- Adhere to ethical and legal standards in forensic investigations.
- Effectively use advanced technologies in forensic anthropology and medicine.
- Prepare detailed forensic reports and provide expert testimony in legal contexts.

PAPER - III
FORENSIC BIOLOGY, SEROLOGY & DNA TECHNOLOGY
(Specialized Core Paper)

Objective of the course:

The course in Forensic Biology, Serology & DNA Technology is designed to provide students with a thorough understanding of the biological principles and advanced techniques essential for forensic investigations. By integrating foundational knowledge with hands-on training, the course aims to equip students with the skills necessary to analyze biological evidence, perform serological tests, and conduct DNA profiling with precision and accuracy. Emphasizing both the scientific and ethical dimensions, the program prepares students to handle complex forensic cases, ensure the integrity of biological evidence, and contribute effectively to the legal process. Graduates will be well-prepared to address challenges in forensic biology and leverage cutting-edge DNA technology to aid in criminal investigations, identification of individuals, and resolution of legal matters.

After undergoing the study, the student will be able to understand the following:

- Techniques for collecting and analyzing biological evidence from crime scenes.
- Methods for performing serological tests to identify biological fluids.
- Principles and applications of DNA extraction, quantification, and profiling.
- Ethical and legal standards in the handling and interpretation of forensic biological evidence.

COURSE OUTLINE

Module 1: Fundamentals of Forensic Biology

- a) Introduction to Forensic Biology - Overview of forensic biology and its role in criminal investigations - History and development of forensic biological techniques - Key concepts and terminology
- b) Biological Evidence Collection - Methods for collecting biological evidence from crime scenes- Preservation and contamination prevention techniques- Chain of custody procedures
- c) Microscopic and Macroscopic Analysis - Examination of biological samples under the microscope - Identification of biological materials (hair, fibers, tissues)
- d) Legal and Ethical Considerations- Ethical issues in the collection and analysis of biological evidence - Legal standards and guidelines for forensic biological evidence

Module 2: Forensic Serology

- a) Introduction to Serology - Basics of serology and its importance in forensic science- Types of biological fluids analyzed in forensic serology (blood, saliva, semen)- Overview of immunological principles
- b) Blood Analysis - Techniques for detecting and identifying bloodstains- Bloodstain pattern analysis and interpretation - Serological tests for blood grouping and species determination
- c) Semen and Saliva Analysis- Methods for detecting and identifying semen and saliva stains - Serological tests for semen and saliva identification
- d) Challenges and limitations of forensic serology- Case studies highlighting the role of serology in solving crimes

Module 3: DNA Extraction and Quantification

- a) Introduction to DNA Technology- Basics of DNA structure and function - Historical development of forensic DNA analysis Importance of DNA evidence in forensic investigations

- b) DNA Extraction Techniques - Methods for extracting DNA from various biological samples - Best practices for ensuring high-quality DNA extraction
- c) DNA Quantification - Techniques for quantifying DNA samples - Understanding DNA yield and purity measurements
- d) Quality Control and Assurance- Standards and protocols for maintaining quality in DNA analysis - Role of quality assurance in forensic DNA laboratories - Case studies on the impact of DNA quality on forensic results

Module 4: DNA Profiling and Analysis

- a) Introduction to DNA Profiling - Principles and techniques of DNA profiling - Short Tandem Repeats (STR) analysis - Mitochondrial DNA analysis
- b) Advanced DNA Analysis Techniques - Next-generation sequencing (NGS) in forensic DNA analysis - Single nucleotide polymorphisms (SNPs) and their applications
- c) Interpretation of DNA Evidence - Statistical methods for interpreting DNA profiles - Mixed DNA samples and their analysis
- d) Legal and Ethical Issues in DNA Profiling - Legal standards for the admissibility of DNA evidence in court - Ethical considerations in DNA data storage and privacy

Module 5: Applications of Forensic DNA Technology

- a) Forensic DNA Databases - Overview of national and international DNA databases - Role of DNA databases in criminal investigations - Ethical and legal issues surrounding DNA databases
- b) Identification of Missing Persons - Techniques for using DNA to identify missing persons and unidentified remains - Role of forensic DNA in disaster victim identification (DVI)
- c) Familial Searching and Genetic Genealogy - Principles and techniques of familial DNA searching - Applications of genetic genealogy in forensic investigations
- d) Emerging Trends and Future Directions - Advances in forensic DNA technology - Potential future applications and challenges

Recommended reading

Books

1. Lee, Steven B. Forensic Biology. McGraw-Hill Education LLC., 2021.
2. Dash, Hirak Ranjan, Kelly M. Elkins, Noora Rashid Al-Snan, and Hirak Ranjan Dash. Advancements in Forensic DNA Analysis. Springer, 2023.
3. Dash, Hirak Ranjan, Pankaj Shrivastava, and Surajit Das. Principles and practices of DNA analysis: A laboratory manual for forensic DNA typing. Humana Press, 2020.
4. Primorac, Dragan, and Moses Schanfield, eds. Forensic DNA applications: An interdisciplinary perspective. CRC press, 2023.
5. Gill, Peter, Øyvind Bleka, Oskar Hansson, Corina Benschop, and Hinda Haned. Forensic practitioner's guide to the interpretation of complex Dna profiles. Academic Press, 2020.
6. Turgeon, Mary Louise. Immunology & Serology in Laboratory Medicine-E-Book: Immunology & Serology in Laboratory Medicine-E-Book. Elsevier Health Sciences, 2013.
7. Turgeon, Mary Louise. Immunology & Serology in Laboratory Medicine-E-Book: Immunology & Serology in Laboratory Medicine-E-Book. Elsevier Health Sciences, 2020.
8. Landsteiner, Karl. The specificity of serological reactions. Courier Corporation, 2013.
9. Alhabbab, Rowa Yousef. Basic Serological Testing. Berlin, Germany:: Springer, 2018.
10. Al-Moslih, Moslih, ed. Serological Diagnosis of Certain Human, Animal and Plant Diseases. BoD–Books on Demand, 2012.

Articles

1. Butler, John M. "Recent advances in forensic biology and forensic DNA typing: INTERPOL review 2019–2022." *Forensic Science International: Synergy* 6 (2023): 100311.
2. Malhotra, Seema, and Lipokyang Jamir. "Application of Forensic Biology in Criminal Justice System." In *Forensic Justice*, pp. 367-386. Routledge, 2024.
3. Puri, A. C. "Comparative role of serology and DNA profiling in forensics."
4. Chong, Kevin Wai Yin, Zhonghui Thong, and Christopher Kiu-Choong Syn. "Recent trends and developments in forensic DNA extraction." *Wiley Interdisciplinary Reviews: Forensic Science* 3, no. 2 (2021): e1395.
5. Singh, Harendra Nath. "Collection, preservation and transportation of biological evidence for forensic DNA analysis." (2021).
6. da Silva, Mafalda Palhares Falcão Ferreira. "Optimization of the use of biological traces in forensic routine: DNA extraction from fluid identification tests." (2023).
7. Sitamahalakshmi, S. "The Role of Biological and Serological Exhibits as Corroboration Evidence in Forensic Investigation."
8. Joseph, Chelsea Marie. "Forensic Biology: A Passport for Biological Evidence." In *Crime Scene Management within Forensic Science: Forensic Techniques for Criminal Investigations*, pp. 121-153. Singapore: Springer Singapore, 2022.
9. Shrivastava, Pankaj, R. K. Kumawat, Pushpesh Kushwaha, and Manisha Rana. "Biological sources of DNA: the target materials for forensic DNA typing." *Handbook of DNA Profiling* (2020): 1-17.
10. González, B., M. Mercado, O. Salas, J. Reyes, M. Ramos, E. Esquivel, G. Aguilar, and P. Torres. "Biological Evidence Analysis in Cases of Sexual Assault." *Biochemical Analysis Tools-Methods for Bio-Molecules Studies* (2020).

Learning Outcomes

- Accurately collect, preserve, and analyse biological evidence from crime scenes.
- Perform and interpret serological tests for identifying blood, semen, and saliva.
- Utilize advanced DNA analysis techniques, including next-generation sequencing and STR analysis.
- Adhere to ethical and legal guidelines in forensic biological practices.
- Prepare detailed forensic reports and provide expert testimony in legal contexts.

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PAPER -IV
FORENSIC TOXICOLOGY & FORENSIC PHARMACOLOGY
(Specialized Core Paper)

Objective of the course:

The course in Forensic Toxicology & Forensic Pharmacology is designed to equip students with a thorough understanding of the scientific principles and practical techniques necessary for analyzing toxic substances and their effects within forensic contexts. By integrating foundational knowledge with hands-on training, the course aims to develop expertise in identifying, quantifying, and interpreting various toxic agents, including drugs, poisons, and chemicals, as well as understanding their pharmacological impacts. Emphasis is placed on the ethical and legal aspects of forensic toxicology, ensuring that students are prepared to handle complex forensic cases with integrity and professionalism. Graduates will be well-prepared to contribute to criminal investigations, postmortem examinations, and legal proceedings, using advanced toxicological methods to uncover critical evidence and support justice.

After undergoing the study, the student will be able to understand the following:

- Techniques for collecting, preserving, and analyzing toxicological samples.
- Methods for identifying and quantifying drugs, poisons, and other toxic substances.
- Pharmacological effects and interactions of various drug classes.
- Ethical and legal considerations in forensic toxicology and pharmacology.

COURSE OUTLINE

Module 1: Introduction to Forensic Toxicology

- a) Fundamentals of Toxicology - Definition and scope of forensic toxicology - History and development of toxicology in forensic science - Basic principles of toxicology (dose-response relationship, toxicokinetics, toxicodynamics)
- b) Types of Toxic Substances - Classification of toxic substances (Narcotics, psychotropic substances, poisons, alcohol, chemicals) - Sources and routes of exposure
- c) Sample Collection and Preservation - Techniques for collecting biological samples (blood, urine, hair, tissues) - Preservation methods to prevent contamination and degradation - Chain of custody in forensic toxicology
- d) Legal and Ethical Issues - Legal standards for the admissibility of toxicology evidence - Ethical considerations in forensic toxicology - Role of toxicologists as expert witnesses

Module 2: Analytical Techniques in Forensic Toxicology

- a) Qualitative and Quantitative Analysis - Principles of qualitative and quantitative analysis in toxicology - Techniques for screening and confirmation of toxic substances - Interpretation of analytical results
- b) Instrumental Methods of Analysis - Gas chromatography (GC) and mass spectrometry (MS) - High-performance liquid chromatography (HPLC) - Spectroscopic techniques (UV, IR, NMR)
- c) Biological Matrices and Their Analysis - Analysis of different biological matrices (blood, urine, hair, tissues) - Challenges and limitations in the analysis of complex matrices
- d) Quality Control and Assurance - Standards and protocols for maintaining quality in toxicological analysis - Role of quality assurance in forensic toxicology laboratories

Module 3: Forensic Pharmacology

- a) Introduction to Pharmacology - Basic concepts of pharmacology (pharmacokinetics, pharmacodynamics) - Drug metabolism and mechanisms of action - Therapeutic vs. toxic effects of drugs
- b) Drug Classes and Their Effects - Overview of major drug classes (stimulants, depressants, hallucinogens, opioids) - Pharmacological effects and potential for abuse
- c) Drug Interaction and Toxicity - Mechanisms of drug interactions and their toxicological significance - Factors influencing drug toxicity (age, genetics, health status)
- d) Forensic Pharmacology Case Studies - Role of pharmacologists in forensic investigations

Module 4: Post-mortem Toxicology

- a) Principles of Post-mortem Toxicology - Differences between ante mortem and post-mortem toxicology - Post-mortem redistribution and its effects on toxicology results - Techniques for post-mortem sample collection
- b) Interpretation of Post-mortem Toxicology Results - Factors affecting the interpretation of post-mortem toxicology results - Correlation between toxicology findings and cause of death
- c) Special Challenges in Post-mortem Toxicology - Decomposition and its impact on toxicology analysis - Analysis of embalmed and exhumed bodies
- d) Legal and Forensic Implications - Role of post-mortem toxicology in death investigations - Presentation of post-mortem toxicology findings in court

Module 5: Emerging Trends and Advanced Topics in Forensic Toxicology

- a) New Psychoactive Substances (NPS) - Overview of new psychoactive substances and their forensic relevance - Analytical challenges and methods for detecting NPS
- b) Forensic Toxicology in Doping Control - Role of forensic toxicology in sports doping investigations - Techniques for detecting performance-enhancing drugs - Legal and ethical issues in doping control
- c) Environmental and Occupational Toxicology - Principles of environmental and occupational toxicology - Analysis of environmental toxins and their forensic significance
- d) Future Directions in Forensic Toxicology - Advances in analytical techniques and their forensic applications - Emerging trends and future challenges in forensic toxicology

Recommended reading**Books**

1. Levine, Barry, and Sarah Kerrigan, eds. Principles of forensic toxicology. Vol. 2. Washington, DC: American Association for Clinical Chemistry, 1999.
2. Kintz, Pascal, Alberto Salomone, and Marco Vincenti. Hair analysis in clinical and forensic toxicology. Academic Press, 2015.
3. Cooper, Gail, and Adam Negrusz, eds. Clarke's analytical forensic toxicology. Pharmaceutical Press, 2013.
4. Molina, Diane Kimberley, and Veronica Hargrove. Handbook of forensic toxicology for medical examiners. CRC press, 2018.
5. Houck, Max M., ed. Forensic toxicology. Academic Press, 2018.
6. Rao, Kalipatnapu N. Forensic Toxicology: Medico-legal Case Studies. CRC Press, 2012.
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Learning outcomes:

- Understand the importance of proficiently collect, preserve, and analyze toxicological samples from various biological matrices.
- Competence in identifying and quantifying drugs, poisons, and toxic substances using advanced analytical techniques.
- Understanding the pharmacological effects and interactions of different drug classes and their implications in forensic investigations.
- Adhere to ethical and legal standards in the practice of forensic toxicology and pharmacology.
- Prepare accurate and comprehensive forensic reports and provide expert testimony in legal proceedings.

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PAPER - V

QUESTIONED DOCUMENTS & FINGERPRINT EXAMINATION

(Specialised Core Paper)

Objective of the Course

The course on "Questioned Documents & Fingerprint Examination" equips students with specialized knowledge and skills for forensic investigations involving documents and fingerprints. It covers forensic document examination techniques for detecting forgeries, alterations, and authenticating documents through handwriting, paper, ink, and printing analysis. The course also delves into fingerprint science, including classification, individualization, and ridge pattern analysis. Practical training in fingerprint collection, preservation, and enhancement, along with the use of automated fingerprint identification systems (AFIS), is provided. Emphasis is placed on ethical handling of forensic evidence and professional standards. Students will learn to prepare comprehensive forensic reports and present findings as expert witnesses. The course culminates in a capstone project applying knowledge to a practical forensic case study. By the end, students will be prepared to contribute effectively to forensic investigations, supporting justice with advanced document and fingerprint examination techniques.

After undergoing the study, the student will be able to understand the following:

- Principles and techniques of forensic document examination, including detection of forgery and alterations.
- Fundamentals of fingerprint classification, identification, and analysis techniques.
- Use of advanced technologies like AFIS in fingerprint comparison and identification.
- Ethical considerations and professional standards in handling and presenting forensic evidence.

COURSE OUTLINE

Module 1: Introduction to Forensic Document Examination

- a) Overview of Questioned Documents- Introduction to forensic document examination- Types of questioned documents: forgery, fraud, alterations, etc- Role of forensic document examiners in legal investigations.
- b) Document Analysis Techniques- Methods for examining handwriting, signatures, and typewriting- Analysing paper, ink, and other physical characteristics
- c) Legal Aspects and Admissibility- Legal standards for admitting questioned documents as evidence- Expert witness roles and responsibilities in document examination
- d) Practical Applications- Practical exercises in document examination techniques- Mock scenarios for analysing and interpreting different types of questioned documents

Module 2: Advanced Techniques in Questioned Documents

- a) Detection of Alterations and Erasures- Techniques for detecting alterations and erasures in documents.- Chemical and physical methods for revealing hidden information

b) Document Authentication- Criteria for determining authenticity of documents.- Examination of security features and anti-counterfeiting measures

c) Emerging Technologies- Use of digital forensics in examining electronic documents.- Role of spectroscopy and other advanced technologies in document analysis.- Challenges and advancements in forensic document examination.

d) Ethical Considerations- Ethical guidelines and considerations in document examination.- Professional standards for handling sensitive or confidential documents

Module 3: Introduction to Fingerprint Examination

a) Fundamentals of Fingerprint Science- History and development of fingerprint examination.- Basic principles of ridge patterns, minutiae, and ridgeology.- Legal admissibility and reliability of fingerprint evidence.

b) Fingerprint Classification and Identification- Techniques for classifying fingerprint patterns (loops, whorls, arches).- Methods for individualizing fingerprints through minutiae comparison

c) Fingerprint Collection and Preservation- Techniques for collecting fingerprints from different surfaces.- Preservation methods to maintain integrity of fingerprint evidence.

d) Fingerprint Analysis Techniques- Methods for analysing latent fingerprints at crime scenes.- Use of chemicals, powders, and alternate light sources in fingerprint development.

Module 4: Advanced Techniques in Fingerprint Examination

a) Automated Fingerprint Identification Systems (AFIS)- Overview of AFIS technology and its role in forensic investigations.- Matching and comparison of fingerprints using AFIS.- Limitations and challenges of AFIS in forensic practice.

b) Fingerprint Enhancement and Reconstruction- Techniques for enhancing faint or partial fingerprints.- Methods for reconstructing damaged or distorted fingerprint impressions.

c) Fingerprint Analysis in Crime Scene Investigation- Application of fingerprint examination techniques in crime scene investigation.- Case studies demonstrating the significance of fingerprint evidence in solving crimes

d) Research and Innovations- Current research trends in fingerprint examination and analysis.- Innovations in fingerprint technology and their forensic applications.

Module 5: Forensic Reports and Expert Testimony

a) Preparation of Forensic Reports- Guidelines for writing comprehensive forensic reports.- Documentation of findings and conclusions in questioned documents and fingerprint examinations.- Incorporating scientific principles and methodologies into forensic reports.

b) Expert Testimony in Court- Role and responsibilities of forensic document and fingerprint examiners as expert witnesses.-

c) Preparation and presentation of expert testimony in legal proceedings.- Cross-examination techniques and strategies for expert witnesses.

d) Case Studies - Analysis of real-world cases involving questioned documents and fingerprints.- Courtroom environments and expert testimony scenarios.

Recommended Reading

Books

1. Awasthi, Kumud Kant. Friction Ridge Analysis: Applications of Nanoparticles for Latent Fingerprint Development. Edited by Mahipal Singh Sankhla, Sally Lukose, and Kapil Parihar. Springer, 2023.
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3. David L. Grieve. "Review of: Fingerprints and Other Ridge Skin Impressions." *Journal of Forensic Sciences*, 50 (2005): 1-1. <https://doi.org/10.1520/JFS2004340>.
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6. S. Bleay, R. Croxton and M. Puit. "Fingerprint Development Techniques: Theory and Application." (2018). <https://doi.org/10.1002/9781119187400>.
7. S. McKasson. "Review of The Scientific Examination of Documents, Methods and Techniques, Second Edition." *Journal of Forensic Sciences*, 45 (2000): 1175-1175. <https://doi.org/10.1520/JFS14858J>.
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9. M. Allen. "Foundations of Forensic Document Analysis: Theory and Practice." (2015). <https://doi.org/10.1002/9781118729922>.
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3. Busey, Thomas, and Meredith Coon. "Not all identification conclusions are equal: Quantifying the strength of fingerprint decisions." *Forensic Science International* 343 (2023): 111543.
4. Corbett, Brooklyn, and Jason M. Tangen. "Capturing Fingerprint Expertise with Protocol Analysis." (2023).
5. Grouns, Bethany, Erwin JAT Mattijssen, Jessica M. Salerno, N. J. Schweitzer, Simon A. Cole, and Kristy A. Martire. "Finding the perfect match: Fingerprint expertise facilitates statistical learning and visual comparison decision-making." *Journal of Experimental Psychology: Applied* 29, no. 2 (2023): 386.

6. Primeau, Charlotte, Veronika Dzetkuličová, and Tom Shepherd. "Can latent fingerprint disclose the sex of the donor? A preliminary test study using GC–MS analysis of latent fingerprints." *Journal of forensic sciences* 68, no. 4 (2023): 1178-1189.
7. Micheletto, Marco, Giulia Orrù, Roberto Casula, David Yambay, Gian Luca Marcialis, and Stephanie Schuckers. "Review of the fingerprint liveness detection (livdet) competition series: from 2009 to 2021." *Handbook of Biometric Anti-Spoofing: Presentation Attack Detection and Vulnerability Assessment* (2023): 57-76.
8. J. Tangen, M. Thompson and Duncan J. McCarthy. "Identifying Fingerprint Expertise." *Psychological Science*, 22 (2011): 995 - 997. <https://doi.org/10.1177/0956797611414729>.
9. C. Lennard, Moteaa El-Deftar and J. Robertson. "Forensic application of laser-induced breakdown spectroscopy for the discrimination of questioned documents.." *Forensic science international*, 254 (2015): 68-79 . <https://doi.org/10.1016/j.forsciint.2015.07.003>.
10. Reeta R Gupta. "Evidential proof as questioned document examination report for criminal cases." , 5 (2020): 90-94. <https://doi.org/10.18231/j.ijfmts.2020.021>.

Learning Outcomes:

- Analyse and authenticate questioned documents using advanced forensic techniques.
- Classify fingerprints and utilize technologies like AFIS for identification purposes.
- Adhere to ethical standards in handling and presenting forensic evidence.
- Utilize modern tools for document examination and fingerprint analysis.
- Prepare detailed forensic reports and provide expert testimony in legal contexts.

Paper VI

DIGITAL AND MULTIMEDIA FORENSICS

(Specialized Core Paper)

Objective of the Course

The course in Digital and Multimedia Forensics aims to provide students with a comprehensive understanding of the principles, techniques, and methodologies used in the forensic analysis of digital and multimedia evidence. It focuses on equipping students with the skills necessary to investigate cybercrimes, analyze digital artifacts, and present findings in legal proceedings. Emphasis is placed on integrating theoretical knowledge with practical applications to prepare students for careers in law enforcement, cybersecurity, and digital forensics.

After undergoing the study, the student will be able to understand the following:

- Comprehend techniques for collecting and preserving digital evidence, ensuring its integrity and admissibility in court.
- Master techniques for analyzing digital artifacts, including file systems, metadata, and network traffic, to uncover evidence of cybercrimes.
- Understand the legal frameworks and ethical guidelines governing the collection, analysis, and presentation of digital evidence in legal proceedings.
- Develop proficiency in multimedia forensics techniques, including image and video analysis, audio authentication, and steganography detection.

COURSE OUTLINE

Module 1: Introduction to Digital Forensics

- a) Fundamentals of Digital Forensics - Definition and scope of digital forensics - History and evolution of digital forensic techniques- Legal aspects and forensic principles in digital investigations
- b) Digital Evidence Types - Classification of digital evidence (volatile vs. non-volatile, direct vs. indirect) - Sources of digital evidence (computers, mobile devices, cloud storage)
- c) Digital Evidence Collection and Preservation- Techniques for acquiring and preserving digital evidence - Chain of custody and documentation in digital forensic investigations
- d) Legal and Ethical Issues in Digital Forensics- Legal considerations for the admissibility of digital evidence Ethical challenges in digital forensic investigations- Role of digital forensic experts in legal proceedings

Module 2: Forensic Analysis of Digital Artifacts

- a) File System Analysis - Techniques for recovering deleted files and file fragments - Analysis of file metadata and timestamps
- b) Network Forensics - Methods for capturing and analyzing network traffic - Identification of network-based cyber threats and attacks
- c) Mobile and Cloud Forensics - Techniques for acquiring and analyzing data from mobile devices- Challenges and methods in cloud-based forensic investigations

d) Malware and Memory Forensics- Analysis of malware behavior and digital footprints - Memory forensics techniques for volatile data acquisition

Module 3: Multimedia Forensics

a) Image and Video Analysis - Techniques for authenticating digital images and videos - Enhancement and restoration methods in image and video forensics

b) Audio Forensics - Methods for analyzing and authenticating audio recordings - Voice recognition and speaker identification techniques

c) Steganography Detection- Techniques for detecting and recovering hidden data in digital media- Tools and methods for steganalysis

d) Multimedia Authentication and Integrity- Verification techniques for ensuring the authenticity and integrity of multimedia data- Role of multimedia forensics in intellectual property disputes

Module 4: Case Studies and Practical Applications

a) Digital Forensics in Legal Contexts- Role of digital forensics in criminal investigations and litigation - Presentation of digital forensic findings in court

b) Emerging Trends in Digital Forensics - Advances in digital forensic tools and technologies - Emerging challenges and future directions in digital forensics

c) Practical Lab Sessions - Hands-on training in digital forensic tools and software- Simulation exercises in evidence acquisition and analysis

d) Capstone Project: Digital Forensics Investigation - Development and execution of a comprehensive digital forensics investigation- Integration of forensic analysis techniques and legal considerations

Recommended reading

Books

1. Gogolin, Greg. Digital forensics explained. CRC Press, 2021.
2. Kävrestad, Joakim. Fundamentals of digital forensics. Springer International Publishing, 2020.
3. Roy, Aniket, Rahul Dixit, Ruchira Naskar, and Rajat Subhra Chakraborty. Digital image forensics. Singapore: Springer, 2020.
4. Ghonge, Mangesh M., Sabyasachi Pramanik, Ramchandra Mangrulkar, and Dac-Nhuong Le, eds. Cyber security and digital forensics: Challenges and future trends. John Wiley & Sons, 2022.
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2. Jarrett, Aaron, and Kim-Kwang Raymond Choo. "The impact of automation and artificial intelligence on digital forensics." *Wiley Interdisciplinary Reviews: Forensic Science* 3, no. 6 (2021): e1418.
3. Bhagtani, Kratika, Amit Kumar Singh Yadav, Emily R. Bartusiak, Ziyue Xiang, Ruiting Shao, Sriram Baireddy, and Edward J. Delp. "An overview of recent work in media forensics: Methods and threats." *arXiv preprint arXiv:2204.12067* (2022).
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6. Ferreira, Sara, Mário Antunes, and Manuel E. Correia. "Exposing manipulated photos and videos in digital forensics analysis." *Journal of Imaging* 7, no. 7 (2021): 102.
7. Vamsi, Vurimi Veera Venkata Naga Sai, Sukanya S. Shet, Sodum Sai Mohan Reddy, Sharon S. Rose, Sona R. Shetty, S. Sathvika, M. S. Supriya, and Sahana P. Shankar. "Deepfake detection in digital media forensics." *Global Transitions Proceedings* 3, no. 1 (2022): 74-79.
8. Al-Dhaqm, Arafat, Richard Adeyemi Ikuesan, Victor R. Kebande, Shukor Abd Razak, George Grispos, Kim-Kwang Raymond Choo, Bander Ali Saleh Al-Rimy, and Abdulrahman A. Alsewari. "Digital forensics subdomains: the state of the art and future directions." *IEEE Access* 9 (2021): 152476-152502.
9. Hall, Stuart W., Amin Sakzad, and Kim-Kwang Raymond Choo. "Explainable artificial intelligence for digital forensics." *Wiley Interdisciplinary Reviews: Forensic Science* 4, no. 2 (2022): e1434.
10. Dalal, Mukesh, and Mamta Juneja. "Steganography and Steganalysis (in digital forensics): a Cybersecurity guide." *Multimedia Tools and Applications* 80, no. 4 (2021): 5723-5771.

Learning Outcomes

- Demonstrate proficiency in handling digital evidence, from collection through preservation, to ensure its reliability and admissibility in legal contexts.
- Will analyze digital artifacts effectively, using specialized tools and methodologies to extract and interpret data crucial for cybercrime investigations.
- Adhere to legal and ethical standards in the acquisition, analysis, and presentation of digital evidence, ensuring the integrity of investigative processes.

- Apply multimedia forensics techniques to analyze and authenticate digital images, videos, and audio recordings, supporting investigative findings.
- Communicate forensic findings clearly and effectively, both orally and in written reports, for use in legal proceedings and cybersecurity investigations.

PAPER - VII

FORENSIC BALLISTICS AND EXPLOSIVES ANALYSIS

(Discipline Specific Elective Paper)

Objective of the Course

This course aims to provide a comprehensive understanding of the principles and practices in forensic ballistics and explosives analysis. It will cover the theoretical foundations of ballistics, the forensic examination of firearms and ammunition, and the investigation and analysis of explosives. Students will learn about the legal and forensic aspects of ballistics and explosives, with a focus on practical applications in criminal investigations. By the end of the course, students will be equipped with the knowledge to analyse ballistic and explosive evidence, understand the laws governing their use, and apply forensic techniques in real-world scenarios.

After undergoing the study, the student will be able to understand the following:

- Understand the fundamental principles of internal, external, and terminal ballistics.
- Learn the methods of examining and identifying firearms and ammunition.
- Gain knowledge in the investigation and analysis of explosive devices and materials.
- Understand the legal and ethical issues surrounding the use and investigation of firearms and explosives.

COURSE OUTLINE

Module 1: Introduction to Forensic Ballistics

- a) Principles of Ballistics - Definition and scope of ballistics - Internal, external, and terminal ballistics - Ballistic trajectories and flight characteristics
- b) Firearms and Ammunition - Types of firearms and their components - Ammunition types and characteristics - Manufacturing and forensic significance of firearms and ammunition
- c) Ballistic Evidence Collection - Collection and preservation of ballistic evidence - Documentation and chain of custody
- d) Analysis of Notable Ballistic Cases - Application of ballistic principles in criminal investigations

Module 2: Forensic Examination of Firearms

- a) Firearms Identification - Methods of firearm identification - Comparison microscopy and ballistic fingerprinting - Individual and class characteristics of firearms
- b) Tool Marks and Striations - Analysis of tool marks and striations on bullets and cartridge cases - Identification and comparison of tool marks - Forensic significance of tool marks
- c) Gunshot Residue Analysis - Detection and analysis of gunshot residue - Methods for collecting and analysing residue - Interpretation of gunshot residue evidence
- d) Legal Aspects of Firearms Examination - Laws and regulations governing firearms - Legal challenges in firearm examinations

Module 3: Forensic Explosives Analysis

- a) Types of Explosives - Classification of explosives: primary, secondary, and tertiary - Chemical composition and properties of explosives - Common explosives used in criminal activities
- b) Explosive Devices - Types and components of explosive devices - Methods of constructing explosive devices - Forensic examination of explosive devices
- c) Explosion Scene Investigation - Procedures for investigating explosion scenes - Collection and preservation of explosive evidence - Safety protocols and considerations
- d) Analysis of Explosive Residues - Methods for detecting and analysing explosive residues - Chemical analysis techniques (e.g., chromatography, spectroscopy) - Interpretation of explosive residue evidence

Module 4: Legal and Ethical Considerations

- a) Legal Frameworks for Firearms and Explosives - National and international laws regulating firearms and explosives - Legal procedures for handling ballistic and explosive evidence
- b) Ethical Issues in Ballistics and Explosives Analysis - Ethical responsibilities of forensic scientists - Ethical dilemmas in the investigation of firearms and explosives - Standards and guidelines for ethical conduct
- c) Expert Testimony - Role of forensic experts in court - Preparing and presenting expert testimony - Challenges and considerations in providing expert testimony
- d) Case Studies and Legal Precedents - Analysis of landmark legal cases involving ballistic and explosive evidence - Future trends and developments in forensic ballistics and explosives analysis

Module 5: Advanced Theoretical Topics in Ballistics and Explosives

- a) Ballistic Trauma Analysis - Understanding the effects of ballistic trauma on the human body - Forensic pathology related to gunshot wounds - Medical-legal implications of ballistic injuries
- b) Computational Ballistics - Application of computer models in ballistics - Simulation techniques for ballistic trajectories and impact analysis - Integration of computational tools in forensic investigations
- c) Forensic Analysis of Unconventional Weapons - Study of improvised and non-traditional weapons - Forensic challenges posed by unconventional weapons
- d) Emerging Technologies in Explosives Detection - Advances in detection technologies for explosives - Innovations in field-deployable detection systems - Future directions in explosives detection and forensic analysis

Recommended Reading

Books

1. B. Karger. "Forensic Ballistics." (2011). https://doi.org/10.1007/978-1-59745-110-9_9.
2. H. E. Cassidy. "Ballistics Forensically Applied." *Journal of Criminal Law & Criminology*, 20 (1929): 439. <https://doi.org/10.2307/1134539>.

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4. B. Brinkmann. "Book review." *International Journal of Legal Medicine*, 107 (2005): 313. <https://doi.org/10.1007/BF01246880>.
5. J. Sinha. "Forensic Investigation of Unusual Firearms: Ballistic and Medico-Legal Evidence." (2014). <https://doi.org/10.1201/b17679>.
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2. Bhumika Sharma and R. Gadi. "Analytical Tools and Methods for Explosive Analysis in Forensics: A Critical Review.." *Critical reviews in analytical chemistry* (2023): 1-27 . <https://doi.org/10.1080/10408347.2023.2274927>.
3. M. Kotrlý and I. Turková. "New Possibilities of Complex Analysis of Explosives and Post Blast Residues in Forensic Practice." *Microscopy and Microanalysis*, 26 (2020): 816 - 817. <https://doi.org/10.1017/S1431927620015949>.
4. J. Yinon and J. Hoffsommer. "Analysis of Explosives." *Critical Reviews in Analytical Chemistry*, 7 (1977): 1-35. <https://doi.org/10.1080/10408347708542697>.
5. H. E. Hutson and E. McGee. "Introduction to the Forensic Analysis of Intact Explosives." *Forensic Analysis of Fire Debris and Explosives* (2019). https://doi.org/10.1007/978-3-030-25834-4_7.
6. H. E. Cassidy. "Ballistics Forensically Applied." *Journal of Criminal Law & Criminology*, 20 (1929): 439. <https://doi.org/10.2307/1134539>.
7. G. Price. "Forensic ballistics.." *Medicine, science, and the law*, 17 3 (1977): 164-6 . <https://doi.org/10.1177/002580247701700303>.
8. B. Karger. "Forensic Ballistics." (2011). https://doi.org/10.1007/978-1-59745-110-9_9.
9. F. Whitehurst. "Forensic analysis of explosives." , 10264 (1992). <https://doi.org/10.1117/12.141391>.
10. B. McCord, Kelly A. Hargadon, K. E. Hall and S. G. Burmeister. "Forensic analysis of explosives using ion chromatographic methods." *Analytica Chimica Acta*, 288 (1994): 43-56. [https://doi.org/10.1016/0003-2670\(94\)85115-8](https://doi.org/10.1016/0003-2670(94)85115-8).

Learning Outcomes

- Understand the principles of internal, external, and terminal ballistics.

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PAPER - VIII

FORENSIC ANALYSIS OF TOOL MARKS AND TRACK EVIDENCE

(Discipline Specific Elective Paper)

Objective of the Course

The course on Forensic Analysis of Tool Marks and Track Evidence aims to provide students with a comprehensive understanding of forensic techniques used in the examination and analysis of tool marks and track evidence. It covers the identification and comparison of marks left by tools on various surfaces, the examination and comparison of tire tracks, footprints, and other impressions, analysis of micro traces such as fibres, paint, and glass fragments, and the investigation of motor vehicle accidents including damage analysis and reconstruction techniques. By the end of the course, students will be proficient in applying forensic methodologies to investigate and analyse tool marks and track evidence in criminal investigations.

After undergoing the study, the student will be able to understand the following:

- Proficient in identifying and comparing marks left by tools on various surfaces, aiding in forensic investigations.
- Understand the techniques for examining and comparing tire tracks, footprints, and other impressions found at crime scenes.
- Analyse small trace evidence such as fibres, paint, and glass fragments using forensic methods.
- Skills in investigating motor vehicle accidents, including damage analysis and reconstruction techniques.

COURSE OUTLINE

Module 1: Tool Marks Analysis

- a) Types of Tool Marks - Identification and classification of tool marks - Methods for preserving and documenting tool marks - Tool mark impression analysis techniques
- b) Tool Mark Comparison - Comparison microscopy and digital imaging techniques - Criteria for individualizing tool marks
- c) Forensic Significance of Tool Marks - Role of tool mark evidence in linking suspects to crime scenes - Legal considerations and admissibility of tool mark evidence - Challenges and limitations in tool mark analysis
- d) Advanced Techniques in Tool Mark Analysis - Emerging technologies in tool mark examination - Research developments and future trends in tool mark analysis - Comparative analysis of traditional and modern techniques

Module 2: Track Evidence Examination

- a) Types of Track Evidence - Analysis of tire tracks, shoe prints, and footwear impressions - Techniques for recording and preserving track evidence - Collection and casting methods for three-dimensional impressions

b) Comparison and Identification - Methods for comparing and identifying track evidence - Impression evidence databases and resources

c) Forensic Significance of Track Evidence - Use of track evidence in crime scene reconstruction - Limitations and challenges in track evidence analysis - Role of digital imaging and 3D scanning in track evidence examination

d) Advanced Techniques in Track Evidence Analysis - Developments in track evidence analysis technologies - Integration of digital tools in track evidence examination - Comparative analysis of traditional and modern techniques

Module 3: Micro traces Analysis

a) Types of Micro traces - Analysis of fibers, hair, paint, and glass fragments - Techniques for micro trace collection and preservation - Microscopy and spectroscopy in micro trace analysis

b) Comparison and Identification - Methods for comparing and identifying micro traces - Analytical techniques for chemical composition analysis - Case studies on micro trace analysis in forensic science

c) Forensic Significance of Micro traces - Use of micro traces in linking suspects to crime scenes - Chain of custody and preservation of micro trace evidence - Legal considerations and admissibility in court

d) Emerging Technologies in Micro trace Analysis - Advances in micro trace analysis instrumentation - Future trends in micro trace detection and analysis - Comparative analysis of traditional and modern techniques

Module 4: Motor Vehicle Forensics

a) Investigation of Motor Vehicle Accidents - Methods for analysing vehicle damage and trajectories - Reconstruction techniques in motor vehicle accidents - Role of forensic engineering in accident investigations

b) Vehicle Damage Analysis - Techniques for analysing impact damage and patterns - Damage assessment and interpretation

c) Legal and Ethical Considerations - Legal frameworks for motor vehicle accident investigations - Ethical responsibilities in analysing vehicle accident evidence - Expert testimony and reporting in accident reconstructions

d) Advanced Techniques in Motor Vehicle Forensics - New developments in vehicle accident analysis - Integration of technology in motor vehicle forensic investigations - Comparative analysis of traditional and modern techniques

Module 5: Advanced Theoretical Topics in Tool Marks and Track Evidence Analysis

a) Forensic Integration - Combining tool mark and track evidence in forensic investigations - Interdisciplinary approaches to integrating forensic evidence

b) Contemporary Issues in Tool Mark and Track Evidence Analysis - Current trends and challenges in tool mark and track evidence analysis - Ethical dilemmas and considerations in the forensic analysis of tool marks and track evidence

c) Forensic Psychology and Behavioural Analysis in Tool Mark and Track Evidence - Psychological principles applied to tool mark and track evidence analysis - Behavioural analysis and its role in interpreting tool mark and track evidence.

d) Legal and Forensic Interpretation - Legal frameworks governing the use of tool mark and track evidence - Interpretation of forensic evidence in court - Role of forensic experts in providing testimony on tool mark and track evidence

Recommended Reading

Books

1. Sachil Kumar, Geetika Saxena and Archana Gautam. "Forensic Analysis and Interpretation of Tool Marks." Forensic Analysis [Working Title] (2021). <https://doi.org/10.5772/intechopen.98251>.
2. Amy Beth Hoeksema. "Statistical methods for the forensic analysis of striated tool marks." (2013). <https://doi.org/10.2172/1226173>.
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6. Malojirao S. Bhosale. "Forensic DNA biomarkers : Advancements and applications in criminal investigations." Biochemical and Cellular Archives (2023). <https://doi.org/10.51470/bca.2023.23.2.1297>.
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1. Grant Thomson and S. Black. "Principles of tool mark analysis and evidential best practice." (2017): 79-95. <https://doi.org/10.1201/9781315373126-7>.
2. Matthias Weber, S. Banaschak and M. Rothschild. "Sharp force trauma with two katana swords: identifying the murder weapon by comparing tool marks on the skull bone."

- International Journal of Legal Medicine, 135 (2020): 313 - 322.
<https://doi.org/10.1007/s00414-020-02372-3>.
3. G. Horsman and D. Errickson. "When finding nothing may be evidence of something: Anti-forensics and digital tool marks.." Science & justice : journal of the Forensic Science Society, 59 5 (2019): 565-572 . <https://doi.org/10.1016/J.SCIJUS.2019.06.004>.
 4. Maria Cuellar, Sheng Gao and Heike Hofmann. "Revolutionizing Forensic Toolmark Analysis: An Objective and Transparent Comparison Algorithm." ArXiv, abs/2312.00032 (2023). <https://doi.org/10.48550/arXiv.2312.00032>.
 5. Piret Vilborn and Herman Bernitz. "A systematic review of 3D scanners and computer assisted analyzes of bite marks: searching for improved analysis methods during the Covid-19 pandemic." International Journal of Legal Medicine (2021). <https://doi.org/10.1007/s00414-021-02667-z>.
 6. Ana Molina and S. Martín-de-las-Heras. "Accuracy of 3D Scanners in Tooth Mark Analysis." Journal of Forensic Sciences, 60 (2015). <https://doi.org/10.1111/1556-4029.12598>.
 7. L. Ekstrand, Song Zhang, Taylor Grieve, L. Chumbley and M. Kreiser. "Virtual Tool Mark Generation for Efficient Striation Analysis ,." Journal of Forensic Sciences, 59 (2014). <https://doi.org/10.1111/1556-4029.12435>.
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Learning Outcomes

- Identify and compare marks left by various tools on different surfaces, crucial for linking tools to crime scenes.
- Analyse and compare tire tracks, footprints, and other impressions for forensic investigation purposes.
- Conduct detailed analysis of micro traces such as fibres, paint, and glass fragments using forensic techniques.
- Investigate motor vehicle accidents, including damage analysis and reconstruction techniques.

PAPER - IX

SPORTS LAW AND FORENSIC INVESTIGATIONS

(Discipline Specific Elective Paper)

Objective of the Course

This course aims to provide students with a comprehensive understanding of the intersection between sports law and forensic science. It focuses on equipping students with the knowledge and skills necessary to analyse and resolve complex legal issues within the realm of sports using forensic methodologies. The course will explore various forensic techniques applicable to sports-related incidents such as doping, match-fixing, and athlete injuries. Additionally, students will gain insights into the ethical considerations and dispute resolution mechanisms specific to the sports industry, preparing them to navigate and contribute effectively to this specialized field.

After undergoing the study, the student will be able to understand the following:

- Grasp the foundational principles and regulatory frameworks governing sports activities, coupled with the application of forensic science in legal contexts.
- Proficient in applying forensic methods to investigate and analyse critical aspects of sports law, including doping allegations, match-fixing scandals, and athlete injury incidents.
- Recognize and address ethical dilemmas inherent in sports law and forensic investigations, fostering a responsible approach to legal and scientific practices in sports.
- Develop expertise in utilizing forensic insights to effectively resolve disputes within the sports domain, employing arbitration, mediation, and litigation strategies as applicable.

COURSE OUTLINE

Module 1: Introduction to Sports Law

- a) Overview of Sports Law - Definition and scope of sports law - Historical development of sports law - Key legal principles and frameworks governing sports
- b) Sports Organizations and Regulations - Roles and responsibilities of national and international sports organizations - Regulatory bodies and their functions - Compliance with sports regulations and standards
- c) Legal Rights and Obligations - Rights and obligations of athletes, coaches, and sports organizations - Contractual agreements and labour laws in sports
- d) Sports Legislation - Overview of sports-specific legislation in India and globally - Analysis of landmark legal cases in sports

Module 2: Forensic Science in Sports

- a) Role of Forensic Science in Sports - Application of forensic techniques in sports investigations - Importance of forensic evidence in resolving sports disputes
- b) Doping Control and Testing - Methods of doping control and testing in sports - Role of forensic toxicology in detecting performance-enhancing substances - Legal implications of doping violations

c) Match-Fixing and Corruption - Forensic approaches to investigating match-fixing and corruption
- Techniques for gathering and analysing evidence in sports fraud cases

d) Injury and Accident Analysis - Forensic investigation of sports-related injuries and accidents -
Role of forensic pathology in determining causes of sports injuries - Legal implications of sports
injuries and liability issues

Module 3: Ethical Considerations in Sports

a) Ethics in Sports - Ethical principles and values in sports - Issues of fairness, integrity, and
sportsmanship

b) Doping and Ethics - Ethical implications of doping in sports - Balancing performance
enhancement and athlete health - Preventative measures and education on doping ethics

c) Match-Fixing and Ethics - Ethical challenges in combating match-fixing and corruption - Role of
sports organizations in promoting ethical behaviour

d) Legal and Ethical Responsibilities - Legal and ethical responsibilities of sports professionals -
Compliance with codes of conduct and ethical guidelines - Strategies for fostering ethical sports
environments

Module 4: Dispute Resolution in Sports

a) Introduction to Dispute Resolution - Types of disputes in sports: contractual, disciplinary, doping,
etc. - Overview of dispute resolution mechanisms - Importance of fair and effective dispute
resolution in sports

b) Arbitration in Sports - Role of the Court of Arbitration for Sport (CAS) - Arbitration process and
procedures - Analysis of arbitration cases in sports

c) Mediation and Negotiation - Mediation techniques and their application in sports disputes - Role
of negotiation in resolving sports conflicts

d) Legal Proceedings and Litigation - Legal proceedings in sports-related cases - Role of sports
lawyers in litigation

Module 5: Advanced Topics in Sports Law and Forensics

a) Intellectual Property in Sports - Trademark and copyright issues in sports - Licensing agreements
and merchandising rights

b) Financial Regulations and Compliance - Financial fair play and salary cap regulations - Role of
forensic accounting in sports finance

c) Anti-Discrimination Laws in Sports - Legal frameworks addressing discrimination in sports -
Analysis of gender, race, and disability discrimination cases - Role of sports organizations in
promoting inclusivity

d) Cybersecurity and Data Protection - Legal issues surrounding data protection in sports -
Cybersecurity threats and measures in sports organizations

Recommended Reading

Books

1. Hessert, Björn. Sports Investigations Law and the ECHR: Collection, Use and Exchange of Intelligence. Routledge, 2023.
2. Bakhaya, Irina, and Sorin Cristian Niță. "Sports Forensic: Academic and Practical Approaches." In Proceedings of the International Conference on Business Excellence, vol. 17, no. 1, pp. 1431-1437. 2023.
3. Mitten, Matthew J., Timothy Davis, N. Jeremi Duru, and Barbara Osborne. Sports Law and Regulation: Cases, Materials, and Problems [Connected EBook]. Aspen Publishing, 2023.
4. G. Wong. "Essentials of Sports Law." (2002). <https://doi.org/10.5040/9798400647468>.
5. Spengler, John O., Paul M. Anderson, Daniel P. Connaughton, and Thomas A. Baker. Introduction to sport law with case studies in sport law. Human Kinetics, 2022.
6. McNamee, Mike, and Verner Møller, eds. Doping and anti-doping policy in sport: Ethical, legal and social perspectives. Routledge, 2011.
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8. Nafziger, James AR, and Stephen F. Ross, eds. Handbook on international sports law. Northampton, USA: Edward Elgar, 2011.
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2. F. Pivovarov. "Theoretical Foundations of Forensic Economic Expertise in Cases on the Protection of the Rights and Interests of Athletes and Coaches." Actual Problems of Russian Law (2023). <https://doi.org/10.17803/1994-1471.2023.149.4.133-145>.
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4. M. Korabel, Yurii Shynkarov, Alina Plotnikova, Yu. B. Kuryliuk and Oleksandr Motlyakh. "Criminal liability for causing harm to health during sports." SPORT TK-Revista EuroAmericana de Ciencias del Deporte (2022). <https://doi.org/10.6018/sportk.532901>.
5. Yuliia Chornous, Dmytro Baranenko, Yena Yena, Vitalii Hvozdiuk and O. Dulskyi. "Collecting Evidence in the Investigation of Crimes Committed in the Field of Sports: International and European Standards." Retos (2023). <https://doi.org/10.47197/retos.v51.99286>.
6. Timothy A. Davis. "What is Sports Law?." Modern Sports Law (2010). https://doi.org/10.1007/978-90-6704-829-3_1.
7. M. Miranda and Marie-Helen Maras. "Sexual violence perpetrated against women in India: the role of forensic evidence." International Journal of Comparative and Applied Criminal Justice, 41 (2017): 107 - 95. <https://doi.org/10.1080/01924036.2016.1245205>.
8. Rohit Kumar Dugar. "Overview of Sports Law in India: Meaning, Concept, and Laws." Journal of Legal Studies & Research (2023). <https://doi.org/10.55662/jlsr.2023.9402>.
9. Irina Bakhaya and S. Niță. "Sports Forensic: Academic and Practical Approaches." Proceedings of the International Conference on Business Excellence, 17 (2023): 1431 - 1437. <https://doi.org/10.2478/picbe-2023-0129>.

10. Anisha Tak. "Scientific Mechanisms In Crime Investigation:A Study." The Journal Of Unique Laws And Students (2021). <https://doi.org/10.59126/v1i3a14>.

Learning Outcomes

- Understand the legal frameworks that regulate sports organizations and activities.
 - Apply forensic methods to investigate doping, match-fixing, and other sports-related incidents.
 - Identify and address ethical challenges in sports law and forensic investigations.
 - Gain knowledge in dispute resolution mechanisms specific to sports, including arbitration and mediation.
 - Integrate legal knowledge with forensic science to address complex issues in sports.
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PAPER -X
FORENSIC PSYCHOLOGY & CRIMINAL PSYCHOLOGY
(Generic Elective Course)

Objective of the Course

The course "Forensic Psychology & Criminal Psychology" provides students with a comprehensive understanding of how psychological principles intersect with the legal system. It equips students with the skills to apply psychological expertise in legal contexts, promoting justice and enhancing legal processes. The course covers the scope, history, and roles of forensic and criminal psychologists, emphasizing assessment techniques for evaluating competency, risk of reoffending, and mental state at the time of the offense. Students will explore theories of criminal behaviour, the relationship between mental disorders and criminality, and the role of forensic psychologists in the courtroom. Practical applications include interviewing, interrogation, and psychological support for victims. The course also covers correctional psychology and the rehabilitation of offenders. Students will learn research methods relevant to forensic psychology and conduct original research or case analyses. Ethical principles are emphasized throughout, promoting professionalism and ethical decision-making. By the end, students will be prepared to excel in forensic psychology, contributing to the legal system through rigorous analysis and ethical practice.

After undergoing the study, the student will be able to understand the following:

- Integration with the legal system and distinct responsibilities of forensic and criminal psychologists.
- Proficiency in clinical interviews, standardized tests, and behavioral observations to evaluate competency and risk of reoffending.
- Analysis of psychological and sociological theories explaining criminal behavior and the relationship with mental disorders.
- Application in legal settings, including expert witness testimony and victim support, while adhering to ethical principles.

COURSE OUTLINE

Module 1: Foundations of Forensic Psychology

- a) Introduction to Forensic Psychology - Definition and scope - Historical development and key milestones
- b) Roles and Responsibilities - Roles of forensic psychologists in the legal system - Distinction between forensic psychology and criminal psychology
- c) Legal and Ethical Issues - Ethical principles and dilemmas - Confidentiality, consent, and reporting
- d) Psychological Theories - Overview of psychological theories relevant to forensic psychology - Application of these theories to legal contexts

Module 2: Psychological Assessment and Evaluation

- a) Assessment Techniques - Clinical interviews, psychological testing, and behavioural observation - Use of standardized assessment tools
- b) Evaluating Competency - Competency to stand trial - Assessing mental state at the time of the offense (insanity defence)

- c) Risk Assessment - Assessing risk of reoffending - Tools and methods for risk prediction
- d) Case Studies - Analysis of landmark cases

Module 3: Criminal Behaviours and Psychopathology

- a) Understanding Criminal Behaviours - Psychological and sociological theories of criminal behaviour - Factors influencing criminal behaviour (biological, social, environmental)
- b) Psychopathology and Crime - Relationship between mental disorders and criminal behaviour - Specific disorders commonly associated with criminality (e.g., antisocial personality disorder, psychopathy)
- c) Juvenile Delinquency - Psychological factors in juvenile offending - Assessment and intervention strategies for young offenders
- d) Examination of High-Profile Criminal Cases - Profiling and behavioural analysis

Module 4: Forensic Psychology in Practice

- a) Forensic Psychology in the Courtroom - Role of expert witnesses - Preparing and presenting psychological evidence
- b) Interviewing and Interrogation - Techniques and ethical considerations - Assessing reliability and validity of statements
- c) Victimology - Psychological impact of crime on victims - Support and rehabilitation for victims
- d) Correctional Psychology - Psychological services in correctional settings - Rehabilitation and treatment of offenders

Module 5: Advanced Theoretical Topics in Forensic Psychology

- a) Neuropsychology and Crime - The role of brain function and dysfunction in criminal behaviour - Techniques for assessing neuropsychological factors in offenders
- b) Cultural Issues in Forensic Psychology - Impact of cultural factors on criminal behaviour and forensic assessments - Cross-cultural considerations in forensic psychology practice
- c) Psychological Autopsy - Techniques and methodologies for conducting psychological autopsies - Applications in cases of ambiguous death
- d) Forensic Psychology and Human Rights - Intersection of forensic psychology and human rights issues - Ethical and legal implications of human rights in forensic practice

Recommended Reading

Books

1. H. Wolfram. "Forensic Psychology in Historical Perspective." (2020). <https://doi.org/10.1093/acrefore/9780190236557.013.639>.
2. "Forensic Psychology." Introduction to Clinical Psychology (2020). <https://doi.org/10.1017/9781108676908.015>.
3. N. Nishad and M. Hariharan. "Developments in Forensic Psychology: A Content Analysis." , 9 (2021). <https://doi.org/10.25215/0901.196>.
4. A. Valli. "Application of Forensic Psychology in Indian Judiciary- An overview." Journal of emerging technologies and innovative research (2020).
5. Alison B. Concannon and Matthew T. Huss. "Forensic Psychology." Psychology (2019). <https://doi.org/10.1093/obo/9780199828340-0248>.
6. Grant C. B. Sinnamon. "Psychopathology and Criminal Behavior." (2015): 208-252. <https://doi.org/10.1016/B978-0-323-29460-7.00011-9>.

7. A. Needs and G. Towl. "Applying Psychology to Forensic Practice." (2004). <https://doi.org/10.1002/9780470693971>.
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9. Terri Gullickson. "The Psychology of Criminal Conduct.." *Psyccritiques*, 40 (1995). <https://doi.org/10.1037/003923>.
10. Antonio Andrés Pueyo. "THE PSYCHOLOGY OF CRIMINAL CONDUCT." (2008). <https://doi.org/10.2307/3792235>.

Articles

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2. T. Neal. "Forensic psychology and correctional psychology: Distinct but related subfields of psychological science and practice.." *The American psychologist*, 73 5 (2018): 651-662 . <https://doi.org/10.1037/amp0000227>.
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8. R. Otto and A. Goldstein. "Overview of Forensic Psychology." (2003): 1-20. <https://doi.org/10.1002/0471264385.WEI1101>.
9. Pinkey Kumari Singh, J. Mishra and P. Singh. "Criminal Psychology and Criminal Behaviour of Population." , 9 (2021). <https://doi.org/10.25215/0903.176>.
10. R. Otto and K. Heilbrun. "The practice of forensic psychology. A look toward the future in light of the past.." *The American psychologist*, 57 1 (2002): 5-18 . <https://doi.org/10.1037/0003-066X.57.1.5>.

Learning Outcomes

- Understand principles, theories, and methodologies of forensic psychology and their legal applications.
- Conduct psychological assessments using clinical interviews, tests, and observations.
- Analyse theories of criminal behaviour for forensic evaluations and profiling.
- Apply forensic psychology in legal scenarios, including expert testimony and victim support.
- Understand ethical considerations, including confidentiality and informed consent.

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PAPER - XI

ENVIRONMENTAL FORENSIC INVESTIGATION

(Generic Elective Paper)

Objective of the Course

The course in Environmental Forensic Investigation aims to equip students with comprehensive skills and knowledge to conduct forensic investigations into environmental issues using scientific and legal methodologies. Students will explore the application of forensic techniques in identifying, analysing, and interpreting evidence related to environmental pollution, contamination, and ecological damage across various domains including land, marine, air, water, and other environmental factors like sound and light pollution. This course emphasizes integrating scientific principles with legal frameworks to effectively address environmental challenges and promote sustainability. By the end of the course, students will be proficient in conducting forensic investigations in diverse environmental contexts, applying their expertise to protect and preserve natural resources.

After undergoing the study, the student will be able to understand the following:

- Mastery of forensic techniques applied to environmental investigations across land, marine, air, water, and other environmental factors like sound and light pollution.
- Proficiency in analysing pollutants and contaminants in various environmental samples and conditions.
- Understanding of legal frameworks and regulations related to environmental protection in diverse environmental contexts.
- Ability to develop strategies for environmental conservation and sustainable practices across different environmental domains.

COURSE OUTLINE

Module 1: Introduction to Environmental Forensics

a) Foundations of Environmental Forensics-Definition and scope of environmental forensics-History and development of environmental forensic techniques- Interdisciplinary nature of environmental forensic investigations

b) Environmental Crimes and Incidents-Types of environmental crimes and incidents across land, marine, air, water, and other environmental factors-Legal and ethical considerations in environmental forensic practice

c) Forensic Techniques in Environmental Investigations-Methods for collecting environmental evidence across diverse environmental domains-Preservation and chain of custody of environmental samples

d) Role of Forensic Scientists in Environmental Protection-Contribution of forensic scientists to environmental conservation and sustainability

Module 2: Analysis of Environmental Pollutants

a) Types of Environmental Pollutants- Air pollutants: particulate matter, gases, and volatile organic compounds (VOCs)-Water pollutants: heavy metals, pesticides, industrial effluents, and marine pollution-Soil pollutants: contaminants from agriculture, industry, and waste disposal

b) Sampling and Analysis Techniques-Sampling methods for air, water, soil, and marine pollutants-Laboratory techniques: chromatography, spectroscopy, and mass spectrometry-Interpretation of analytical data in diverse environmental contexts

c) Impact of Pollutants on Ecosystems-Ecological effects of environmental pollutants across land, marine, air, water, and other environmental factors-Risk assessment and mitigation strategies for polluted environments

d) Forensic Assessment of Environmental Damage -Methods for assessing long-term environmental impacts-Expert testimony and reporting in environmental forensic cases

Module 3: Legal and Regulatory Frameworks

a) International and National Environmental Laws-Overview of international treaties and agreements on environmental protection-National legislation: environmental laws and regulations across different environmental domains-Role of government agencies and regulatory bodies in enforcing environmental laws

b) Environmental Compliance and Enforcement-Compliance monitoring and enforcement strategies across land, marine, air, water, and other environmental factors-Penalties and fines for environmental violations

c) Ethical Considerations in Environmental Forensics-Ethical responsibilities of environmental forensic scientists-Professional codes of conduct and standards in diverse environmental contexts

d) Public Policy and Advocacy-Influence of environmental forensic findings on public policy-Advocacy for environmental conservation and sustainable development across different environmental domains

Module 4: Conservation and Sustainability Strategies

a) Environmental Conservation Practices-Strategies for protecting natural resources, biodiversity, and ecosystems across land, marine, air, water, and other environmental factors-Restoration and rehabilitation of polluted and degraded environments-Sustainable development and land-use planning practices

b) Corporate Responsibility and Sustainability-Role of businesses and industries in environmental stewardship and sustainability-Corporate sustainability initiatives, practices, and environmental management systems

c) Community Engagement and Education-Stakeholder engagement in environmental decision-making and policy development-Community-based conservation projects and initiatives-Environmental education and awareness programs for public engagement

d) Future Trends in Environmental Conservation-Emerging technologies and innovations in environmental conservation-Research and development in sustainable practices and technology-Advancements in conservation policies and strategies

Module 5: Public Policy and Advocacy

a) Influence of Environmental Forensic Findings on Public Policy-Impact of environmental forensic investigations on policy development-Advocacy for environmental conservation and sustainable development across different environmental domains-Public engagement and community outreach in environmental protection

b) Emerging Technologies in Environmental Forensics-Advances in forensic technologies for environmental monitoring and analysis-Research and development in environmental forensic science and technology-Applications of new technologies in pollution prevention, control, and mitigation strategies

c) Legal and Regulatory Implications-Influence of environmental forensic findings on legal frameworks and regulations- Role of government policies in shaping environmental conservation efforts

d) Global Perspectives on Environmental Sustainability-International cooperation and agreements on environmental sustainability-Comparative analysis of environmental policies and practices worldwide-Strategies for addressing global environmental challenges through collaborative efforts

Recommended Reading

Books

1. Morrison, Robert D., and Brian L. Murphy. Environmental forensics: contaminant specific guide. Elsevier, 2010.
2. Petrisor, Ioana Gloria. Environmental forensics fundamentals: A practical guide. CRC Press, 2014.
3. Wang, Zhendi, and Scott Stout. Oil spill environmental forensics: fingerprinting and source identification. Elsevier, 2010.
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5. Mohr, Thomas KG, William H. DiGuseppi, James W. Hatton, and Janet Katherine Anderson. Environmental investigation and remediation: 1, 4-dioxane and other solvent stabilizers. CRC Press, 2020.
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9. Santos, Fernanda Da Silva, Leandro Vitor da Silva, Paulo Victor Soares Campos, Carolina de Medeiros Strunkis, Camilla Machado Gentil Ribeiro, and Maiara Oliveira Salles. "Recent advances of electrochemical techniques in food, energy, environment, and forensic applications." ECS Sensors Plus 1, no. 1 (2022): 013603.
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1. Muhammed Siddik Abdul Samad, G. Varghese and B. Alappat. "Environmental Forensics in India – Four Years after the National Green Tribunal Act, 2010☆." *Procedia environmental sciences*, 30 (2015): 91-96. <https://doi.org/10.1016/J.PROENV.2015.10.016>.
2. D. Megson, E. Reiner, K. Jobst, F. Dorman, Mathew Robson and J. Focant. "A review of the determination of persistent organic pollutants for environmental forensics investigations.." *Analytica chimica acta*, 941 (2016): 10-25 . <https://doi.org/10.1016/j.aca.2016.08.027>.
3. G. Toranzos and R. Cano. "Definitions and Historical Perspectives in Environmental Forensics.." *Microbiology spectrum*, 6 2 (2018). <https://doi.org/10.1128/microbiolspec.EMF-0016-2018>.
4. R. Philp. "An overview of environmental forensics." *Geologica Acta*, 12 (2014): 363-374. <https://doi.org/10.1344/GEOLOGICA2014.12.4.7>.
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6. P. Boehm and B. Murphy. "Applications of Environmental Forensics." (2015): 3-20. <https://doi.org/10.1016/B978-0-12-404696-2.00001-1>.
7. I.Brčeski and Ashok Vaseashta. "Environmental Forensic Tools for Water Resources." *Advanced Sciences and Technologies for Security Applications* (2021). https://doi.org/10.1007/978-3-030-76008-3_15.
8. J. Millette, Richard S. Brown and W. B. Hill. "Using environmental forensic microscopy in exposure science." *Journal of Exposure Science and Environmental Epidemiology*, 18 (2007): 20-30. <https://doi.org/10.1038/sj.jes.7500613>.
9. V. Spikmans. "Complexity of scientific evidence in environmental forensic investigations." , 1 (2015): 223-232. <https://doi.org/10.1108/JCRPP-07-2015-0031>.
10. A. Carpi and Andrew J. Schweighardt. "Forensic Environmental Chemistry." (2012): 1-22. <https://doi.org/10.1002/9781118062241.CH1>.

Learning Outcomes

- Ability to conduct forensic investigations into environmental crimes and incidents across multiple environmental domains.
- Proficiency in analysing environmental pollutants and contaminants in diverse environmental samples and conditions.
- Understanding of international, national, and regional laws governing environmental protection, and proficiency in navigating legal complexities in environmental forensic investigations.
- Development of strategies for environmental conservation and sustainable practices across various environmental domains.
- Integration of scientific knowledge with legal principles in diverse environmental contexts.