



BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI-620024

B.Sc. FORENSIC SCIENCE

**CHOICE BASED CREDIT SYSTEM–LEARNING OUTCOMES BASED
CURRICULUM FRAMEWORK (CBCS - LOCF)**

(Applicable to the candidates admitted from the academic year 2026-2027 onwards)

Sem	Part	Courses	Title	Ins. Hrs.	Credits	Exam. Hours	Maximum Marks		
							Int.	Ext.	Total
I	I	Ability Enhancement Course – I (AEC - I)	(Tamil\$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – II (AEC - II)	English Course - I	6	3	3	30	70	100
	III	Core Course -1 (CC - 1)	Introduction to Forensic Science and Crime Scene Management	4	4	3	30	70	100
		Core Practical - 1 (CP - 1)	Forensic Science and Crime Scene Management Laboratory	4	4	3	40	60	100
		Allied Course – 1 (AC - 1)	Fundamentals of Physics	4	4	3	30	70	100
		Allied Course Practical - 1 (ACP-1)	Fundamentals of Physics Laboratory	2	**	**	**	**	**
	IV	Value Education		2	2	3	30	70	100
		Interdisciplinary Course –1 (IDC - 1) #	One Course from Outside Department	2	2	3	30	70	100
	Total			30	22	--	--	--	700
II	I	Ability Enhancement Course – III (AEC - III)	(Tamil\$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – IV (AEC - IV)	English Course - II	6	3	3	30	70	100
	III	Core Course- 2 (CC - 2)	Forensic Instrumentation	4	4	3	30	70	100
		Core Practical - 2 (CP - 2)	Forensic Instrumentation Laboratory	4	4	3	40	60	100
		Allied Course – 2 (AC - 2)	Introduction to Psychology	4	4	3	30	70	100
		Allied Course Practical - 1 (ACP-1)	Fundamentals of Physics Laboratory	2	4	3	40	60	100
	IV	Skill Enhancement Course - 1 (SEC - 1) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 2 (IDC - 2) #	One Course from Outside Department	2	2	3	30	70	100
	Total			30	26	--	--	--	800

III	I	Ability Enhancement Course – V (AEC - V)	(Tamil\$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – VI (AEC - VI)	English Course - III	6	3	3	30	70	100
	III	Core Course- 3 (CC - 3)	Forensic Physics and Ballistics	4	4	3	30	70	100
		Core Practical - 3 (CP - 3)	Forensic Physics and Ballistics Laboratory	4	4	3	40	60	100
		Allied Course – 3 (AC - 3)	Fundamentals of Chemistry	4	4	3	30	70	100
		Allied Course Practical - 2 (ACP-2)	Fundamentals of Chemistry Laboratory	2	**	**	**	**	**
	IV	Skill Enhancement Course - 2 (SEC - 2) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 3 (IDC - 3) \$\$	One Course from Outside Department	2	2	3	30	70	100
		Health & Wellness @		--	1	--			100
Total			30	23	--	--	--	800	
I	Ability Enhancement Course – VII (AEC - VII)	(Tamil\$ / Other Languages+, #)	6	3	3	30	70	100	
IV	II	Ability Enhancement Course – VIII (AEC - VIII)	English Course - IV	6	3	3	30	70	100
	III	Core Course- 4 (CC - 4)	Forensic Biology and Serology	4	4	3	30	70	100
		Core Practical - 4 (CP - 4)	Forensic Biology and Serology Laboratory	4	4	3	40	60	100
		Allied Course – 4 (AC - 4)	Fundamentals of Computers	4	4	3	30	70	100
		Allied Course Practical - 2 (ACP-2)	Fundamentals of Chemistry Laboratory	2	4	3	40	60	100
	IV	Skill Enhancement Course - 3 (SEC - 3) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 4 (IDC - 4) \$\$	One Course from Outside Department	2	2	3	30	70	100
	Total			30	26	--	--	--	800
	Summer Internship / Industrial Activity during the Summer Vacation after II Year								

V	III	Core Course - 5 (CC - 5)	Forensic Chemistry and Toxicology	4	4	3	30	70	100
		Core Course - 6 (CC - 6)	Forensic Medicine	5	4	3	30	70	100
		Core Course - 7 (CC - 7)	Cyber Crime	5	4	3	30	70	100
		Core Course - 8 (CC - 8)	DNA Forensics	5	4	3	30	70	100
		Core Practical - 5 (CP - 5)	Forensic Chemistry and Toxicology Laboratory	5	4	3	40	60	100
	IV	Skill Enhancement Course - 4 (SEC - 4)	Basics of Forensic computers	2	2	3	30	70	100
		Skill Enhancement Course - 5 (SEC - 5) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Introduction to Disaster Management		2	2	3	30	70	100
		Summer Internship / Industrial Activity @@	(with Viva-Voce)	--	2	--	20	80	100
	Total			30	28	--	--	--	900
VI	III	Core Course - 9 (CC - 9)	Digital Forensics	4	4	3	30	70	100
		Core Course- 10 (CC - 10)	Forensic Anthropology	5	4	3	30	70	100
		Core Course- 11 (CC - 11)	Forensic Psychology	5	4	3	30	70	100
		Core Project Work (CPW) @@	Project Work (with Viva-Voce)	6	4	3	20	80	100
	IV	Value Added Course	General Studies for Competitive Examinations	2	1	--	30	70	100
		Skill Enhancement Course - 6 (SEC - 6)	Mobile Forensics	2	2	3	30	70	100
		Skill Enhancement Course - 7 (SEC - 7) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Environmental Studies		2	2	3	30	70	100
		Gender Studies		2	1	3	30	70	100
		Extension Activities *		--	1	--	--	--	--
	Total			30	25	--	--	--	900
	Grand Total			180	150	--	--	--	4900

ALLIED COURSE

First Year	Second Year
1. Fundamentals of Physics 2. Fundamentals of Physics Laboratory 3. Introduction to Psychology	1. Fundamentals of Chemistry Computers 2. Fundamentals of Chemistry Laboratory 3. Fundamentals of Computers

SKILL ENHANCEMENT COURSE(SEC)

Sl. No.	Title of paper	Sl. No.	MANDATORY Naan Mudhalvan Scheme##
1.	Introduction to Biometrics	1.	2nd Semester:
2.	Basics of Audio and Video Evidences		
3.	Accident Investigation	2.	3rd Semester:
4.	Basics of Forensic Computers		
5.	Basics of Digital Evidences	3.	4th Semester:
6.	Mobile Forensics		
7.	Food Safety and Testing	4.	5th Semester:
--		5.	6th Semester:

INTERDISCIPLINARY COURSE (IDC) FOR WHO HAVE OPT TAMIL AS PART-I (for other Department Students only)

1 st Semester	Fundamentals of Crime, Criminology and Policing
2 nd Semester	Criminal Law
3 rd Semester	Fingerprints and Other Impressions
4 th Semester	Examination of Questioned Documents

INTERDISCIPLINARY COURSE (IDC)# FOR WHO HAVE NOT OPT TAMIL AS PART - I

Those who have studied Tamil upto 10 th +2 but opt for other languages in degree	1 st Semester	Special Tamil - I
	2 nd Semester	Special Tamil – II
Those who have not studied Tamil in school level	1 st Semester	Basic Tamil – I
	2 nd Semester	Basic Tamil – II
Those students who opt for either special Tamil (or) Basic Tamil as IDCs, have to choose 2 more IDCs courses in their 3 rd and 4 th Semester from Outside his/her department.		

INTERDISCIPLINARY COURSE (IDC) \$\$ FOR NCCCADETS ONLY	
NCC Course is a Compulsory Course for the NCC Cadets in the 3rd Semester:	NCC Course is a Compulsory Course for the NCC Cadets in the 4th Semester:
Introduction to NCC	1. Special Subject Army (or) 2. Special Subject Navy (or) 3. Special Subject Air force
Those students who opt for NCC Courses as IDCs, have to choose 2 more IDCs courses in their 1st and 2nd Semester from Outside his/her department.	

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	Credits for Each Course	Total Credits	Marks
1.	I	Ability Enhancement Course	4	3	12	400
2.	II	Ability Enhancement Course	4	3	12	400
3.	III	Core Courses	11	4	44	1100
4.		Core Practical	5	4	20	500
5.		Allied Courses	4	4	16	400
6.		Allied Courses Practical	2	4	8	200
7.		Core Project Work	1	4	4	100
8.	IV	Skill Enhancement Courses	7	2	14	700
9.		Interdisciplinary Course	4	2	8	400
10.		Value Education	1	2	2	100
11.		Health & Wellness	1	1	1	100
12.		Introduction to Disaster Management	1	2	2	100
13.		Summer Internship / Industrial Activity	1	2	2	100
14.		Value Added Course	1	1	1	100
15.		Environmental Studies	1	2	2	100
16.		Gender Studies	1	2	2	100
17.		Extension Activities (NCC / NSS / SPORTS / ANTI DRUG CELL / YRC & Any Other Activities)	--	1	1	--
	Total		49	-	150	4900

- \$ For those who have studied Tamil upto 10th+2 (Regular Stream)
- + Syllabus for other Languages should be on par with Tamil at degree level
- # Those who have studied Tamil upto 10th+2 but opt for other languages in degree level under Part-I should study special Tamil and those who have not studied Tamil in the school level should study Basic Tamil in Part-IV under the Interdisciplinary Course.
- ** Examination at the end of the next semester
- ## Naan Mudhalvan Scheme: As per the Naan Mudhalvan Scheme instructions, 5 courses from 2nd to 6th semester should be studied under Skill Enhancement Course.
- \$\$ NCC Course is one of the Choices in the Interdisciplinary Course. Only the NCC Cadets are eligible to choose this course. However, NCC Course is a Compulsory Course for the NCC Cadets.
- @ **Health and Wellness: Assessments:**
- Use self-reflective worksheets to assess their understanding
 - submit the worksheets to internal audit / external audit
 - Every student's activity report should be documented and the same have to be assessed by the Physical Director with Mentor. The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation:

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		100

@@ Summer Internship / Industrial Activity

Internship will be carried out during the summer vacation after the second year. Viva-Voce will be conducted by the college and Marks shall be sent to the University and the same will be included in the 5th semester Mark Statement.

Summer Internship / Industrial Activity & Project

Work Scheme of Evaluation:

Description	Marks
Report	80
Attendance	20
Total	100

* Extension Activities shall be outside instruction hours.

Programme outcomes (PO):

PO1	Communication Skill: Mandatory language courses facilitate to become proficient in communication, culturally aware, and more employable in both Indian and global contexts. Improve presentations skill, debates, and professional communication.
PO 2	Disciplinary Knowledge: Learn in-depth complex scientific concepts, demonstrate their ability to explain and apply their knowledge. Consistent in learning by earning extra credits in specialized courses within the science domain and enhance disciplinary knowledge.
PO 3	Critical thinking: Field and academic visits will help students to develop observation skills, grasping ability, collect and interpret data and propose models that will help them to understand hypotheses and conclusions.
PO 4	Analytical Reasoning: Through the interactions, students will develop skills of critical reading of texts, identifying gaps in knowledge, formulating scientific questions, and on will recognizing the synthesis of new ideas.
PO 5	Scientific Reasoning: Skill oriented courses will provide details on principles, conduct of proper calibration and use of scientific instrumentation and appropriate use of scientific techniques in experimental design
PO 6	Self-directed Learning: Preparation of field reports helps them to present their results and discussion in a written format that is typically required for their future professions.
PO 7	Reflective Thinking: All core courses with laboratory components will provide exposure to a wide range of research techniques, therein enhancing their understanding of the application of techniques in their domain.
PO 8	Problem Solving: Students will develop the ability to reason, apply numerical concepts, and equations in their fields of study for interpreting scientific data and drawing relevant scientific conclusions.
PO 9	Research-related Skills: Students undertaking a internship will have the opportunity to design, develop and execute their own research ideas in their experiments, thus expanding their knowledge of research methods and laboratory skills.
PO10	Lifelong Learning: Ability to understand the gaps in knowledge and skill, adapt to technological change, engage in self-directed learning.

Year: First

CORE COURSE 1

Semester: I

Code:

**INTRODUCTION TO FORENSIC SCIENCE AND
CRIME SCENE MANAGEMENT
(Theory)**

Credits: 4

COURSE OBJECTIVE:

- The significance of Forensic science to human society.
- The fundamental principles and functions of Forensic science.
- The divisions in a Forensic science laboratory.
- The methods of securing, searching and documenting crime scenes.
- The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.
- The legal importance of chain of custody.

UNIT – I: Introduction to Forensic Science

Definitions and Concepts – Meaning, Interdisciplinary nature. Historical Aspects of Forensic Science - Early developments, Key milestones in forensic evolution. Development of Forensic Science Laboratories – Globally & India. Basic Principles of Forensic Science - Frye Standard and Daubert Standard - Scope of Forensic Science - Forensic Science in the Indian Scenario.

UNIT – II: Branches of Forensic Science and Their Importance

Branches of Forensic Science - Forensic biology, Forensic chemistry, Forensic physics, Digital forensics, Toxicology, Ballistics. Hierarchical Setup of Government Forensic Science Laboratories - National, state, and regional labs. Basic Services of Crime Laboratories. Qualifications of Forensic Scientists. Duties of Forensic Scientists. Code of Conduct for Forensic Scientists.

UNIT – III: Crime Scene

Meaning of Crime Scene - Definition and significance. Types of Crime Scenes - Indoor and outdoor, Primary and secondary, Organized and disorganized. Safety Measures at Crime Scenes - Personal safety, Use of protective equipment. Role of First Responding Officer - Securing the scene, Preserving evidence. Coordination at Crime Scene. Evaluation of Crime Scene - 5Ws: Who, What, When, Where, Why, 1H: How

UNIT – IV: Documentation of Crime Scenes

Photography and Videography – Importance & Need. Techniques and procedures - Crime Scene Sketching Methods - Baseline method,

Triangulation method, Coordinate method, Extended coordinate method. Crime Scene Notes – Types and its importance. Search of Crime Scene - Definition and objectives. Search Patterns - Strip/Lane method, Grid method, Zone method, Spiral method, Wheel method. Classification of Evidence. Collection, Handling & Preservation of Evidence. Chain of Custody.

UNIT – V: Importance of Evidence

Definition of Evidence. Importance and Nature of Evidence. Principles of Evidence – Reliability, Validity. Stages of Evidence Evaluation. Management of Mass Disaster Scenes - Identification challenges, Role of forensic teams. Important Evidences for Human Identification – Fingerprints, DNA, Dental records, Skeletal analysis.

UNIT - VI: Current Contours (for Continuous Internal Assessment Only):

Recent developments in forensic science. Basics of cyber and digital forensics. Use of Artificial Intelligence in forensics. New technologies in crime scene investigation. Biometric systems (fingerprint, face, iris). Challenges in forensic science. Legal and ethical issues.

REFERENCES:

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

COURSE OUTCOMES:

CO1: Understand basic concepts, history, and importance of forensic science.

CO2: Know different branches of forensic science and roles of forensic laboratories.

CO3: Understand types of crime scenes and their management.

CO4: Learn methods of crime scene documentation and evidence handling.

CO5: Understand the importance of evidence and its use in investigation and court.

MAPPING OF CO-PO

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C01	L	S	M	M	M	L	M	M	L	M
C02	L	S	M	M	S	L	M	M	M	M
C03	L	S	S	M	S	L	M	S	M	M
C04	M	S	S	S	S	M	S	S	S	M
C05	M	S	S	S	S	L	M	S	M	M

S – Strong, M – Moderate, L – Low

Year: First

CORE PRACTICAL 1

Semester: I

Code:

**FORENSIC SCIENCE AND CRIME SCENE
MANAGEMENT LABORATORY
(Practical)**

Credits: 4

COURSE OBJECTIVE:

- To provide practical knowledge of crime scene management and investigation procedures.
- To develop skills in crime scene documentation using photography, videography, and sketching.
- To train students in searching, collecting, and preserving evidence properly.
- To familiarize students with handling different types of evidence and maintaining chain of custody.
- To enable students to perform a complete mock crime scene investigation with accuracy and professionalism.

LIST OF EXPERIMENTS

1. Introduction to Crime Scene Management
2. Securing and Isolating a Crime Scene
3. Crime Scene Safety Measures
4. Crime Scene Photography
5. Videography of Crime Scene
6. Crime Scene Sketching
7. Crime Scene Search Techniques (3) – Baseline, Triangulation, Coordinate method etc.,
8. Collection, Handling and Packing of Evidences – Physical, Trace, Biological etc.,
9. Chain of Custody Documentation
10. Mock Crime Scene Investigation (3) - Murder / Suicide, House Breaking, Accidents etc.,

COURSE OUTCOMES:

- CO1:** To Secure and protect a crime scene properly.
CO2: To record crime scenes using photography, video, and sketches.
CO3: To Use different search methods to find evidence.
CO4: To Collect and preserve evidence correctly.
CO5: To perform a mock crime scene investigation.

MAPPING OF CO-PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	M	M	S	M	M
CO2	S	S	M	S	S	M	M	M	M	M
CO3	M	S	S	S	S	M	M	S	M	M
CO4	M	S	S	S	S	M	S	S	S	M
CO5	S	S	S	S	S	M	S	S	S	M

COURSE OBJECTIVES:

- To understand the mechanical properties of matter such as elasticity and viscosity.
- To learn the fundamentals of sound and acoustics and their real-life applications.
- To develop knowledge of ray optics and wave optics phenomena.
- To understand the principles and applications of lasers and optical fibers.
- To study basic nuclear physics, radiation, and detection techniques.

Unit I: Properties of matter

Elasticity: Hooke's law – Stress-Strain diagram - Three moduli of elasticity - Poisson's ratio –Relation between η , n , k and σ (No derivation)- Factors affecting elasticity – Bending moment – Young's modulus by uniform bending.

Viscosity: Stream lined motion & turbulent motion – Poiseuille's formula to determine η (without correction for pressure head) – equation of continuity – Bernoulli's theorem (Statement only).

Unit II: Sound

Classification of sound – decibel – Weber Fechner law - Reverberation theory - Sabine's formula – derivation of Sabine's equation – Acoustic design of a Hall – Common acoustical defects and their remedies - Production of ultrasonics by magnetostriction and piezoelectric methods – Acoustical grating – SONAR.

Unit III: Ray and Wave Optics

Dispersion by a prism – Dispersive power- Achromatic combination of prisms – deviation without dispersion - dispersion without deviation – Aberration - chromatic aberration in lenses. Interference, Young's double slit experiments - Fresnel diffraction, Diffraction at a single slit and a circular aperture, plane diffraction grating - Polarization: (Malus's law) Polarization by reflection and refraction, Brewster's law, Production and analysis of elliptically and circularly polarized light.

Unit IV: Laser and Fiber Optics

Laser and its properties – Spontaneous and stimulated emission - Einstein's coefficients - Population inversion – Pumping and its types – Gas laser (He-Ne laser) – Solid state laser (Nd-YAG laser) - Hologram -construction and reconstruction process – General ideas of optical fibre – Numerical aperture and Acceptance angle of fibre – Types of optical fibre – Applications.

Unit V: Nuclear Physics

Nuclear Physics: Isotopes, Nuclear Forces, Atomic Mass Unit, Binding Energy, Mass Defect, Nuclear Reactions (Fission and Fusion), Radioactivity, Half-life and Mean life, Carbon dating

Detectors: Solid-state Detectors; Geiger-Muller Counter - Radiation Hazards: Radiation Levels for Safety; Radiation Protection Methods.

UNIT – VI: Current Contours (For CIA Only)

Applications of Fluid Mechanics in Forensic Science, Role of Viscosity in Industrial and Daily Life Applications, Noise Pollution in Urban Areas and Its Control Measures, Acoustic Design of Auditoriums and Modern Smart Classrooms, Use of Optical Instruments in Forensic Science, Fiber Optics in Internet and Communication Technology, Applications of Lasers in Forensic science. Nuclear Energy: Benefits and Risks in Modern Society, Radiation Hazards and Safety Measures in forensic lab.

Text Books:

1. Properties of Matter – Brijlal & N. Subrahmanyam – S. Chand & Co, 2002.
2. A text book of Optics, Multicoloured Revised Edition, Subramanyam, Brij Lal, Avadhanulu, S. Chand and Co. Pvt Ltd, 2014
3. Engineering Physics, 7th Edition, M.N Avadhanulu and P.G.Kshirsagar, S. Chand and Company Ltd.

Reference Books:

1. Properties of Matter, R. Murugesan, S. Chand & Co. publication, 2016.
2. University Physics, FW Sears, MW Zemansky and HD Young 13/e, Addison-Wesley 1986.
3. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
4. Optics, Ajoy Ghatak, 3rd Edition, Mc Graw Hill Co.
5. Fundamentals of Optics, Jenkins and White, 4th Edition, Mc Graw Hill International Publications.
6. An introduction to Laser theory and applications, M.N. Avadhanulu, S. Chand publications Ltd.
7. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
8. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Course Outcomes

- CO1:** Explain elasticity, viscosity, and fluid behavior in physical systems.
- CO2:** Understand and apply concepts of sound, acoustics, and ultrasonics.
- CO3:** Analyze optical phenomena like interference, diffraction, and polarization.
- CO4:** Explain the working and applications of lasers and optical fibers.
- CO5:** Understand nuclear processes, radiation detection, and safety measures.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C01	L	S	M	M	M	L	L	S	L	M
C02	L	S	M	M	M	L	L	M	L	M
C03	L	S	S	S	M	L	M	S	M	M
C04	L	S	M	M	S	L	M	M	M	S
C05	L	S	M	M	S	L	M	S	M	M

Year: First

ALLIED COURSE PRACTICAL 1

Semester: I, II

Code:

**FUNDAMENTALS OF PHYSICS LABORATORY
(Practical)**

Credits: 4

Course Objectives

- To understand the mechanical properties of matter such as elasticity and viscosity.
- To learn the fundamentals of sound and acoustics and their real-life applications.
- To develop knowledge of ray optics and wave optics phenomena.
- To understand the principles and applications of lasers and optical fibers.
- To study basic nuclear physics, radiation, and detection techniques.

Fundamentals of Physics Laboratory

- Determine Young's modulus of a beam using the uniform bending method.
- Determine Young's modulus of a beam using the non-uniform bending method.
- Determine the coefficient of viscosity of a liquid flowing through a capillary tube.
- Determine the coefficient of viscosity of glycerine using a falling sphere.
- Determine the frequency of a tuning fork by resonance in an air column.
- Study the relationship between frequency, length, and tension.
- Determine the velocity of sound using resonance apparatus.
- Determine the refractive index of prism material.
- Determine the dispersive power of prism material.
- Determine the wavelength of monochromatic light.
- Study polarization and verify Malus' law.
- Determine the refractive index of glass using Brewster's law.
- Determine the numerical aperture and acceptance angle of an optical fibre.
- Study divergence and diffraction of a laser beam (He-Ne or semiconductor laser).
- Measure background radiation and study the operating characteristics of a GM counter.

Course Outcomes

CO1: Explain the fundamental properties of matter, including elasticity, viscosity, and fluid dynamics.

CO2: Describe the principles of sound, acoustics, ultrasonics, and their applications.

CO3: Analyze optical phenomena such as interference, diffraction, polarization, and dispersion.

CO4: Explain the working principles of lasers, holography, and optical fiber communication systems.

CO5: Understand nuclear structure, radioactivity, radiation detection techniques, and radiation safety measures.

MAPPING OF CO-PO

COs / POs	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C01	1	3	2	2	2	1	1	3	-	2
C02	1	3	2	2	2	1	1	2	-	2
C03	1	3	3	3	2	1	2	3	1	2
C04	1	3	2	2	3	1	2	2	1	3
C05	1	3	2	2	3	1	2	3	2	2
C06	2	2	3	3	3	3	3	3	3	2

Year: First

INTERDISCIPLINARY COURSE 1

Semester: I

Code:

**FUNDAMENTALS OF CRIME, CRIMINOLOGY
AND POLICING
(Theory)**

Credits: 2

Course Objectives

- To understand the basic concept of crime, its causes, and effects in society.
- To learn the basic theories of criminology and criminal behaviour.
- To understand the structure and function of the criminal justice system.
- To learn the organization and development of the police system in India.
- To understand basic policing methods and crime prevention techniques.

Unit – I: Introduction

Crime – Meaning, Definition, Historical perspectives, nature, origin and scope. Elements, nature, causes and consequences of crime. Deviance, social context of deviance, delinquency – Criminology and its relations with other social sciences – Criminology's interdisciplinary nature.

Unit – II: Basics of Criminology

Definition, Aims and Scope of criminology, Theories of criminal behaviour – Pre-Classical, Classical, Neo-Classical, Positivist, Psychological, Economical, Biological, Cartographical, Sociological Theories and Multiple Factor Approach.

Unit – III: Criminal Justice System

Meaning, Definition and purpose of CJS. The concept of justice - retributive, reformatory and restorative. Broad components of criminal justice system. Role of Legislative, Judiciary & Executive in criminal justice system, Supremacy of Judiciary in criminal justice system.

Unit – IV: Police Organization

Historical development of police - Ancient, Medieval and Modern Indian Police. Central Police Organisation – Line Units, Staff Units, Mixed Units. Organization of the State Police - Administrative hierarchy and the Ranges. Meaning & establishment of a Police Station – Rural; Urban and Metropolitan. Types & functions of different kinds of police stations - Civil Police Station, Traffic Police Station, Women Police Station.

Unit – V: Policing

Police methods: Beat – Meaning, Type, Advantage. Patrolling – Meaning, Type Advantage. Surveillance – Meaning, Type, Advantage and Criminal Intelligence – Meaning, Type, Source, Advantage. Voluntary agencies in crime prevention. Police Public Relationship. Police Relationship with Media & other related departments.

UNIT – VI: Current Contours (For CIA Only)

Causes and Consequences of Crime in Modern Society, Difference between Deviance, Crime, and Delinquency, Comparative Study of Classical and Positivist Theories of Crime, Role of Sociological Theories in Explaining Criminal Behaviour, Structure and Functions of the Criminal Justice System in India, Evolution of Police System in India: Ancient to Modern, Organizational Structure of State Police in India, Role of Police in Crime Prevention and Public Safety, Police-Public Relationship and Its Importance in Modern Policing.

Text Book

1. N. V. Paranjape. Criminology & Penology. Central Law Publication. 2018.
2. Frank E Hagan. Introduction to Criminology-Theories, Methods & Criminal Behaviours. Sage Publication 2016.
3. Surjeet Kumar. Fundamentals of Criminology. The New Gate Way 2024.

Reference Books:

1. William G Bailey. The Encyclopaedia of Police Science. Routledge
2. Shankar Sen. Indian Police Today. APH Publication. 1989.
3. Siegel Larry. Criminology: Theories, Patterns and Typologies. Cengage Learning, 2016.
4. Garry W. Cordner. Introduction to Police Administration. 9th Ed. Taylor & Francis. 2016.
5. Ahuja, R. Criminology. Rawat Publication: Jaipur. (2000).
6. Swanson, C.R.; Territo, L.J. and Taylor, R.W. Police Administration: Structures, Processes, and Behaviour 8th ed. Prentice Hall, USA (1998).
7. Meguire, M., Morgan, R. and Reiner, R. The Oxford Handbook of Criminology 6th Ed. Oxford University Press: New York; 2017.

Course Outcome(s):

CO1: Understand what crime is and how different subjects help study it.

CO2: Learn why people commit crimes and how criminology explains it.

CO3: Know how the police, courts, and jails work together in the justice system.

CO4: Learn about the history and setup of the Indian police and what police stations do.

CO5: Understand how police prevent crime and work with other groups.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	M	L	M	M	L	M
CO2	L	S	S	S	M	L	M	S	M	M
CO3	M	S	S	S	S	L	M	S	M	M
CO4	M	S	M	M	S	L	M	M	L	M
CO5	M	S	S	S	S	M	M	S	M	M

COURSE OBJECTIVES

- To understand basic physical and biological concepts used in forensic instrumentation.
- To learn principles and applications of microscopy techniques.
- To understand spectroscopy methods used in forensic analysis.
- To study chromatography techniques for separation and identification.
- To learn electrophoresis and laboratory instruments used in forensic science.

UNIT – I: General Concepts of Instrumentation

Basic concepts: Mass, density. Electromagnetic radiation (range & interaction). Fluorescence and phosphorescence. pH and buffers. Importance of instrumentation in forensic science. Centrifuge: Principle, types, applications.

UNIT – II: Microscopy

Principle and working of microscopes. Types and applications: Simple microscope, Compound microscope, Stereo microscope, Polarized light microscope, Dark-field microscope, Comparison microscope, Fluorescent microscope, Electron microscope. Forensic applications of microscopy.

UNIT – III: Spectroscopy

Principles of spectroscopy - Beer-Lambert Law. UV-Visible spectroscopy - basic principle & application, IR and FTIR - basic principle & application, Atomic Absorption & Emission spectroscopy - basic principle & application, Raman spectroscopy - basic principle & application, X-ray spectroscopy - basic principle & application, Mass spectrometry - basic principle & application.

UNIT – IV: Chromatography

Principles of chromatography. Types & application - Paper chromatography, Column chromatography, TLC. LC, HPLC, GC. Hyphenated techniques: GC-MS, LC-MS. Forensic applications.

UNIT – V: Electrophoresis & Lab Instruments

Principles of electrophoresis. Types: Horizontal, Vertical, SDS-PAGE, AGE. Capillary electrophoresis, Genetic analyzer. Applications in forensics. Laboratory instruments: Autoclave, Laminar air flow (HEPA), Incubators, CO₂ incubator.

UNIT – VI: Current Contours (CIA Only)

Recent advances in forensic instrumentation. Use of automation and digital instruments. Modern analytical techniques (AI-based analysis). Nanotechnology in forensic analysis. Challenges and limitations of modern instruments. Ethical and legal issues in instrumental analysis.

REFERENCES

1. Houck, M.M. Fundamentals of Forensic Science. Academic Press. 2015.
2. Khandpur, R.S. Handbook of Analytical Instruments. 3rd Ed. McGraw Hill Pub. New Delhi, 2015.
3. W. Kemp, Organic Spectroscopy, 5th Ed. Macmillan, Hampshire. 2011.
4. J. W. Robinson, Undergraduate Instrumental Analysis, 8th Ed. Marcel Dekker, Inc., New York 2015.
5. Thomas, Nicholas, K. P. Forensic science laboratory manual and workbook. 3rd Ed. CRC press. 2011.
6. Carpenter, W. B. and Dallinger, W. H. The Microscope and Its Revelations, Wentworth Press, India. 2019.

COURSE OUTCOMES

CO1: Understand basic concepts and the importance of forensic instrumentation.

CO2: Explain different types of microscopes and their applications.

CO3: Apply principles of spectroscopy in forensic analysis.

CO4: Understand chromatography techniques and their uses.

CO5: Explain electrophoresis and laboratory instruments in forensic work.

MAPPING OF CO – PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	L	M
CO2	L	S	M	M	S	L	M	M	M	M
CO3	L	S	S	S	S	L	M	S	M	M
CO4	L	S	S	S	S	L	M	S	S	M
CO5	L	S	M	S	S	L	M	S	S	M

COURSE OBJECTIVES

- To understand the basic principles of laboratory instruments used in forensic science.
- To develop skills in microscopic examination and comparison of samples.
- To study basic spectroscopic techniques for the identification of substances.
- To perform separation techniques such as chromatography and electrophoresis.
- To gain practical knowledge in electrophoretic techniques for the analysis of biomolecules.

LIST OF EXPERIMENTS

1. To determine the pH of different forensic samples and prepare buffer solutions.
2. To study the principle and operation of a centrifuge and separate biological samples.
3. To study and identify samples using a compound microscope.
4. To compare two samples using a comparison microscope.
5. To experiment Beer-Lambert's law and learn Forensic applications.
6. To identify drug samples using UV-Visible spectroscopy.
7. To carry out the separation of organic compounds by paper chromatography.
8. To carry out thin-layer chromatography of ink samples.
9. To carry out the separation of biomolecules using gel electrophoresis.
10. To study the working of capillary electrophoresis.

COURSE OUTCOMES

CO1: Apply basic concepts of pH, buffers, and centrifugation in forensic sample analysis.

CO2: Use different types of microscopes for examination and comparison of forensic evidence.

CO3: Apply spectroscopic techniques for the identification and analysis of chemical substances.

CO4: Perform chromatographic techniques for separation and identification of forensic samples.

CO5: Perform electrophoretic separation of biomolecules.

MAPPING OF CO-PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	M	M	M	M	M
CO2	M	S	S	S	S	M	M	S	M	M
CO3	L	S	S	S	S	M	M	S	S	M
CO4	L	S	S	S	S	M	M	S	S	M
CO5	L	S	S	S	S	M	M	S	S	M

COURSE OBJECTIVES

1. To understand the fundamental schools of psychology and their historical evolution to establish a foundation for forensic applications.
2. To study the cognitive mechanisms of sensation, perception, and attention and how they influence the accuracy of information at crime scenes.
3. To analyse the biological and social drivers of human behaviour and identify the motivational factors behind criminal conduct.
4. To examine the principles of learning, memory processing, and intelligence assessment to understand behavioural changes and recall.
5. To evaluate various personality frameworks and assessment tools used in forensic profiling and the interrogation of suspects.

UNIT – I: Introduction to Psychology

Definition, Scope, and Importance in Forensic Science. Brief history: Structuralism, Functionalism, Behaviourism, Gestalt, Psychoanalytic, Humanistic. Modern Perspectives: Biological and Cognitive, Socio-cultural. Areas of Specialisation: Forensic and Criminal Psychology.

UNIT – II: Sensation, Perception, and Attention

Sensation: Meaning, Types, and Sensory Processes. Perception: Definition and processes, Gestalt principles, Depth perception & cues, illusions, ESP. Attention: Determinants, Span, and Shifting of attention. Factors affecting focus at crime scenes.

UNIT – III: Motivation and Motives

Definition and importance of motivation in behaviour. Theories: Instinct, Drive-Reduction, and Incentive. Biological motives and social motives. Link with criminal motivation.

UNIT – IV: Learning, Memory & Intelligence

Learning: Nature and importance in behaviour change. Classical (Pavlov) and Operant (Skinner) Conditioning. Memory: Definition and types (Sensory, ST, LT). Processes: Encoding, Storage, and Retrieval. Intelligence: Definition and nature. IQ and Stanford-Binet testing. Applications in criminal behaviour.

UNIT – V: Personality Theories and Assessment

Definition and importance of personality in forensic profiling. Theories: Psychodynamic, Humanistic, and cognitive. Assessment: Questionnaires and Projective Tests (TAT, Rorschach). Applications in interrogation.

UNIT – VI: Current Contours (For CIA Only)

Sensory adaptation and its forensic implications. Selective and Divided Attention. Observational Learning (Bandura) and Trial/Error (Thorndike). Spearman, Gardner, and Sternberg intelligence theories. Wechsler scales. Applications in Eyewitness testimony and rehabilitation.

REFERENCES

1. Dennis Coon, John O. Mitterer. Introduction to Psychology. Cengage Learning. 2010.
2. Clifford T. Morgan, Richard A. King, John Shopler. Morgan and King Introduction to Psychology. 8th Ed. East West Publisher. 2024.
3. Cicarelli, S. K. & White, J. N. Psychology. Pearson. 2017.
4. Kalat, J. W. Introduction to Psychology. Cengage Learning. 2016.
5. Feldman, R. S. Understanding Psychology. 12th Edition. New Delhi, Tata Mc Graw Hill. 2015.
6. Daniel Schacter. Daniel Gilbert. Daniel Wegner. Bruce hood. Psychology. Worth Publisher. 2014.

COURSE OUTCOMES

CO1: Differentiate between major psychological perspectives and explain the specific role of psychology within the forensic science domain.

CO2: Identify how sensory processes, perceptual illusions, and attention shifts can impact witness reliability and investigative focus.

CO3: Recognise the link between core human motives (biological and social) and the development of criminal intent.

CO4: Apply the concepts of conditioning, memory encoding, and IQ testing to assess individual behaviour and cognitive capacity.

CO5: Utilise personality theories and projective assessment techniques to assist in criminal profiling and effective interrogation strategies.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	L	M	M	L	M
CO2	M	S	S	S	S	M	M	S	M	M
CO3	L	S	S	S	M	L	M	S	M	M
CO4	M	S	S	S	S	M	M	S	M	M
CO5	M	S	S	S	S	M	M	S	S	M

COURSE OBJECTIVES

- To understand the foundational architecture and biological principles of biometric systems.
- To study the operational workflows of enrolment, verification, and identification.
- To learn the mathematical metrics used to evaluate the accuracy and reliability of biometric technologies.
- To analyze the unique features of physiological and behavioral traits for human individualization.
- To examine the historical evolution and technical components of biometric hardware and data management.

UNIT – I: Fundamental Aspects

Definition and core characteristics of biometric systems. Basic operational architecture. Classification of biometric systems: Physiological vs. Behavioural. Comparative analysis: strengths and weaknesses of each biometric category.

UNIT – II: Features of Biometric Processes

Key biometric operations: Enrolment, Identification, and Verification. Understanding Positive and Negative identification. Introduction to Multimodal biometrics: need, benefits, and integration of multiple traits for enhanced security.

UNIT – III: Performance Measurement and Evaluation

Scientific measures used in biometric systems: False Acceptance Rate (FAR), False Rejection Rate (FRR), and Genuine Acceptance Rate (GAR). Technical metrics: Failure to Acquire (FTA), Failure to Enrol (FTE), and Acquisition Toughness Value (ATV). Comparative study: Biometric versus Traditional identification technologies.

UNIT – IV: Physiological Biometrics

Technical analysis of Fingerprints and Palm prints. Ocular biometrics: Iris structure and Retina blood vessel patterning. Morphological recognition: Geometry of the hand and facial landmark analysis.

UNIT – V: Behavioral Biometrics

Dynamics of Handwriting and Signature Verification. Keystroke rhythms and typing latency. Biomechanical analysis of Gait. Acoustic analysis of Voice: pitch, tone, and frequency spectrum.

UNIT – VI: Current Contours (For CIA Only)

Historical development and the evolution of biometric systems, system architecture: Sensors, Feature Extractors, and Matchers. Database management and the Biometric Data Lifecycle. Security concerns and the scope of biometrics in forensic investigations.

REFERENCES

1. S. Nanavati, M. Thieme and R. Nanavati, Biometrics, Wiley India Pvt. Ltd. (2012).
2. P. Reid, Biometrics for Network Security, New Delhi (2014).
3. J.R. Vacca, Biometric Technologies and Verification Systems, Butterworth-Heinemann, Oxford (2017)

COURSE OUTCOMES

CO1: Understand the fundamental characteristics and differences between physiological and behavioural biometric systems.

CO2: Know the core biometric processes and the advantages of integrating multimodal traits for security.

CO3: Recognise the importance of performance measures like FAR and FRR in assessing system efficiency.

CO4: Comprehend the structural features of fingerprints, ocular patterns, and facial geometry used in identification.

CO5: Apply the mechanisms of behavioural traits and understand the technical functions of sensors and matchers within the biometric architecture.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	M	M
CO2	L	S	M	M	S	M	M	M	M	M
CO3	L	S	S	S	S	M	M	S	M	M
CO4	L	S	S	S	S	L	M	S	M	M
CO5	M	S	S	S	S	M	M	S	S	M

COURSE OBJECTIVES

- To understand the transition from the IPC/CrPC/IEA to the new Bharatiya legal framework.
- To study the essential sections of BNS related to crimes against persons and property.
- To understand the procedural powers of courts and the legal provisions governing criminal proceedings under BNSS.
- To analyze the powers of police and the procedures followed during investigation, arrest, search, and seizure under BNSS.
- To analyse the evidentiary value of forensic, oral, and digital evidence under BSA.

Unit – I: Introduction to Bharatiya Nyaya Sanhita (BNS) - I

Historical development and comparison of the Old Penal Code vs. BNS 2023. General Explanations and Definitions (Sec 2). Provisions for Punishments (Sec 4-13). General Exceptions (Sec 14-44). Fundamentals of Criminal Conspiracy (Sec 60) and Attempt (Sec 62). Crimes against the State/Nation (Sec 147-151).

UNIT – II: Bharatiya Nyaya Sanhita (BNS) – II

Offences against Human Body: Homicide, Murder, and Negligence (Sec 100-106); Hurt and Grievous Hurt (Sec 114-118); Kidnapping and Abduction (Sec 137-140). Offences against Women: Sexual offences, Voyeurism, and Stalking (Sec 63-79); Cruelty and Dowry Death (Sec 80-85). Offences against Property: Theft, Robbery, and Cheating (Sec 303-318).

Unit – III: Bharatiya Nagarik Suraksha Sanhita (BNSS) - I

Introduction and comparison with CrPC. Constitution and Powers of Criminal Courts. Trial Procedure – Types of Trials, Framing of Charges, Examination of witness, New provisions with respect to electronic evidence.

Unit – IV: Bharatiya Nagarik Suraksha Sanhita (BNSS) - II

Information FIR (First Information Report) – registration and importance Zero FIR, Investigation protocols, Arrest, Search, and Seizure Procedures. Legal provisions regarding Summons, Warrants, Proclamations, Bail/Bonds.

Unit – V: Bharatiya Sakshya Adhiniyam (BSA)

Historical Development, Comparison with the Indian Evidence Act. Relevance and Facts, Admissions and Confessions. Dying Declarations and Expert Evidence. Special provisions for Digital and Electronic Evidence. Procedural rules for Examination, Cross-Examination, and Re-Examination of witnesses.

UNIT – VI: Current Contours (For CIA Only)

Transgender rights under new criminal laws, Community Service as a new form of punishment, E-Summons and Digital Court Proceedings, Custodial Rights and Human Rights Jurisprudence, Reformative vs. Retributive Justice.

REFERENCES

1. Taxman's – Indian Constitution. Taxman. 2023.
2. Taxman's Bare Act – Bharatiya Nyaya Sanhita – 2023, Taxman.
3. Taxman's Bare Act – Bharatiya Nagarik Suraksha Sanhitha – 2023, Taxman.
4. Taxman's Bare Act – Bharatiya Sakshya Adhiniyam – 2023, Taxman.
5. Lawman's Bare Act – Mahor Criminal Law & Minor Bare Act. 2025.

COURSE OUTCOMES

CO1: Know the fundamental changes and definitions in the new Bharatiya Nyaya Sanhita.

CO2: Understand the specific legal sections governing crimes against the human body, women, and property.

CO3: Recognise and apply court procedures and powers in criminal cases as per BNSS.

CO4: Evaluate police powers and procedural steps in investigation and relate them to forensic practice.

CO5: Identify the role of social legislation in providing justice to victims of social crimes.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	M	L	M	M	L	M
CO2	M	S	S	S	S	L	M	S	M	M
CO3	M	S	S	S	S	M	M	S	M	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	M	S	M	M	S	L	M	M	M	M

COURSE OBJECTIVES

- To understand the classification, development, and firing mechanisms of firearms and ammunition.
- To study the principles and factors influencing internal and external ballistics.
- To understand the effects of projectiles on targets and the principles of terminal ballistics.
- To develop skills in the identification of firearms, analysis of gunshot residues, and reconstruction of shooting incidents.
- To understand the collection, packaging, and examination of physical evidence such as glass, soil, paint, and fibres.

Unit I – Classification of Firearms.

History and development of firearms. Classification of firearms. Types of weapons and their operation. Firing mechanisms of various firearms. Ammunition – classification and structural features of different types of cartridge cases and bullets. Different types of marks produced during the firing process, including firing pin marks, breech face marks, chamber marks, extractor marks, ejector marks, and striation marks on bullets.

Unit – II: Ballistics

Internal Ballistics: Definition, ignition of propellants, shape and size of propellants, mechanism of burning, and various factors affecting internal ballistics, such as lock time, ignition time, barrel time, erosion, corrosion, and gas cutting. External Ballistics: Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape and stability of the projectile, trajectory computation, ballistic coefficient, limiting velocity, and measurement of trajectory parameters. Introduction to automated systems for trajectory computation and management of ballistic data.

Unit – III: Terminal Ballistics

Effect of projectiles on impact with the target: function of bullet shape, striking velocity, striking angle, and nature of target. Tumbling of bullets, effects of instability, influence of intermediate targets, and range. Ricochet and its effects. Stopping power. Wound ballistics - Entry wound characteristics, Exit wound characteristics, Differences between entry and exit wounds.

Unit – IV: Mechanisms of Firearms

Matching of bullets and cartridge cases in standard firearms. Identification of bullets, pellets, and wads fired from improvised and country-made firearms. Automated methods for comparison of bullets and cartridge cases. Determination of the range of fire. Tattooing, Blackening, Burning/scorching effects. Mechanism of formation of gunshot residues. Methods for analysis of gunshot residues from shooting hands and targets, with special reference to clothing. Identification and

characteristics of firearm injuries. Reconstruction of shooting incidents in cases of accident, suicide, homicide, and self-defence.

Unit – V: Physical Evidence

Glass – composition, types, collection, packaging, examination of glass samples, and fracture analysis. Soil – composition, types, collection, packaging, and examination of soil samples. Paint – composition, types, collection, packaging, and examination of paint samples. Fibre – composition, types, collection, packaging, and examination of fibre samples. Tampering with electric meters.

Unit – VI: Current Contours (CIA Only)

Physiological Biometrics: Fingerprints, palm prints, iris, retina, hand geometry, facial recognition. Automated biometric systems, biometric databases, multimodal biometrics. Behavioural Biometrics: Handwriting, signatures, keystroke dynamics, gait, voice. Dynamic signature verification, advancements in gait and voice analysis. Application of artificial intelligence in biometric identification. Limitations and ethical issues in biometric identification.

REFERENCES

1. Vincent Di Maio, Gunshot Wounds, 3rd Edition, CRC Press, Washington DC.
2. J. S. Wallace, Chemical Analysis of Firearms, Ammunition & Gun Shot Residue, 2nd Edition, (2018).
3. B. R. Sharma, Firearms in Criminal Investigation & Trial, (2017).
4. T. Warlow, Firearms, the Law, & Forensic Ballistics, 3rd Edition, CRC Press, (2011)
5. W.F. Rowe, Firearms identification, Forensic Science Handbook, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).
6. A.J. Schwoeble and D.L. Exline, Current Methods in Forensic Gunshot Residue Analysis, CRC Press, Boca Raton (2000).
7. E. Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).
8. B.J. Heard, Handbook of Firearms and Ballistics, Wiley and Sons, Chichester (1997).
9. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).

COURSE OUTCOMES

C01: Understand classification and identification of firearms and ammunition.

C02: Apply principles of internal and external ballistics.

C03: Analyse projectile effects and differentiate entry and exit wounds.

C04: Apply firearm identification, GSR analysis, and reconstruction techniques.

C05: Understand the collection and examination of physical evidence.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C01	L	S	M	M	S	L	M	M	M	M
C02	L	S	S	S	S	L	M	S	M	M
C03	M	S	S	S	S	L	M	S	M	M
C04	M	S	S	S	S	M	M	S	S	M
C05	M	S	S	S	S	M	S	S	S	M

COURSE OBJECTIVES

- To develop skills in estimating firing range and analyzing gunshot residue in forensic ballistics.
- To understand and perform comparison of bullets and cartridge cases for firearm identification.
- To study the role of photography in documentation of ballistic evidence.
- To apply analytical techniques for comparison of soil, paint, glass, and fibre evidence.
- To develop practical skills in examination and interpretation of physical evidence in forensic investigations.

LIST OF EXPERIMENTS

1. To estimate the range of fired bullets.
2. To carry out the comparison of fired bullets.
3. To carry out the comparison of fired cartridge cases.
4. To identify and carry out the analysis of gunshot residue.
5. To study the importance of Photography in Forensic Ballistics.
6. To compare soil samples by the density gradient method.
7. To compare paint samples by the physical matching method.
8. To compare paint samples by the thin-layer chromatography method.
9. To compare glass samples by the refractive index method.
10. To compare fibre analysis using various types of cloth evidence.

COURSE OUTCOMES

CO1: Estimate firing range and analyse gunshot residue in ballistic investigations.

CO2: Compare and identify fired bullets and cartridge cases.

CO3: Apply photographic techniques in forensic ballistics documentation.

CO4: Analyse and compare soil, paint, and glass samples using standard methods.

CO5: Examine and compare fibre evidence for forensic identification.

MAPPING OF CO-PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	S	M	M	S	S	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	S	S	M	S	S	M	M	M	M	M
CO4	L	S	S	S	S	M	M	S	S	M
CO5	L	S	S	S	S	M	M	S	S	M

COURSE OBJECTIVES

- To understand the fundamental concepts of atomic and molecular structure and their applications.
- To learn the principles and applications of spectroscopic techniques in analysis.
- To develop knowledge of thermodynamics, electrochemistry, and water chemistry.
- To understand periodic properties and intermolecular interactions in chemical systems.
- To study stereochemistry and basic reaction mechanisms in organic chemistry.

Unit - I: Atomic and molecular structure

Wave-particle duality of electrons. Schrodinger equation. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations (s, p and d). Molecular orbitals of diatomic molecules (Hydrogen, nitrogen, oxygen, carbon monoxide and nitric oxide) and plots of the multicentre orbitals. Equations for atomic and molecular orbitals.

Unit - II: Spectroscopic techniques

Principles of spectroscopy and selection rules. Electronic spectroscopy (Instrumentation and working). Fluorescence (Instrumentation and working) and its applications. IR spectroscopy: Instrumentation, working and applications. Nuclear magnetic resonance (NMR) spectroscopy: Instrumentation, working and applications.

Unit - III: Equilibrium Thermodynamics and water chemistry

Thermodynamic functions: Work, heat, enthalpy, entropy and free energy. Free energy and EMF. Electrode potentials. Nernst equation and applications. Acid-base, oxidation-reduction and solubility equilibria. Water analysis: Hardness by EDTA method and chloride ion by Argentometric method.

Unit – IV: Periodic properties and molecular interactions

Electronic configurations - Effective nuclear charge and its significance. Periodic properties: Atomic and ionic sizes, ionization energies, electron affinity and electronegativity. Hard and soft acids and bases. Ionic, dipolar and van der Waals interactions. Equations of state of real gases and critical phenomena.

Unit - V: Stereochemistry and reaction mechanism

Representations of 3-D structures, structural isomers and stereoisomers, configurations. Symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations (CIP rule) and conformational analysis of ethane, propane, butane and cyclohexane. Geometrical isomerism in alkenes and E/Z nomenclature. Introduction to reactions involving substitution (S_N1 , S_N2 , S_Ni , S_NAr ,

benzyne, halogenation, sulphonation, nitration, Friedel Crafts alkylation and acylation), addition (Electrophilic and nucleophilic) and elimination (E1 and E2).

UNIT – VI: Current Contours (For CIA Only)

Role of Quantum Chemistry in Modern Drug Design, Nanotechnology and Its Applications in Everyday Life, Use of Molecular Modeling in Crime Investigation, Applications of Spectroscopy in Forensic Science and Crime Detection, Role of NMR and IR Spectroscopy in Forensic, Water Pollution and Modern Methods of Water Purification, Importance of Intermolecular Forces in Drug Action, Green Chemistry and Sustainable Chemical Practices in forensics, Green Synthesis of Drugs: Eco-friendly Approaches, Chemical Reactions in Daily Life and forensic Applications.

Reference books:

- Universal Chemistry, Bruce M. Mahan and Rollie J. Meyers, 4th edition, Pearson Education India (2009).
- Engineering Chemistry, P.C. Jain and Monika Jain, 17th edition, Dhanpat Rai Publishing Company Ltd (New Delhi) (2015).
- Fundamentals of Molecular Spectroscopy, Colin N. Banwell and Elaine McCash, 4th edition, McGraw Hill (India) Private Limited (2016).
- Organic Chemistry: Structure and Function, K. P. C. Volhardt and N. E. Schore, 5th edition, W. H. Freeman; 6th edition (2010).
- Organic Chemistry: A mechanistic approach, Tadashi Okuyama and Howard Maskill, Oxford University Press (2014).
- Principles of Physical Chemistry, B. R. Puri, Madan S. Pathania and L. R. Sharma, 47th edition, Vishal Publishing Company (2020).
- Reactions, Rearrangements and Reagents, S.N. Sanyal, 4th edition, Bharati Bhawan Publishers & Distributors (2019).

Course Outcomes

CO1: Explain atomic structure, bonding, and molecular orbitals.

CO2: Understand and apply spectroscopic techniques for analysis.

CO3: Apply concepts of thermodynamics, electrochemistry, and corrosion.

CO4: Analyze periodic trends and molecular interactions.

CO5: Understand stereochemistry and organic reaction mechanisms.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1:	L	S	M	M	S	L	M	M	L	M
CO2:	L	S	S	S	S	L	M	M	S	M
CO3:	L	S	M	S	S	L	M	S	M	M
CO4:	L	S	S	S	M	L	M	S	L	M
CO5:	L	S	S	S	M	L	M	S	M	M

COURSE OBJECTIVES:

- To introduce the principles of atomic and molecular structure and their role in chemical bonding.
- To familiarize students with spectroscopic methods used for chemical identification and analysis.
- To develop an understanding of thermodynamic, electrochemical, and equilibrium processes in chemical systems.
- To explain periodic properties, molecular interactions, and the behavior of real gases.
- To provide foundational knowledge of stereochemistry and organic reaction mechanisms relevant to chemical transformations.

Fundamentals of Chemistry Lab:

1. Construction and visualization of atomic orbitals (s, p, d) using molecular model/software.
2. Molecular model study of diatomic molecules (H_2 , N_2 , O_2 , CO).
3. Determination of molecular geometry using model kits.
4. Determination of λ_{max} of a colored solution using UV-Visible spectrophotometer.
5. Verification of Beer-Lambert's law.
6. Estimation of concentration of a colored solution using colorimetry.
7. Demonstration and interpretation of IR spectra of common organic compounds.
8. Interpretation of simple NMR spectra of organic molecules.
9. Determination of hardness of water by EDTA method.
10. Determination of chloride content in water by argentometric titration.
11. Determination of pH of various solutions using pH meter.
12. Construction of a galvanic cell and measurement of EMF.
13. Study of periodic trends using physical models/data tables.
14. Determination of viscosity or surface tension of liquids (demonstration/simple experiment).
15. Molecular model study of stereoisomers and geometrical isomers.
16. Preparation and identification of cis-trans isomers using models.
17. Demonstration of optical activity using polarimeter (if available).

Course Outcome:

CO1: Explain the fundamentals of atomic structure, wave mechanics, and molecular bonding.

CO2: Understand the principles and applications of spectroscopic techniques such as UV-Visible, Fluorescence, IR, and NMR spectroscopy.

CO3: Apply concepts of thermodynamics, electrochemistry, chemical equilibria, and water quality analysis.

CO4: Describe periodic properties, intermolecular forces, and the behavior of real gases.

CO5: Understand stereochemistry, isomerism, and basic organic reaction mechanisms.

MAPPING OF CO-PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	L	M
CO2	L	S	S	S	S	L	M	M	S	M
CO3	L	S	M	S	S	L	M	S	M	M
CO4	L	S	S	S	M	L	M	S	L	M
CO5	L	S	S	S	M	L	M	S	M	M

COURSE OBJECTIVES

- To understand the fundamental principles and various types of digital multimedia evidence in forensic investigations.
- To learn technical methods for the enhancement and analysis of audio and video recordings.
- To study the scientific techniques used to detect digital forgeries and verify file authenticity.
- To analyse the specialised forensic tools and software used for multimedia data recovery and examination.
- To recognise the legal framework and procedural standards for admitting digital evidence in a court of law.

UNIT – I: Introduction to Multimedia Forensics

Definition, scope, and importance in criminal justice. Types of multimedia evidence: Audio, Video, and Images. Basics of file formats and compression. Fundamentals of the chain of custody for digital media.

UNIT – II: Audio Evidence Analysis

Types of audio evidence and enhancement techniques. Waveform and spectrogram analysis for noise reduction. Basics of speaker recognition and identification of tampering. Introduction to tools like Audacity and Adobe Audition.

UNIT – III: Image and Video Forensics

Principles of image and video authentication. Detection of digital forgeries and falsification. Analysis of CCTV and surveillance footage. Techniques for frame-by-frame examination and enhancement.

UNIT – IV: Authentication and Verification

File metadata examination and hash/checksum verification. Introduction to steganography and watermark analysis. Forensic techniques for ensuring file integrity and validation against original evidence.

UNIT – V: Tools and Legal Framework

Overview of forensic tools (Open-source vs. Commercial). Role of legal standards: Indian Evidence Act and IT Act. Procedures for evidence handling, documentation, and expert witness testimony.

UNIT – VI: Current Contours (For CIA Only)

Deepfake detection and AI-generated content analysis. Advanced forensic multimedia workstations. International guidelines for digital evidence admissibility. Challenges in cloud-based multimedia forensics.

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1. Chang-Tsun Li. Multimedia Forensics and Security. Springer. 2008.
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4. Anthony T. S. Ho, Shujun Li. Handbook of Digital Forensics of Multimedia Data and Devices. Wiley. 2015.
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8. Eoghan Casey. Digital Evidence and Computer Crime. Academic Press. 2011.
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10. Eddy Brixen. Digital Audio Forensics: Theory and Practice. Focal Press. 2012.
11. Brian Dalrymple. Forensic Image and Video Analysis. CRC Press. 2022.

COURSE OUTCOMES

CO1: Understand the core concepts of multimedia forensics, including file formats, compression, and the importance of the chain of custody.

CO2: Apply audio enhancement and analysis techniques to isolate voices and detect tampering in recorded media.

CO3: Execute forensic examinations of images and video footage to identify modifications and authenticate surveillance data.

CO4: Utilize metadata analysis, hash verification, and steganography detection to validate the integrity of digital evidence.

CO5: Comprehend the legal requirements under the IT Act and Indian Evidence Act for documenting and presenting forensic findings.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	L	M	M	M	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	S	S	S	S	S	M	M	S	M	S

COURSE OBJECTIVES

- To understand the basic concepts and importance of fingerprints in forensic science.
- To develop knowledge of classification and identification of fingerprints.
- To learn methods for development, lifting, and preservation of fingerprints.
- To gain practical skills in handling and analyzing fingerprint and impression evidence.
- To introduce other impression evidence like footprints, palm prints, and lip prints.

UNIT – I: Basics of Fingerprinting

Introduction – Definition, Meaning, Significance and history – World & India. Biological basis and ridge formation. Principles of fingerprinting. Types and patterns of fingerprints. Fingerprint minutiae. Plain and rolled fingerprints

UNIT – II: Classification of Fingerprints

Fingerprint classification and recording. Ten-digit classification system. AFIS (Automated Fingerprint Identification System). Core and delta. Ridge counting and ridge tracing. Poroscopy and Edgeoscopy.

UNIT – III: Development of Fingerprints

Latent fingerprints: meaning and formation. Sweat composition. Development of Latent print - Physical methods (powders), Chemical methods (iodine, ninhydrin, superglue etc.). Use of alternate light sources. Basic photography of developed prints.

UNIT – IV: Lifting & Preservation

Lifting techniques (tape, gel, hinge lifters). Lifting from different surfaces. Storage methods of lifted prints. Long-term storage techniques - Laminating, digitizing, and archiving. Digital Imaging - Scanning techniques for fingerprints - Optical, flatbed and digital SLR cameras. Digital enhancement techniques Legal admissibility.

UNIT – V: Other Impression Evidence

Finger printing the deceased. Developing fingerprints on & in gloves. Footprint – Meaning, Types, Importance of footprints. Documentation of footprint – Tracing, Casting of footprints, Electrostatic lifting of latent footprints, Gait pattern analysis and forensic significance. Palm prints - Structure, patterns, and historical significance. Lip prints - Nature, location, Methods of collection and examination of lip prints. Ear prints - Collection, comparison, and forensic significance.

UNIT – VI: Current Contours (for Continuous Internal Assessment Only):

Modern fingerprint techniques. AFIS (Automated Fingerprint Identification

System). Use of AI in forensic science. New methods for developing latent fingerprints. Digital image enhancement. Fingerprint biometrics (Aadhaar, security). Problems in fingerprint analysis. Legal aspects of fingerprint evidence. New technologies in crime scene investigation. Ethics in forensic science.

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1. J. E. Cowger. Friction Ridge Skin. CRC Press. 2013.
2. D. A. Ashbaugh. Quantitative-Qualitative Friction Ridge Analysis. CRC Press. 2010.
3. Lee and Gaensleen. Advances in Fingerprint Technology. 3rd Ed. CRC Press. 2013.
4. C. Champod, C. Lennard, P. Margot and M. Stoilovic. Fingerprints and other Ridge Skin Impressions. CRC Press. 2014.
5. Nalini Ratha Ruud Bolle. Automatic Fingerprint Recognition Systems. Springer. 2004.
6. Moses Daluz Hillary. Fingerprint Analysis Laboratory Workbook. 2nd Ed. CRC Press. 2020.

COURSE OUTCOMES

CO1: Understand basics, types, and patterns of fingerprints.

CO2: Classify and analyze fingerprint records.

CO3: Apply methods to develop latent fingerprints.

CO4: Perform lifting and preservation of fingerprints.

CO5: Analyze other impression evidence like footprints and lip prints.

MAPPING OF CO-PO

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	M	M
CO2	L	S	S	S	S	L	M	S	M	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	S	S	S	M
CO5	L	S	S	S	S	M	M	S	M	M

COURSE OBJECTIVES

- To understand the nature, collection, and forensic significance of biological evidence.
- To study the composition, identification, and analysis of body fluids in forensic investigations.
- To develop skills in bloodstain pattern analysis and crime scene reconstruction.
- To understand the role of insects in forensic investigations and estimation of postmortem interval.
- To analyse wildlife evidence and understand legal and conservation aspects.

Unit- I: Biological Evidences

Nature and significance of biological evidence. Collection, preservation, and packaging of biological materials. Hair evidence – origin, transfer, persistence, and recovery. Structure and morphology of human hair. Comparative analysis of hair samples. Biochemical aspects of human hair. Differentiation between human and animal hair. Racial identification using human hair. Forensic importance of botanical evidence – pollen grains, wood, and diatoms.

Unit – II: Body Fluids I

Overview of common body fluids. Blood – composition, functions, collection, and preservation. Differentiation between human and non-human blood. Determination of blood groups. Examination of blood – preliminary and confirmatory tests. Forensic characterisation and typing of bloodstains, including dried stains. Blood enzymes and proteins. Semen – composition, function, morphology of spermatozoa, collection, evaluation, and identification tests. Individualisation based on semen analysis. Other body fluids – composition, functions, and forensic significance of saliva, sweat, urine, faecal matter, milk, and vomit. Tests for their identification.

Unit – III: Body Fluids II

Bloodstain characteristics and classification. Impact bloodstain patterns, cast-off patterns, projected patterns, and contact patterns. Blood trails and drying patterns. Angle of impact. Area of convergence and area of origin. Documentation and interpretation of bloodstain pattern evidence. Crime scene reconstruction using bloodstain pattern analysis.

Unit – IV: Forensic Entomology

Fundamentals of forensic entomology. Insects of forensic importance. Collection, preservation, and handling of entomological evidence during death investigations. Estimation of postmortem interval (PMI) using insect evidence.

Unit – V: Wildlife Forensics

Significance and scope of wildlife forensics. Organisations involved in wildlife protection. IUCN Red List categories – Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, and Least Concern. Protected species in India and legal aspects. Illegal wildlife trade and trafficking. Illegally traded wildlife products. Identification of pug marks of various animals. Identification and examination of physical evidence related to wildlife crimes.

Unit – VI: Current Contours (for CIA Only)

Cellular antigens. ABO blood group system. Extracellular proteins and intracellular enzymes. Significance of genetic marker typing. Sexual assault investigations. Recent advances in forensic serology and DNA-based identification.

REFERENCES

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

COURSE OUTCOMES

CO1: Understand the nature, collection, and forensic significance of biological evidence.

CO2: Apply techniques for the identification and analysis of body fluids.

CO3: Analyse bloodstain patterns for interpretation and reconstruction of crime scenes.

CO4: Apply principles of forensic entomology for estimation of postmortem interval.

CO5: Understand wildlife forensic evidence and its role in crime investigation.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	M	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	L	S	S	S	S	M	M	S	S	M
CO5	L	S	M	M	S	M	M	M	S	M

COURSE OBJECTIVES

- To understand the identification and examination of biological evidence such as hair, pollen, and diatoms.
- To develop skills in the detection and analysis of body fluids using standard forensic tests.
- To study blood grouping and bloodstain pattern interpretation for crime scene reconstruction.
- To understand the identification of species using biological and physical evidence, including paw marks.
- To develop analytical and reporting skills through case studies in wildlife forensics and forensic entomology.

LIST OF EXPERIMENTS

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

COURSE OUTCOMES

CO1: Examine and identify biological evidence such as hair, pollen, and diatoms.

CO2: Apply preliminary and confirmatory tests for identification of body fluids.

CO3: Determine blood groups and analyse bloodstain patterns for forensic interpretation.

CO4: Identify species using biological evidence and paw mark analysis.

CO5: Develop case reports in wildlife forensics and forensic entomology.

MAPPING OF CO-PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	S	M	S	M	M	S	S	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	L	S	S	S	S	M	M	S	S	M
CO5	S	S	M	S	M	M	S	M	S	M

COURSE OBJECTIVES

- To provide a comprehensive understanding of computer architecture, operating systems, and peripheral device management.
- To equip with the knowledge of network topologies, internet protocols, and collaborative digital tools.
- To train the methodical assembly, configuration, and upgrading of PC hardware and BIOS/UEFI systems.
- To develop systematic troubleshooting skills and preventive maintenance strategies for sustaining system health.
- To instil industry-standard safety protocols and ethical laboratory practices for handling sensitive electronic equipment.

UNIT I: Basic Computer Knowledge

Computer organisation, types of computers, hardware components, input devices, keyboard, mouse, touch pad, pointing devices, desktop icons, control panel objects, operating system types, file management, creating files and folders, exploring folders, programs, editing document files.

UNIT II: Introduction to Computer Networks

Computer networks, intranet, surfing the internet, internet service providers (ISPs), connection types, search engines, email protocols, virtual communities, social networks, web-based tools.

UNIT III: Components of Computer and Printers

Computer hardware, power supplies, motherboards, internal PC components, external ports, cables, input and output devices, select computer components, printers, installing and configuring printers, printer options, default settings, optimizing printer performance, sharing printers, print servers.

UNIT IV: Computer Assembly

Assembling the computer, install the motherboard, install drives, install cables, install adapter cards, BIOS beep codes, BIOS setup, UEFI configuration, upgrade and configure a computer, storage devices, and peripheral devices.

UNIT V: Preventive Maintenance and Troubleshooting

PC preventive maintenance, benefits of maintenance, maintenance tasks, cleaning the case, cleaning internal components, inspecting internal components, identifying the problem, establishing probable cause, testing the theory, plan of action, implementing the solution.

UNIT VI: Current Contours (For CIA Only)

Safe lab procedures, procedures to protect equipment, procedures to protect data, proper use of tools, software tools, antistatic wrist strap, computer disassembly, maintaining and troubleshooting printers, troubleshooting printer issues, common

problems and solutions.

REFERENCES

1. Introduction to IT essentials Version 6 by CISCO
2. Fundamentals of Computers by Balagurusamy, McGraw Hill by: Balagurusamy
3. Fundamentals of computers by Rajaraman
4. Computer Fundamentals Course back by Anita Goel
5. Computer Fundamentals 6th Ed by P.K. Sinha
6. Fundamentals of Computers by Rajaraman V

COURSE OUTCOME

CO1: Explain the functional organization of computer hardware and manage files, folders, and system settings across various operating systems.

CO2: Navigate computer networks and utilize internet-based tools, search engines, and communication protocols for professional collaboration.

CO3: Configure, install, and optimize internal hardware components and imaging devices (printers) in a networked environment.

CO4: Execute a complete computer assembly/disassembly process, including the configuration of BIOS/UEFI and adapter cards.

CO5: Implement preventive maintenance plans and apply logical troubleshooting steps to identify and resolve hardware and peripheral failures.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	M	M	M	L	M
CO2	S	S	M	M	S	M	M	M	M	S
CO3	M	S	S	S	S	M	M	S	M	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	M	S	S	S	S	M	S	S	S	M

COURSE OBJECTIVES

- To understand the fundamental principles of evidence collection and speed estimation at motor vehicle and railway accident sites.
- To learn technical methods for analysing vehicle dynamics and distinguishing between genuine and fraudulent injury patterns.
- To study the forensic interpretation of tachograph records and digital recording devices to verify speed and route data.
- To recognize the legal statutes and reporting protocols governing formal accident investigations and courtroom admissibility.
- To analyse scientific theories of causation to systematically identify the human and mechanical root causes of accidents.

UNIT – I: Motor Vehicle Accident Scene

Sources of Forensic information. Eyewitness accounts, Locard's principle. Extent of vehicle damage. Examination of vehicular lights, Visibility conditions. Photographs of accident site. Introduction to Photogrammetry and Scene Mapping. Estimation of speed. Tyre marks, skid marks, scuff marks. Maintenance of vehicles. Abandoned vehicles. Importance of air bags. Railway accidents.

UNIT – II: Accident Analysis

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

UNIT – III: Tachographs: Forensic Significance

Tachograph charts. Principles of chart analysis. Accuracy of speed record. Tyre slip effects. Falsification and diagnostic signals. Route tracing.

UNIT – IV: Legal Procedure

Legal requirements for accident investigations and control. Overview of relevant sections of the Motor Vehicles Act. Accident reporting requirements and procedures. Admissibility of accident reconstruction reports in court.

UNIT – V: Theoretical Basis

Accident causation theory: identifying root causes of accidents. Collecting and analysing information.

UNIT – VI: Current Contours (For CIA Only)

Interview techniques: taking statements from witnesses. Recommending and implementing preventative measures. Disclosure of information. Securing remedial action. Monitoring and review.

REFERENCES

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

COURSE OUTCOMES

CO1: Evaluate accident scenes to identify critical physical evidence like tyre marks, vehicle damage, and visibility factors.

CO2: Reconstruct pre-crash and post-crash movements while detecting potential insurance fraud in injury claims.

CO3: Interpret tachograph charts and electronic records to detect data falsification and ensure route accuracy.

CO4: Comprehend the legal requirements and procedural standards for drafting comprehensive, court-ready accident reports.

CO5: Apply causation theories and human factor analysis to determine the primary reasons for a collision.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	S	M	M	S	S	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	S	S	S	S	S	M	S	S	M	M
CO5	L	S	S	S	S	M	M	S	M	M

COURSE OBJECTIVES

- To understand the nature, types, and legal significance of questioned documents.
- To develop skills in using tools and techniques for forensic document examination.
- To analyse handwriting and recognise class and individual characteristics for identification.
- To compare and evaluate printed, typed, Xeroxed, and charred documents.
- To detect and interpret alterations, forgeries, and counterfeit documents.

Unit – I: Nature and Scope of Questioned Documents

Definition and importance of questioned documents. Types of questioned documents. Preliminary examination of documents. Examples of questioned documents. Introduction to forgery – definition, types, and relevant legal sections.

Unit - II: Tools and Techniques for Document Examination

Basic and advanced tools for forensic document examination: Ultraviolet (UV), Visible, Infrared (IR), and Fluorescence spectroscopy. Photomicrography and microphotography. Video Spectral Comparator (VSC) and Electrostatic Detection Apparatus (ESDA). Determining age and relative age of documents.

Unit - III: Handwriting Examination

Introduction and development of individuality in handwriting. Factors influencing handwriting. Basic Principles of Handwriting. Class and individual characteristics. Natural variations and fundamental divergences in handwriting. Merits and demerits of exemplar and non-exemplar samples. Standards for comparison of handwriting. Forgery detection: alterations, erasures, additions, over-writings, obliterations, disguised writing, and anonymous letters.

Unit – IV: Comparative Procedure of Documents

Comparison of paper, ink, printed, typed, and Xeroxed documents. Examination of toner, grabber marks, defect marks, and individual characteristics in printed documents. Typewriters: introduction, parts, working principle, and forensic examination. Printers: introduction, types, parts, and forensic examination. Examination of charred documents.

Unit - V: Examination of Currency and Official Documents

Characteristic features of Indian currency notes and coins, passports, visas, and stamp papers. Detection and analysis of counterfeit documents. Examination techniques for alterations and forgeries in official documents.

Unit – VI: Current Contours (for CIA Only)

Alterations in documents produced by modern technology, including computer outputs and photocopies. Indented and invisible writings. Advanced techniques for

the detection of erasures, additions, overwriting, and obliterations.

REFERENCES

1. O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (2010).
2. A.A. Moenssens, J. Starrs, C.E. Henderson, and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 6 th Edition, Foundation Press, New York (2015).
3. E. David, The Scientific Examination of Documents – Methods and Techniques, 4 th Edition, Taylor & Francis, Hants (2011).
4. R.N. Morris, Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2010).
5. Albert S. Osborn, Questioned Documents, 2nd Edition.

COURSE OUTCOMES

CO1: Understand the types, significance, and legal aspects of questioned documents.

CO2: Apply forensic tools and techniques for the analysis of ink, paper, and documents.

CO3: Analyse handwriting to determine individuality and detect forgeries.

CO4: Compare printed, typed, Xeroxed, and charred documents for forensic evaluation.

CO5: Detect alterations, erasures, and counterfeit documents using standard and modern techniques.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	L	M	M	M	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	M	S	S	S	S	M	M	S	S	M

COURSE OBJECTIVES

- To understand the properties, analysis, and forensic significance of petroleum and petroleum products.
- To study fire chemistry, fire scene investigation, and methods for analysing arson evidence.
- To understand the classification, behaviour, and investigation of explosives, including post-blast analysis.
- To learn the fundamentals of toxicology, types of poisons, their effects, and methods of detection.
- To understand the analysis, identification, and forensic implications of narcotics, drugs, and psychotropic substances.

Unit - I: Petroleum and Petroleum Products

Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Analysis of petroleum products. Analysis of traces of petroleum products in forensic exhibits. Comparison of petroleum products. Adulteration of petroleum products.

Unit - II: Arson cases and Investigation

Chemistry of fire. Conditions necessary for fire. Fire scene patterns and behaviour. Determination of the point of ignition. Recognition and classification of fire types. Fire scene search techniques. Collection and preservation of arson evidence. Analysis of fire debris. Detection and analysis of ignitable liquid residues. Post-flashover effects. Scientific evaluation of clue materials. Interpretation of smoke staining.

Unit - III: Explosives and Explosive Investigation.

Classification of explosives: low and high explosives. Improvised explosive devices (IEDs). Military explosives. Blasting agents. Synthesis and properties of TNT, PETN, and RDX. Explosion dynamics. Blast waves and their effects. Bomb scene management and investigation. Searching techniques at explosion sites. Mechanisms of explosion. Collection and analysis of post-blast residues. Assessment of blast injuries. Detection of concealed explosives.

Unit - IV: Basics of Toxicology and Poisons

Significance of toxicological findings. Techniques and methods employed in toxicology. Post-mortem toxicology. Dose-response relationships. Determination of lethal dose 50 (LD₅₀). Classification of poisons and their physico-chemical properties and mechanisms of action. Accidental, suicidal, and homicidal poisonings. Signs, symptoms, and antidotes for common poisons. Collection and preservation of viscera, blood, and urine for toxicological analysis. Metabolism and excretion pathways of poisons.

Unit - V: Analysis of Narcotics, Drugs, and Psychotropic Substances (NDPS)

Definition and scope of narcotics, drugs, and psychotropic substances. Broad classification into narcotics, stimulants, depressants, and hallucinogens. Designer drugs. Tolerance, addiction, and withdrawal effects of narcotics, drugs, and psychotropic substances. Clandestine drug laboratories. Collection, handling, and preservation of drug evidence. Testing and analysis of narcotics, drugs, and psychotropic substances. Isolation and purification techniques, including thin-layer chromatography (TLC), gas-liquid chromatography (GLC), and high-performance liquid chromatography (HPLC). Presumptive and screening tests. Microcrystalline tests for identification of drugs of abuse.

Unit – VI: Current Contours (for CIA Only)

Drugs and driving, Dope tests. Postmortem toxicological analysis of narcotics, drugs, and psychotropic substances in blood and tissues. Influence of postmortem changes on drug stability and interpretation of toxicological results. Emerging challenges in forensic toxicology. Case studies in forensic toxicology.

REFERENCES

1. J D DeHaan, Kirk's Fire Investigation, 5 th Edition, Prentice Hall, New Jersey (2015).
2. A.A. Moenssens, J. Starrs, C. E. Henderson and F. E. Inbau, Scientific Evidence in Civil and Criminal Cases, 8 th Edition, The Foundation Press, Inc., New York (2013).
3. R. Saferstein, Criminalistics, 12 th Edition, Prentice Hall, New Jersey (2017).
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5. W. J. Tilstone, M. L. Hastrup, and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
6. F. G. Hofmann, A Handbook on Drug and Alcohol Abuse, 4th Edition, Oxford University Press, New York (2010).
7. S. B. Karch, The Pathology of Drug Abuse, CRC Press, Boca Raton (2013). A. Poklis, Forensic toxicology in, Introduction to Forensic Sciences, 5th Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (2015).
8. W.J. Tilstone, M.L. Hastrup, and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

COURSE OUTCOMES

CO1: Understand the properties, collection, and forensic significance of petroleum products.

CO2: Apply knowledge to analyse fire scenes and evaluate arson evidence.

CO3: Analyse explosives and post-blast residues for forensic investigation.

CO4: Apply toxicological principles for the detection and interpretation of poisons.

CO5: Understand the analysis of narcotics, drugs and psychotropic substances in forensic cases.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	M	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	M	S	S	S	S	M	M	S	S	M

COURSE OBJECTIVES

- To understand the legal framework of forensic medicine and the basics of personal identification.
- To study the biological changes after death and the procedures of medico-legal autopsies.
- To classify and interpret mechanical, firearm, and thermal injuries for forensic analysis.
- To examine the signs of asphyxial deaths and the legal aspects of forensic obstetrics.
- To learn the protocols for sexual offence examinations and the basics of forensic psychiatry.

UNIT – I: Basics of Forensic Medicine & Jurisprudence

Definition, history, and scope of Forensic Medicine. Legal procedures in India: Medical Jurisprudence. Role of the first responding officer: protecting the scene, recording dying declarations. Approaching and documenting a death crime scene. Medical certification and the preparation of medico-legal reports. Personal Identification: parameters of race, religion, sex, age, and stature.

Unit – II: Death & Post-Mortem Investigations

Definition and types of death: natural, unnatural, and suspended animation. Modes of death: Coma, Syncope, and Asphyxia. Post-mortem changes: Rigor Mortis, Cadaveric Spasm, Putrefaction, Mummification, and Adipocere formation—determination of time since death. Handling buried body cases: search methods and exhumation. Medico-legal autopsy: external/internal examination, collection, and preservation of viscera.

Unit – III: Injuries

Definition and classification of injuries. Mechanism of injury: abrasions, bruises, lacerations, incised, and stab wounds. Distinguishing Antemortem vs. Post-mortem injuries. Ageing of injuries (healing stages). Firearm injuries: entry/exit wounds and ballistics. Thermal injuries: burns, scalds, electricity, and lightning. Forensic significance of defence wounds and self-inflicted (artificial) injuries.

Unit – IV: Asphyxial Deaths & Forensic Obstetrics

Violent asphyxial deaths: hanging, strangulation, suffocation, and drowning. Medico-legal aspects of death from starvation, heat, and cold. Forensic Obstetrics: Abortion (MTP Act), Infanticide, and Foeticide. Determination of live birth (Hydrostatic test) and developmental stages of the foetus. Causes of death in the newborn and sudden infant death syndrome (SIDS).

Unit – V: Sexual Offences & Forensic Psychiatry

Legal definitions and examination of Natural sexual offences and Unnatural sexual offences. Examination of the victim and the accused. Forensic Psychiatry:

definitions and classification of mental illness (Psychosis, Schizophrenia). Civil and criminal responsibility of the mentally ill; the McNaghten Rules. Restraint and discharge of mentally ill patients.

Unit – VI: Current Contours (for CIA Only)

Forensic Odontology, Mass Disaster Management, Psychological Autopsy, Virtopsy, and Explosive and blast injuries.

REFERENCES

1. Sharma, B.R., Forensic Science in Criminal Investigation and Trials (3rdEdn.) Universal Law Publishing Co. Ltd. New Delhi.
2. Modi, Jaishring P, Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Pub. 2001.
3. Parikh, Textbook of Medical Jurisprudence & Toxicology, 2001.
4. K. Smyth, The Cause of Death, Van Nostrand and Company, New York (2010)
5. J. Dix, Handbook for Death Scene Investigations, CRC Press, Boca Raton (2010).

COURSE OUTCOMES

CO1: Apply relevant IPC sections and document death crime scenes accurately.

CO2: Estimate the time since death and manage the collection of post-mortem evidence.

CO3: Distinguish between different types of wounds and determine their forensic origin.

CO4: Identify causes of asphyxia and determine the live-birth status of a foetus.

CO5: Evaluate sexual assault cases and assess the legal sanity of a suspect.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	M	S	M	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	M	S	M	M
CO5	S	S	S	S	S	M	S	S	M	M

Year: Third

CORE COURSE 7

Semester: V

Code:

**CYBER CRIME
(Theory)**

Credits: 4

COURSE OBJECTIVES

- To understand the fundamental nature, history, and classification of cybercrimes against various targets.
- To identify the technical methods, malware types, and infrastructure-level attacks used in cybercrime.
- To analyse the mechanisms of identity-based, economic, and behavioural offences in digital environments.
- To learn the procedural roles of law enforcement and the critical steps in incident response.
- To gain a comprehensive understanding of the IT Act 2000 and its legal applications in India.

UNIT – I: Basics and Nature of Cyber Crimes

Definition, History, and Scope of Cyber Crimes. Characteristics and Motives of Cyber Crime. Recognising and Defining Computer Crime. Classification of cybercrime: against Individuals, Organizations, and Society. Cyber Laws and Ethics.

UNIT – II: Modes and Manner of Cyber Crime

Methods of committing Cyber Crime: Cracking and Hacking. Data-level attacks: Data Theft and Data Diddling. Network attacks: Email bombing, Salami attacks, DOS & D-DOS attacks. Malware types: Virus/worm attacks and Logic bombs. Infrastructure crimes: Internet time theft, electronic eavesdropping, and Cyber-squatting.

UNIT – III: Behavioural and Identity-Based Crimes

Identity crimes: Password sniffing, Spoofing, Masquerading, and Identity theft. Behavioural offences: Cyber stalking, Cyber Bullying, Cyber venting, and Cyber defamation. Online fraud: Email Scams (Phishing/Credit Card), Online gambling, and Cyber laundering. Industrial Espionage and Illegal trafficking.

UNIT – IV: Law Enforcement and Incident Response

Law Enforcement Roles and Responses. Incident Response and the Role of the First Responder. Digital crime scene evaluation process. Introduction to Digital Evidence: Types of Digital Evidence and the Chain of Custody. Legal Procedure to gather information from Outside India.

Unit – V: The Information Technology Act (2000)

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

UNIT – VI: Current Contours (For CIA Only)

Digital Piracy, Patent & Copyright Infringement, Child Pornography, Cyber Terrorism, Steganography, Dark Web Crimes.

REFERENCES

1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, Computer Crimes and Computer Forensics, Select Publishers, New Delhi (2003).
2. C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey (1997).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. E. Casey, Digital Evidence and Computer Crime, Academic Press, London (2000).
5. Richard Nolan et al., First Responder's Guide to Computer Forensics, Carnegie Mellon (2005).
6. Information Technology Act (2000) and its Amendments.
7. Kelvin Mandia, Incident Response and Computer Forensics, TMH Publication.

COURSE OUTCOMES

CO1: Classify cybercrimes by motive and target within an ethical and historical framework.

CO2: Identify technical attack vectors, including malware, Salami attacks, and D-DOS mechanisms.

CO3: Detect identity-based fraud and behavioural offences such as stalking and cyber defamation.

CO4: Execute first responder protocols while maintaining the legal chain of custody for evidence.

CO5: Apply the IT Act 2000 and its amendments to evaluate legal cybercrime case studies.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	M	L	M	M	M	M
CO2	L	S	S	S	S	L	M	S	M	M
CO3	M	S	S	S	M	L	M	S	M	M
CO4	M	S	S	S	S	M	S	S	S	M
CO5	M	S	S	S	S	M	M	S	M	S

COURSE OBJECTIVES

- To understand the biological structure of DNA and the laboratory methods for its extraction and quantification.
- To study the mechanisms of PCR, RFLP, and STR in the individualisation of biological evidence.
- To analyse the principles of heredity and Bayesian logic used in disputed paternity cases.
- To learn the techniques for personal identification and the recovery of unrecognisable remains.
- To apply Mendelian laws and mathematical models to forensic reporting and population genetics.

UNIT – I: Basic Principles: DNA as Biological Blueprint of Life

DNA as biological blueprint of life. Extraction, amplification and identification of STR alleles using a genetic analyser. Quantitation of DNA – yield gel quantitation and slot blot quantitation. Mitochondrial DNA – sequence analysis.

UNIT – II: Forensic DNA Typing & Collection of Specimens

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

UNIT – III: Parentage Testing & Heredity

Principles of heredity and the genetics of paternity. DNA testing protocols for disputed paternity cases. Bayes Theorem in analysis and its specific applications in DNA forensics.

UNIT – IV: Personal Identification

Methods for individual identification. The role of DNA typing in identifying unrecognisable bodies. Application of DNA profiling in forensic anthropology and human remains.

UNIT – V: Models & Reporting

Mendelian laws of parentage testing. Mathematical basis of parentage identification. Investigation of missing body cases. Preparation and structuring of technical DNA forensic reports.

UNIT – VI: Current Contours (For CIA Only)

Reference populations and databases. Allele frequency determination. Hardy-Weinberg law. Probability determination in a population database. Applications of DNA databases in forensic investigations.

REFERENCES

1. J M Butler, Advanced topics in Forensics DNA typing - Methodology
2. J M Butler, Fundamentals of Forensic DNA typing
3. J M Butler, Forensic DNA typing - Biology, Technology and Genetics of STR markings
4. J M Butler, Advanced topics in Forensics DNA typing – Interpretation
5. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

COURSE OUTCOMES

CO1: Understand the extraction and quantification processes for both nuclear and mitochondrial DNA.

CO2: Recognise the technical significance of PCR and RFLP in the forensic individualisation of evidence.

CO3: Evaluate disputed paternity cases using principles of heredity and Bayesian analysis.

CO4: Apply DNA profiling techniques for personal identification and identifying missing persons.

CO5: Utilise mathematical models and Mendelian laws to interpret results and draft forensic reports.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	M	M	M	S	M
CO2	L	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	S	S	S	S	S	M	S	S	S	M

Year: Third

CORE PRACTICAL 5

Semester: V

**Code: FORENSIC CHEMISTRY AND TOXICOLOGY
LABORATORY
(Practical)**

Credits: 4

COURSE OBJECTIVES

- To develop practical skills in the analysis of petroleum products.
- To acquire hands-on experience in separating and identifying explosive substances.
- To learn procedures for documenting and reporting bomb scenes.
- To gain competence in identifying organic poisons and alcohol in biological samples.
- To develop skills for the identification and differentiation of narcotics, drugs, and psychotropic substances.
- To prepare professional toxicological and forensic reports based on practical findings.

LIST OF EXPERIMENTS

1. To carry out an analysis of Petrol.
2. To carry out an analysis of diesel.
3. To carry out an analysis of kerosene oil.
4. To separate explosive substances using thin-layer chromatography.
5. To prepare a case report on bomb scene management.
6. To identify organic poisons.
7. To identify ethyl alcohol.
8. To identify drugs of abuse by spot tests.
9. To differentiate drugs of abuse by thin-layer chromatography.
10. To prepare a toxicological report on poison cases.

COURSE OUTCOMES

CO1: Apply analytical techniques to identify and compare petroleum products.

CO2: Perform separation and detection of explosive substances using chromatography.

CO3: Demonstrate proper procedures for bomb scene investigation and reporting.

CO4: Differentiate and identify drugs of abuse using spot tests and thin-layer chromatography.

CO5: Prepare accurate and professional toxicological and forensic case reports.

MAPPING OF CO-PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	S	M	M	S	S	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	S	S	S	S	S	M	S	S	S	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	S	S	M	S	M	M	S	M	S	M

COURSE OBJECTIVES

- To examine the functional relationship between computer hardware architecture and the digital encoding of information.
- To analyse the design, security frameworks, and data lifecycle management of major operating systems from a forensic perspective.
- To understand the scientific basis of file system structures and the procedural requirements for integrity-aware data acquisition.
- To study the theoretical aspects of network communication, internet artefacts, and the mechanisms of digital threat mitigation.
- To develop a conceptual understanding of computational logic and the principles of structured data organisation for investigations.

UNIT – I: Computer Architecture and Data Encoding

Principles of Computer Hardware: Functionality of the CPU, Memory hierarchy (RAM), and Storage media. Logic of Input/Output operations. Data Representation: Conceptual basis of ASCII and Unicode. Characteristics and internal structures of forensic file formats (.docx, .csv, .log, .jpeg).

UNIT – II: Operating System Architecture

Theoretical comparison of Windows, Linux, and macOS environments. OS Security Models: User permissions and system hardening in Windows and UNIX. Data Lifecycle: The internal mechanics of file deletion and the forensic significance of temporary storage repositories (Recycle Bin).

UNIT – III: Data Storage and Acquisition Theory

File System Theory: Structural analysis of FAT32 vs. NTFS. Physical vs. Logical disk storage. Concepts of Digital Preservation: Principles of bit-stream imaging and the methodology of data capture in forensic investigations.

UNIT – IV: Network Communication and Cyber Threats

Fundamentals of network traffic and packet theory. Forensic artefacts of internet activity: Examining the nature of browsing history and cache. Cybersecurity Principles: Taxonomy of Phishing attacks and the functional role of Firewalls and Antivirus in threat mitigation.

UNIT – V: Computational Logic and Data Organization

Algorithmic Thinking: Concepts of searching and sorting logic. Visualising processes through flowcharts. Principles of Relational Database Management Systems (RDBMS): Data normalisation and the role of structured queries in organising investigative data.

UNIT – VI: Current Contours (For CIA Only)

Standards for Forensic Case Documentation. Theory of Data Recovery: Understanding undelete utilities. Temporal Forensics: Significance of timestamps

and metadata integrity. Introduction to Programming Logic: Variables, control structures (loops), and the role of scripting in automated data parsing.

REFERENCES

1. Nelson Phillips, Christopher Steuart and Andrew Clark. *Guide to Computer Forensics and Investigations*. Cengage Learning. 2019.
2. Bill Nelson, Amelia Phillips and Christopher Steuart. *Guide to Computer Forensics and Investigations*. Course Technology. 2015.
3. Abraham Silberschatz, Peter B. Galvin and Greg Gagne. *Operating System Concepts*. Wiley. 2018.
4. William Stallings. *Computer Organization and Architecture: Designing for Performance*. Pearson. 2019.
5. Elmasri Ramez and Shamkant B. Navathe. *Fundamentals of Database Systems*. Pearson. 2017.
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein. *Introduction to Algorithms*. MIT Press. 2022.
7. Brian Carrier. *File System Forensic Analysis*. Addison-Wesley Professional. 2005.
8. Jason Andress. *The Basics of Information Security: Understanding the Fundamentals of InfoSec in Theory and Practice*. Elsevier. 2019.
9. Daniel J. Solove and Paul M. Schwartz. *Information Privacy Law*. Wolters Kluwer. 2021.
10. Keith J. Jones, Richard Bejtlich and Curtis W. Rose. *Real Digital Forensics: Computer Security and Incident Response*. Addison-Wesley Professional. 2006.

COURSE OUTCOMES

CO1: Explain the internal functions of hardware components and how character encoding schemes represent forensic data formats.

CO2: Contrast the security models and file management behaviours of Windows and UNIX-based systems during a digital investigation.

CO3: Describe the technical differences between FAT32 and NTFS file systems and the core requirements for forensically sound imaging.

CO4: Identify the signatures of network-based attacks and explain the forensic significance of web-based activity artefacts.

CO5: Construct logical algorithms for data processing and understand how relational databases are used to index complex evidence.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	L	M
CO2	M	S	S	S	S	M	M	S	M	M
CO3	L	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	M	S	S	S	S	M	M	S	S	M

COURSE OBJECTIVES

- To understand the fundamental characteristics of digital evidence and its role within the forensic investigation lifecycle.
- To learn the diverse origins of digital data and the technical differences between volatile and non-volatile storage.
- To study the legal statutes and standards that govern the reliability and relevance of digital evidence in court.
- To master the procedural standards for the secure collection, imaging, and systematic documentation of electronic evidence.
- To analyse the mechanisms required to ensure the long-term integrity and continuity of digital evidence.

UNIT – I: Introduction to Digital Evidence

Definition and types of digital evidence (text, multimedia, metadata, logs). Role in civil and criminal cases. Comparison between digital and physical evidence. Overview of the investigation lifecycle.

UNIT – II: Sources of Digital Evidence

Common sources: computers, mobile devices, and cloud services. Extraction of browser history, emails, and chat logs. Differentiating between volatile and non-volatile data.

UNIT – III: Admissibility and Legal Aspects

Key laws governing digital evidence: Indian Evidence Act and IT Act. Understanding authenticity, reliability, and relevance. The role of expert witnesses in digital forensics.

UNIT – IV: Evidence Handling & Documentation

Standard procedures for collection and labelling. Introduction to digital imaging and write-blockers. Best practices for documentation: evidence forms, timestamps, and investigator notes.

UNIT – V: Preservation and Chain of Custody

Principles of evidence preservation and storage methods. Establishing and maintaining a secure Chain of Custody. Importance of audit trails and legal implications of broken chains.

UNIT – VI: Current Contours (For CIA Only)

NIST and ISO guidelines for digital evidence. Advanced analysis: Memory dumps, encrypted files, and hidden data. Legal precedents and the Daubert standard. Digital Evidence Management Systems (DEMS) and real-world case studies.

REFERENCES

1. Bill Nelson, Amelia Phillips, Christopher Steuart. Guide to Computer Forensics and Investigations. Cengage Learning. 2019.
2. Eoghan Casey. Digital Evidence and Computer Crime. Academic Press. 2011.
3. Albert J. Marcella Jr. Foundations of Digital Evidence. Wiley. 2008.
4. Eoghan Casey. Handbook of Digital Forensics and Investigation. Academic Press. 2009.
5. Gerard Johansen. Digital Forensics and Incident Response. Packt Publishing. 2020.
6. Talat Fatima. Cyber Law and Information Technology. LexisNexis. 2016.
7. Sherri Davidoff, Jonathan Ham. Network Forensics: Tracking Hackers through Cyberspace. Pearson. 2012.
8. Linda Volonino, Reynaldo Anzaldúa. Computer Forensics: Principles and Practices. Pearson. 2008.
9. Irina D. Manta. Digital Evidence and the Use of New Technologies in Evidence. Wolters Kluwer. 2020.
10. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar. Cybercrime and Digital Forensics: An Introduction. Routledge. 2017.
11. Nishesh Sharma. Cyber Forensics in India: A Legal Perspective. LexisNexis. 2021.

COURSE OUTCOMES

CO1: Identify various types of digital evidence and distinguish their unique properties from traditional physical evidence.

CO2: Recognise primary sources of evidence like cloud services and mobile devices while identifying critical data like logs and browser history.

CO3: Comprehend the requirements of the IT Act and the Indian Evidence Act regarding the admissibility of digital findings and the role of an expert witness.

CO4: Apply best practices for using write-blockers and maintaining precise investigator notes and evidence forms.

CO5: Execute a tamper-proof chain of custody and understand the legal consequences of audit trail failures.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	L	M
CO2	L	S	M	M	S	M	M	M	M	M
CO3	M	S	S	S	S	M	M	S	M	M
CO4	M	S	S	S	S	M	S	S	S	M
CO5	S	S	S	S	S	M	S	S	S	M

Year: Third

**SUMMER INTERNSHIP /
INDUSTRIAL ACTIVITY**

Semester: V

Code:

INTERNSHIP

Credits: 2

Course Objective(s):

To provide students with real-world exposure to forensic science practices through hands-on training in forensic laboratories, crime scene units, or related organizations, enhancing their technical skills, professional behaviour, and understanding of the criminal justice system.

Course Outcome(s):

After completing this course, the student will be able to:

Students will understand how forensic science is applied in real investigations, gain hands-on experience with evidence and lab tools, observe professional forensic work, apply classroom knowledge to solve basic forensic problems, and demonstrate ethical behavior and clear communication.

Students are expected to undergo training/internship at any CFSL/SFSL/RFSL/FPB/Private Chemical Examiner's Laboratory/Police Academy/ or any other State, Central, or Private Institution of forensic importance to gain hands-on experience in crime scene investigation and to develop the analytical skills required of a forensic scientist.

- The training/internship should be undertaken during the summer vacation after the second year.
- The report on the training/internship will be based on the work carried out at the Forensic Laboratory and will be evaluated accordingly.
- A certificate confirming the completion of the training must be provided by the respective institution and countersigned by the Head of the Department.
- A well-documented internship report, duly attested by the Course Coordinator and the Head of the Department, must be submitted by *each student* for evaluation on the day of the viva voce examination in the sixth semester.

COURSE OBJECTIVES

- To understand the physical construction of digital storage media and the basics of computer hardware.
- To learn the professional protocols for the forensic seizure and acquisition of digital evidence.
- To study the technical structures of file systems and methods for recovering deleted data.
- To identify operating system artefacts and detect advanced anti-forensic data-hiding techniques.
- To master the skills of technical malware analysis and the structuring of forensic reports.

UNIT – I: Fundamentals of Digital Media

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

UNIT – II: Forensic Seizure and Acquisition

Preparation required before the seizure. Protocol to be taken at the scene. Seizure of suspected computers and magnetic media. Creating a bit-stream of the original media. Volatile Data Acquisition: techniques for acquiring RAM, process lists, and network connections. Tools: FTK Imager and DumpIt.

UNIT – III: File System Forensics & Recovery

Understanding file system structures: FAT, NTFS, and EXT. Analysis of metadata, MFT (Master File Table), and inode analysis. Hidden files and slack space. Data recovery: recovering deleted and fragmented files. File carving techniques using signature analysis. Forensic tools: Autopsy and Sleuth Kit.

UNIT – IV: Artefact and Anti-Forensics Analysis

Exploring OS artefacts: registry hives, event logs, prefetch files, and link (.lnk) files. Analysing startup files and installed software records. Steganography: principles of data hiding in images, audio, and video. Anti-forensic techniques: data wiping, trail obfuscation, and time-stamping attacks.

UNIT – V: Analysis and Technical Reporting

Basic malware analysis: understanding file headers and analysing behaviour in sandbox environments. Password cracking and email tracking. Encryption and decryption methods. Report structuring: writing technical findings, executive summaries, and maintaining the chain of custody documentation.

UNIT – VI: Current Contours (For CIA Only)

Reverse Engineering, Cloud Forensics, Network Forensics, Registry Viewer, Advanced Persistent Threats (APT) Attribution, Tactics, Techniques, and Procedures (TTPs),

REFERENCES

1. Marjie T. Britz. Computer Forensics and Cyber Crime. Pearson. 2012. 7. Gil Azar. APT Attack & Defense: Applied Incident Response and Threat Hunting. BPB Publications. 2021.
2. Albert Marcella, Doug Menendez. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes. CRC Press. 2008.
3. Jessica Fridrich. Steganography in Digital Media: Principles, Algorithms, and Applications. Cambridge University Press. 2009.
4. Deepak Tiwari. Advanced Computer Forensics. Wiley. 2018.
5. Brian Carrier. File System Forensic Analysis. Addison-Wesley. 2005.
6. Shiva V. N. Parasram. Digital Forensics with Kali Linux. Packt Publishing. 2020.

COURSE OUTCOMES

CO1: Understand the hardware fundamentals and network configurations of digital storage systems.

CO2: Know the proper forensic imaging and volatile memory acquisition of digital media.

CO3: Recover deleted files and fragments through file system analysis and carving techniques.

CO4: Detect hidden information and track user activities through system logs and registry analysis.

CO5: Produce technically accurate forensic reports while maintaining the legal chain of custody.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	M	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	L	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	S	S	S	S	S	M	S	S	S	M

COURSE OBJECTIVES

- To understand the biological development of the human skeleton and its role in forensic identification.
- To study the anthropometric and somatoscopic methods used to describe and measure human physical traits.
- To learn the professional protocols for the collection and analysis of dental and bite mark evidence.
- To analyse the technical processes involved in craniofacial superimposition and facial reconstruction.
- To explore the historical and modern biometric systems used for personal individualisation.

UNIT – I: Significance of Forensic Anthropology

Scope and history of Forensic Anthropology. Nature, formation, and structural identification of human bones. Systematic study of the human skeleton. Determination of age and differentiation of sex. Methods for the estimation of stature from skeletal remains. 3D Surface Scanning and digital skeletal analysis.

UNIT – II: Personal Identification – Somatoscopy and Somatometry

Somatoscopy: Morphological observation of the head, forehead, eyes, and nasal structure (root, bridge, tip). Identification through ear lobes, Darwin's tubercle, and supra-orbital ridges. Forensic significance of scar marks and occupational marks. Somatometry: Linear measurements of the face, nose, cheeks, hand, and foot. Calculation of body weight and height. Application of forensic indices: Cephalic, Nasal, Cranial, and Upper Facial indices.

UNIT – III: Facial Reconstruction

Importance and procedural steps in facial reconstruction. Introduction to the Portrait Parl  and the Bertillon system of identification. Modern identification tools: Photofit and Identi-kit. Illustrative case studies. AI-driven automated facial ageing and digital reconstruction.

UNIT – IV: Facial Superimposition Techniques

Principles of Cranio-facial identification. Techniques in Photographic Superimposition. Mechanisms of Video-to-video superimposition. Digital 3D-to-2D skull-to-photo overlay methods. Correlation of skull morphology with living facial features.

UNIT – V: Forensic Odontology

Definition and legal scope of forensic odontology. Comparative study of primary and secondary teeth. Estimation of age through dental development and wear patterns. Procedural dental charting. Analysis of bite marks: collection, preservation, photography, and evidence comparison. Digital Dental Radiography

and Imaging.

UNIT – VI: Current Contours (For CIA Only)

Forensic importance of soft tissue depth in facial reconstruction. Genetic and congenital anomalies: causes, types, and identification. Forensic Taphonomy: environmental effects on bone decomposition.

REFERENCES

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

COURSE OUTCOMES

CO1: Know the fundamental structure of human bones and the methods used to determine age, sex, and stature.

CO2: Understand the procedures for somatometric measurements and the observation of physical traits.

CO3: Recognise the principles of facial reconstruction and the historical significance of the Bertillon system.

CO4: Comprehend the technical mechanisms of photographic and video-based craniofacial superimposition.

CO5: Apply the knowledge of dental charting and bite mark analysis to forensic investigation scenarios.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	S	S	S	L	M	S	M	M
CO2	M	S	S	S	S	M	M	S	M	M
CO3	L	S	M	M	S	L	M	M	M	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	M	S	S	S	S	M	M	S	S	M

COURSE OBJECTIVES

- To understand the basic concepts, scope, and ethical issues in forensic psychology.
- To learn the role of psychology in law and courtroom procedures.
- To understand criminal profiling and psychological aspects of evidence and interrogation.
- To study psychological disorders and their relation to criminal behavior.
- To learn methods and tools used for detecting deception in investigations.

Unit-I: Basics of Forensic Psychology

Definition and fundamental concepts of forensic psychology and forensic psychiatry. Forensic psychology compared to Forensic Psychiatry, the Scope and Goals of forensic psychology and Ethical issues in forensic psychology. Daubert's standard and Frye standard, Mc Naughten rule. Definitions of Sexual Assault and Rape, Typologies of Men Who Rape, The Massachusetts Treatment, Centre Rapist Typology and The Groth Rapist Typology.

Unit-II: Legal Aspects of Forensic Psychology

Psychology and law. Ethical issues in forensic psychology. Psychology in the courtroom, with particular reference to Section 84 IPC. Stages in Judicial Process in forensic psychological cases and competency to stand trial. Assessment of mental competency. Mental disorders and forensic psychology. The legal status of forensic psychological tests in India.

Unit-III: Criminal Profiling

Psychology of evidence – eyewitness testimony, confession evidence. Assessment of false memory, Interrogation and Confession: Reid Techniques in Interrogation of Suspects and PEACE Model. Criminal Profiling: Introduction-Types of profiling: Inductive and Deductive profiling- Process of profiling- FBI profiling stages.

Unit-IV: Psychology and Criminal Behavior

Psychopathology and personality disorder. Psychological assessment and its importance. Psychology of terrorism. The Criminal Psychopath-General Behavioural Characteristics of Psychopaths. Antisocial Personality Disorder Sociopathy and Psychopathy. Criminal Homicide-Multiple Murder, Serial Killers, Mass Murders.

Unit-V: Detection of Deception

Tools for detecting deception – interviews, non-verbal detection, statement analysis, voice stress analyzer, hypnosis. Polygraph: Instrumentation, principles and procedure- Methods of formulation of relevant, irrelevant and control questions- Scoring and analysis. Brain Electrical Oscillation Signature Profiling (BEOS): Principles and procedure- Designing probes: audio and visual. Narco-Analysis: History- Principles and procedure.

UNIT – VI: Current Contours (For CIA Only)

Psychology Behind Online Scams and Digital Fraudsters, Impact of Social Media Addiction on Aggressive Behaviour, Cybercrime and the Changing Mindset of Criminals, Influence of Movies and Web Series on Criminal Behaviour, Peer Pressure and Youth Involvement in Crime, Use of Artificial Intelligence in Crime Detection, Challenges in Detecting Lies Without Technology, Gender-Based Violence in Modern Society: A Psychological View, Mob Lynching and Crowd Psychology in India.

References:

1. Bartol, C., & Bartol, A. (2012). Introduction to Forensic Psychology: Research and Application (Third ed.). London: SAGE.
2. Gordon, N. Essentials of Polygraph and Polygraph Testing. Boca Raton: CRC Press.
3. Howitt, D. (2009). Introduction to Forensic and Criminal Psychology (Third ed.). England: Pearson Education Limited.
4. Sadock, B., Sadock, V., & Ruiz, P. (2015). Synopsis of Psychiatry (Eleventh ed.). Philadelphia: Wolters Kluwer.
1. Towl, G., & Crighton, D. (2010). Forensic Psychology. Oxford: Blackwell Publishing Ltd.
2. Anderson, G. (2011). Biological Influences on Criminal Behavior. Boca Raton: CRC Press.

Course Outcome

CO1: Explain fundamental concepts and legal standards used in forensic psychology.

CO2: Understand legal provisions and assess mental competency in cases.

CO3: Analyze criminal behavior using profiling and interrogation techniques.

CO4: Identify different criminal behaviors and personality disorders.

CO5: Understand and evaluate techniques like polygraph, BEOS, and narco-analysis.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	L	M	M	L	M
CO2	M	S	S	S	S	M	M	S	M	M
CO3	M	S	S	S	S	M	M	S	M	M
CO4	L	S	S	S	M	L	M	S	M	M
CO5	M	S	S	S	S	M	M	S	S	M

Course Objectives:

To develop research skills by applying forensic science concepts to investigate and analyze a specific forensic problem or topic.

Course Outcome:

After completing this course, the student will be able to:

By the end of the course, students will be able to choose and design a forensic research project, collect and analyze relevant data, solve research problems, and draw meaningful conclusions. They will also develop skills to write clear, well-structured reports and confidently present their findings.

- Students are required to undertake project work on problems pertaining to Forensic Science 6th Semester. Project work should be done as an extension of topics in the syllabus. Scientific study on the topic selected is required to be carried out under the supervision and guidance of faculty members. Project work may be done individually or as group of maximums of four students.
- A part of the project may be done in collaboration (association) with any of the CFSL/FSL/RFSL/FPB/Chemical Examiner's Laboratory/ Police Academy/ Any other State or Central Institutions of Forensic importance. The hours spent for the project work in any of the above-mentioned institutions shall be counted for the percentage of attendance, provided that the attendance certificate shall be produced from the institution. Each student must actively participate in the project work. The problem/ topic chosen by an earlier batch of students for their project work shall not be repeated by a latter batch.
- A certificate to this effect must be attached by the Head of the department. A well-documented project report duly attested by the supervising teacher and the Head of the Department must be submitted by *each candidate* for evaluation separately on the day of examination – viva voce during VIth semester. The research project must contain the following sections.
 1. *Introduction and Significance of Study*
 2. *Review of Related Literature*
 3. *Methodology.*
 4. *Interpretation of Results*
 5. *Summary & Conclusion*
 - *Reference & Appendices*

COURSE OBJECTIVES

- To understand the internal architecture and security frameworks of major mobile operating systems.
- To learn the standard procedures for the secure seizure and preservation of mobile devices and storage media.
- To study various data acquisition methods and the technical tools used to extract information from mobile hardware.
- To analyse application artefacts and database files to recover user communication and location history.
- To master the use of forensic toolkits and the formal documentation required for presenting mobile evidence in court.

UNIT – I: Mobile OS and Architecture

Understanding Android and iOS architecture, boot sequence, and file systems. Sandboxing and permission models. System partitions and user data structures. Basics of encryption and secure boot.

UNIT – II: Mobile Evidence Collection

Handling and preserving mobile devices (live vs. powered off). SIM, SD card, and internal memory handling. Using Faraday bags and isolation techniques. Chain of custody documentation for mobile evidence.

UNIT – III: Logical and Physical Acquisition

Techniques for logical acquisition (ADB, MTP, iTunes backup). Physical acquisition overview: chip-off and JTAG methods. Data integrity and hashing. Introduction to tools like Cellebrite UFED and Magnet AXIOM.

UNIT – IV: App and Network Artifact Analysis

Recovery of chat logs, call logs, and browsing history. Analysing SQLite databases and plist files. Extraction of GPS data and media files. Basic analysis of cached files and cloud sync data.

UNIT – V: Toolkits and Report Generation

Overview of commercial and open-source tools (Cellebrite, Oxygen, Autopsy). Automated vs. manual reporting. Legal report structure and writing expert opinions. Evidence correlation and maintaining report integrity.

UNIT – VI: Current Contours (For CIA Only)

Rooting and jailbreaking concepts. Forensic implications of OS updates and custom ROMs. Anti-forensics detection. Network traffic analysis for app communication. VoIP and encrypted data handling. Validation and repeatability of tool outputs.

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1. Rohit Tamma, Heather Mahalik, Satish Bommisetty. Practical Mobile Forensics. Pack Publishing. 2020.
2. Mattia Epifani, Pasquale Stirparo. Learning iOS Forensics. Packt Publishing. 2015.
3. Iosif I. Androulidakis. Mobile Phone Security and Forensics. Springer. 2012.
4. Heather Mahalik, Rohit Tamma, Satish Bommisetty. Mobile Forensics: Advanced Investigative Strategies. Packt Publishing. 2016.
5. Andrew Hoog. Android Forensics. Syngress. 2011.
6. Lee Reiber. Guide to Mobile Forensics. Cengage Learning. 2017.
7. Michael Hale Ligh, Andrew Case, Jamie Levy, A. Walters. The Art of Memory Forensics. Wiley. 2014.
8. Shiva V. N. Parasram. Digital Forensics with Kali Linux. Packt Publishing. 2017.
9. Eoghan Casey. Digital Evidence and Computer Crime. Academic Press. 2011.
10. Lee Reiber. Mobile Device Forensics: A Guide for Investigators. Academic Press. 2016.

COURSE OUTCOMES

CO1: Identify the structural differences between Android and iOS and understand their impact on forensic accessibility.

CO2: Execute proper evidence collection protocols using isolation techniques to prevent data contamination.

CO3: Perform logical and physical data extractions while ensuring data integrity through hash verification.

CO4: Extract and interpret data from SQLite databases and system files to reconstruct user activities.

CO5: Generate comprehensive forensic reports that meet legal standards and correlate evidence across multiple mobile sources.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	L	M
CO2	L	S	M	M	S	M	M	M	M	M
CO3	M	S	S	S	S	M	M	S	M	M
CO4	M	S	S	S	S	M	S	S	S	M
CO5	S	S	S	S	S	M	S	S	S	M

COURSE OBJECTIVES

- To understand the fundamental concepts of food safety hazards and the forensic significance of foodborne outbreaks.
- To learn the types of intentional and unintentional food adulterants and common chemical contaminants.
- To study the basic sampling protocols and instrumental methods used for qualitative and quantitative food testing.
- To examine the microbiological profiles of foodborne pathogens and methods for estimating microbial loads.
- To analyse the regulatory frameworks and quality control systems required for national food safety compliance.

UNIT – I: Introduction to Food Safety and Standards

Definitions: Food safety, food quality, and food security. Food safety hazards: Biological, chemical, and physical. Role of forensic science in food safety. Foodborne illnesses and outbreaks.

UNIT – II: Food Contaminants and Adulterants

Intentional and unintentional adulterants in milk, spices, tea, coffee, and cereals. Chemical contaminants: Pesticides and heavy metals. Microbiological contaminants: Bacteria, viruses, and fungi. Natural toxins: Mycotoxins and marine biotoxins.

UNIT – III: Food Testing Methods and Instrumentation

Sampling techniques for food analysis. Qualitative vs. quantitative analysis. Basics of UV-Vis spectroscopy, GC, HPLC, MS, and AAS in food testing.

UNIT – IV: Microbiological Analysis of Foods

Microorganisms in food: Pathogens and spoilage organisms. Indicator organisms: Coliforms, E. coli, and Salmonella. Culture media and incubation techniques.

UNIT – V: Food Quality Control and Regulatory Aspects

Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP). Hazard Analysis and Critical Control Points (HACCP). Role of FSSAI and food testing labs.

UNIT – VI: Current Contours (For CIA Only)

Codex Alimentarius, PFA, ISO 22000. Antibiotics and veterinary drugs. Immunoassays in food testing. Rapid detection: PCR, ELISA, and biosensors. Risk analysis, auditing, and food recall systems.

REFERENCES

1. K. R. Aneja. Modern Food Microbiology. Medtech Pub. 2018.
2. Lynne McLandsborough. Food Microbiology Laboratory. CRC Press. 2004.
3. Mike Adams. Food Forensics. BenBella Books. 2016.
4. Titus A. M. Msagati. Food Forensics and Toxicology. Wiley. 2017.

5. Var L. de St. Jeor. Food Forensics Handbook. DEStech Pub. 2022.
6. Bhatanagar. Commentry on Food Safety Law. 8th Ed. Whyte Pub. 2024.
7. Seth, Capoor. Commentry on Food Safety and Standards Act 2006. 11th Ed. Delhi Law House. 2023.

COURSE OUTCOMES

CO1: Identify various food safety hazards and understand their impact on public health and forensic investigations.

CO2: Detect common adulterants in various food matrices using standard chemical and physical methods.

CO3: Execute precise food sampling and utilise spectroscopic or chromatographic techniques for basic food analysis.

CO4: Perform microbial load estimations to identify indicator organisms and assess the safety of food samples.

CO5: Apply quality control principles (GMP/HACCP) and understand the regulatory role of FSSAI in food inspection.

MAPPING OF CO - PO

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	M	S	L	M	M	M	M
CO2	M	S	S	S	S	M	M	S	S	M
CO3	M	S	S	S	S	M	M	S	S	M
CO4	M	S	S	S	S	M	M	S	S	M
CO5	M	S	M	M	S	M	M	M	M	S