

Annexure- K

**GENERAL INSTRUCTIONS  
&  
COURSE WORK CURRICULUM**

**FOR**

**(Ph. D. Forensic Science)  
(Effective from Academic Session 2024-2025)**



**DEPARTMENT OF FORENSIC SCIENCE  
HIMACHAL PRADESH UNIVERSITY**

**(NAAC Accredited "A" Grade University)**

**SUMMERHILL, SHIMLA-171005 (HP)-India.**

**[www.hpuniv.ac.in/forensic](http://www.hpuniv.ac.in/forensic)**

**CHAIRMAN**  
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**DEPARTMENT OF FORENSIC SCIENCE  
HIMACHAL PRADESH UNIVERSITY  
SUMMER HILL, SHIMLA-171 005  
Ph.D. FORENSIC SCIENCE PROGRAMME**

**PROGRAM OUTCOME**

The Ph.D. in Forensic Science program at the Department of Forensic Science, Himachal Pradesh University encompasses a comprehensive study of foundational research methods, ethical principles, and advanced techniques across various forensic disciplines. It includes rigorous training in experimental design, data collection methods, statistical analysis, and the use of specialized tools like chromatography and spectroscopy for chemical analysis. Students explore the intricacies of forensic biology, DNA analysis, serology, and forensic entomology, alongside forensic medicine and toxicology. The program also covers crucial aspects such as questioned documents, fingerprint analysis, forensic photography, and the examination of physical evidence like firearms, tool marks, and vehicle examination. Emphasis is placed on interdisciplinary perspectives, ethical standards, and legal aspects pertinent to forensic investigations, preparing graduates for leadership roles in research, academia, and forensic practice with a strong foundation in scientific inquiry and application.

**GENERAL INSTRUCTIONS/GUIDELINES FOR EXECUTION OF CURRICULUM**

1. All candidates admitted to the Ph.D. Programme at the Department of Forensic Science must complete a minimum of 12 credits.
2. There will be four (4) courses in the Ph.D. Forensic Science Programme. The students must take 3 compulsory courses [PhDFS-101, PhDFS-102, PhDFS-103] and at least one additional course out of six **elective courses** [PhDFS-104(i), PhDFS-104(ii), PhDFS-104(iii), PhDFS-104(iv), PhDFS-104(v), PhDFS-104(vi)].
3. A Ph.D. scholar must obtain a minimum of 55% marks or its equivalent grade in the UGC 10-point scale in the course work to be eligible to continue in the program and submit his or her thesis.
4. The detailed syllabi for the courses offered by the Department are appended with a list of suggested readings.

**Outline of Ph. D Course Work Forensic Science**

Code	Title of Paper	Max. Marks	Credits
PhDFS-101	Research Methodology (Compulsory)	100	4 Credits
PhDFS-102	Research and Publication Ethics (Compulsory)	50	2 Credits
PhDFS-103	Modern Instrumentations in Forensic Science (Compulsory)	50	2 Credits
Elective any one of the following i.e. Ph. D. FS-104 (i-vi)		100	4 Credits
PhDFS-104 (i)	Forensic DNA, Anthropology & Medicine	100	4 Credits

PhDFS-104 (ii)	Environmental Forensic	100	4 Credits
PhDFS-104 (iii)	Forensic Chemistry, Narcotics & Toxicology	100	4 Credits
PhDFS-104 (iv)	Forensic Biology & Serology	100	4 Credits
PhDFS-104 (v)	Forensic Documents, Photography and Fingerprinting	100	4 Credits
PhDFS-104 (vi)	Forensic Physics and Ballistics	100	4 Credits

**Ph.D. in Forensic Science (Compulsory Course)**  
**COURSE: PhDFS-101**  
**(Common with all disciplines under Faculty of Life Sciences)**  
**Research Methodology**

		L	T	P	C
<i>Theory: 60 Credit Hours</i>		4	0	0	4
		<i>Theory examination: 100 marks</i>			

NOTE: Instructions for setting question paper

Examiner will set **nine** questions in total covering the entire syllabus. However, there will be **one compulsory** question containing twenty parts [One mark each], besides two questions from each of the four Units. The students will attempt **five questions** in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (20 marks each).

**UNIT-I**

**(15 hours)**

**Foundation of Research:** Meaning, objectives of research; criteria of good research; basic steps of research; Qualitative and Quantitative Research.

**Problem Identification & Formulation:** selection of research problems.

**Hypothesis:** Qualities of a good Hypothesis, Null & Alternative Hypothesis, Hypothesis Testing, Logic & Importance

**Review of related literature:** Meaning, necessity and sources.

**Ethical Foundations and Research Integrity**

**UNIT-II**

**(15 hours)**

**Research process and Experiment Design:** Concept and Importance in Research, features of a good research design, Exploratory Research Design concept, types and uses, Descriptive Research Designs concept, types and uses, Concept of Independent & Dependent variables.

**Research Report:** Writing preliminaries, main body of research, references and bibliography

**Research and Development of Projects:** Project formulation, National and international funding agencies for R & D projects, proposal submission, Intellectual Property Right (IPR).

**UNIT-III**

**(15 hours)**

**Sampling:** Meaning and types of sampling; Probability and Non-Probability, Practical considerations in sampling and sample size.

**Tools and Techniques of Data Collection:** questionnaire, schedule, interview, observation, case study, survey etc. statistics and its significance in research.

**Data Analysis:** Frequency distribution, measures of central tendency, measures of dispersion, correlation, regression analysis, test of significance (Z-test, t-test, Chi-square test, F-test).

**UNIT-IV**

**UNIT-IV**

**(15 hours)**

**Use of Tools / Techniques for Research:** Search engines: NCBI, PubMed, Google Scholar, Thomson Reuters, SCI etc, Reference Management Software like Zotero/Mendeley, Software for

4 Credits  
4 Credits  
Credits  
Credits

paper formatting like LaTeX/MS Office. Bioinformatics tools and applications

**Course objectives:**

1. To provide basic framework and guidelines for researchers to clearly and define research problems, hypotheses, and objectives.

**Course learning outcomes:**

1. Will help the researchers to identify the most appropriate research design, sampling technique, and data collection and analysis methods.
2. Researchers will be able to understand and comprehend the basics of research methodology and applying them in their research.

**Suggested books [Latest Edition]**

1. Council of Biology Editors –CRE Style Manual, American Institute of Biological Sciences, Washington. D.C.
2. Effective Writing for Engineers, Managers, Scientists: Tichy AJ.
3. Scientific and Technical papers: Tribcase SF.
4. How to write and publish a scientific paper: Day RA.

**Ph.D. in Forensic Science (Compulsory Course)**  
**COURSE: PhDFS-102**  
**(Common with all disciplines under Faculty of Life Sciences)**  
**Research and Publication Ethics**

L	T	P	C
2	0	0	2

*Theory: 30 Credit Hours*

*Theory examination: 50 marks*

NOTE: Instructions for setting question paper

The examiner will **set nine** questions in total covering the entire syllabus. However, there will be **one compulsory** question containing ten parts [One mark each], besides two questions from each of the four Units. The students will attempt **five questions** in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (10 marks each).

**UNIT-I**

**(8 hours)**

**Philosophy, ethics and scientific conduct:** Introduction to philosophy: definition, nature and scope, concept, branches

**Ethics:** Definition, moral philosophy, Nature of moral judgements and reaction.

**Scientific conduct:** Ethics with respect to science research, intellectual honesty and research integrity; Scientific misconduct: Falsification, fabrication and plagiarism; Redundant publications: Duplicate and overlapping publications, salami slicing; Selective reporting & misrepresentation of data.

**UNIT-II**

**(7 hours)**

**Publication ethics:** Definition, introduction and importance, best practices/ standards setting initiatives and guidelines [COPE, WAME etc.], conflict of interest.

**Publication misconduct:** Definition, concept, problem that lead to unethical behaviour and vice versa, and types; conflict of interest, violation of publication ethics, authorship and contribution ship. Identification of publication misconduct, complaints and appeals.

**UNIT-III**

**(8 hours)**

**Open-access Publishing & publication misconduct:** Open-access publications and initiatives, SHERPA/ RoMEO online resource to check publisher copyright and self-archiving policies, software tools to identify predatory publications developed by SPPU; journal finder/ journal suggestion tools

viz. JANE, Elsevier Journal finder, Springer Journal *etc.*

**Publication misconduct:** Group discussion: Subject specific ethical issues, FFP, authorship; Conflict of interest; complains and appeals: Examples and fraud from India and abroad.

**Software tools:** Use of plagiarism check software's like Turnitin, Urkund and other open-source software tools.

**UNIT-IV**

**(7 hours)**

**Databases and Research metrics:** Databases - Indexing databases, and Citation databases: Web of Science, Scopus *etc.*

**Research Matrices:** Impact factor of a journal as per citation report, SNIP, SJR, IPP, Cite Score & Research Interest (Research Gate).

**matrices:** H-index, I-Index *etc.*

**Course objectives:**

1. To provide students with the fundamental knowledge of basics of philosophy of science, ethics in research and publication.
2. Concept and understanding of predatory publication, indexing, citation databases, open-access publications and research matrices such as citations, h-index, i-index, impact factor, research interest score *etc.*
3. Guide and mentor students in using plagiarism checking tools for a valid and ethical research.
4. To prepare an evaluation report of a manuscript/ article.

**Course learning outcomes:**

1. The students will be able to know and practice ethical principles involved in research work and in publication that will help in maintaining integrity and credibility of scientific literature.

**Suggested books [Latest Edition]**

1. The Ethics of Teaching and Scientific Research by Miro Todorovich; Paul Kurtz, Sidney Hook.
2. Research Ethics Publication Approaches by Brbara H Stanley; Joan E, Sieber; Gary R. Midbow.
3. Research Methods in Applied Sciences: An Integrated Approach to Design and Analysis by; Morgan Lawrence Erlbaum Associates.
4. Ethics and Values in Industrial –Organizational Psychology by Joel Lefkowitz. Wiley Publishers.

**Ph.D. in Forensic Science (Compulsory Course)**

**COURSE: PhDFS-103**

**Modern Instrumentation in Forensic Science**

L	T	P	C
2	0	0	2

Theory: 30 Credit Hours

Theory examination: 50 marks

NOTE: Instructions for setting question paper

The examiner will **set nine** questions in total covering the entire syllabus. However, there will be **one compulsory** question containing ten parts [One mark each], besides two questions from each of the four Units. The students will attempt **five questions** in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (10 marks each).

**Unit I** Introduction to Forensic Science

**(8 hours)**

Overview of Forensic Science Laboratories: Introduction to types and functions, Need and Scope of Forensic Science, Importance in criminal justice and societal impact, Basic Principles of Forensic Science, Brief discussion on Locard's Exchange Principle, chain of custody, evidence integrity, Branches of Forensic Science; Future and Current Research Perspectives in Forensic Science.

**UNIT-II** Forensic Chemical Analysis Techniques

**(7 hours)**

Chemical Analysis in Forensic Investigations: Introduction to drug analysis and material

Ship- Conflict  
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identification, Chromatographic Techniques: Brief overview of TLC, HPLC, GC, LC-MS etc.; Spectroscopic Techniques: Introduction to UV-VIS, FTIR, AAS, NMR spectroscopy; X-ray techniques in forensic analysis: XRF (X-ray Fluorescence), XRD (X-ray Diffraction)

<b>UNIT-III</b>	<b>Biological Analysis in Forensic Science</b>	<b>(7hours)</b>
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Electrophoretic Techniques: Introduction to theory, Types, principles, and applications; DNA Fingerprinting: Brief overview of PCR and its types, Combined DNA Index System (CODIS), Short Tandem Repeat (STR) & mitochondrial DNA analysis, Next-Generation Sequencing (NGS) etc.; Microbial Forensics: Introduction to identifying and analysing microbial evidence.

<b>UNIT -IV</b>	<b>Physical Analysis in Forensic Science</b>	<b>(7 hours)</b>
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Role of Microscopy: Brief overview of light, scanning microscopes and Comparison Microscopy; Fingerprint Identification: Introduction to AFIS and profiling techniques; Video spectral comparator (VSC); Digital Forensics: Brief overview of advanced computer and cyber forensic tools; Forensic Psychological techniques and their legal prospectus, Methods of Criminal.

**Course objectives:**

1. Understand the foundational principles and scope of forensic science, including its role in criminal justice and societal impact.
2. Identify and explain the various branches of forensic science and their specific functions and applications.
3. Explore advanced techniques in chemical analysis for forensic investigations, including chromatography and spectroscopy.
4. Analyze biological evidence using electrophoretic techniques, DNA fingerprinting methods, and microbial forensic approaches.
5. Examine physical evidence through microscopy, fingerprint identification systems, digital forensics tools, and psychological techniques applied in forensic contexts.

**Course learning outcomes:**

At the end of the course, students will:

1. Acquire expertise in chemical analysis methods like chromatography and spectroscopy for forensic investigations.
2. Develop proficiency in biological analysis techniques, including DNA fingerprinting and electrophoresis, vital for identifying and examining biological evidence.
3. Master physical analysis approaches such as microscopy, fingerprint identification, and digital forensics for comprehensive forensic examination.
4. Understand the critical role of forensic science in the criminal justice system, emphasizing evidence integrity and legal considerations.
5. Stay informed about emerging research avenues in forensic science to adapt to evolving investigative methodologies and technological advancements.

**Suggested books [Latest Edition]**

1. Forensic Science: An Introduction to Scientific and Investigative Techniques" by Stuart H James, Jon J. Nord, and Suzanne Bell
2. Criminalistics: An Introduction to Forensic Science" by Richard Saferstein
3. Forensic Chemistry by Suzanne Bell
4. Forensic Biology by Richard Li
5. Forensic Microbiology by David O. Carter
6. Principles of Forensic Toxicology by Barry Levine

**Ph.D. in Forensic Science (Elective Course)**  
**COURSE: PhDFS-104-i**  
**Forensic DNA, Anthropology & Serology**

*Theory: 60 Credit Hours*

L	T	P	C
4	0	0	4

*Theory examination: 100 marks*

NOTE: Instructions for setting question paper

Examiner will **set nine** questions in total covering the entire syllabus. However, there will be **one compulsory** question containing twenty parts [One mark each], besides two questions from each of the four Units. The students will attempt **five questions** in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (20 marks each).

<b>Unit-I</b>	<b>Forensic DNA Analysis</b>	<b>(15 hours)</b>
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Introduction to Forensic DNA Analysis: Principles and significance of DNA analysis in forensic science, Overview of DNA extraction, amplification, and profiling techniques; DNA Typing Methods: Polymerase Chain Reaction (PCR) for DNA amplification, Short Tandem Repeat (STR) analysis for DNA profiling, Mitochondrial DNA sequencing and Single Nucleotide Polymorphism (SNP) analysis.

<b>Unit-II</b>	<b>Forensic Anthropology</b>	<b>(15 hours)</b>
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Introduction to Forensic Anthropology: Methods for human skeletal identification, Estimation of age, sex, ancestry, and stature from skeletal remains; Skeletal Trauma Analysis: Identification and interpretation of skeletal trauma patterns, Forensic analysis of blunt force, sharp force, and gunshot injuries.

<b>Unit-III</b>	<b>Serology &amp; Immunology</b>	<b>(15 hours)</b>
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Beverages, their composition and detection of impurities by Alcoholic and nonalcoholic by chemical and instrumental methods. Extraction of Volatile compounds (Solvent Extraction & distillation methods, Headspace-GC). Extraction and isolation of Neutral, nonvolatile compounds, acidic and basic non-volatile compounds from Viscera, blood, urine, and hairs. (Stas-otto method, Dovbriey Nickolls (ammonium sulphate) method, acid digest and Valov (Tungstate) methods. Relevant Sections of Excise Act.

<b>UNIT-IV</b>	<b>Forensic Serology</b>	<b>(15 hours)</b>
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Introduction to Forensic Biology: Principles of forensic biology, importance in criminal investigations, Overview of biological evidence types: blood, saliva, hair, tissue. Blood: Composition and Histology, Examination & Identification of blood, blood stains & Analysis of Blood Pattern, and other body fluids/stains viz. menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail, Secretors and Non-secretors. Serological Techniques: Bloodstain pattern analysis, Identification and characterization of blood groups, Enzyme-linked immunosorbent assay (ELISA) for serological analysis; Forensic Entomology: Role of insects in forensic investigations, Estimation of post-mortem interval using entomological evidence.

**Course objectives:**

1. Understand the principles and significance of DNA analysis in forensic investigations, including techniques for DNA extraction, amplification, and profiling.
2. Explore methods in forensic anthropology for the identification and analysis of human skeletal remains, including estimation of age, sex, ancestry, and stature.
3. Examine serological and immunological techniques used in forensic biology for the detection and analysis of biological evidence such as blood, saliva, and hair.
4. Analyse blood composition, histology, and techniques for bloodstain pattern analysis, including the identification of body fluids and stains crucial to criminal investigations.
5. Investigate the role of forensic entomology in estimating post-mortem intervals and its

application in forensic investigations involving insects as evidence.

**Course learning outcomes:**

At the end of the course, students will:

1. Apply methods of forensic anthropology to identify human skeletal remains and estimate age, sex, ancestry, and stature from skeletal features.
2. Analyze serological and immunological techniques for detecting and interpreting biological evidence types crucial to criminal investigations.
3. Perform forensic serological analysis, including the examination and identification of various body fluids and tissues using specialized techniques.
4. Evaluate the role of forensic entomology in estimating the post-mortem interval and its application in forensic investigations involving insect evidence.
5. Understand the principles and significance of DNA analysis in forensic investigations, including the application of DNA extraction, amplification, and profiling techniques

**Suggested books [Latest Edition]**

1. "Forensic Biology: Identification and DNA Analysis of Biological Evidence" by Richard Li
2. "Introduction to Forensic Anthropology" by Steven N. Byers
3. "Principles of Forensic Medicine" by Narayan Reddy
4. "Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers" by John M. Butler
5. "Forensic Entomology: An Introduction" by Dorothy Gennard
6. "Forensic Serology Research" by Travis Crowe

**Ph.D. in Forensic Science (Elective Course)**

**COURSE: PhDFS-104-ii**

**Environmental Forensics**

**Theory: 60 Credit Hours**

L	T	P	C
4	0	0	4

**Theory examination: 100 marks**

NOTE: Instructions for setting question paper

The examiner will **set nine** questions in total covering the entire syllabus. However, there will be **one compulsory** question containing twenty parts [One mark each], besides two questions from each of the four Units. The students will attempt **five questions** in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (20 marks each).

Unit-I	Fundamentals of Environmental Forensics	(15 hours)
Introduction to Environmental Forensics: Principles and significance in environmental investigations, Overview of environmental contaminants and pollutants; Environmental Sampling Techniques: Methods for collecting and preserving environmental samples, Considerations for sample chain of custody and documentation; Natural Source Damage Assessment, Environmental site assessment, Epidemiology and Environmental Health, Environmental Forensic Microscopy; Legal and Ethical Considerations in Environmental Forensics		
Unit-II	Environmental Toxins and their Forensic Analysis	(15 hours)
Environmental Pollutants and their Types: Soil, water, sediments, air pollutants, algal blooms, Toxicity of environmental contaminants, Fate of chemicals in the environment, Analytical Methods for Environmental Investigation: Geochemical analysis of soil, sediment, and water chemistry, Identification of environmental signatures and anomalies, Geological mapping, stratigraphic analysis, Radioactive Contaminants: Environmental Distribution and Forensic Analysis, Remediation		



Strategies: Introduction to bioremediation and algal bloom mitigation, Methods for microbial analysis and identification, Application of remediation strategies in environmental pollution and disaster assessments.

<b>Unit-III</b>	<b>Geo-Tech in Environmental Forensics</b>	<b>(15 hours)</b>
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Remote Sensing Technology and Geographic Information System (GIS): Definition and basic principles of remote sensing, Application of GIS and GPS technology in environmental investigations, Use of GIS in environmental disasters; Case Studies and Practical Applications: Review of real-world environmental forensic investigations, Analysis of case studies involving pollution incidents and environmental disasters.

<b>UNIT-IV</b>	<b>Interdisciplinary Perspectives in Environmental Forensics</b>	<b>(15 hours)</b>
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Forensic Palynology: Introduction and importance in forensic science, Fundamentals of microbial forensics, definition and importance, Geological analysis of soil and anthropogenic material, pesticides in soil, environmental impact of pesticides. Micro/nano plastic pollutants in water and their impact on human health; Climate Change Forensics: Investigating Environmental and Human Impact; Forensic Entomology: Role in Environmental and Criminal Investigations; Heavy Metal Contamination: Detection and Impact on Ecosystems; Emerging Contaminants: Detection and Environmental Impact; Forensic Ecology: Linking Organisms to Environmental Crimes.

**Course objectives:**

1. Understand the principles and significance of environmental forensics in investigating contaminants and pollutants in various environmental matrices.
2. Apply environmental sampling techniques and methods for assessing natural source damage and conducting site assessments with adherence to legal and ethical considerations.
3. Analyze environmental toxins, including their types and impacts, and utilize analytical methods to investigate their distribution and fate in the environment.
4. Evaluate the role of geo-technological tools like remote sensing and GIS in environmental forensic investigations through practical applications and case studies.
5. Explore interdisciplinary perspectives in environmental forensics, including the use of palynology, microbial forensics, and analysis of emerging contaminants to assess environmental impact and link organisms to environmental crimes.

**Course learning outcomes:**

At the end of the course, students will:

1. Analyze real-world case studies of environmental forensic investigations to understand the complexities and challenges in assessing pollution incidents and disasters.
2. Evaluate the environmental and human impacts of climate change through forensic methods, linking scientific data to legal and policy implications
3. Investigate the presence and impact of microplastic pollutants in water bodies using forensic techniques, addressing potential health risks
4. Assess the role of forensic palynology in identifying geographic origins and environmental contexts through pollen analysis
5. Understand the interdisciplinary approach of forensic ecology in linking organisms to environmental crimes, emphasizing conservation and legal strategies

**Suggested books [Latest Edition]**

1. "Environmental Forensics Principles and Applications" by Brian L. Murphy and Robert D. Morrison
2. "Environmental Forensics Contaminant Specific Guide" by Robert D. Morrison and Brian L. Murphy

Microbial analysis  
A disaster

3. "Introduction to Environmental Forensics" by Brian L. Murphy, Robert D. Morrison, and Frank T. Spelman
4. "Environmental Analytical Chemistry" by Paolo L. G. P. Moraga
5. "Handbook of Environmental Analysis: Chemical Pollutants in Air, Water, Soil, and Solid Wastes" by Pradyot Patnaik
6. "Environmental Chemistry" by Stanley E. Manahan

Ph.D. in Forensic Science (Elective Course)				
COURSE: PhDFS-104-iii				
Forensic Chemistry, Narcotics and Toxicology				
<b>Theory: 60 Credit Hours</b>			<b>L</b>	<b>T</b>
			<b>4</b>	<b>0</b>
			<b>0</b>	<b>4</b>
<b>Theory examination: 100 marks</b>				
NOTE: Instructions for setting question paper				
Examiner will <b>set nine</b> questions in total covering the entire syllabus. However, there will be <b>one compulsory</b> question containing twenty parts [One mark each], besides two questions from each of the four Units. The students will attempt <b>five questions</b> in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (20 marks each).				
<b>Unit-I</b>	<b>Explosive</b>			<b>(15 hours)</b>
Explosive: Composition, Classification, and Characteristics. Pyrotechnics, IEDs. Mechanism of explosion. Detection, Assessment of Hazards, Effect of Blast Wave on Structures, Human, etc., Post Blast Scene Investigation, Residue Collection, Reconstruction of Sequence of Events, Evaluation and Assessment of Scene of Explosion, Systematic Examination of low and high explosives by different Chemical and Instrumental Techniques				
<b>Unit-II</b>	<b>Arson/ Fire Investigation and Petroleum Products</b>			<b>(15 hours)</b>
Arson: Introduction, chemistry of fire, scientific investigation and evaluation of clue materials, collection and preservation, analysis of flammable residues. Petroleum and its products: Properties and Testing of Petroleum Products, detection of Adulterants, Characterization of Petroleum Products in Oil Spills, Application of Conventional and Modern Techniques in the Analysis of Petroleum Products. Analysis of trace evidence – cosmetics dyes, pigments, clues of trap cases.				
<b>Unit-III</b>	<b>Alcohol and its analysis of from Biological Samples</b>			<b>(15 hours)</b>
Beverages, their composition and detection of impurities by Alcoholic and nonalcoholic by chemical and instrumental methods. Extraction of Volatile compounds (Solvent Extraction & distillation methods, Headspace-GC). Extraction and isolation of Neutral, nonvolatile compounds, acidic and basic non-volatile compounds from Viscera, blood, urine, and hairs (Stas-otto method, Dovbriey Nickolls (ammonium sulphate) method, acid digest and Valov (Tungstate) methods. Relevant Sections of Excise Act				
<b>UNIT-IV</b>	<b>Narcotics and Toxicology</b>			<b>(15 hours)</b>
Narcotic substances and their types, NDPS act. Drug Abuse in Sports, Prohibited Substances, Evidence Handling Techniques, Separation of Bound and Unbound Drug. Analytical Approach for Analysis of NDPS Evidences for Common Adulterants and Determination of Percentage Purity in Seized Samples by Various Procedures. Toxicology and types of Toxic Agents. Mode of Action, Sampling techniques. Collection & Preservation of Viscera. Isolation and diagnosis of Poisons from Viscera, Blood, and Urine by different Chemical and Instrumental Methods. Metabolism, Disposition, Translocation and Excretion of Poisons. Factors affecting mode of action. Types of Treatments, Antidotes & Antidotal therapy				

Poisonous Mushrooms, Poisonous Fungi, Food Poisoning, Common vegetable abortifacients  
Relevant Sections of act and law.

**Course objectives:**

1. Provide knowledge of the chemical compositions of explosives and their blast effects and post blast / pre blast residue analysis of explosives.
2. Endow with knowledge of Fire/Arson investigation and their role in arson/ Petroleum products.
3. Equip the students with understanding of the techniques of determination of Percentage Purity in Seized Samples by Various Procedures.

**Course learning outcomes:**

At the end of the course, students will:

1. Able to explain the chemical compositions, detonation power, blast effects and post blast / pre blast residue analysis of explosives and its forensic examination.
2. Able to explain the role of Forensic Science in Fire/Arson investigation and analysis of arson/ Petroleum products.
3. Expert in explaining and understanding Narcotic substances and their types, NDPS act, and determination of Percentage Purity in Seized Samples by Various Procedures

**Suggested books [Latest Edition]**

1. Fisher's Techniques of Crime Scene Investigation by Tilstone, W.J.; Hastrup, M.L. and Hald, C
2. Methods & Application in Analysis of Explosives by Yinon, J. and Zitrin, S
3. Illustrated Guide to Home Forensic Science Experiments by Thompson, R.B. and Thompson, B.F
4. Criminalistics by Saferstein R
5. Toxicology: The Basic Science of poisons by Klaassen C, Doull J and Casarett L.J
6. A Textbook of Medical Jurisprudence and Toxicology by Modi.

**Ph.D. in Forensic science (Elective Course)**

**COURSE: PhDFS-104-iv**

**Forensic Biology**

Theory: 60 Credit Hours

L	T	P	C
4	0	0	4

Theory examination: 100 marks

NOTE: Instructions for setting question paper

Examiner will **set nine** questions in total covering the entire syllabus. However, there will be **one compulsory** question containing twenty parts [One mark each], besides two questions from each of the four Units. The students will attempt **five questions** in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (20 marks each).

**Unit-I**

**Forensic Odontology and Entomology**

**(15 hours)**

Development and scope, role in mass disaster and anthropology, structural variation in human and non-human teeth. Determination of age from teeth (eruption sequence of milk and permanent teeth), Gustafson's method. Gunshot wounds, Bite marks: location, collection, preservation, analysis of bite marks and forensic significance. Determination of Species of Origin, Sex, Age, Stature, and individual identification through skeletal remains. Identification through Skull superimposition and facial reconstruction

Forensic Entomology: Introduction, Definition, insects of forensic importance, collection of entomological evidence during death investigation, role of insects in forensic investigation. Insect life

cycle and relationship to determine time since death.

<b>Unit-II</b>	<b>Forensic Medicine</b>	<b>(15 hours)</b>
Brief history of forensic medicine. Death: Signs of death and changes after death. Somatic death, molecular death. Early changes after death: Algor mortis, rigor mortis, cadaveric spasm, heat stiffening, cold stiffening, changes in blood, Time since death by postmortem lividity. Late changes: putrefaction- external and internal changes. Adipocere, mummification, gastric content and bladder content and time of death from growth of hair and nails. Sudden death, post-mortem demonstration of myocardial infarction.		

<b>Unit-III</b>	<b>Medico legal aspects of death</b>	<b>(15 hours)</b>
Asphyxia, syncope, coma, suspended animation, drowning, hanging and strangulation. Modes & Manner of deaths, Sexual offences and its medicolegal importance, Amendments in law related to sexual offences Post-mortem examination and Post - mortem changes, Estimation of time since death Injuries & Wounds: Types, Medicolegal importance, Classification of traumatic deaths.		

<b>Unit-IV</b>	<b>Injuries</b>	<b>(15 hours)</b>
Legal definition and medical definition. Types of Injuries: Mechanical Injuries - Blunt weapon: Abrasions, Bruises, Sharp weapon: Lacerations, Incised wounds, Stab wounds. Defence injuries, Fabricated injuries. Thermal injuries: Burn and scalds, Lightning, Electricity, Explosions. Injuries- Accidental, self-inflicted, or inflicted by others. Transportation injuries: vehicular injuries, railway injuries and aircraft injuries, Ante -mortem and post-mortem, artificial injuries and aging of injuries, collection of evidence.		

**Course objectives:**

1. Provide the knowledge forensic odontology, role of insects in forensic investigation and tracing.
2. Able to explain the composition, histology, examination & identification of blood and other body fluids, their stains & analysis of blood pattern.
3. Expert in explaining and understanding the autoimmunity, apoptosis, red cell enzymes and serum proteins

**Course learning outcomes:**

At the end of the course, students will:

1. Able to explain the development and scope of forensic odontology, role of insects in forensic investigation and tracing.
2. Able to demonstrate knowledge of composition, histology, examination & identification of blood and other body fluids, their stains & analysis of blood pattern.
3. Expert in explaining the different types of Injuries, Modes, Manner of deaths, Post-mortem changes, and time since death.
4. Master the information of autoimmunity, apoptosis, red cell enzymes and serum proteins.

**Suggested books [Latest Edition]**

1. Forensic Examination of Hair by J Robertson J
2. Medical Jurisprudence and Toxicology Modi by J.K
3. Modern Medical Toxicology by Pillay, V.V
4. Interpretation of Blood Stain Evidence at Crime Scenes by Oliver & Boyd, Edinburgh
5. Science Handbook, Vol. I, II and III by Saferstein R

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Ph.D. in Forensic science (Elective Course)

COURSE: PhDFS-104-v

Forensic Documents, Photography and Fingerprinting

Theory: 60 Credit Hours

L	T	P	C
4	0	0	4

Theory examination: 100 marks

NOTE: Instructions for setting question paper

Examiner will set **nine** questions in total covering the entire syllabus. However, there will be **one compulsory** question containing twenty parts [One mark each], besides two questions from each of the four Units. The students will attempt **five questions** in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (20 marks each).

Unit-I	Questioned document and Handwriting	(15 hours)
Nature and Scope of Questioned Documents Definition of questioned documents, Types of questioned documents, Hand writings: Class and Individual characteristics of Handwritings, Factors affecting handwritings, Standard samples for comparison, Comparison of hand-written texts; Anonymous and disguised writings; Identification of hand writings, signatures, detection of forged signature.		
Unit-II	Forgeries	(15 hours)
Forgeries Alterations in documents, including erasures, additions, over-writings and obliterations, Indented and invisible writings, Charred documents, Examination of counterfeit Indian currency notes, passports, visas and stamp papers. Disguised writing and anonymous letters, holographic documents, Examination of black & white Xeroxed copies and colour Xeroxed copies, carbon copies, fax messages, VSC and ESDA.		
Unit-III	Fingerprint Detection	(15 hours)
History and development of fingerprint Science, formation of ridges, pattern types, pattern areas, Fundamental Principles and levels of Fingerprints, Classification of fingerprints – Henry system of ten digit classification, Extension of Henry system, search of fingerprints. Battley's Single digit classification, fingerprint Bureau, Poroscopy and Edgioscopy, Development of latent fingerprints: conventional methods of development of fingerprints – fluorescent method, magnetic powder method, fuming method, chemical method.		
Unit-IV	Forensic Photography	(15 hours)
Introduction to forensic photography, Equipment for photography – Camera, lens, shutter, depth of field, film; Importance of Forensic photography in a crime scene investigation, History and Development of Photography. Basic principles and techniques of Black & White and colour photography. Developing techniques and methods of photography, Different kinds of developers and fixers, modern developments in photography, linkage of cameras and film negatives.		

**Course objectives:**

1. Understand the nature and scope of questioned documents, including the classification of handwriting characteristics and methods for comparison.
2. Identify various types of forgeries and alterations in documents, employing techniques such as VSC and ESDA to analyze counterfeit currency, passports, and other documents.
3. Explore the history and development of fingerprint science, including ridge formations, classification systems, and methods for developing latent prints.
4. Gain proficiency in forensic photography equipment and techniques, including the use of cameras, lenses, and film development methods for crime scene documentation.
5. Apply fundamental principles of forensic photography to capture accurate visual evidence crucial for criminal investigations, incorporating modern developments in photographic technology.

**Course learning outcomes:**

At the end of the course, students will:

1. Apply advanced techniques in forensic document analysis to distinguish between genuine and forged documents, including anonymous and disguised writings.
2. Demonstrate proficiency in identifying and analyzing alterations in documents using specialized forensic tools and methods, such as VSC and ESDA.
3. Implement systematic approaches to classify and analyze fingerprints according to the Henry system and other classification methods, utilizing various development techniques for latent prints.
4. Utilize forensic photography principles and equipment effectively to capture and document crime scenes, ensuring accuracy and integrity of photographic evidence.
5. Evaluate historical developments and modern advancements in forensic photography, linking techniques to enhance investigative outcomes in criminal cases.

**Suggested books [Latest Edition]**

1. Scientific Examination of Questioned Documents by Ordway Hilton.
2. Questioned Documents by Albert S. Osborn.
3. Suspect Documents Their Scientific Examination by Wilson R. Harrison.
3. Forensic Handwriting Identification by Morris Ron N
4. Questioned Documents by Lerinson Jay.
5. Forensic Linguistics-Advances in Forensic Stylistics by Mcmenamin Gerald R.
6. Questioned Documents – Scientific Examination by Ellen Davin.

**Ph.D. in Forensic science (Elective Course)**

**COURSE: PhDFS-104-vi**

**Forensic Physics and Ballistics**

Theory: 60 Credit Hours

L	T	P	C
4	0	0	4

Theory examination: 100 marks

NOTE: Instructions for setting question paper

Examiner will **set nine** questions in total covering the entire syllabus. However, there will be **one compulsory** question containing twenty parts [One mark each], besides two questions from each of the four Units. The students will attempt **five questions** in total by selecting one question from each unit and the compulsory question. All questions shall carry equal marks (20 marks each).

Unit-I	Physical evidence	(15 hours)
Forensic Examination of Paint, Glass, Soil, Fibre, Cement, Metals, Glass: types of glass and their composition, manufacturing of various types of glass and their properties, Fibre- Types, Constituents & their forensic importance, Tool marks- Types, Class and Individual Characteristics, Comparisons, Impression Marks, Compression Marks, Striated Marks, Combination of Impression and Striated Marks, Repetitive Marks, Materials for making Test Tool Marks, Evaluation of Footwear Impression.		
Unit-II	Firearms and ammunition	(15 hours)
History and background of Firearms, their classification and characteristics, Ammunition types and classification, Identification of origin, improvised/ country made/ imitative firearms and their constructional features, Internal, External & Terminal Ballistics, Different types of marks produced during firing process on cartridge-firing pin marks, breech face marks, chamber marks, extractor and ejector marks and on bullet number/direction of lands and grooves, striation marks on lands and grooves, identification of various parts of firearms, techniques for obtaining test material from various types of weapons and their linkage with fired ammunition, Gunshot Residue, Bore, caliber and choke		

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Unit-III	Forensic voice analysis	(15 hours)
<p>Physics of sound: waves and sound, analysis and synthesis of complex waves, Anatomy of vocal tract; vocal formants, analysis of vocal sound, frequencies and overtones, Sound recording and reproduction, Voice production theory, Electronics of Audio Recording, Transmission and Playback devices, noise and distortion, voice storage and preservation, Various approaches in Forensic Speaker Identification, Analog signal &amp; Digital signal processing, Analysis and interpretation of video evidence, Multimedia Forensic.</p>		
Unit-IV	Forensic Engineering	(15 hours)
<p>Vehicle examination: Automobile common component and failure analysis, damage assessment, tyres – types speed and load rating, inflation and failures, brakes –types and brake systems, door lock and speed recording devices, safety restraint system – theory and examination of seat-belt child-seat and air-bag, vehicular fires, Speed determination: skid marks measurement, speed from vehicle yaw, speed calculation on different road surfaces, falls, flips and vault speeds, special speed problem, Road evidence, road engineering and design.</p>		
<p><b>Course objectives:</b></p> <ol style="list-style-type: none"> <li>1. Demonstrate proficiency in forensic examination techniques for paint, glass, soil, fibres, metals, and other physical evidence types, including analysis of tool marks and footwear impressions.</li> <li>2. Identify and classify firearms and ammunition types, analyze ballistic markings, and apply techniques for firearm origin identification and linkage to fired ammunition.</li> <li>3. Analyze vocal characteristics using forensic voice analysis principles, including sound wave analysis, voice production theory, and speaker identification techniques.</li> <li>4. Apply forensic engineering principles to examine vehicles, assess common components and failures, determine vehicle speed through skid marks and road evidence analysis, and evaluate vehicular safety systems.</li> <li>5. Utilize multimedia forensic techniques to analyze and interpret video evidence, employing analog and digital signal processing methods for accurate forensic analysis and presentation.</li> </ol>		
<p><b>Course learning outcomes:</b></p> <p>At the end of the course, students will:</p> <ol style="list-style-type: none"> <li>1. Analyze and interpret physical evidence such as paint, glass, fibres, and tool marks using forensic techniques to establish links to crime scenes or suspects.</li> <li>2. Evaluate firearms and ammunition through comprehensive understanding of their classification, ballistic characteristics, and analysis of marks produced during firing processes.</li> <li>3. Apply principles of forensic voice analysis to identify and analyze vocal characteristics and electronic signals for speaker identification and audio evidence interpretation.</li> <li>4. Conduct forensic engineering assessments on vehicles, including component analysis, speed determination techniques, and examination of safety systems to determine causes of accidents or vehicle failures.</li> <li>5. Utilize advanced forensic methods in multimedia analysis to interpret and authenticate video evidence in legal and investigative contexts.</li> </ol>		
<p><b>Suggested books [Latest Edition]</b></p> <ol style="list-style-type: none"> <li>1. Footwear Impression Eviden by Bodziak, W.</li> <li>2. The Forensic Examination of Paints and Pigments by David A. Crown</li> <li>3. Forensic Physics by Mengel E.R.</li> <li>4. Forensic Voice Identification by Harry H.</li> <li>5. Forensic Speaker Identification by Rose, P.</li> <li>6. Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence by Byrd M.</li> </ol>		