

Chaudhary Bansi Lal University

Hansi Road, Prem Nagar, Bhiwani

(A State University Established under Govt. of Haryana Act No 25 of 2014)



Scheme & Syllabus of Post Graduate Diploma in Forensic Sciences (In accordance with NEP-2020)

DEPARTMENT OF Microbiology Evaluation Scheme of P.G Diploma in Forensic Sciences

Summary

Programme	: P.G Diploma in Forensic Sciences
Duration	: One years (two Semesters)
Minimum Attendance Required	: 75%
Total Credits	50
Total Marks	: 1250

For details go through the ordinance available on university-website

To qualify for the course, a student is required to secure a minimum of 40% marks in aggregate, including the internal evaluation and Major Test (End Semester Examination). A candidate who secures less than 40% of marks in a course shall be deemed to have failed in the course. The student should have obtained at least 40% marks in aggregate to qualify for the semester.

Examination scheme (Question Paper Structure) Note:

For the course having 4 credits

Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing seven short answer type questions from all sections. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each Section. All questions will carry equal marks.

For the course having 2 credits

Examiner will set five questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing seven short answer type questions from all sections. Further, examiner will set two questions from each section and the candidates will be required to attempt three question from each Section. All questions will carry equal marks.

Programme Learning Outcomes (PLO) of Diploma in Forensic Sciences

PLO 1	Make students familiar with the field of forensic science which includes investigating a crime by applying forensic science principles.
PLO 2	Enhance knowledge, in depth understanding and application of forensic science, policing and criminal investigation by teaching and research.
PLO 3	Develop critical and analytical subject specific skills involving the principles, practices and techniques of specific field.
PLO 4	Develop competence in research methods and presentation of information
PLO 5	Develop skills in forensic identification, forensic problem solving either independently or as a team member.
PLO 6	Keep abreast with all recent developments and emerging trends in Forensic science, Ethics and the law
PLO 7	Understand application of Forensic Science, Photography and Crime Scene Management



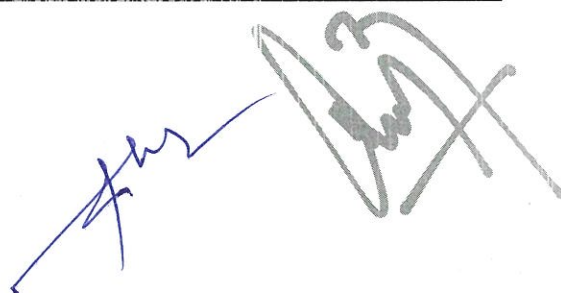
Chaudhary Bansi Lal University
Scheme of Examination and Syllabus for Post Graduate Diploma in Forensic Sciences
(w.e.f. 2025-26)

Semester	Course Type	Course Code	Nomenclature of the Paper	Credits	Hours/Week	External Assessment Marks	Internal Assessment Marks	Total Marks	Duration of Exam.
I	CC-1	25PGDFS-101	Basics of Forensic Science	4	4	70	30	100	3 Hours
	CC-2	25PGDFS-102	Essentials of Forensic Science	4	4	70	30	100	3 Hours
	CC-3	25PGDFS-103	Crime Scene Management	4	4	70	30	100	3 Hours
	CC-4	25PGDFS-104	Forensic Physical Anthropology and Medicine	4	4	70	30	100	3 Hours
	PC-I	25PGDFS-105	Lab Course I	4	8	70	30	100	3 Hours
	DEC - I	25PGDFS-106	Criminology, Criminal Law, and Police	4	4	70	30	100	3 Hours
		25PGDFS-107	General Forensic Tools and Techniques						
			MOOC/SWAYAM						
II	CC-5	25PGDFS-201	Forensic Biology and DNA Profiling	4	4	70	30	100	3 Hours
	CC-6	25PGDFS-202	Theoretical and Practical Aspects of Biological Evidence	4	4	70	30	100	3 Hours
	CC-7	25PGDFS-203	Fingerprint Science	4	4	70	30	100	3 Hours
	CC-8	25PGDFS-204	Forensic Documents						
	PC-II	25PGDFS-205	Lab Course -II	4	8	70	30	100	3 Hours
	DEC-2	25PGDFS-206	Cybercrime and Cyber Security	4	4	70	30	100	3 Hours
		25PGDFS-207	Fundamentals of Forensic Ballistics						
			MOOC/SWAYAM						
	VAC	25PGDFS-208	Instrumental Techniques	2	2	35	15	50	3 Hours

P. G. DIPLOMA IN FORENSIC SCIENCE**SEMESTER- I SYLLABUS**

PGDFS	1.1 Basics of Forensic Science (25PGDFS-101)
Course outcomes	After successfully completing this course students • Are able to understand the origin of forensic science. • Will understand different branches been helping hand for forensic science in probing crime. • Will obtain knowledge regarding forensic science laboratories, its functions and administration. • Will gain knowledge regarding conclusive evidences like fingerprint and DNA • Will be able to gain knowledge regarding different laws

CourseCode	25PGDFS-101
PGDFS	1.1 Basics of Forensic Science
UnitNo.	Contents of Unit
Unit I	History, Development and Fundamentals of Forensic Science 1. Definition and origin of term "Forensic" 2. Nature and scope, Principles of Forensic Science 3. Global development of Forensic Science 4. Pioneers of forensic science and their contribution to various branches of forensic science 5. Organizational structure of Forensic science Laboratories in India
Unit II	Branches in Forensic Science 1. Physics divisions-Ballistics, voice, audio-video, automobiles engineering 2. Chemistry division- chemicals, drugs, poisons extraction and examination 3. Questioned documents division-(stylistics, linguistics, counterfeit) 4. Cyber division, superimposition, forensic artistry 5. Fingerprint division(Prints and other impressions) 6. Forensic Psychology(Criminal profiling, polygraph, narcoanalysis, brain mapping)



Unit III	Physical Evidences 1. Physical evidences- Definition, Types 2. Biological evidences- Blood, semen, saliva, Hairs and fibers 3. Physical evidences- Fingerprints, footprints, Tool mark, explosives, ballistics etc 4. Chemical evidences- Drugs, Poisons, Alcohol 5. Trace evidences-Glass, fibres, Paint, petroleum products, cement etc
Unit IV	Laws relating to expert and scientific evidence 1. Expert- Definition, expert evidence. 2. Special provisions in CrPC 1973 on experts' attendance in court. 3. Important sections in Indian Evidence act about expert and evidences(e.g.-Section 45) 4. Special laws- The drugs Act-1940, Narcotic Drugs and Psychotropic Substances Act-1985, The Arms Act-1959, Explosives Act-1984.

Suggested Readings

1. Bare Acts with short notes on the following:
Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act
2. Criminal Procedure code, 1973
3. Girad, J. E. (2017). *Criminalistics: Forensic science in crime*, Jones and Bartlett Publishers, Inc; 4th edition, ISBN-10: 1284142612, ISBN-13: 978-1284142617.
4. Indian Evidence Act, 1872
5. Indian Penal Code, 1860.
6. Krishnamurthy, R. (2011). *Introduction to Forensic science in crime investigation*, India: Selective & Scientific Books.
7. Lee, H. C. (2011). *Physical Evidence in Forensic Science*, Lawyers & Judges Pub Co; 3rd edition, ISBN-10: 1936360012, ISBN-13: 978-1936360017.
8. Nabar, B. S. (2013). *Forensic science in crime investigation*, Hyderabad, India: Asia Law House Hyderabad.
9. Sharma, B.R. (2014). *Forensic science in criminal investigation and trials*, New Delhi, India: Universal Law Publishing Co. Pvt. Ltd.
10. Universal's Legal Manual, (2015). *Criminal Manual: Cr.P.C., I.P.C. & Evidence*, Universal Law Publishing - An imprint of LexisNexis

PGDFS	1.2 Essentials of Forensic Science (25PGDFS-102)
Course outcomes	After successfully completing this course students • Will be able to understand the historical development of fingerprint science, its types, development and classification. • Will have a general understating regarding types of documents, and its characteristics • Will gain knowledge regarding various aspects of forensic biology and serology • Will understand the importance of ballistic evidences in investigation.

Course Code	25PGDFS-102
PGDFS	1.2 Essentials of Forensic Science
Unit No.	Contents of Unit
Unit I	Fingerprints and other impressions 1. History and development 2. Formation of friction ridges, Classification of fingerprints(Patterns), Types of fingerprints (latent, patent and plastic) 3. Henry's classification system, extension of Henry's system, Single digit classification, Three levels of examination 4. Comparison of fingerprints-Class and Individual characteristics 5. Developmental techniques latent fingerprints
Unit II	Questioned document 1. Introduction, definition, scope and significance. 2. Principles of handwriting, factors affecting hand writing, Class and individual characteristics of handwriting and type writings. 3. Various types of forgeries, alterations and their examination 4. Handling, care and preservation of documents. 5. Detection and decipherment of alterations, erasures including additions, overwriting, obliterations. 6. Advancements in forensic document examination.
Unit III	Forensic biology and serology 1. Basics and Examination of various body fluids-blood, semen, saliva, sweat, urine 2. Examination of various biological evidences-diatoms, human and animal hair. 3. DNA-Structure, coding and non coding DNA 4. PCR amplification, technology and methodology 5. Paternity and maternity testing

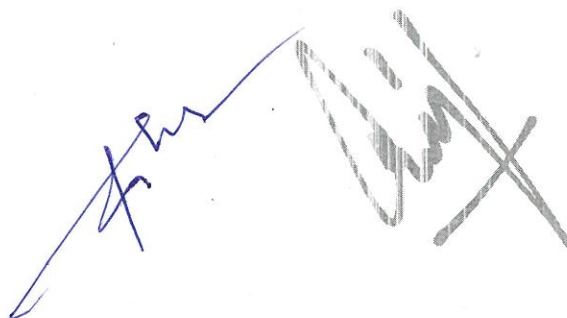
Unit IV	Forensic Physics and Ballistics 1. Introduction to Forensic ballistic, History of Firearms 2. Classification of firearms 3. Types of Ammunition, Projectiles, Mechanism of Firing 4. GSR-Detection methods and analysis 5. Gunshot wounds, Nature of Injuries--Entry and Exitwounds
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Suggested Readings

1. Galton, F. (1892). *Finger Prints*, London: Macmillan And Co.
2. Hawthorne, M. R. (2008). *Fingerprints: Analysis and Understanding*, USA: CRC Press, ISBN-10: 1420068644, ISBN-13: 978-1420068641.
3. Henry, E. R. (1900). *Classification and Uses of Finger Prints*, London : George Routledge and Sons, Limited.
4. Hunter, W. (2005). *Solving Crimes with Physics (Forensics: the Science of Crime Solving S.)*, Mason Crest Publishers; Illustrated edition, ISBN-10: 1422200361, ISBN-13: 978-1422200360.
5. James, S. H., & Nordby, J. J. (2015). *Forensic Science an Introduction to Scientific and Investigative Techniques*, CRC Press; 4th Edition, ISBN-10: 1439853835, ISBN-13: 978-1439853832.
6. Krishnamurthy, R. (2011). *Introduction to Forensic science in crime investigation*, India: Selective & Scientific Books.
7. Nabar, B. S. (2013). *Forensic science in crime investigation*, Hyderabad, India: Asia Law House Hyderabad.
8. Osborn, A. S. (1910). *Questioned Documents*, Brooklyn, New York: The Genesee Press.
9. Sharma, B. R. (2014). *Forensic science in criminal investigation and trials*, New Delhi, India: Universal Law Publishing Co. Pvt. Ltd.
10. Tripathi, A., & Dwivedi, A. K. (2012). *Forensic Serology & Blood Examination*, Selective & Scientific Books, ISBN-10: 818912840X, ISBN-13: 978-8189128401.

PGDFS	1.3 Crime Scene Management (25PGDFS-103)
Course outcomes	After successfully completing this course students • Will be able to understand basics of crime scene, significance, physical evidences and certain procedures relating to crime scene investigation • Will have a deeper understanding regarding crime scene photography, Collection and preservation of various evidences. • Will be able to reconstruct the crime scene.

Course Code	25PGDFS-103
PGDFS	1.3 Crime Scene Management
Unit No.	Contents of Unit
Unit I	Crime Scene investigation 1. Crime scene:- Definition, Importance, problems, location, nature of scene 2. Classification of crime scene 3. Significance and ethics of crime scene investigation 4. Physical Evidences: Definition, Importance, Utility and sources, Types of physical evidences (physical, chemical, biological and digital) 5. Crime scene procedure- Role of first responding officer, initial crime scene response, crime scene communication, legal implications for crime scene search
Unit II	Crime scene documentation, collection and preservation of physical evidences 1. Crime Scene photography- Types of Cameras, types media, number of photographs, admissibility of photographs, videography of the crime scene 2. Collection and preservation of trace and physical evidences- Fingerprints, Impression Evidence, Tool Marks, Hair and Fiber Evidence, other Trace Evidence (Glass, Paint and Soil), 3. Collection and preservation of explosives-Firearms, explosives Accelerants and Flammable Fluids. 4. Collection and preservation of Biological Evidence-Blood, Body Fluids and Tissue), Questioned Document, Drug Evidence and Bite Mark Evidence.



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Unit III	Crime scene reconstruction 1. Definition, nature and stages of crime scene reconstruction. 2. Reconstruction based on blood spatter patterns, shooting range of firearm projectile and gunshot residue 3. Linking cases by Modus oprendi and signatures 4. Crime scene analysis, interpretation of exhibits and data interpretation. 5. Principle of analysis and ethics in crime scene analysis
Unit IV	Crime scene investigation 1. Crime investigation in case of homicide 2. Crime investigation in case of suicide 3. Crime investigation in case of accidental and negligence death 4. Crime investigation in case of road and vehicular accidents 5. Crime investigation in case of rape and sexual assault

Suggested Readings

1. Bevel, T., & Gardner, R. M. (2008). *Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction*, CRC Press; 3rd edition, ISBN-13: 978-1420052688
2. Chatterjea, M. N., & Shinde, R. (2012). *Textbook of Medical Biochemistry*, JPB; eighth edition, ISBN-10: 9350254840, ISBN-13: 978-9350254844.
3. Fish, J. T., Miller, L. S., & Wallace, E. W. (2014). *Crime Scene Investigation*, Elsevier Inc., ISBN: 978-1-4557-7540-8
4. Gardner, R. M., & Bevel, T. (2009). *Practical Crime Scene Analysis and Reconstruction*, CRC Press, ISBN 9730367778217.
5. Houck, M. M., & Siegel, J. A. (2015) *Fundamentals of Forensic Science*, Elsevier Ltd., 978—12-800037-3. doi: <https://doi.org/10.1016/C2013-0-12985-6>
6. Malocco, D. E. (2015). *Forensic Science: Crime Scene Analysis*, Createspace Independent Pub; 2nd edition, ISBN-10: 1508934401, ISBN-13: 978-1508934400.
7. Nabar, B. S. (2013). *Forensic science in crime investigation*, Hyderabad, India: Asia Law House Hyderabad.
8. Pepper, I. (2004). *Crime Scene Investigation*, Open University Press, ISBN-13: 978-0335214907.
9. Rao, M. S., & Maithil, B. P. (2013). *Crime Scene Management a Forensic Approach*, Selective & Scientific Books; 2nd edition, ASIN: B01M4LAM9T, ISBN-10: 8189128280, ISBN-13: 978-8189128289
10. Sharma, B. R. (2014). *Forensic science in criminal investigation and trials*, New Delhi, India: Universal Law Publishing Co. Pvt. Ltd.



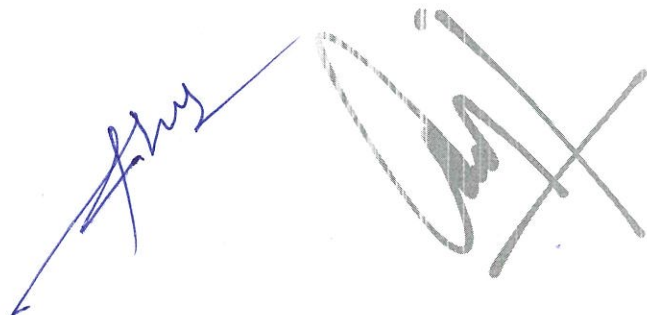
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PGDFS	1.4 Forensic Physical Anthropology and Medicine (25PGDFS-104)
Course outcomes	After successfully completing this course students • Will be able to understand basics of forensic medicine which includes identification of living or dead, inquest, autopsy and etc. • Will have a greater knowledge of medico-legal importance of wounds and injuries. • Will be able critically evaluate factors affecting death and time since death. • Will begin to determine age, height and gender on the basis of bones as evidence.

Course Code	25PGDFS-104
PGDFS	1.4 Forensic Physical Anthropology and Medicine
Unit No.	Contents of Unit
Unit I	Forensic Physical Anthropology: Definition and Scope within the medical-legal context of personal identification of human remains as in cases of homicides or mass disasters, Brief introduction to Forensic Archeology and Anthropometry. Human skeletal system: Nature and formation of bones, introduction to Human skeleton, Classification of human bones. Determination of Age and sex from human bones. Determination of Race and estimation of stature from skeletal remains. Personal Identification: Portrait Parle/Bertillon system, Somatoscopy and Somatometry
Unit II	Forensic Facial Reconstruction: Two Dimensional and 3 Dimensional Methods, Importance of tissue depth to reconstruct various facial features. Forensic Odontology: Development and scope, role in mass disaster and anthropology, structural variation in teeth (human and non-human), types of teeth and their functions. Determination of age from teeth: Eruption sequence, Gustafson's method, dental anomalies, their significance in personal identification. Bites marks: Forensic significance, collection and preservation of bite marks, photography of bite marks, and evaluation of bite marks, Legal aspects of bite marks.
Unit III	Forensic Medicine: Definition of Forensic Medicine and Medical Jurisprudence, Dying declaration, Death: Definition, types; somatic, cellular and brain-death, Sudden natural and unnatural deaths. Identification: Definition, Identification of unknown person, dead bodies and remains of a person by age, sex, stature, dental examination, scars, moles, tattoos, dactylography, DNA typing and personal belonging including photographs. Medicolegal Death Investigation: Aspects of death scene analysis by a medical examiner, including autopsy procedures, unidentified remains, child death investigations and mass disaster investigations. Determination of Time Since Death: Immediate changes, Livor, Rigor and Algor mortis, cadaveric spasm, cold stiffening and heat stiffening. Putrefaction,



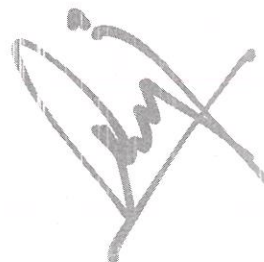

	mummification, adipocere and maceration Postmortem artifacts.
Unit IV	Injuries: Wounds, Bruises Abrasions, Lacerations, Incised wounds, Stab wounds, Bone damage, Burns and scalds, ante-mortem and post-mortem injuries, aging of injuries, artificial injuries. 52 Sexual Offences: Medico-legal investigation of Sexual offences, including examination of victim and suspect. Asphyxial deaths: Definition, causes, types, post-mortem appearances and medicolegal significance of hanging, strangulation, suffocation and drowning. Infanticide: Definition and related issues. Forensic Pathology: Terminology and scientific techniques used in medico-legal investigations, sudden or unexpected deaths, homicides, suicides, accidental deaths, and trauma



The image shows a handwritten signature in blue ink on the left, which appears to be 'J. S. S.'. To the right of the signature is a circular official stamp in grey ink. The stamp contains some illegible text and a central emblem or logo. A large 'X' is drawn over the stamp.

Suggested Readings

1. Agarwal, A. (2019). *Forensic Medicine and Toxicology for MBBS*, Avichal Publishing Company; 2nd edition, ISBN-13: 978-8177394917.
2. Bardale, R. (2021). *Principles of Forensic Medicine & Toxicology*, Kundli, Haryana, India: Jaypee Brothers Medical Publishers; Third edition, ISBN-13: 978-9390595419.
3. Biswas, G. (2012). *Review of Forensic Medicine and Toxicology*, Daryaganj, New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., ISBN 978-93-5025-896-5
4. Hodgson, E. (2010). *A textbook of Modern Toxicology*, Hoboken, New Jersey: A John Wiley & Sons, Inc., ISBN 978-0-470-46206-5
5. Klaassen, C. D. (2013). *Casarett & Doull's Toxicology: The basic Science of Poisons*, India: Mc Graw Hill Education/Exclusively distd . By Jaypee; 8th edition, ISBN-13: 978-0071769235.
6. Narayan Reddy, K. S. (2017). *The Essentials of Forensic Medicine and Toxicology*, India: Jaypee Brothers Medical Publishers; Thirty-fourth edition, ISBN -13: 978-9352701032
7. Parikh, C.K. (2007). *Parikh's Textbook of Medical Jurisprudence, Forensic medicine and Toxicology*, CBS Publishers and Distributors. 6th Ed., ISBN-13: 978-8123906751.
8. Singhal, S. K. (2020). *Singhal's Forensic Medicine & Jurisprudence*, India: The National Book Depot; 5th edition, ISBN-13: 978-9380206554
9. Singh, V. P. (2020). *Legal Issues in Medical Practices*, India: Jaypee Brothers Medical Publishers; 2nd edition, ISBN-13: 978-9389776058.
10. Umadethan, B. (2017). *Principles and Practice of Forensic Medicine*, India: CBS; 2nd edition, ISBN-13: 978-9385915376.



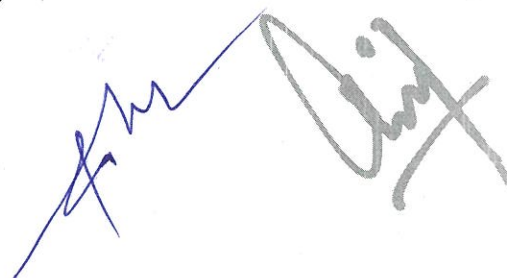
PGDFS	1.5 PRACTICALS – I (25PGDFS-105)
Course outcomes	After successfully completing this course, students • Will be able to scientifically analyse the scene of crime • Will be able to sketch different types of crime scenes • Will be able to identify types of wounds and injuries • Will be able to differentiate between genders through human dentition • Will be able to apply different types of blood tests

1.5	PRACTICALS – I
Course code	(25PGDFS-105)
1. Locating and fixing of physical clues in different types of simulated crime scenes (Murder, suicide, theft, burglary, rape, etc) 2. Analysis of different types of Simulated crime scenes (Murder, suicide, theft, burglary, rape, etc) 3. Sketching of different types of simulated crime scenes (Murder, suicide, theft, burglary, rape, etc) 4. Examination and analysis of various types of wounds and injuries 5. Determination of sex through bones and age through human dentition 6. Evaluation of Crime scene. 7. Sole prints comparison and their lifting from the scene of crime 8. General comparison of Paints, Soils and Glass	

*This is tentative list of practical, final list will be notified in the running semester

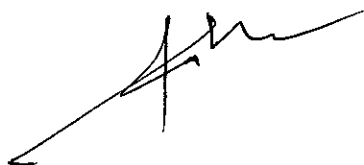
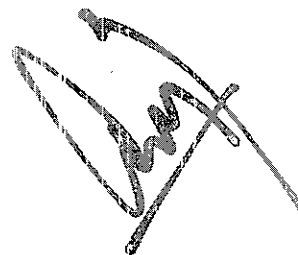
Suggested readings:

- 1) Borrow (1980) Molecular Spectroscopy.
- 2) Willdard, H. H (1974) Instrumental Methods of Analysis.
- 3) Moonesens A.A. (1979) Scientific Evidence in Criminal Cases.
- 4) Lundquist & Curry (1963) Methods of Forensic Science.
- 5) Settle, F.A. (1997) Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.
- 6) E. Stahl (1969) Thin Layer Chromatography: A Laboratory Handbook.
- 7) Sue Jickells and Adam Negrusz (2008) Clarke's Analytical Forensic Toxicology.
- 8) Forensic Chemistry: Max M Houck (2015)



PGDFS	1.6 Criminology, Criminal Law and Police Administration
Course outcomes	After successfully completing this course students • Understand concept of crime and recent development in its control and prevention. • Understand the aim and scope of criminology. • Elucidate Criminal profiling and modus operandi, portrait parley, voice stress analysis • Able to describe History and development of police administration; Police duties, responsibilities and powers.

Course Code	25PGDFS-106
PGDFS	1.6 Criminology, Criminal Law and Police Administration
Unit No.	Contents of Unit
Unit I	Crime Definition, concept and scope of crime. Types of crime. Causes, effects, control and prevention of crime. Recent developments. Types of crime and its causes: Property crimes, public order crimes, violent crimes, cyber crimes, juvenile delinquency, Society-Criminal interaction and various types of crimes in India
Unit II	Criminology and criminal anthropology Aim and scope of criminology; Criminal behavior and theories of criminal behavior: classic, positivist, sociological. Organized crimes, white collar crime. Juvenile delinquency. Role of correctional institutions. Criminal profiling and modus operandi, portrait parley, voice stress analysis. Victimology..
Unit III	Criminal Law Indian Penal Code: sections-23, 24, 25, 39, 44, 52, 76-79, 84-86. Criminal Procedure Code: sections-2, 6-35, 41-60, 61-90, 154-176, 293, 294. Charges: bailable/non-bailable offences, cognizable/ non-cognizable, summon case and warrant cases. Indian Evidence Act: sections- 3, 24-30, 45, 135-138, 141. Expert testimony. NDPS Act, Food and Adulteration Act, Drugs and Cosmetic Act, Arms Act, Explosives Act.

Unit IV	Police Administration History and development of police administration; Police duties, responsibilities and powers. Organization and structure of police station; maintenance of crime records and accountability of police to law. People and society. Custodial deaths, Police and Human Rights.
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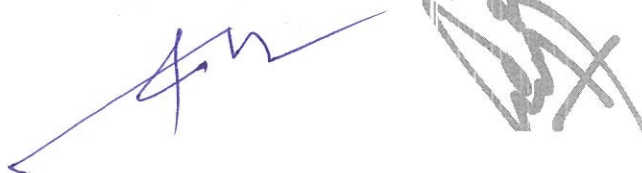
Suggested Readings

1. Swanson, C.R, Terrles, L & Taylor, R.W; Police Administration, Prentice Hall, USA, 1998.
2. Gross, H; Criminal Investigation- A Practical Textbook for Magistrates, Police Officers, and Lawyers; Universal Law Publishing Co., New Delhi, 2000.
3. Lyman, M.D; Criminal Investigation – The Art & the Science, Prentice Hall, New Jersey, 2002.
4. O'Hara CE & Osterburg, JW; An Introduction to Criminalistics., Indiana University. Press, London, 1972.
5. Swanson, C.R, Chamelin, N.C, & Territ, L; Criminal Investigator, McGrawhill, New York, 2000.
6. The Indian Evidence Act, (1872), Amendment Act (2002); Universal Law Publishing Co., 2003.
7. The Code of Criminal Procedure (1973) Amendment Act, (2001); Universal Law Publishing Co., 2002.
8. Rattan Lal & Dhiraj Lal; The Indian Penal Code, 28th Ed. Wadhwa & Co. Nagpur, 2002



PGDFS	1.7 General Forensic Tools and Techniques(25PGDFS-107)
Course outcomes	After successfully completing this course students • Understand concept of crime and recent development in its control and prevention. • Understand the aim and scope of criminology. • Elucidate Criminal profiling and modus operandi, portrait parley, voice stress analysis • Able to describe History and development of police administration; Police duties, responsibilities and powers.

Course Code	25PGDFS-107
PGDFS	1.7 General Forensic Tools and Techniques
Unit No.	Contents of Unit
Unit I	Meaning and Terminology of Instrumentation: Definition, Need of Instrumentation in Forensic Science, Qualitative and quantitative methods of analysis, Destructive and Non-Destructive Methods, Separatory techniques, Hyphenated techniques, Accuracy, Precision, Signal to noise ratio, Sensitivity and detection limit, sources of noise, Instrument calibration. Scientific Calculations: Scientific volume and weight measurements, Centrifugation, Extraction, Filtration, Distillation, Density, Specific Gravity, Specific Volume, Percentage, Ratio Strength, and other Expressions of Concentration.
Unit II	Schematic analysis of Chemical, Biological and Physical samples, Preliminary and Confirmatory methods of analysis, Colour spot tests in Forensic Biological, Chemical and Physical analysis, Microcrystalline test. Centrifuge Techniques: Centrifugation Techniques, Basic principles of sedimentation, Various types of centrifuges, Density gradient centrifugation, Preparative centrifugation, Ultra-centrifuge-Refrigerated Centrifuges.
Unit III	Microscopy: Theory and basic principles, setup and Forensic applications of Compound, Comparison, Fluorescence, Polarized, Stereo-zoom microscope. Introduction, Geometrical optics, Image formation, Magnification and Resolution, Lens aberrations, Distortion of image and curvature of field. Electron Microscopy- Theory and basic principles of Electron Microscopy, Structure and Forensic applications of Scanning Electron microscope (SEM), Transmission Electron Microscope (TEM).
Unit IV	Introductory Chromatography: Definition, Chromatographic Techniques, History of Chromatography, Theoretical principles of Chromatography, Classification of Chromatographic Methods, Adsorption and Partition Chromatography. Thin Layer Chromatography: Basic Principle, Setup, visualization and Forensic applications etc..: Definition, Chromatographic Techniques, History of Chromatography, Theoretical principles of Chromatography, Classification of Chromatographic Methods, Adsorption and Partition Chromatography. Thin Layer Chromatography: Basic Principle, Setup, visualization and Forensic applications etc..



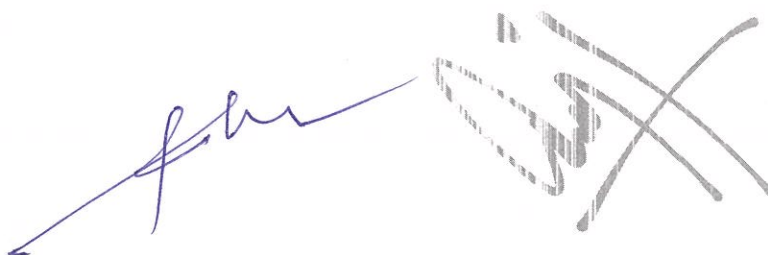
SEMESTER - II

PGDFS	2.1 Forensic Biology and DNA Profiling(25PGDFS-201)
Course outcomes	After successfully completing this course students - would be able to understand the forensic DNA profiling and its application in criminal and civil investigations. - Able to analyze microscopic and macroscopic examination of biological samples like plant, hair recovered from crime scene. - learn the techniques used in DNA Profiling - understand the Concept of gene and sequence variation.

Course Code	(25PGDFS-201)
PGDFS	2.1 Forensic Biology and DNA Profiling
UnitNo.	Contents of Unit
Unit I	Human Genetics, Heredity, Alleles, Mutations and Population Genetics, The concept of Genetics polymorphism, Hardy-Weinberg Law.
Unit II	DNA Profiling: Introduction, History of DNA Typing, molecular biology of DNA, variations, polymorphism, DNA Extraction-Organic and Inorganic extraction, Comparison of Extraction methods, Commercial kits DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR, Mitochondrial DNA, Ancient DNA typing, Evaluation of results.
Unit III	DNA Statistics: frequency estimate calculations, interpretations, allele frequency determination, Paternity/Maternity index, Sibling index, Probability of match. Human Genome Project: Introduction, History, Goals, Benefits, Social, Ethical and Legal Issues DNA Forensic Databases, Ethical, Legal, and Social Issues Associated with DNA Databanking, Potential. Benefits of DNA Databanking Quality control, certification and accreditation.
Unit IV	Forensic Significance of DNA profiling: Applications in disputed paternity cases, child swapping, missing person's identity- civil immigration, veter inary, wildlife and agriculture cases, legal perspectives- legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad. New and future technologies: DNA chips, SNPs and limitations of DNA profiling.

Suggested Readings

- 1) Saferstein, R. (1982) Science Handbook, Vol. I, II, & III, Prentice Hall New Jersey.
- 2) Kirby : DNA Fingerprinting Technology.
- 3) DNA structure and functions by Richard R. Sinden; Academic Press, Inc. 1994.
- 4) DNA Profiling and DNA fingerprinting (1999) Edited by Jorg T. Epplen and Thomas Lubjuhn; Birkhauser Verlag, Switzerland.
- 5) Forensic DNA Profiling Protocols (1998) Patrick J. Lincoln and Jim Thomson; Humana Press, Inc.
- 6) DNA and other Polymorphism in Forensic Science (1990) Henry C. Lee and R.E. Gaensslen; Year book nMedical Publishers, Inc.
7. Keith In man and Norah Rudin (1997) An Introduction to Forensic DNA Analysis, CRC Press; Ny.
- 7) Koblinsky et al. (2005) DNA -Forensic and Legal Implications.
- 8) John M. Butler (2005) Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers Academic Press.

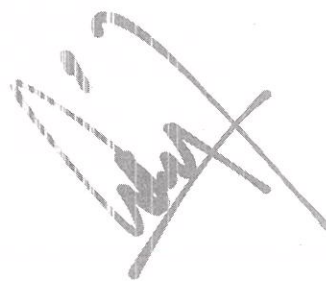
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PGDFS	2.2 Theoretical and Practical Aspects of Biological Evidences(25PGDFS-202)
Course outcomes	After successfully completing this course students - would be able to understand the forensic DNA profiling and its application in criminal and civil investigations. - Able to analyze microscopic and macroscopic examination of biological samples like plant, hair recovered from crime scene. - learn the techniques used in DNA Profiling - understand the Concept of gene and sequence variation.

Course Code	(25PGDFS-202)
PGDFS	2.2 Theoretical and Practical Aspects of Biological Evidences
UnitNo.	Contents of Unit
Unit I	Forensic Hair characterization: Morphology and types, their importance, nature, location, collection, evaluation and tests for their identification: Species of origin, variation in different major population groups, somatic origin. Methods of Individualization: Blood grouping, enzyme typing and DNA typing
Unit II	Forensic Characterization of Blood: Chemistry and properties, Presumptive and Confirmatory tests, Individualization (Blood Grouping, Polymorphic enzyme typing). Forensic Characterization of Semen: Formation, Composition, Morphology of spermatozoa, forensic significance, Presumptive and Confirmatory tests (including Azoospermic semen stains). Individualization (Blood Grouping, seminal fluid isozymes typing, forensic significance, Collection and analysis of evidences in Rape cases.
Unit III	Blood grouping from stains of blood, semen, saliva and other body fluids by Absorption-inhibition, Absorption-elution and mixed agglutination techniques, determination of secretor/nonsecretor status.
Unit IV	Serological Techniques: Primary binding assays (ELISA, Immunochromatographic assays), Secondary binding assays (Precipitation based assays- Immunodiffusion and electrophoretic methods for species. Identification, Agglutination based assays- Direct agglutination assay, Passive agglutination assay)

Suggested Readings

1. Brown, T; Gene cloning and DNA analysis: An Introduction , 5th ed. Blackwellpublishing, London, 2006 .
2. Butler, J; Advanced Topics in Forensic DNA Typing: Methodology, 1st Ed., Academic Press, London, 2009.
3. Easteal, S. McLeod, N. & Reed, K; DNA Profiling: Principles, Pitfalls and Potential, Harwood Academic Publishers, New Jersey, 1991.
4. Primorac, D.&Schanfield, M; Forensic DNA Applications: An Interdisciplinary Perspective, CRC Press, New York, 2014.
5. Rudin, N. & Inman, K; An Introduction to Forensic DNA Analysis, Second Ed.,CRC press, New York, 2001.
6. Spencer, C; Genetic testimony: a guide to forensic DNA profiling, Pearson, New Delhi, 2004.

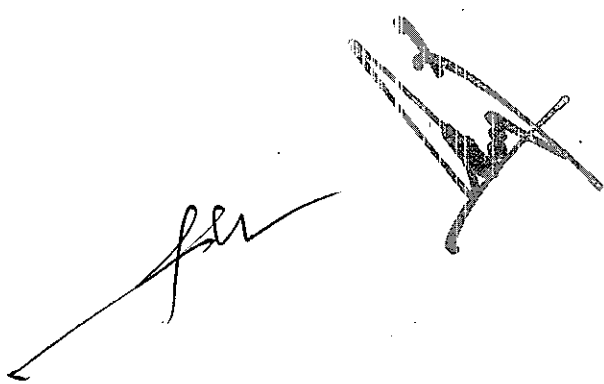


PGDFS	2.3 Fingerprint Science ((25PGDFS-203))
Course outcomes	After successfully completing this course students • Will be able to understand the origin of fingerprint science. • Will obtain knowledge regarding different patterns of fingerprint and its applicability in crime investigation. • Will have a general understating regarding formation of ridges in fingers, ridge characteristics and its applicability in court of law. • Will be able critically evaluate new methods of identification and analysis.

Course Code	(25PGDFS-203)
PGDFS	2.3 Fingerprint Science
Unit No.	Contents of Unit
Unit I	Introduction to Dactyloscopy Fingerprints in General: Dactylography, Dermatoglyphics, and Dactyloscopy, basis for the science of fingerprints, Friction Ridge Skin, Morphogenesis of Friction Ridge Skin, Primary Dermal Ridge Development, Definition of fingerprint, History of Fingerprint Identification, Fingerprint as forensic Evidence, Visible Fingermarks, Latent Fingermarks,
Unit II	Biological formation of friction ridges Classification of Fingerprints for Comparison purposes: Pattern area, Core, Delta, Type lines, Poroscopy, edgeoscopy, ridge characteristics, Fingerprint Pattern Types: Essentials and its types of Loop, Arch, whorl, Composites, accidental patters etc, Ten Digit and Single Digit fingerprint classification.
Unit III	Methods of Taking Fingerprints: From living and dead persons, preserving and lifting of fingerprints. Comparison Protocols: Class and individual characteristics (Galton's details), different ridge characteristics, Standards of proof, Automatic Fingerprint Identification System (AFIS), Poroscopy and Edgeoscopy.
Unit IV	Fingerprint Developing Methods: Chemistry of latent fingerprint residue, factor contributing to latent fingerprints, Methods of Development of latent fingerprints using conventional methods– Powdering (Black and grey, fluorescent and magnetic), Fuming method, Vacuum Metal Deposition (VMD) Method, Chemical method, Reagent chemistry and formulations, Sequential Treatment and Enhancement., Photography of fingerprints, Digital Transmission. Report Writing & Court Room Testimony: Evidence and testimony in court, Information required by the Forensic expert, Components of Forensic Reports, Preparation of Report, Presenting findings in a Report format.

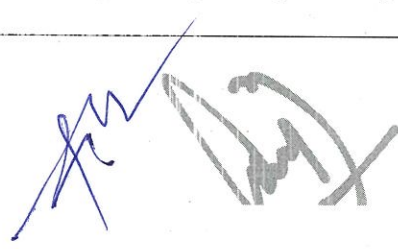
Suggested readings:

1. Daluz, H. M. (2019). *Fundamentals of Fingerprint Analysis*, CRC Press, ISBN 9780367778743.
2. Federal Bureau of Investigation & Department of Justice, (2010). *The Science of Fingerprints: Classification and Uses*, Books Express Publishing, ISBN: 978-1780390345
3. Galton, F. (1892). *Finger Prints*, London: Macmillan And Co nts
4. Giuliao, A. (2016). *Fingerprint Identification Handbook*, Edizioni Minerva Medica, ISBN- 978-8877118776
5. Henry, E. R. (1900). *Classification and Uses of Finger Prints*, London: His Majesty's Stationary Office.
6. Houck, M. M., & Siegel, J. A. (2015). *Fundamentals of Forensic Science*, Elsevier Ltd., 978—12-800037-3. doi: <https://doi.org/10.1016/C2013-0-12985-6>
7. Lee, H. C. (2011). *Physical Evidence in Forensic Science*, Lawyers & Judges Pub Co; 3rd edition, ISBN-10: 1936360012, ISBN-13: 978-1936360017.
8. Nabar, B. S. (2013). *Forensic science in crime investigation*, Hyderabad, India: Asia Law House Hyderabad.
9. Sharma, B.R. (2014). *Forensic science in criminal investigation and trials*, New Delhi, India: Universal Law Publishing Co. Pvt. Ltd.
10. Tubid, P. T. (n.d.). *Dactyloscopy: Science of Fingerprint Classification and Identification*, Rex Bookstore, Inc., ISBN- 9789712320644

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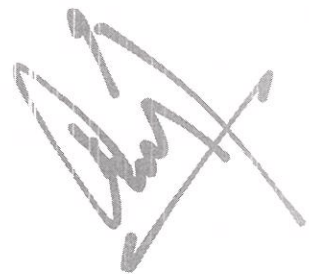
PGDFS	2.4 Forensic Documents (25PGDFS-204)
Course outcomes	After successfully completing this course students • Will be able to understand evolution and functions of question document examiner • Will have a general understating regarding questioned documents, its characteristics in crime investigation • Will be able to analyze the effects of writing instruments on handwriting • Will have better understanding regarding things effecting documents, Neurological disease and its identification in suspects.

Course Code	25PGDFS-204
PGDFS	2.4 Forensic Documents
Unit No.	Contents of Unit
Unit I	Introduction to handwriting Questioned Document: Definition, Importance, Classification and Preliminary Examination of questioned documents. Handwriting: Definition, Scripts, Development, Graphology, Systems of Writing, Instruments and Appliances of handwriting expert. Handwriting Characteristics: General Characteristics, Individual Characteristics, Development of Individuality in Handwriting Comparison of Handwriting: Natural Variations, Fundamental Divergences
Unit II	Forgeries: Forgery and its types and characteristics, identification and examination of forgeries. Decipherment of secret indented and charred documents: Preservation of documents, Examination of seal and other mechanical impressions, examination of sequence of intersecting of strokes. Standards for Comparison and Disguise etc.
Unit III	Age of Document & Alterations: Determination of Age of Document- Absolute/relative Age, Indented and Invisible Writings, Alterations in the document: erasures, additions, overwriting and obliterations. Comparison of type written/printed matter: Working of typewriter, Printing and Machine Defects, alterations in typed text, various type of typewriting devices- check writing machines, electronic. Typewriter and proportional spacing typewriter. Comparison of Printed matter: Various Printing Processes. Currency Note examination: Identifying features of fake and genuine Indian currency notes
Unit IV	Instrumentation and Photography of Documents: - Basic Principles & Techniques Visible and Florescence (UV and IR), Photomicrography & Microphotography, Stereo-zoom Microscopy, Video Spectral Comparator (VSC) and Electrostatic Detection Apparatus (ESDA). Report Writing & Court Room Testimony: Evidence and testimony in court, Information required by the Forensic expert, Components of Forensic Reports, Preparation of Report, Presenting findings in a Report format.



Suggested readings:

1. Angel, M., & Kelly, J. S. (2021). *Forensic Document Examination in the 21st century*, CRC Press, ISBN: 9780367251550
2. Bisesi, M. (2006). *Scientific Examination of Questioned Documents*, CRC Press, ISBN: 978-0849320446
3. Djioua M., and Plamondon, R. (2009). Studying the variability of handwriting patterns using the kinematic theory. *Human Movement Science*.
4. Girad, J. E. (2017). *Criminalistics: Forensic science in crime*, Jones and Bartlett Publishers, Inc; 4th edition, ISBN-10: 1284142612, ISBN-13: 978-1284142617.
5. Hilton, O. (1956). *Scientific Examination of Questioned Documents*, Callaghan.
6. Koppennavar, K. M. (2007). *Forensic Document Examination: Principles and Practice*, Springer Science & Business Media
7. Nabar, B. S. (2013). *Forensic science in crime investigation*, Hyderabad, India: Asia Law House Hyderabad.
8. Osborn, A. S. (1910). *Questioned Documents*, Brooklyn, New York: The Genesee Press.
9. Sharma, B.R. (2014). *Forensic science in criminal investigation and trials*, New Delhi, India: Universal Law Publishing Co. Pvt. Ltd.
10. Vastrick, T. W. (2004). *Forensic Document Examination Techniques*, Inst of Internal Auditors, ISBN- 978-0894135415



PGDFS	2.5 PRACTICALS – I (25PGDFS-205)
Course outcomes	After successfully completing this course students • Will be able to develop latent fingerprints through physical and chemical methods • Will be able to conduct fingerprint examination • Will be able to identify the authenticity of a document • Will be able to conduct TLC on inks

2.5	PRACTICALS – II
Course Code	25PGDFS-205
1. Recording of fingerprints 2. Development of latent fingerprints through physical and chemical methods 3. Identification and comparison of ridge characteristics 4. Fingerprint classification: Henry's 10 digit classification, Single digit classification 5. Examination of Questioned Documents through class and individual characteristics of Handwritten documents 6. Examination of Questioned Documents through class and individual characteristics of Typewritten documents 7. Examination of security features of currency notes and coins 8. Distribution of inks through TLC 9. Visit to University Instrumentation centre for observation of different scientific instruments 10. To prepare slides of scale patterns of human hair. 11. Examination of hair of different domestic animals as cat, dog, cow, horse and goat. 12. To determine blood group from fresh blood and blood stains. 13. To identify blood stains. 14. To identify semen stains. 15. To identify saliva stains. 16. To determine titre of antisera. 17. To perform precipitin test for species of origin determination.	

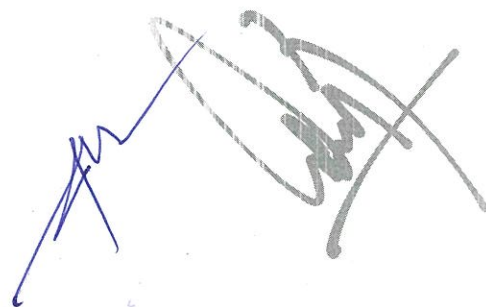
*This is tentative list of practical, final list will be notified in the running semester

PGDFS	2.6 Cybercrime and Cyber Security (25PGDFS-206)
Course outcomes	After successfully completing this course students • Will be able to use and understand the subject matter of cybercrime and cyber security • Will have a general understating regarding evolution of the cybercrime and its laws • Will be able critically evaluate trends in cyber crime • Will begin to think critically about types of cybercrime, investigative methods and recent trends in cybercrime.

Course Code	25PGDFS-206
PGDFS	2.6 Cybercrime and Cyber Security
UnitNo.	Contents of Unit
Unit I	Introduction to computer forensics Introduction, Nature of digital evidence, Retrieval and analysis of digital evidence, Sources of digital evidence, Computer security and its relationship to computer forensics. Emergence of computer crime: Classification of computer crimes, computer virus and types, computer worms, Trojan Horse, trap door, super zapping, logic bomb, salami logic, characteristics of computer crime and criminals.
Unit II	Identity Theft and Identity Frauds 1. Physical Methods of Identity Theft 2. Mail Theft, Dumpster Diving, Theft of Computers, Bag Operations, 3. Child Identity Theft, Insiders, Fraudulent or Fictitious Companies, 4. Card Skimming, ATM Manipulation, and Fraudulent Machines 5. Virtual or Internet-Facilitated Methods, Phishing, Spyware and Crimeware
Unit III	Cyber forensic investigative tools and Mobile forensics Investigating on various imaging methods. Lay down the image provided onto a hard disk and provide a disk map of the suspect drive. Extraction of all relevant information from a hard disk. Cell phone/mobile forensics: Introduction, Forensic toolkit, EnCase, Ilook Investigator. Digital signature and cryptography: signature in paper based society, Transfer of computer based documents, digital signature and authentication, digital signature generation and verification, certification of public keys, certification of authority.
Unit IV	Cyber security and cyber terrorism 1. SCADA systems, Firewalls and wireless access points, 2. Network protocols, Password management, OTP, antivirus software and QR code. 3. Roots of Contemporary Terrorism, Propaganda, Information Dissemination, Recruiting, and Fundraising, Attack Mechanism. 4. Brief introduction to Cyber space and cyber Laws, IT Act

Suggested readings:

1. Bhusan, M. (2018). *Fundamental of cyber security: Principles, Theory and Practices*, BPB Publications, ISBNB-9789387284807
2. Bothra, H. (2017). *Hacking*, Khanna Publishing, ISBN-9789386173058
3. Britz, M. T. (2004). *Computer Forensic Science and Cybercrime: An Introduction*, Pearson Education India; third edition, ISBN-13: 978-0132677714.
4. Godbole, N., & Belapure, S. (2011). *Cyber Security*, Wiley Publication, ISBNB- 978-8126521791
5. Jain, N., & Kalbande, D. R. (2016). *Digital Forensic: The Fascinating World of Digital Evidences*, Wiley Publication, ISN- 978-8126565740
6. Jain, N., & Menon, R. (2020). *Cyber Security and Cyber Laws*, Noida, India: Wiley India Pvt Ltd. 1402, ISBN- 978-9390395750
7. Mali, P. (2017). *Cyber law & Cyber Crimes simplified*, Cyber Infomedia.
8. Pieprzyk J., & Hardjono, T. (2010). *Fundamentals of Computer Security*, Springer, ISBN-13: 978-3642077135
9. Sandhu, J. S. (2021). *Cyber Infomedia*, Notion press, ISBN- 979-8885036221
10. Singer, P. W., & Friedman, A. (2013). *Cybersecurity and Cyberwar: What Everyone Needs to Know*, USA: Oxford University Press India; Illustrated edition, ASIN: 0199918112, ISBN-13: 978-0199918119.

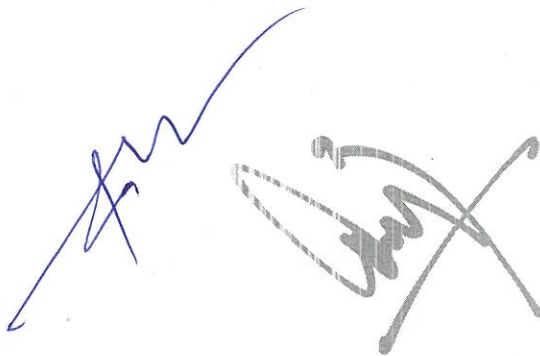


PGDFS	2.7 Fundamentals of Forensic Ballistics(25PGDFS-207)
Course outcomes	After completing this course, students • Students would be able to describe different mechanisms of firearms. • would be able to compare cartridge cases and bullets. • They would be able to estimate the range of fire and the use of GSR in catching the suspect. • They may be able to present testimony in court of law on ballistics evidence.

Course Code	25PGDFS-207
PGDFS	2.7 Fundamentals of Forensic Ballistics
UnitNo.	Contents of Unit
Unit I	Forensic Ballistics: Definition and scope, Types of evidences associated, History and mechanism of Muzzleloaders (Match lock, Wheel lock, Flint lock firearms), Briefs of Pinfire, Rimfire and Centrefire systems of firearms. Different parameters of classification of firearms, Introduction to Shotgun, Revolver, Pistol, Rifle and Country Made/ Improvised Firearms. Proof Marks of Weapons.
Unit II	Firearm Ammunition: Ammunition Components of Shotgun and Rifled firearm cartridges, Headstamp Markings on Ammunition. Internal Ballistics: Definition, Shapes and manner of Propellant burning, Muzzle velocity and Factors affecting muzzle velocity.
Unit III	External Ballistics: Definition- Bullet Trajectory and factors affecting bullet flight. Wound Ballistics: Definition of wound ballistics, Ballistic aspect of firearm injuries, significance of studying cavitations in body, Bullet Entry/Exit Hole Identification, Evaluation of Accident, Suicide, Homicide firearm injuries.
Unit IV	Range of Firing determination: Introduction and methods of estimation. Gunshot Residue: Introduction and methods of analysis. Bullet and Cartridges matching: Class and individual characteristics on bullet and cartridge case for comparing and matching with suspected firearm. Briefs of NIBIN and IBIS.

Suggested readings:

- 1) Hatcher Jury & Weller, 1987 : Firearm Investigation Identification and Evidence, The University Book Agency, Allahabad.
- 2) Gunther & Gunther, 1935 : The Identification of Firearms, Woldies, New York.
- 3) Jauhri, M. 1980 : Monograph on Forensic Ballistics, Govt. of India Publication, New Delhi.
- 4) Burrad, 1951 : The Identification of Firearms and Forensic Ballistics.
- 5) Sharma, B.R. : Firearms in Criminal Investigation and Trails, 1990.
- 6) Di Maio : Gunshot Wounds, 1987. 8. Kumar : Forensic Ballistics in Criminal Justice, 1987.
- 7) Yallop Explosion Investigation, 1980.
- 8) Edward Hueske: Firearms and Fingerprints
- 9) Brian J Heard: Handbook of Firearms and Ballistics, Examining and Interpreting Forensic Evidence, Second Edition



PGDFS .	2.8 Instrumental Techniques) (25PGDFS-208)
Course outcomes	After completing this course, students - would know about the concept of Spectroscopy, electromagnetic spectrum, sources of radiation, their utility, and limitations. - Able to describe the different Physical instrumentation techniques. - Will have understanding of basic principles and theory of radiochemical techniques. - Able to highlight general principles of biological and biochemical techniques

Course Code	25PGDFS-208
PGDFS	2.7 Instrumental Techniques
UnitNo.	Contents of Unit
Unit I	Physical instrumentation techniques IR spectroscopy- correlation of infrared spectra with molecular structure, fourier transform, infrared (FTIR) and Raman spectroscopy, fluorescence and phosphorescence spectrophotometry, Ultra violet and visible spectrophotometry: Types of sources, filters-cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection. Mass Spectrometry, GCMS, LCMS, Secondary Mass Spectrometry, Laser Mass spectrometry, Fast Atom bombardment and liquid secondary Ion Mass spectrometry, High performance liquid chromatography, Electrospray Ionization mass spectrometry. Application of these techniques in forensic science
Unit II	Biochemical techniques Biological and biochemical techniques: General principles of Biological/ Bio-chemical Analysis, pH and buffers, Physiological solution, cell and tissue culture, Cell fractionation, Biological variations etc. Centrifugation Techniques, Immuno-chemical Technique, General principles, Production of antibodies, Precipitin reaction, Gel immune-diffusion, Immunoelectrophoresis, complement fixation, Radio Immuno Assay (RIA), Enzyme-linked ImmunoSorbent Assay (ELISA), Fluorescence immune assay. Chromatographic Techniques, Electrophoretic Technique: General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis, Sodium dodecylsulphate (SDS) polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical Electrophoresis. Application of these techniques in forensic science. .

Suggested readings:

- 1) Hatcher Jury & Weller, 1987 : Firearm Investigation Identification and Evidence, The University Book Agency, Allahabad.
- 2) Gunther & Gunther, 1935 : The Identification of Firearms, Woldies, New York.
- 3) Jauhri, M. 1980 : Monograph on Forensic Ballistics, Govt. of India Publication, New Delhi.
- 4) Burrad, 1951 : The Identification of Firearms and Forensic Ballistics.
- 5) Sharma, B.R. : Firearms in Criminal Investigation and Trails, 1990.
- 6) Di Maio : Gunshot Wounds, 1987. 8. Kumar : Forensic Ballistics in Criminal Justice, 1987.
- 7) Yallop Explosion Investigation, 1980.
- 8) Edward Hueske: Firearms and Fingerprints
- 9) Brian J Heard: Handbook of Firearms and Ballistics, Examining and Interpreting Forensic Evidence, Second Edition