



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Forensic Science

B.Sc. with Major Forensic Science – Batch (2022-2025)
SEMESTER - IV

BFS401 FORENSIC BALLISTICS

Course Code	CATEGORY	Course Name	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End-Sem University Exam	Teachers Assessment*				
BFS401	Major	Forensic Ballistics	60	20	20	60	40	4	0	4	6

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.**

Course Objectives: After studying this paper the students will know –

1. The classification of firearms and their firing mechanisms.
2. The characteristics of ammunition.
3. The importance of firearm evidence.
4. The methods for characterization of gunshot residue.
5. The nature of firearm injuries.

Course Outcomes:

1. Student will be able to understand the historical development and basic concepts of Firearms and Ammunition.
2. Student will be able to know the classification of firearms.
3. Students will be familiar with the various aspects of internal ballistics and external ballistics.
4. Student will be able to evaluate and interpret crucial information from firearm injuries and
5. Understand the concepts behind linkage of firearm and ammunition.

Unit 1: Firearms

Definition of Firearms, History and development of firearms- Early history of firearms, the earliest firearms, the fifteenth century Match lock, sixteenth & seventeenth century small arms, The age of the Flint lock, the percussion lock firearms.

Classification of firearms: Characteristics and firing mechanism of smooth bored firearms (M.L., B.L.) Rifled firearms (Pistol, Revolver, Rifles, and Machine Guns), Classification, nomenclature and construction of country made firearms.

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Unit 2: Ammunition

Types of ammunition. Constructional features (Cartridge case primer propellant, Bullets, Pellets and wads). and characteristics of different types of cartridges and bullets. Primers and priming compounds. Projectiles. Headstamp markings on ammunitions. Different types of marks produced during firing process on cartridge – firing pin marks, breech face marks, chamber marks, extractor and ejector marks.

Unit 3 Types of Ballistics

Internal Ballistics: Definition, Ignition of the propellant, manner of burning, Piobett's law, Shape and Size of the propellant, pressure space curve, shot start pressure. All burnt point, Velocity, Space curve, Le Due's formula, muzzle velocity, Factors affecting muzzle velocity, theory of recoil.

External Ballistics: Definition-trajectory drop in the flight of the projectiles force of gravity, air resistance-base drag, Yaw, Shape of bullet (Spherical ball, Cylinder- conical, flat nose, round nose etc.) effective range, extreme range.

Terminal Ballistics: Definition, behavior of various types of bullets on hitting the target, remaining velocity, stopping power, Ricochet.

Unit 4: Firearm Evidence

Range of Firing determination: Visual and Chemical, instrumental methods with special reference to the applications of Neutron activation, Atomic absorptions, Scanning Electronmicroscopy and other miscellaneous methods.

Gunshot Residue: Mechanism of formation of GSR, modern methods of analysis of GSR from the shooting hand & target with special reference to clothings.

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.

Unit 5: Firearm injuries:

Ballistic aspect of firearm injuries, nature, Effect of target, Velocity, constructional features and range on the wounding, significance of studying cavitations in body, Bullet Entry/Exit Hole Identification Evaluation of Firearm injuries.

Reconstruction: Accident, Suicide, murder and self-defense.

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Practicals:

1. To describe, with the aid of diagrams, the firing mechanisms of different types of firearms.
2. To correlate the velocity of bullet with the impact it produces on the target.
3. To correlate the striking angle of the bullet with the impact on the target.
4. To estimate the range of fired bullets.
5. To carry out the comparison of fired bullets.
6. To carry out the comparison of fired cartridge cases.
7. Determination of Shot number from size and weight of shots
8. To identify gunshot residue.
9. To correlate the nature of injuries with distance from which the bullet was fired.
10. To differentiate, with the aid of diagram, contact wounds, close range wounds and distant wounds.

Suggested Readings:

1. B.J. Heard, Handbook of Firearms and Ballistics, Wiley and Sons, Chichester (1997).
2. W.F. Rowe, Firearms identification, Forensic Science Handbook, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).
3. A.J. Schwoeble and D.L. Exline, Current Methods in Forensic Gunshot Residue Analysis, CRC Press, Boca Raton (2000).
4. J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.) in Encyclopedia of Forensic Science, Volume 2, (Eds.), Academic Press, London (2000).
5. Kumar, Forensic Ballistics in Criminal Justice (1987)
6. Burrad, The Identification of Firearms and Forensic Ballistics (1951)
7. B.R. Sharma, Firearms in Criminal Investigation and Trails (1990).

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BFS402 PHYSICS

Course Code	CATEGORY	Course Name	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End-Sem University Exam	Teachers Assessment*				
BFS402	Minor	Physics	60	20	20	60	40	4	0	4	6

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
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Learning Objectives: After studying this paper the students will know –

1. & refraction of Light
2. Interference Properties of mechanics and acoustic
3. Reflection of Light
4. Properties & applications of Laser
5. Phenomenon of Radioactivity

Unit 1: Mechanics & Acoustics

Concept of force, Inertia, Newton's first law of motion; Momentum , Newton's second law of motion; Impulse; Newton's third law of motion, Law of conservation of linear momentum, Static and kinetic friction, Laws of friction. Velocity of sound, echo , absorption coefficient, introduction to ultrasonic, production of ultrasonic waves, applications of ultrasonic waves, Generation of sound, amplitude, Vibration, Physical properties of vibrating systems .

Unit 2: Wave Optics -I

Reflection of light, Refraction of light, Total internal reflection and its applications, Diffraction of light, types of diffraction, Diffraction of light in a single slit, Aberrations in images and types of aberrations. Principle and applications of some optical instruments: Simple Microscope, Compound Microscope, Polarizing Microscope, Stereomicroscope, Comparison Microscope, Electron Microscope, Simple table spectrometer.

Unit 3:Wave Optics-II

Wave front and Huygens's principle, Huygen's theory of secondary wavelets, Introduction to interference, Interference in thin films, Michelson's Interferometer, Coherent sources, Polarisation, Plane polarised light, Brewsters' law, Malus law.

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Unit 4: Electronics and LASER

Conductors, semi-conductors & Insulators, Types of semi-conductors, Conduction in N-type and P-type semi-conductors, Diode, Bias, Rectifier, Transistors, Emitter characteristic curve, Collector characteristic curve, Transconductance, Amplifier.

Production of LASER, Types of LASER, Properties of Laser, applications of LASER, Optical fibres, Propagation of light through optical fibre, Angle of acceptance and numerical aperture.

Unit 5: Nuclear Physics

Composition and size of nucleus, atomic masses, isotopes, isobars, isotones, Nuclear forces, fission, fusion, nuclear properties and half life, Radioactive decays, alpha, beta & gamma rays, Applications of Radio Isotopes, counters and detectors- Geiger-muller counter, scintillation counter.

Practicals:

1. Standard Operating Procedures for using Vernier Caliper, Micrometer Screw Gauge ,
2. Standard Operating Procedures for using Travelling Microscope, Comparison Microscope
3. Standard operating Procedure for using Abbes Refractometer, Stereo Microscope.
4. Determination of refractive index of given liquid using Abbes refractometer (Four Liquid).
5. Determination of refractive index of material of prism using Spectrometer.
6. To identify the fibre using stereo microscope.
7. To determine the wavelength of Sodium lamp using Newton's Ring Experiment
8. To study the 'n' diffraction pattern using spectrometer.
9. To study Forward and Reverse characteristics of Zener diode.
10. Measurement of wavelength of LASER light source using diffraction grating.

Suggested Readings:

1. Applied Fluid Mechanics, by- Mott Robert, Pearson Benjamin Cummir, VI Edition, Pearson Education/Prentice Hall International, New Delhi
2. Atomic and Nuclear physics, by- N. Subramanyam, Brijlal.
3. Fundamental of Acoustics 4th Edition, by- Kinsler , John Wiley and Sons
4. Mechanics, by- D. S. Mathur, S Chand.
5. Nuclear Physics, by- S. N. Ghoshal.
6. Optics, by- Brijlal and Subramayam.
7. Physics for Degree Students B.Sc.-Part-I, by- C. L. Arora, Dr. P. S. Hemne, S Chand & Company.
8. The Physics of waves and oscillation, by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd.
9. Waves and oscillation, by- N. Subrahmanuam and Brijlal.
10. Laser and Optical fiber communication, by- P.Sarah.
11. LASERS- Theory and Applications, by- Thyagarajan and A. K. Ghatak

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VOFS102 QUESTIONED DOCUMENT

Course Code	CATEGORY	Course Name	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End-Sem University Exam	Teachers Assessment*				
VOFS102	VC	Questioned Document	0	0	0	60	40	0	2	4	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.**

Learning Objectives: After studying this Paper the Students will Know-

1. The fundamentals of questioned document.
2. Examination, identification and comparison of questioned document.
3. The basic principles and characteristics of handwriting.

Unit 1:Nature and Scope of Questioned Documents:

Definition of questioned documents. Types of questioned documents. Preliminary examination of documents.

Unit 2:Basic tools needed for forensic documents' examination:

Ultraviolet, Visible, Infrared and Fluorescence Spectroscopy, Photomicrography, Microphotography, Visible Spectral Comparator, Electrostatic Detection Apparatus. Determining the age and relative age of documents.

Unit 3: Comparison of Documents

Comparison of handwriting. Development of individuality in handwriting. Natural variations and fundamental divergences in handwritings. Class and individual characteristics.

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Unit 4: Comparison of Handwriting

Merits and demerits of exemplar and non-exemplar samples during comparison of handwriting. Standards for comparison of handwriting. Comparison of paper, ink, printed documents, typed documents, Xeroxed documents.

Unit 5: 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.

Practicals:

1. To identify handwriting characters.
2. To study natural variations in handwriting.
3. To compare handwriting samples.
4. To detect simulated forgery.
5. To detect traced forgery.
6. To study the line quality defects in handwriting samples.
7. To examine the security features of currency notes, passports and plastic money.
8. To study alterations, obliterations and erasures in handwriting samples.
9. To cite a case wherein Section 45 of Indian Evidence Act was invoked, seeking expert opinion for authentication of handwriting and/or signatures.
10. To cite a case wherein Section 489A of the Indian Penal Code was invoked in context of fake currency.

Suggested Readings:

1. O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (1982).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, Foundation Press, New York (1995).
3. R.N. Morris, Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2000).
4. E. David, The Scientific Examination of Documents – Methods and Techniques, 2nd Edition, Taylor & Francis, Hants (1997).

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