



Syllabus
Gyanmanjari Science College
Semester-6 (B.Sc)

Subject: Forensic Ballistics- BSCFS16312

Type of course: Major

Prerequisite: Basic understanding of Physics (velocity, motion and energy), Chemistry (propellants and combustion), and fundamentals of Forensic Science is recommended.

Rationale: This course introduces students to the science of firearms, ammunition, and ballistic evidence analysis. It covers internal, external, and terminal ballistics, the study of firearm mechanisms, gunshot residue analysis, and crime scene reconstruction related to shooting incidents.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		C	SEE		CCE		
			Theory		Practical	MSE	LWA/V	ALA	
3	0	2	4	75	25	30	20	50	200

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; MSE- Mid Semester Examination; LWA - Lab Work Assessment; V – Viva voce; CCE-Continuous and Comprehensive Evaluation; ALA- Active Learning Activities.

Course Content:

Unit No	Course Content	Hrs	% Weightage
1	Firearms: Introduction of firearms , History and background of firearms , firearms classifications and characteristics , various components of small arms , class characteristics of a firearm , purpose of rifling , types of rifling , trigger and firing mechanism , ejection mechanism of a cartridge , chocking mechanism , bore classification , improvised/ country made/ imitative firearm and their constructional features , provisions of Arms	13	25%



2	<p>Ammunition: Introduction of ammunition, types and classification of ammunition, constructional features and characteristics of different types of cartridges , types of primers and priming composition , propellants and their compositions , various types of bullets and its compositional aspects, safety aspects of handling firearm and ammunition.</p>	12	25%
3	<p>Ballistics: Introduction to ballistics, types of ballistics, Internal Ballistics- definition, ignition of propellant, size and shape of propellant, manner of burning and factors affection internal ballistics, theory of recoil, recoil velocity, angle of elevation of the barrel, barrel fouling.</p>	10	25%
4	<p>External and Terminal Ballistics: External- Vacuum Trajectory, effect of air resistance and trajectory, base drag, drop, drift, yaw, shape of projectile and stability, ballistics coefficient and limiting velocity, measurements of trajectory parameters, BDAS and IBIS Terminal- effect of projectile hitting the target , function of bullet shape, striking velocity, angle an nature target, range of firing, entry and exit wound , analysis of GSR, comparison of bullets.</p>	10	25%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	<p>Case Study Analysis (Legal Aspect of Firearms – Arms Act, 1959) Divide students into small groups and provide them real or hypothetical case studies involving firearms (e.g., illegal possession, misuse). Each group analyzes the case using the relevant provisions of the Arms Act, 1959, and presents their findings with recommendations.</p>	10
2	<p>Hands-on Cartridge & Bullet Identification Workshop Provide dummy cartridges, bullets, or detailed diagrams (if real ones not available). Students classify ammunition based on construction, type of primer, and bullet shape, then explain the safety handling procedures.</p>	10
3	<p>Trajectory Simulation & Recoil Calculation Exercise Use software simulation tools (or simple physics equations) to model projectile trajectory and calculate recoil velocity. Students work in pairs to input different</p>	10



	parameters (angle, velocity, mass) and predict the bullet's path, then discuss factors affecting accuracy.	
4	Group Presentation on Ballistics (Internal, External, Terminal) Assign each group one type of ballistics (internal, external, or terminal). Students research their assigned topic, prepare visual aids (charts, diagrams), and present the process (e.g., ignition, trajectory, wound ballistics).	10
5	Attendance	10
Total		50

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1	To study and caliber and rifling characteristics of given firearm	All Units	03
2	To study assembling and dismantling of firearms		04
3	To Study the working mechanisms of firearms		03
4	Examination of air guns/rifles as per Arms Act 1959		04
5	Study of constructional features of cartridge and Physical examination of propellant of ammunition.		03
6	Study of constructional features of country made firearms		03
7	Examination of fired barrels to identify powder residue, fouling, and leading		03
8	Demonstration of Gunshot Residue test by using chemical method		03
9	Comparison of two fired bullets under comparison microscope(or high resolution images)		04
		Total	30



Suggested Specification table with Marks (Theory):75

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	30%	30%	20%	00	00

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Explain the history, classification, components, and mechanisms of firearms, including rifling, cartridge ejection, bore classification, and legal provisions under the Arms Act, 1959.
CO2	Describe the types, construction, and characteristics of ammunition, primers, propellants, and bullets, and apply safety measures for proper handling.
CO3	Analyze internal ballistics by explaining propellant ignition, factors affecting bullet motion inside the barrel, and calculating recoil and barrel effects.
CO4	Interpret projectile motion, trajectory parameters, and wound ballistics, and evaluate bullet comparison and GSR analysis for forensic investigation.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.



Reference Books:

- [1]Firearms in Criminal investigation and trials, B.R. Sharma
- [2]Forensic Ballistics in Criminal Justice, Kausalendra Kumar
- [3]Integrated Ballistics Identification System [IBIS] operating manual
- [4]Firearm, the law and Forensic Ballistics, Tom Warlow

