Part B

Syllabus Prescribed for 03 Year UG Programme

Programme: B. Sc. in Forensic Science

Semester 3

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
3S Forensic Science	**Forensic Physics**	**84**
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Students will be able to

1. identify and analyze trace evidences.
2. collect and document the evidences of forensic importance.
3. differentiate various firearms and tool marks.
4. classify bullets, ammunition.
5. investigate accident crime scenes.
6. explain the basics of photography and forensic photography.
7. handle the various microscopes.

Unit	Content
Unit I	• **Trace Evidences Physical Properties of Materials:** Composition, Temperature, Weight and Mass, Density, Refractive Index, Classification, Collection and Preservation and their Forensic Importance. • **Glass:** Classification of Glass Samples, Glass Fractures, Collection and Preservation of Glass Evidence and Forensic significance • **Soil:** Variations in Soil, Collection and Preservation of Soil Evidence, Forensic Significance. • **Fibre:** Types, Identification and Comparison of Manufactured Fibres (Microscopic Examination, Dye Composition, Chemical Composition, Other Properties for Examination), Significance of Match, Collection and Preservation of Fibre Evidence. Forensic significance • **Paint:** Composition of Paint, Classification of Common Paints, Significance of Soil Evidence, Analytical Tools used in Paint Comparison, Collection and Preservation of Paint Evidence, Forensic significance. **(14 periods)**
Unit II	• **Fire Arms:** History of firearms, Smooth Bore Firearms, Rifling, Revolver, Pistols, Actions of Firearms, Shotgun, Sub Machine Gun, Machine Gun, Improvised Firearms. • **Ammunitions:** Propellants- Black Powder, Smokeless Powders, Primers- Berdan Primer, Boxer Primer, Primer Cap Types - Rim Fire, Centre Fire, Pin Fire. Caseless, Blank Ammunition, Tear Gas, Grenade Launcher, Dummy, Cartridge Cases - Rimless, Semi Rimmed, Rimmed, Belted. Bullets and Its Types, Components of Shotgun Ammunition. • **Internal Ballistics:** Initiation, Combustion of Propellants, Density of Loading, Atmospheric Temperature, Shape of the Cartridge Case. Heat Problems, Barrel Pressure and Its Determination, Recoil, Measurement of Recoil, Barrel Fouling. **(14 periods)**
Unit III	• **Exterior Ballistics**: Trajectory Formation, Vacuum Trajectories, Range, Experimental Determination and Shape of Trajectory, Spin, Drift, Angle of Fire, Structure of the Projectile, Sectional Density, Ballistic Coefficient, Influence of Earth and Escape Velocity, Air Resistance, Retardation, Wind Deflection, Firing Guns in the Air, Ricochet. • **Terminal Ballistics:** Introduction, Stopping Power of Bullet, Injuries and the Quantity of Energy of Projectiles, Shockwave and Cavitation Effect, Wounding Mechanism, • **Elements of Wound Ballistics:** Nature of Target, Velocity of Projectile, Constructional features of Projectile. Range; Classification of Range Contact Range, Near Range, Distant Range, Penetration of Shots in Different Regions of the Body. (**14 periods)**

Unit IV

- **Tools & Tool Marks Common Hand Tools**: Levers (Screw Drivers, Crow Bars, Pry Bars, Nail Pullers, Pinch Bars, Moulding Bar, Wrecking Bar), Hand Saw (Rip Saw, Cross Cutting Saw, Bow Saw, Teeth Saw, Compass Saw, Dip Cut, Coping Saw, Wall Board Saw, Bow Saw, Hacksaw, Chisel Teeth Saw, Coarse Cut Carpenter Saw), Striking Tools (Hammers, Hatches and Axes), Grasping Tools (Wrenches, Vise Grips, Pliers), Cutting Tools (Metal Snips, Wire Cutters, Bolt and Cable Cutters), Crimping Tools, Knives, Scissors and Shears, Chisels and Punches, Drill Bits.
- **Tool Marks: Marks Made by Hand Tools** (Impression / Compression Marks, Dent, Saw Marks, Drill Marks and Holes, Punctures, Point to Point Blade Cut Marks, Scratch and Scour Marks), Collection, Documentation and Forensic Examination of Tool Marks.

(14 periods)

Unit V

- **Vehicular Accidents:** Primary Causes of Road Accident, Types of Road Accident, Sources of Information, Eye Witnesses, Tyre and Other Marks, Pedestrian Impacts and Vehicle Speed and damage, Vehicle Condition, Types of Skid Marks, Curved Scuffmarks, Speed Estimation from Skid/Scuffmarks. Peripheral Vision of a Driver, Brake System and Steering Failure, Motor Vehicle Examination.
- **Rail Accidents:** Investigation of Rail Crash: Criminal and Safety Investigation, Investigation Principles, Best Practices: Tests, Inspection of Driving Cab, Examination of Electrical/Electronic/Technological System and their Failure. Necessary Equipments Required for Forensic Examination.

(14 periods)

Unit VI

- **Microscopy** Principle, Working, Advantages and Disadvantages of Optical Microscopes: Stereomicroscope, Polarizing Microscope, Phase Contrast Microscope And Comparison Microscope. Advanced Microscopes: Scanning Electron Microscopes (SEM), Transmission Electron Microscope (TEM), X-Ray Diffraction (XRD), Fourier Transform Spectrophotometer (FTIR).
- **Photography:** Introduction, 35 Mm Film / Digital SLR Camera, Digital Photo Imaging, ISO Number, Exposure Index, Photo Imaging Evidence; Angle, Scale, Depth of Field, Light, Ambient Light, Colour Temperature, Flash/ Strobe, Photography of Footwear Impressions, Crime Scene Investigation Report Writing. Forensic Image Processing and Analysis.

(14 periods)

***SEM**

1. Understanding the basics of forensic Physics and Ballistic. Its collection, analysisand reporting.
2. MOOC on SWAYAM relevant
3. Identify: Physical and Ballistic evidences from crime scene, analytical methods, Forensic Ballistics, Explosive, Bullet, Firearms, etc.

****Activities** Quiz Competitions, seminar competitions, project assignment unit test, visits to Government Forensic Science Laboratory, Explosive industry, Ordnance Factory, Police Station, Jail, make the tool marks on different surfaces, create a dummy accident crime scene, investigate and reconstruct it, model making for various physical evidences.

Course Material/Learning Resources/ Suggested Readings

1. Handbook of Firearms and Ballistics Examination and Interpreting Forensic Evidence by Brain J Heard, 2nd Ed. Publication: Wiley-Blackwell
2. Firearms in Criminal Investigation and Trials: B. R. Sharma, 4th Edition, Universal Law Publishing Company. New Delhi.
3. Encyclopedia of Forensic Science, Volume one: Jay A Siegel, Pekka J Saukko, Geoffery Knupfer. Academic Press.
4. Criminalistics, An Introduction to Forensic Science: Richard Saferstein, 10th Edition, Pearson Education International.
5. Forensic Science An Introduction to Scientific and Investigative Techniques : Stuart H. James and Jon J. Nordby., 3rd Edition CRC Press, Taylor & Francis Group.
6. Forensic Ballistics in Criminal Justice: Kaushalendra Kumar.
7. Firearm in criminal investigation and trials; B. R. Sharma
8. Firearms and Forensic Ballistics; S. N. Gaur, B. C. Jauhari
9. Fire Arms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence; S. N. Gaur
10. Forensic Medical Investigation of Motor Vehicle Incidence; Michel P. Burke

Employability Skills Categories

Effective Relationships	Interpersonal Skills- Students should be able to lead the investigation team with ease Personal Qualities- Students should have moral values while dealing with victims, survivors and their families
Workplace Skills	Resource Management- Students should be able to use minimum resources effectively provided by the investigation agency Information Use- Students should be able to search the relevant resources over the internet or in books or reading materials and can use to solve crimes using the same Communication Skills- Students should be able to communicate and support the technical details of their findings in a clear, logical manner that can easily be understood in a court of law Systems Thinking- Students should be curious and open to solve all types of crimes Technology Use- Students should be able to use advanced and sophisticated techniques
Applied Knowledge	Applied Academic Skills- Students should learn how to create an unbiased sampling of evidence and select proper methods to process that evidence. Critical Thinking Skills- Students should be able to use fundamental scientific principles to approach and solve problems in forensic science.

Syllabus Prescribed for 03 Year UG Programme

Programme: B.Sc. Practical Forensic Physics

Semester 3

Code of the Course/Subject	Title of the Course/Subject	(No. of Periods/Week)
3S FRS Practical	(Laboratory/Practical/practicum/hands-on/Activity)	**21 Sessions**
	Forensic Physics Practical	
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*** List of Practical/Laboratory Experiments/Activities etc.**

1. To study working and handling of Compound microscope
2. To understand the working and handling of Stereo-microscope.
3. To understand the working and handling of Comparison microscope.
4. To determine magnification of Microscope
5. To Study various types of glass.
6. Analysis of glass fractures.
7. Analysis of soil samples.
8. Analysis of fibers (Flame test, Solubility test and microscopic test).
9. To study class and individual characteristics of Fired shot gun and rifled cartridge cases.
10. Classification of bullets.
11. To study given cartridge case using Vernier caliper (measurement of length, diameter, rim, diameter, volume)
12. Study of tool marks.
13. To understand the DSLR (working and handling).
14. To perform Forensic Photography.
15. Examination of skid marks and calculate the speed of vehicles.
16. Analysis of various type of pre and post explosive materials.
17. Measurement of Speed using Tyre Marks.
18. Investigations of fake documents using UV light.
19. Determination of density of a given sample.
20. Analysis of accident scene photography and Physical examination accidental vehicle

Suggested Readings

1. Handbook of Firearms and Ballistics Examination and Interpreting Forensic Evidence by Brain J Heard, 2nd Ed. Publication: Wiley-Blackwell
2. Firearms in Criminal Investigation and Trials: B. R. Sharma, 4th Edition, Universal Law Publishing Company. New Delhi.
3. Encyclopedia of Forensic Science, Volume one: Jay A Siegel, Pekka J Saukko, Geoffery Knupfer. Academic Press.
4. Criminalistics, An Introduction to Forensic Science: Richard Saferstein, 10th Edition, Pearson Education International.
5. Forensic Science An Introduction to Scientific and Investigative Techniques : Stuart H. James and Jon J. Nordby., 3rd Edition CRC Press, Taylor & Francis Group.
6. Forensic Ballistics in Criminal Justice: Kaushalendra Kumar.
7. Firearm in criminal investigation and trials; B. R. Sharma
8. Firearms and Forensic Ballistics; S. N. Gaur, B. C. Jauhari
9. Fire Arms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence; S. N. Gaur
10. Forensic Medical Investigation of Motor Vehicle Incidence; Michel P. Burke
11. Laboratory Procedural Manual; Physics Section, DFSL, Mumbai
12. Laboratory Procedural Manual; Forensic Ballistics, DFS, New Delhi
13. Advanced Practical Physics, Vol. II: Dr. S. P. Singh, Pragati Prakashan, Meerut.

Syllabus Prescribed for 03 Year UG Programme

Programme:

Semester 4

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
4S Forensic Science	**Forensic Biology**	**84**

Cos

Students will be able to

1. explain cell structure and function.
2. differentiate bio macromolecules.
3. identify different body fluids.
4. process the biological samples with biotechnology instruments.
5. estimate time of death using entomological evidence.
6. recognize, collect, document biological samples from the crime scene.
7. handle the biological exhibits with care.
8. determine age of a person on the basis of anthropological and odontological evidences.
9. distinguish between terms such as bioterrorism, biosurveillance and biodefence.

Unit | **Content**

Unit I

A) Cell Biology

- Cell structure, function
- Cell organelle
- Prokaryotic and eukaryotic cell

B) Biomolecules

- Estimation of Amino acids, proteins, nucleic acid carbohydrates, lipids
- Enzymes

(14 periods)

Unit II

A) Forensic Serology

- Forensic biology vs Forensic Serology
- Blood Composition
- Blood group typing- ABO, Rh, Mn

B) Other body fluids

- Saliva, Sweat, Semen, Vaginal fluid, Urine, Faeces

C) Biological Evidences

- Hair, bones, teeth, skin, fur, nails, horns

(14 periods)

Unit III

A) Biotechnology of forensic importance

- DNA Extraction methods
- Southern, Northern and Western blotting
- Basics of Polymerase Chain Reaction (PCR), Gel electrophoresis, Restriction Fragment Length Polymorphism (RFLP), Random Amplified Polymorphic DNA (RAPD), Single Nucleotide Polymorphism (SNP), Short tandem repeats (STRs) or microsatellites, Variable Number of Tandem Repeats (VNTR), Mitochondrial DNA, DNA chips, Forensic significance of DNA profiling- application in disputed paternity cases, child swapping

(14 periods)

Unit IV

A) Forensic Entomology

- Basic principle of insect biology, Life cycle, Estimation of time of death, Preservation of sample

B) Forensic Botany

- Identification of plant specimen, Techniques for dating specimen using plant material, Dendrochronology, Algal colonization, Application of plant ecology, Study of spore and its forensic significance, Forensic palynology

(14 periods)

Unit V

A) Forensic Anthropology

- Skeletal system and bone formation,
- Determination of age, sex and race of humans from bones
- Facial reconstruction

B) Forensic Odontology

- Development of dental structure
- Estimation of age
- Bite mark analysis

C) Introduction to Wildlife Forensic- Introduction and importance of wild life, Protected and endangered species of Animals and Plants.

(14 periods)

Unit VI

A) Crime Scene Investigation

- Protection of biological evidences
- Documentation
- Chain of custody
- Recognition of biological evidences encountered in various cases

B) Forensic Microbiology

- Types of biological agents- Category A, B, C
- Bioterrorism, Biosurveillance and Biodefence
- Punishment for bioterrorism act under Prevention Of Terrorism Act 2002

(14 periods)

***SEM**

1. understanding the basics of forensic biology. the collection, analysisand reporting of biological evidences.
2. identify: biological evidences from crime scene

****Activities** Quiz Competitions, seminar competitions, project assignment unit test, visits to Government Forensic Science Laboratory, Pathological laboratory, create a dummy crime scene, investigate and reconstruct it, model making for evidences.

Course Material/Learning Resources/ Suggested Readings

1. Forensic Biology – Richard Li
2. Forensic Biology By Shrikant H. Lade
3. Forensic Medicine – P.V. Guharaj & M. R. Chandran
4. Principles And Techniques Of Biochemistry And Molecular Biology: Wilson And Walker
5. Fundamentals Of Forensic DNA Typing – John M. Butler
6. Scientific & Legal Applications Of Bloodstain Pattern Interpretation – Stuart H. James
7. Forensic Science In Crime Investigation – Dr. Mrs. Rukmani Krishnamurthy
8. Forensic Science – An Introduction To Scientific And Investigative Techniques – Stuart H. James &Jon J. Nordby
9. Forensic Science In Wildlife Investigations. Adrian Linacre Taylor And Francis, 2009
10. The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature By Donna M.Jackson, Wendy Shattil, Bob Rozinski Universal Athenaeum (Denver, Co, U.S.A.)
11. Forensic Entomology: The Utility Of Arthropods In Legal Investigations Jason H. Byrd, James L.Castner Taylor And Francis, 2009
12. Forensic Entomology: An Introduction By Dorothy E. Gennard Wiley.
13. Bryant, V.M. Jr, Mildenhall, D.C. And Jones, J.G., Forensic Palynology In The United States OfAmerica Polynology. 1990, 14.Pp.193-208
14. Forensic Palynology: An In-Depth Look At Its Indispensable Value National University, San Diego,2002
15. Faegri, K. Iverson, J. And Krzywinski, K. Textbook Of Pollen Analysis 4th Edition. John Wiley &Sons, New York 1989.
16. Microbial Forensics By Roger Breeze, Bruce Budowle, Steven E. Schutzer. Elsevier Academic Press
17. The Forensic Laboratory Handbook Procedures And Practice By Ashraf Mozayani, Carla Noziglia.2nd Edition. 2011. Human Press.

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Applied Knowledge	Applied Academic Skills- Students should learn how to create an unbiased sampling of evidence and select proper methods to process that evidence. Critical Thinking Skills- Students should be able to use fundamental scientific principles to approach and solve problems in forensic science.

Syllabus Prescribed for 03 Year UG Programme

Programme: B.Sc. Practical Forensic Science Semester 4

Code of the Course/Subject	**Title of the Course/Subject**	**(No. of Periods/Week)**
4S FRS Practical	(Laboratory/Practical/practicum/hands-on/Activity)	**21 Sessions**
	Forensic Biology Practical	
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*** List of Practical/Laboratory Experiments/Activities etc.**

Identification, collection, preservation of biological evidences.

Antigen- Antibody reaction (ABO Grouping).

Rhesus Factor.

To identify blood stains.

Presumptive test for blood.

To identify saliva stains.

To determine the presence of saliva stain in the given sample.

To identify urine stains.

Determination of sex from pelvis.

Determination of sex from skull.

Determination of sex from sacrum.

Microscopic study of pollens grains of forensic significance.

Qualitative analysis of sugar.

Qualitative analysis of proteins.

Qualitative analysis of lipids.

Suggested Readings

1. Forensic Biology – Richard Li
2. Forensic Biology By Shrikant H. Lade
3. Forensic Medicine – P.V. Guharaj & M. R. Chandran
4. Principles And Techniques Of Biochemistry And Molecular Biology: Wilson And Walker
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15. Faegri, K. Iverson, J. And Krzywinski, K. Textbook Of Pollen Analysis 4th Edition. John Wiley & Sons,New York 1989.
16. Microbial Forensics By Roger Breeze, Bruce Budowle, Steven E. Schutzer. Elsevier Academic Press
17. The Forensic Laboratory Handbook Procedures And Practice By Ashraf Mozayani, Carla Noziglia. 2ndEdition. 2011. Human Press.
18. Practical Skills In Forensic Science – Alan Langford, John Dean Et Al
19. Practical Crime Scene Analysis & Reconstruction – Roos M. Gardner & Tom Bevel Forensic Science InCriminal Investigation And Trials – B.R. Sharma
20. Working Procedures Manual Forensic Biology