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Semester-IV (B.Sc. / B.Sc.-M.Sc.)
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Course Code	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 *				
BSFS401	**Forensic Chemistry**	60	20	20	30	20	3	1	2	5

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 methods of analysing trace amounts of petroleum products in crime scene evidence.
2. The method of searching, collecting, preserving and analyzing arson evidence.
3. The classification of explosives including the synthesis and characterization of representative analogues.
4. The classification and characteristics of NDPS.

Unit 1: Petroleum Products

Distillation and fractionation of petroleum. Commercial use of different petroleum fractions. Analysis of petroleum products. Analysis of traces of petroleum products in forensic exhibits. Comparison of petroleum products. Adulteration of petroleum products.

Unit 2: Analysis of beverages

Types of Beverages- Alcoholic and non-alcoholic beverages, Composition and Analysis of alcoholic beverages as per BIS and PFA Act. Composition of Non-alcoholic beverages. Distinction between licit and illicit liquors.

Unit 3: Cases Involving Arson

Chemistry of fire. Conditions for fire. Fire scene patterns. Location of point of ignition. Recognition of type of fire. Searching the fire scene. Collection and preservation of arson evidence. Analysis of fire debris. Analysis of ignitable liquid residue. Post-flashover burning. Scientific investigation and evaluation of clue materials. Information from smoke staining.

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Unit 4: Explosives I

Definition of explosives, Classification of explosives- Low explosives and high explosives, Homemade explosives. Military explosives., Blasting agents. Primary, Secondary and Tertiary Explosives. Explosion process-Mechanism of explosion.Blast waves

Unit 5: Explosives II

Synthesis and characteristics of TNT, RDX, Bomb scene management. Searching the scene of explosion. Post blast residue collection and analysis. Case Studies of explosion cases.
Blast injuries: Detection of hidden explosives.

List of Practicals

1. To carry out analysis of gasoline.
2. To carry out analysis of diesel.
3. To carry out analysis of kerosene oil.
4. To analyze arson accelerators.
5. To prepare a case report on a case involving arson.
6. To carry out analysis of explosive substances.
7. To separate explosive substances using thin layer chromatography.

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BSFS402	**Questioned Document**	60	20	20	30	20	3	1	2	5

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. Forgeries and Introduction to DAR

Unit 1:Nature and Scope of Questioned Documents

Definition and scope of questioned documents. Types of questioned documents. Disputed Documents. , Instruments and Materials Used to prepare documents, Care, handling and preservation of Documents, Preliminary examination of documents. Basic tools needed for forensic documents' examination-Ultraviolet, Visible, Infrared and Fluorescence Spectroscopy, Photomicrography, Microphotography, Visible Spectral Comparator, Electrostatic Detection Apparatus

Unit 2 : Handwriting and Signatures

Characteristics of handwriting , Development of individuality in handwriting. Natural variations and fundamental divergences in handwritings. Basis of handwriting recognition. Off-line and on-line handwriting recognition. Steps involved in handwriting recognition – pre-processing, feature extraction and classification.

Signatures, Genuine signatures and Unusual genuine signatures- Receipt signatures, signatures influenced by alcohol and drugs, Spurious signatures.

Unit 3: Forgeries and alteration in Documents

Forgery, Detection of forgery, simulated and traced forgeries, Forgery of Holographic documents, Howard Hughes forgeries.

Alterations in documents including erasures, additions, over-writings and obliterations. Indented and invisible writings. Secret inks Torn Documents and Charred Documents. Examination of counterfeit Indian currency notes, passports, visas and stamp papers. Disguised writing and anonymous letters.

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Unit 4: Introduction to Document Analysis and Recognition (DAR)

Processing Steps in DAR, Pre-processing, Layout Analysis- Physical Layout Analysis, Logical Layout Analysis. Text Recognition- Character Recognition, Word Recognition, Classification in DAR- Pixel and Region Classification, Reading Order Detection, Text Recognition, Character segmentation, Script Identification, Signature Verification, Writer Identification, Page Classification, Document Categorization. Training Data- Public Databases, UW databases, NIST databases, MNIST dataset, MediaTeam database, Infty project, IFN/ENIT database, MARG database, IAM database, DAR Applications. Determining the age and relative age of documents

Unit-5 Use of computers in document examination

Automated Signature verification system,. e-Documents, digital signatures. Modules for automated document examination. Automated analysis of ink and paper: acquisition of data, extraction of features, comparison and identification. Automated analysis of torn documents: extraction of data, feature extraction, comparison and matching. Automated analysis of charred documents: acquisition of data and enhancement of charred document.

List of 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.

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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		End Sem University Exam	Two Term Exam	Teachers Assessment *	End Sem University Exam	Teachers Assessment *				
BSFS403	**Forensic Biology**	60	20	20	30	20	3	1	2	5

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***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 significance of biological and serological evidence.
2. The forensic importance of hair evidence.
3. The importance of biological fluids – blood, urine, semen, saliva, sweat and milk – in crime investigations.
4. How wildlife forensics aid in conserving natural resources.
5. How forensic entomology assists in death investigations.

Unit 1: Biological Evidence: Blood

Nature and importance of biological evidence. Biological Fluids- Blood, Semen, Saliva, Urine, Sweat, CSF etc.

Blood: Composition and Histology, Examination of blood-Preliminary and confirmatory test, determination of Species of origin, ABO and other blood grouping system, Role of blood in personal Identification. Examination of blood stains, Identification of nasal blood, lochial blood, and menstrual stains.

Unit 2: Semen and Other Biological Fluids

Composition of semen, Examination of semen- Preliminary and confirmatory test. Structure of Spermatozoa, Forensic importanceof Semen

Identification and examination of other body fluids/stains- vaginal, saliva, urine, pus, faces, vomit, milk, sweat & tears.

Unit-3 Hair Analysis

Comparison of hair samples.Morphology and biochemistry of human hair.Comparison of human and animal hair. Forensic Significance of hair evidence. Transfer, persistence and recovery of hair evidence. Structure of human hair.

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Unit 4: Wildlife Forensics

Fundamentals of wildlife forensic.Significance of wildlife forensic.Protected and endangered species of animals and plants.Illegal trading in wildlife items, such as skin, fur, bone, horn, teeth, flowers and plants.Identification of physical evidence pertaining to wildlife forensics. Identification of pug marks of various animals.

Unit 5:Forensic Entomology and other Microbes

Basics of forensic entomology.Insects of forensic importance.Collection of entomological evidence during death investigations.

Types and identification of microbial organisms of forensic significance. Identification of wood, leaves, pollens and juices as botanical evidence. Diatoms- types and their forensic significance.

Practicals

1. To examine hair morphology and determine the species to which the hair belongs.
2. To prepare slides of scale pattern of human hair.
3. To examine human hair for cortex and medulla.
4. To carry out microscopic examination of pollen grains.
5. To carry out microscopic examination of diatoms.
6. To cite a crime case in which diatoms have served as forensic evidence.
7. To prepare a case report on forensic entomology.
8. To prepare a case report on problems of wildlife forensics

Suggested Readings:

1. E.J. Gardner, M. 1. Simmons and D.P. Snustad; Principles of Genetics; John Wiley, New York
2. H.G. Greenish & E. Collin; An anatomical Atlas of vegetable Powders; J&A Churchill, London
3. Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice Hall, Englewood Cliff, New Jersey
4. P. L. Williams and R. Warwick; Gray's anatomy; Churchill Livingston, London
5. Biology Methods manual; Metropolitan Police Forensic Science Laboratory, London
6. Herbert R. Mauersberger; Mathews Textile Fibres – their physical, Microscopic and chemical properties; John Wiley, New York
7. R.P. Pandey, Plant Anatomy; S. Chand, new Delhi
8. Kimball, John W; Biology; Arvind Publishing Co. New Delhi
9. Edwin, H. Mc Caney – Human Genetics, The Molecular Revolution, Jones & Bartlett Pub. London
10. Albert's, B, Bray, D, Lewis, J, Roberts K & Watson, J.D; Molecular Biology of Cell

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BSFS404	**Anthropology**	60	20	20	30	20	3	1	2	5

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

1. Basics of anthropology.
2. The relationship between biology and anthropology.
3. Fundamentals of physical and biological anthropology.
4. Basics of social anthropology.

Unit – I Basics of anthropology –I

Meaning and scope of anthropology, branches of anthropology; History and subject matter of physical/biological Anthropology.

Unit - II Basics of anthropology-II

Relationship of physical/biological anthropology with other disciplines: medical and health sciences, life sciences, earth sciences, and environmental sciences.

Unit – III Fundamentals of physical / biological anthropology

Human Evolution, Human Variation, Human Genetics, Human Growth and Development. Theories of organic evolution (Lamarckian, Darwinian, Mutational and Synthetic).

Unit – IV Position of man in animal kingdom

living primates, distribution, characteristics, phylogeny, classification; comparative anatomy of man and apes; Primate Behaviour.

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Unit – V Social anthropology

History and subject matter; Relationship of social and cultural anthropology with sociology, psychology, history, economics and political science.

List of Practicals

1. The Practical will include the following techniques and methods in collection of data in social anthropology.
   - Observation
   - Interview
   - Questionnaire and
   - Schedule Genealogy Case Study
2. To study Somatoscopy of Head, Face, Nose, Eyes, Lips and Hair.
3. To study Indices of Cephalic Index, Nasal Index, facial index.
4. To study Somatometry : Drawing, description and use of the instruments used for anthropological measurements Standing Height Vertex, Sitting Height Vertex, Leg Length, Hand Length, Hand Breadth, Head Circumference, Nasal Length, Nasal Breadth, Head length, Head Breadth.
5. To study Osteology: Skull, Axial Skeleton, Appendicular Skeleton and Vertebrae.

Suggested reading

1. Craig Stanford, John S. Allen and Susan C. Anton (2008)Biological Anthropology (2nd Edition).
2. Craig Stanford, John S. Allen and Susan C. Anton (2009) Exploring Biological Anthropology: The Essentials, Prentice Hall.
3. Indera P. Singh and M.K. Bhasin: (1989) Anthropometry. Delhi, Kamla Raj Enterprises.
4. Thomas Hylland Eriksen (2010) Small Places, Large Issues: An Introduction to Social and Cultural Anthropology.
5. Nigel Rapport and Joanna Overing (2006) Social and Cultural Anthropology: The Key Concepts .
6. M. J. Herskovits (1974) Cultural Anthropology, New Delhi, Oxford and IBH Publications.

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BSFS–4051	**Introduction to Biometry**	60	20	20	00	00	3	1	0	4

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

1. The impart knowledge of Basic Biometric System.
2. Concepts of Verification and Identification.
3. Advances Biometric Technologies.
4. The classification of biometric processes.
5. The importance of behavioural biometry.

Unit 1: Fundamental aspects of Biometrics
Definition, characteristics and operation of biometric system, Classification of biometric systems – physiological and behavioral, Strength and weakness of physiological and behavioral biometrics, Multimodal Biometrics.

Unit 2: Biometric Process
Key biometric processes – enrollment, identification and verification, sensor module, feature extraction module, database module, matching module, Positive and negative identification, Performance measures used in biometric systems – FAR, FRR, GAR, FTA, FTE and ATV, Biometric versus traditional technologies.

Unit 3: Types of Biometrics
Fingerprints Identification, Palm prints recognition, Iris recognition, retina identification, geometry of hand and face, Handwriting recognition, signatures identification, keystrokes dynamics, gait pattern analysis, Speaker recognition.

Unit 4: Security of Biometric
Introduction to Security of Biometric System, Adversary attacks: Insider Attacks, Infrastructure attacks, Attacks on user Interface: Impersonation, Obfuscation, Spoofing, Countermeasure of spoof detection, Attacks on biometrics processing: On system modules & at interconnections, Attack on template database & Countermeasures in biometric template security.

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Unit 5: Applications of Biometric Technologies

Applications of Biometric Technologies, Challenges and Issues in Using Biometrics, Biometric technologies under development: Blood pulse, Nailbed Identification, Body salinity Identification, vein Pattern, Facial thermography, Skin Luminescence, Brain Wave Pattern, Foot Dynamics.

Suggested Reading-:

1. S. Nanavati, M. Thieme and R. Nanavati, *Biometrics*, Wiley India Pvt. Ltd. (2002).
2. P. Reid, *Biometrics for Network Security*, New Delhi (2004).
3. J.R. Vacca, *Biometric Technologies and Verification Systems*, Butterworth-Heinemann, Oxford (2007).
4. Anil K. Jain, *Handbook of Biometrics*

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		End Sem University Exam	Two Term Exam	Teachers Assessment *	End Sem University Exam	Teachers Assessment *				
BSFS4052	Forensic Linguistic	60	20	20	0	0	3	1	0	4

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

1. Elements of Science used in Linguistic and areas of Forensic Linguistic
2. Auditory phonetics and speaker identification by victims and witnesses
3. Legal definition of stylistic and its applications from Forensic point of view

UNIT I Linguistic

Definition and history of Linguistic, Linguistic as a science, elements of science used in Linguistic, Linguistic Variation,- variation in languages, Group v/s individual variations, analysis of Variation, applied Linguistic.

UNIT II Introduction to Forensic Linguistic

Definition of Forensic Linguistic, Language and the legal process, areas of Forensic Linguistic. Forensic application of Linguistic,Case Studies in forensic linguistics.

UNIT III Auditory Phonetics

Speaker discrimination and identification by victims and witnesses, voice perception, discrimination and disguise. Identification of class characteristics of speakers including first-language interference, regional of social accent and dialect, speaker age.

UNIT IV Forensic Stylistics I

Concept of style, style in language, legal definition of stylistic, procedural outline for authorship identification studies – organization of case, problems, method, findings and conclusion.

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UNIT V Forensic Stylistics II

Forensic application of linguistic stylistics – questioned authorship, semantic and pragmatic interpretation of meaning, linguistic stylistics as evidence, issues in forensic stylistic analysis.

Reference Books:

1. Geral R. McMenamin, Forensic Linguistic Advance.
2. Bethany K Duman, Forensic Linguistic: A brief Anthrology.
3. John Olsson, Forensic Linguistics - An Introduction to Language, Crime and the Law.
4. CoulthardMalco, TheRoutledge, Handbook of Forensic Linguistics.
5. Malcolm CoulthardAn Introduction to Forensic Linguistics: Language in Evidence.

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