

**B. Sc. Part III****B. Sc. Part-III Forensic Science (CBCS) Syllabus w. e. f. June 2020****1. Structure of Syllabus:****B.Sc. - III Semester - V**

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Title	Lectures per week	Credits
<b>Compulsory Papers</b>						
Applied Forensic Science I	BFST 501	3	2	BFSP 506	10	4
Applied Forensic Chemistry and Forensic Physics I	BFST 502	3	2			
Applied Forensic Biology & Applied Forensic Psychology I	BFST 503	3	2	BFSP 507 + Project 508	10	4
<b>Paper-X: Elective Papers (Any one)</b>						
Digital Forensic	BFST 504 A	3	2			
Forensic Speaker Identification	BFST 504 B					
Forensic Video Analysis	BFST 504 C					
Numerical Skills	BFST 505	2	1	BFSP 509	4	1

## B.Sc.-III Semester-VI

Paper Title	Theory			Practical					
	Paper Code	Lectures Per week	Credits	Paper Title	Lectures per week	Credits			
<b>Compulsory Papers</b>									
Applied Forensic Science II	BFST 601	3	2	BFSP 606	10	4			
Applied Forensic Chemistry and Forensic Physics II	BFST 602	3	2						
Applied Forensic Biology & Applied Forensic Psychology II	BFST 603	3	2	BFSP 607+ Project 608	10	4			
<b>Elective Papers (Any one)</b>									
Digital Data Analysis	BFST 604 A	3	2						
Cyber Crime and Cyber Law	BFST 604 B								
Operating system Forensic Analysis	BFST 604 C								
Entrepreneurship Development	BFST 605	2	1	BFSP 609	4	1			

## Titles of Papers

Sr. No.	Semester-V	Semester-VI
1	BFST 501: Applied Forensic Science I	BFST 601: Applied Forensic Science II
2	BFST 502: Applied Forensic Chemistry and Forensic Physics I	BFST 602: Applied Forensic Chemistry and Forensic Physics II
3	BFST 503 : Applied Forensic Biology & Applied Forensic Psychology I	BFST 603 : Applied Forensic Biology & Applied Forensic Psychology II
<b>Elective Papers (Anyone)</b>		
4	BFST 504 A : Digital Forensic BFST 504 B : Forensic Speaker BFST 504 C : Forensic Video Analysis	BFST 604 A: Digital Data Analysis BFST 604 B: Cyber Crime and Cyber Law BFST 604 C : Operating system Forensic Analysis
5	BFST 505 : Numerical Skills in Forensic Science	BFST605: Entrepreneurship Development
6	BFSP 506: Practical Paper V	BFSP 606: Practical Paper VII
7	BFSP 507: Practical Paper VI	BFSP 607: Practical Paper VIII
8	BFSP 508 - Project	BFSP 608 - Project
9	BFSP 509: Numerical Skills Practical	BFSP609 : Entrepreneurship Development (Industrial Visit and Project Proposal Writing)

**BFST 501 : Applied Forensic Science I**  
**Theory: 45 Lectures of 48 minutes (36Hours)**  
**Marks - 50 (Credits : 02)**

**Course Objectives : Students should :**

1. Learn the basics of document, handwriting and signature examination and detailed knowledge about detection and decipherment of various alterations.
2. Analyse the anonymous letters and determination of relative edge of writing and signature.
3. Study the science of forensic medicine.
4. Study the basics of Forensic Medicine and its forensic significance.

**UNIT - I : Forensic Document Examination I:**

**Basics of document, Handwriting and Signature Examination [11]**

Basics of document, essentials to produce document, types of document, scope of forensic document examination, document expert, basis of forensic examination- examination of writing surface and material, security documents, printed, typewritten and photocopied documents, Handwriting/signature examination- principles of handwriting identification, General and individual characteristics of handwriting, rare/occasional and accidental features in handwriting, effect of posture, emotion, illness, age and drugs/alcohol on handwriting, procurement of handwriting standards- specimens and contemporaneous writings, process of comparison of like with like, best standards for comparison with disputed documents.

**Detection and examination of Forgery in documents**

Detection and decipherment of various alterations- obliterations, additions, overwriting, mechanical and chemical erasures, charred document, torn document and secret writings, Types of Forgery, inherent signs of forgery. Detection and Decipherment of mechanical impressions- rubber stamp impressions, seal impressions, embossed impressions, indentations. Case studies.

**Unit - II : Forensic Document Examination II : [12]**  
**Examination of anonymous letters**

Examination of anonymous letters- Identification of writer of the letter, Features indicating religion, region, sex and educational background of the writer, Importance of preserving envelope containing anonymous letters, Types of anonymous letters and various methods used for their communication, Case studies.

**Determination of age of documents**

Determination of relative age of writing and signatures, determination of relative age by examination of signatures/rubber stamp impression in chronological order, Determination of relative age of document by - Examination of writing paper and ink, Examination of sequence of intersecting strokes, Addition of text with ink or typescript, Anachronistic features and their importance. Case studies. UNIT-I

**UNIT - III: Forensic Medicine - I :****[11]**

Introduction and scope of forensic medicine, historical perspectives of forensic medicine: global and Indian scenario, Legal aspects in view of forensic medicine: Inquest, exhumation, dying declaration, dying deposition, medical certificates, medical report, postmortem reports. Personal identification, Death: definition and types, modes of death, stages of death-somatic death and molecular death, signs of death, changes after death: early changes- Algor mortis, rigor mortis, cadaveric spasm, heat stiffening, cold stiffening, changes in blood, chemical changes in cerebrospinal fluid, changes in vitreous humor, post mortem lividity, fluidity of blood, late changes- putrefaction- external and internal changes, adipocere, mummification, destruction of body and tissues by maggots and other insects. Medico legal aspects of death. Violent asphyxial deaths: Hanging, strangulation, throttling, suffocation and drowning.

**UNIT - IV : Forensic Medicine - II :****[11]**

Medical Autopsy: Introduction and objectives, rules for medico legal autopsy, external and internal examination of body, examination of clothing and weapons, collection of postmortem samples, autopsy report. Injury: Introduction and classification of injury; medico legal aspects of injuries; mechanical injuries-Abrasions, Bruises, Lacerations, Incised wounds, stab wounds, defense wound and self-inflicted wounds; Regional injuries- Head injury, injuries to brain, abdomen and other body parts; accident injuries: vehicular injuries, railway injuries and aircraft injuries; injury due to fall. Thermal injuries: Burn and scalds, Lightning, Electricity and Explosions. Infanticide: Introduction, definition and types. Forensic Psychiatry: Introduction and medico legal aspects.

**Course outcomes :****Unit - I : After completion, Students are able to :**

1. Learn about the basics of document, handwriting and signature.
2. Analyse about the forensic significance of document, handwriting and signature examination.
3. Understand the detailed knowledge about detection and decipherment of various alterations and their forensic significance.

**UNIT - II : After completion students are able to :**

1. Learn about the examination of anonymous letters.
2. Learn about the forensic significance of anonymous letter examination.
3. Learn about the determination of relative age of writing and signature.
4. Analyse the forensic significance of relative age of writing and signature.

**UNIT - III : After completion, Students are able to :**

1. Learn about forensic medicine.

**UNIT - IV : After completion students are able to :**

1. Understand knowledge about the basics of forensic medicine and its forensic significance.

**Reference Books**

- \* Ordway Hilton; "Scientific Examination of Questioned Documents". Revised Edition, Elsevier, NY 1982.
- \* Albert S. Osborn; "Questioned Documents", 2nd Ed., Universal Law Pub., Delhi 1998.
- \* Albert S Osborn; "The Problem of Proof", 2nd Ed., Universal Law Pub. Delhi 1998.
- \* Wilson R. Harrison; "Suspect Documents Their Scientific Examination", Universal Law Pub. Delhi Indian Reprint, 2001.
- \* Working manual of VSC- 8000
- \* Jan Seaman Kelly & Brian S Lindblom; "Scientific Examination of Questioned Documents", Taylor Francis Group London and New York.
- \* Richard L Brunelle & Robert W Reed; "Forensic Examination of Ink and Paper", Charles C Thomas Springfield, Illinois, USA
- \* Review of Forensic Medicine and Toxicology- Book by Gautam Biswas.
- \* Principles of Forensic Medicine and Toxicology- Book by Rajesh Bardale.

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**BFST 502 : Applied Forensic Chemistry & Applied Forensic Physics I**  
**Theory: 45 Lectures of 48 minutes (36 Hours)**  
**Marks -50 (Credits : 02)**

**Course Objectives : Students should**

1. About the basic concepts of toxicology, analysis and detection of toxins.
2. Become aware about the adulteration and become able to detect it.
3. Steps involving investigation of drunken driving.
4. About the general considerations of the external ballistics
5. Factors affecting the trajectory of the projectile
6. Students will be able to learn factors affecting internal ballistics

**UNIT - I : Basics of Chemistry:**

Introduction to Forensic Chemistry, Types of forensic chemistry evidences, Examination in trap cases.

**Study of Analysis of Beverages :**

**[11]**

Introduction, Definition of alcohol and illicit liquor, Alcoholic and nonalcoholic beverages and their composition, Proof spirit, absorption, de-toxication and excretions of alcohol, problems in alcohol cases and difficulties in diagnosis, Alcohol and prohibition, Consequences of drunken driving, Analytical techniques in the analysis of alcohol and other articles. Case study.

**UNIT - II : Adulteration:**

**[12]**

Definition, nature and current scenario, types of adulteration, food adulteration and food safety- Milk and milk product adulteration, edible oil and fat, sweetening agent adulteration, Food grains and product adulteration, drug adulteration- Adulterants used in drug addiction, types of drug adulteration, detection of drug adulteration, cement adulteration Types of cement, sampling, analysis of cement and building materials: silicon dioxide and other metal oxides, sulphide- sulphur, loss on ignition, insoluble residue.

**Basics of Toxicology**

Introduction to toxicology, branches of toxicology, Nature, needs and scope of Forensic Toxicology, Concept of forensic toxicology, Important definitions, Classification of poisons on the bases of state, mode of action, chemical nature. Symptoms of poisons on human body.

Antidote – Definition, Types of antidotes [ mechanical/physical antidote, physiological/ pharmacological antidote, Chemical antidote, Chelating agent, Universal and specific antidotes]

Poisons – Plant, Animal and, Metallic Poisons. Collection and preservation of toxicological samples. Analysis of Toxicological sample.

**UNIT - III : Internal Ballistics****[11]**

Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting. Muzzle velocity; Barrel length and velocity, effect of quantity of gun powder, effect of bullet weight, twist versus muzzle velocity. Strength of barrel and other parts, Recoil, jump and vibration.

**UNIT - IV : External Ballistics****[11]**

Introduction, General consideration, Parabolic trajectory of a bullet, Vacuum trajectory and calculation of remaining velocity, Air resistance, Bullet drop, Wind deflection, Gyroscopic drift, Twist versus stability, Canting, Shooting up/ down, Velocity of falling shot and falling bullet, Escape velocity, Maximum horizontal and vertical range of shot pellets, Ricochet.

**Reference Books :**

1. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
2. F.G. Hofmann, *A Handbook on Drug and Alcohol Abuse*, 2nd Edition, Oxford University Press, New York (1983).
3. P. C. Dixit- *Textbook of Forensic Medicine and Toxicology*
4. Dr.K.S.Narayan Reddy – *The essentials of Forensic Medicine and Toxicology*

5. Nageshkumar G Rao- Textbook of Forensic Medicine and Toxicology.
6. A. Poklis, Forensic toxicology in, *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
7. A.W. Jones, Enforcement of drink-driving laws by use of per se legal alcohol limits: Blood and/or breath concentration as evidence of impairment, *Alcohol, Drug and Driving*, 4, 99 (1988).
8. DFS Manual, India.
9. Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology. CBS Pub. New Delhi (1999)
10. Brian J. Heard, Handbook of Fire arm and ballistics.
11. B R Sharma, Fire arms in criminal investigation and trials
12. Kausalendra Kumar, Forensic ballistics in Criminal Justice
14. Laboratory Procedural Manual, Forensic Ballistics, DFS, New Delhi.
15. Laboratory Procedural manual, Physics Section, DFSL, Mumbai.
17. Encyclopedia of Forensic Science, Volume one: Jay A Siegel, Pekka J Saukko, Geoffery Knupfer. Academic Press

**Course outcomes:****Unit I: After completion, Students are able to :**

1. Identify the beverages by using various instrumentations.
2. Determine trap cases.

**Unit - II : After completion, Students are able to :**

1. Determines various types of adulterations.
2. Determines various types of poison.

**Unit - III : After completion, Students are able to:**

1. Define internal ballistics
2. Understand elements affecting internal ballistics.

**Unit - IV : After completion, Students are able to:**

1. Understand general considerations of external ballistics
2. Understand effect of gravitational force and air resistance

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**BFST 503: Applied Forensic Biology & Applied Forensic Psychology-I**  
**Theory: 45 Lectures of 48 minutes (36Hours)**  
**Marks -50 (Credits: 02)**

**Course Objectives:**

**Student should**

1. Understand the Forensic serology and Forensic Microbiology.
2. Understand the Wildlife Forensic and Forensic Ornithology
3. Understand the Personality of Psychology.
4. Understand the Counseling Psychology.

**UNIT - I: FORENSIC SEROLOGY:**

**[12]**

Determination of human and animal origins from bones, hairs, nails, skin, body tissue, fluids / stains viz. blood, menstrual blood, semen, saliva, sweat, pus, vomit, through immune diffusion and immune – electrophoresis. Serogenetic markers:- Blood groups – biochemistry and genetics of ABO, Rh, Mn systems, stains and other fluids / stains viz.

**FORENSIC MICROBIOLOGY AND PALYNOLOGY:**

Development of forensic microbiology, Types and identification of microbial organisms / fungi of forensic Significance, Techniques in forensic microbiology. Understanding Bioterrorism:- Types of biological agents –Category A, B, C. Planning and response to bioterrorism – Preparedness Biosurveillance, Biodefence. Epidemiology of Bioterrorism. Pollen grain analysis.

**UNIT - II : WILD LIFE FORENSIC AND FORENSIC ORNITHOLOGY & DENDROCHRONOLOGY**

**[11]**

Introduction and importance of wild life, Protected and endangered species of Animals and Plants. Types of wildlife investigations, Application of forensic science to wildlife investigation, Identification of wild life materials by conventional and modern methods. Identification of Pug marks of various animals census of wild life Population. Genetic methodologies in wildlife investigation. Birds flight and means of locomotion, Strikes and collisions, Quarantine issues, Crime Scenes, Confiscated Bird Goods, Anthropological Arte facts, Applications of Forensic Ornithology, Feather structure and topography. Dendrochronology: Types of wood, identification of wood, study of tree rings, dating. Plants of forensic significance.

**UNIT-III : Psychology of Personality****[11]**

Personality: Concept and nature; Basic issues related to study of personality. Eastern and Western perspective, Trait and type approaches: Allport, Cattell, Eysenck, and Big-five model. Psychodynamic and psychosocial approaches: Freud and Erikson Behaviouristic and social learning approaches: Skinner, Bandura and Mischel. Humanistic and phenomenological approaches: Rogers and Kelly.

**UNIT - IV : Counseling Psychology****[11]**

Counselling: Historical perspective. Educational, developmental, and preventive models; ethical issues in counselling. Counseller and the Counsee: Expectations and goals; characteristics of counsee and counselors; role and functions of the counselors. Counselling approaches: Psychoanalytic, person-centered, existential, and cognitive behavioral approaches. Counselling process: External conditions and preparation; structuring the counselling relationship; counselling interview and degrees of lead by the counselor; nonverbal behavior. Areas of counselling: Educational, career, marital and gerontological; stress management oriented counselling; Counselling for terminal disease patients: cancer and HIV /AIDS

**Reference Books:**

- 1 Forensic Science – An introduction to scientific and investigative techniques – Stuart H. James and Jon J. Nordby.
- 2 Faegri, K. Iverson, J. And Krzywinski, K. Textbook of Pollen Analysis 4th Edition, John Wiley & Sons, New York 1989.
- 3 Microbial Forensics by Roger Breeze, Bruce Budowle, Steven E. Schutzer, Elsevier Academic Press.
- 1 Forensic Science in Wildlife Investigations – Adrian Linacre Taylor and Francis, 2009.
- 2 The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature by Donna M. Jackson, Wendy Shattil, Bob Rozinski Universal Antheneum (Denver, CO, U.S.A.)
- 3 Forensic Entomolgy : The Utility of Arthropods in Legal Investigations – Jason H. Byrd, James L. Castner Taylor and Francis, 2009.
- 4 Forensic Entomology : An Introduction by Dorothy E. Gennard Wiley.
- 5 Forensic Palynology by Dallas Mildenhall, Patricia Wiltshire, Vaughn Bryant Elsevier, 2006.

6. Forensic Palynology : An in-depth look at its indispensable value – National University, San Diego, 2002.
7. Forensic Biology – Richard Li.
8. Fundamentals of Forensic DNA Typing – John M. Butler.
9. Scientific and Legal Applications of Bloodstain Pattern Interpretation – Stuart H. James.
10. Bachhav, Aun M. (2012). Criminal Psychology. ChandralokPrakashan, Kanpur - 208021 Bharati, A. (2012).
11. Cervone, D. & Lawrence, P.A. (2013). Personality Psychology (ed. 12). New York: Wiley.
12. Cloninger S.C. (2012). Theories of Personality: Understanding Persons (6th Edition). Pearson Education
13. Feist, J. & Fiest, G. J. (2009). Theories of personality. New York: McGraw Hill.
14. Friedman, H. S. & Schustack, M. W. (2003). Personality: Classic theory and modern research (2nd ed.). Singapore: Pearson Education.
15. Hall, G. C., Lindzey, G., & Campbell, J. C. (1998). Theories of personality (4th ed.). New York: Wiley.
16. Larsen, R. J., & Buss, D. M. (2013). Personality Psychology: Domains of knowledge about human nature (5th ed.). New York: McGraw Hill.
17. Mishra G, & Mohanty A. K. (2002). Perspectives on Indigenous psychology (edited). New Delhi: Concept Publishing Company.
18. Cormier, S., & Hackney, H. (2013) Counseling strategies and interventions (8th International Edition). London: Pearson.
19. Erford, B. (2013) Orientation to the counseling profession: Advocacy, ethics, and essential professional foundations (2nd Ed.). London: Pearson.
20. Fouad, N.A. (Ed) (2012) APA Handbook of counseling psychology. Washington: American Psychological Association
21. Gelso, C. J., & Fretz, B. R. (2000). Counselling psychology (2nd Ed). KY: Cengage Learning.
22. Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education.

- 23 Woolfe, R., Dryden, W., & Strawbridge, S. (Eds.) (2010). Handbook of counselling psychology (3rd Ed). London: Sage Publication Ltd.

**Course outcomes:****Unit I: After completion, Students are able to:**

1. Learn about the Serological technique and its forensic significance.
2. Understand the knowledge about the forensic Microbiology and examination of Pollen grains

**Unit - II : After completion, Students are able to:**

1. Understand the knowledge about the wildlife forensic and its forensic application
2. Understand the examination of Feather topography and application of Forensic ornithology.

**Unit - III: After completion, Students are able to:**

1. To Understand Personality Psychology & its traits.
2. To Understand the Personality & its Approaches Methods.
3. Applications of Personality Psychology for testing in Legal Proceedings.
4. To understand Role & Applications in Forensic Psychology.
5. To understand the Behaviour of Person by using various Personality approaches.

**Unit - IV: After completion, Students are able to:**

1. To identify Personality of Criminal as well as Person.
2. To identify the Personality traits.
3. To define and understand term of Counselling.
4. To Use of Counselling for Legal & Social Purposes.
5. To understand the methods & types of Counselling.
6. To identify or to define Area of Counselling.

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**Elective Papers: Applied Digital and Cyber Forensic I****BFST-504 A -Digital Forensic****Theory: 45 Lectures of 48 minutes (36 Hours)****Marks -50 (Credits: 02)****Course objectives: Student should:**

1. About the basic concepts of Digital Forensic.
2. About the Digital Crime Scene Investigation Process.
3. Steps involving investigation of Digital Crime Scene.
4. To Learn about the Hard Disk Technology & Hard Disk Data Acquisition.
5. To Learn about the File System Attributes & Data Structure.
6. To Learn about NTFS & MFT Concepts & Analysis.

**UNIT - I : Digital investigation foundation.****[11]**

Digital investigations and evidence, Digital crime scene investigation process, Data analysis, overview of toolkits, Computer foundations- Data organizations, booting process, Hard disk technology, Hard disk data acquisition- introduction, reading the source data, writing the output data, a case study.

**UNIT - II : Volume Analysis-****[11]**

Introduction, background, analysis basics, PC based partitions- DOS partitions, Analysis considerations, Apple partitions, removable media, Server based partitions- BSD partitions, Sun Solaris slices, GPT partitions, Multiple disk volumes- RAID, Disk Spanning.

**UNIT-III : File system analysis-****[12]**

What is a file system, File system category, Content category, Metadata category, File name category, Application category, Application-level search techniques, Specific file systems, FAT concepts and analysis- Introduction, File system category, Content category, Metadata category, File name category, The big picture, File recovery, determining the type, Consistency check. FAT data structure- Boot sector, FAT 32 FS info, FAT, Directory entries, Long file name directory entries.

**UNIT - IV : NTFS concepts****[11]**

Introduction, Everything is a file, MFT concepts, MFT entry attribute concepts, Other attribute concepts, Indexes, Analysis tools, NTFS Analysis- File system category, Content category, Metadata category, File name category, The big picture, File recovery, determining the type, Consistency check. NTFS data structure- Basic concepts, Standard file attributes, Index attributes and data structures, File system metadata files.

**Textbooks:**

1. File System Forensic Analysis – Brian Carrier, Addison Wesley, 2005
2. Digital Evidence and Computer Crime- Casey, Eoghan , edition 2, Academic Press, 2004.
3. Computer Forensics- Kruse, Warren and Jay Heiser, Addison Wesley, 2002.

**Reference Books:**

1. Guide to Computer Forensics and Investigations- Bill Nelson, Amelia Phillips, Frank Enfinger, Chris Steuart, Thomson Course Technology, 2004
2. Forensic Discovery – Dan Farmer & Wietse Venema, Addison Wesley, 2005
3. Incident Response and Computer Forensics- Mandia, Kevin, Chris Prosis, Matt Pepe, McGraw Hill/Osborne, 2003.
4. A Fast File System for UNIX-McKusick, William N. Joy, Samuel J. Leffler, Robert S. Fabry , ACM Transactions on Computer Systems , August 1984, pp 181-197.  
<http://docs.freebsd.org/44doc/smm/05.fastfs/paper.pdf>
5. The Common Vulnerabilities and Exposures database, entry CVE-2000-0666. <http://cve.mitre.org/>

**Course Outcomes:****Unit I: After completion, Students are able to**

1. Learn about the Digital Investigation Process.
2. Understand the Reading & Writing of Data & its Analysis.
3. Learn Hard Disk technology.
4. Study & Understand the Data Analysis Process.

**Unit - II : After completion, Students are able to**

1. Understand the Volume & Partition Storage Analysis.
2. Study in detail about Storage Media & Partition.

**Unit III: After completion, Students are able to**

1. Learn about Basics of File System.
2. Understand & Study the Metadata Technology
3. Study the Examination & Analysis of File Recovery.
4. Understand the Boot Sector in Data Structure.

**Unit IV: After completion, Students are able to**

1. Learn about NTFS.
2. Study the NTFS Data Structure.

**Understand the File System Attributes.****The toolkit Requirements:**

- 1 Windows OS
- 2 Ubuntu OS
- 3 MacOS OS

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**BFST-504 B : Forensic Speaker Identification****Theory: 45 Lectures of 48 minutes (36Hours)****Marks -50 (Credits: 02)****Course objectives: Student should :**

- 1 About the basic concepts of Speaker Identification.
- 2 To Learn about Speaker Identification Process.
- 3 Steps involving investigation of Tape Authentication Process.
- 4 To Learn about the Instrumental Analysis of Speech Samples
- 5 To Learn about the Use of Forensic Linguistic in Speaker Identification.
- 6 To Learn about Applications of Voice Biometrics.

**UNIT-I : Introduction to speaker identification****(09)**

Introduction to speaker identification, application of speaker identification in various types of crime, Audio tape authentication and examination.

Physics of sound: waves and sound, analysis and synthesis of complex waves, Human and non-human utterances, anatomy of vocal tract, vocal formants, analysis of vocal sound, frequencies and overtones Electronics of Audio Recording, Transmission and Playback devices, noise and distortion, voice storage and preservation.

**UNIT - II : Forensic Linguistics:****(11)**

Phonetics, Morphology, Syntax, Semantics, Stylistics, Pragmatics, Script, orthography and graphology, Difference between language and speech, Psycholinguistics, Neurolinguistics, Sociolinguistics, Scientific approaches; Reliability and admissibility of evidence in the court, linguistic profile, language register Discourse Analysis: Connivance, acceptance, listening feedback and rejection in the context of Mens-Rea, Narrative, Dialectology, Linguistic variety as a geographical marker, Idiolects and speaker characterization, Phonology, Morphology and Word formation processes as individual linguistic abilities.



**UNIT-III : Various approaches in Forensic Speaker Identification [12]**

Instrumental Analysis of speech sample, Interpretation of result, Statistical interpretation of probability scale, Objective/Subjective methods, discriminating tests, closed test, open test, likelihood ratio calculation, Concept of test and error in Speaker Identification, case studies. Source filters theory.

**UNIT - IV : Techniques and Best Practices for examination of Audio recording authentication and case studies. [12]**

Automatic speaker identification and verification system based on fuzzy logics, neural network, MPCC etc., Voice Biometrics VoIP and other modes of speech communication and their forensic analysis Options, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection ,Artifacts. Collection Steps, Controlling Contamination.

**Reference Book:**

- 1 NCJRS Library collection, Best practices for seizing electronic evidence v.3: A Pocket Guide for First Responders, US department of Homeland Security.
- 2 Robert Moore. Cybercrime: Investigating High-Technology Computer Crime, 2nd edition, Routledge 2015
- 3 Special Report (2nd Edition), Electronic Crime Scene Investigation: A Guide for First Responders, NIJ publication.
- 4 Special Report, Forensic Examination of Digital Evidence: A Guide for Law Enforcement, NIJ Publication.
- 5 Sridhar S. (2011), Digital Image Processing, Oxford University Press.
- 6 Stern D.L. (1993), Preventing Computer fraud, Computing McgrawHill.
- 7 Tewari R.K., Sastry P.K. and Ravikumar K.V. (2003), Computer Crime & Computer Forensics, Select Publisher, New Delhi.

- 8 Veerakumar T., Jayaraman S. and Esakkirajan S. (2009), Digital Image Processing, McGraw Hill.
- 9 Wold G.H. and Shriver R. (1993), Computer Crime techniques Prevention, New Delhi Galgotia Book Source.

**Course Outcomes:****Unit - I: After completion, Students are able to**

1. Learn Speaker Identification Process.
2. Study the Speaker Identification in various Crimes .
3. Learn the hard disk technology
4. Study and understand data analysis process.

**Unit - II: After completion, Students are able to**

1. Understand the volume and partition storage analysis.
2. Study in detail about media and partitions.

**Unit - III : After completion, Students are able to**

1. Learn about basic of file system.
2. Understand and study the meta data technology.
3. Study the examination and analysis of file recovery.
4. Understant the boot sector in data structure.

**Unit - IV : After completion, Students are able to**

1. Do analysis of speech sample.
2. To study and learn about analyse Audio recording as a evidence.
3. Learn about speaker characterization
4. Able to analyse speaker identification approaches and its method.

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**BFST 504 C : Forensic Video Analysis**  
**Theory: 45 Lectures of 48 minutes (36Hours)**  
**Marks -50 (Credits: 02)**

**Course objectives:****Student should :**

- 1 To Learn about the Image Fundamentals.
- 2 About to Learn the Digital Signalling Process.
- 3 To Evaluate and design security systems incorporating CCTV.
- 4 Understand the Privacy challenges of Evidence handling Procedure.
- 5 About to explain the authentication of video evidence.
- 6 Steps involved in handling of CCTV as Evidence.
- 7 To Learn about the Facial Image Recognition Tools.
- 8 To Learn about Watermarking, Collection & Recovery of Video Evidence.

**UNIT-I : Image Fundamentals****[13]**

Image acquisition, sampling and quantization, image resolution, basic relationship between pixels, colour images, RGB, HSI and other models.

Two Dimensional Transforms : Discrete Fourier Transform, Discrete Cosine Transform, KL Transform, and Discrete Wavelet Transform Image Enhancement : Spatial Domain Point Processing: Digital Negative, contrast stretching, thresholding, gray level slicing, bit plane slicing, log transform and power law transform. Neighborhood Processing: Averaging filters, order statistics filters, high pass filters and high boost filters. Frequency Domain: DFT for filtering, Ideal, Gaussian and Butterworth filters for smoothening and sharpening, and Holomorphic filters. Histogram Modeling: Histogram equalization and histogram specification, Laws related to digital evidences. Admissibility of video evidence in court of law

**UNIT - II : CCTV****[12]**

Basics of CCTV, scope recognizing CCTV evidence & its nature, types of DVRs, DVR recording, evidence, best practices of CCTV evidence retrieval and storage at scene of crime and laboratory, challenges and precaution at the scene of crime, evidence handling procedure, legal issues, recommended equipments needed

**UNIT-III : Watermarking****[10]**

Interlacing, De-interlacing, Double Compression, Duplication, Reprojection Forensic analysis: Best practices of collection, recovery, enhancement, analysis and interpretation of video evidence

**UNIT - IV : Facial image recognition****[10]**

vehicle registration plate image enhancement, foreign object detection, Authentication of Video evidence, video source identification techniques, Case studies.

**Course Outcomes:****Unit I: After completion, Students are able to**

1. Learn about the Image Fundamentals.
2. Understand the RGB, HSI and other models.
3. Learn about Digital Negative, contrast stretching, thresholding, gray level slicing, bit plane slicing, log transform and power law transform
4. Study & Understand the Histogram Modeling

**Unit - II : After completion, Students are able to**

1. Understand the Basics of CCTV
2. Understand the types of DVRs, DVR recording.

**Unit III: After completion, Students are able to**

1. Learn about Interlacing, De-interlacing
2. Understand & Study the Duplication, Reprojection
3. Study the interpretation of video evidence

**Unit IV: After completion, Students are able to**

1. Understand the Facial image recognition
2. Learn about foreign object detection
3. Study the Authentication of Video evidence

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**BFST 505: Numerical Skills**  
**Theory: 30 Lectures (48 minutes) (24 HOURS)**

**Course Objective:****Students should:**

1. Understand Mathematical Reasoning and Aptitude:
2. Make students aware about some tricks in mathematics.
3. Study the some basic concepts of reasoning.
4. Make students aware about competitive exams syllabus like SET/NET/JNU/IIT.

**Unit-I: Mathematical Reasoning and Aptitude [15]**

Mathematical Aptitude: Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc. Number series, Letter series, Codes and Relationships. Mathematical Aptitude (Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc)

**Unit - II : Logical Reasoning: (15)**

Understanding the structure of arguments: argument forms, structure of categorical propositions, Mood and Figure, Formal and Informal fallacies, Uses of language, Connotations and denotations of terms, Classical Square of opposition. Analogies, Venn diagram: Simple and multiple use for establishing validity of arguments, Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of Data.

**Reference Books -**

Quantitative Aptitude for Competitive Examinations by Dr. R. S. Agarwal.  
 NTA UGC - NET/SET/ JRF Paper I - SikshanEvamShodhAbhiyogita, second Edition  
 Vidyabhartee SET/NET Anivarya Paper Margadarshak 2017 by [Brijmohan Dayma](#)  
 UGC NET Mathematical Sciences 2018 by [Pawan Sharma](#)

**Course Outcomes:****Unit I : After completion, students are able**

1. Understand the basic fundamentals in basics of Math's and Reasoning
2. Gain an insight in the fascinating topics like Graphical representation

**Unit II : After completion, students are able**

1. Create positive attitude towards Entrance exam and competitive exams.

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**BFSP 506:**  
**Practical of Applied Forensic Physics, Chemistry and Biology I**  
**SECTION A: Applied Forensic Physics I**

**Course objectives:-****Student should:-**

- 1 Understand working of firearm
- 2 Understand difference between entrance wound and exit wound
- 3 Know photographic techniques

**Practicals:-**

- 1 To study the working mechanism of firearm(s).
- 2 To study Documentation, Collection, of fired evidences.
- 3 To study Class characteristics of firearm
- 4 Examination of Entrance Versus Exit wounds.
- 5 Photographic technique by using SLR/ Digital camera.
- 6 Analysis of XRD pattern.
- 7 Trajectory simulation (sample calculations).
- 8 Examination of firearm(s).

**(Note: Minimum 5 practical should be conducted.)**

**Course Outcomes:****After completion, students are able to:**

- 1 Understand XRD pattern and its applications
- 2 Understand examination of firearms
- 3 Understand class characteristics of the firearms
- 4 Understand trajectory simulation.

**Reference Books:-**

- 1 Fire Arms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence By S N Gaur et al
- 2 DFS manual
- 3 Fire arms in criminal investigation and trials By B R Sharma

**SECTION B: Applied Forensic Chemistry I****Course objectives:-****Student should:-**

1. Understand detection methods of poison.
2. Understand detection of various metallic poisons
3. Know detection methods of ethyl alcohol and adulteration.

**Practicals:-**

1. To detect plant poisons. (Any 2)
2. To identify metallic poisons. (Any 2)
3. To identify ethyl alcohol. (Any 2)
4. Detection of adulteration (Any 2)

**(Note: Minimum 5 practical should be conducted.)**

**Reference Books:-**

1. DFS manual
2. Forensic Chemistry and Toxicology by Reddy
3. Forensic Chemistry and Toxicology by P.C. Dixit
4. Forensic Chemistry and toxicology by J.P.Modi

**Course Outcomes:****After completion, students are able to:**

1. Identify the plant poison , its origin and characteristics along with symptoms.
2. Identify the ethyl alcohol
3. Determine the type of metallic poison.
4. Identify the type of adulterant used for adulteration.

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**SECTION C: Applied Forensic Biology I****Course Objectives:****Students should**

1. Study the Gender identification from Blood sample, Electrophoresis separation.
2. Study the Human Hair morphology
3. Study the Presumptive and confirmatory test for Blood

**Practical's-**

- 1) To perform electrophoresis for separation of various polymorphic enzymes.
  - 2) Examination of Barr bodies from blood sample.
  - 3) Determination of human hair morphology.
  - 4) Presumptive tests for Blood :
    - a. Phenolphthalein Assay.
    - b. Benzidine.
    - c. Leucomalachite Green (L.M.G.)
    - d. Luminol Test.
  - 5) Confirmatory test for Blood –
    - a.] Teichmann test      b] Takayama test
  - 6) Detection of Amylase activity by starch-iodine assay in Saliva.
  - 7) Species identification from various biological fluids :
    - a. Electrophoresis b. Precipitin tests.
    - b. Acid phosphatase test for semen.
    - c. Prostate Specific Antigen (P.S.A.)
  - 8) Identification and culture of bacteria of forensic significance.
  - 9) Study of pollen grains and spores of forensic significance.
  - 10) Examination of hair of different animals such as Dogs, Cats, Cow, Horse, Goats etc.
  - 11) To perform precipitin test for species of origin determination.
  - 12) To perform Immunodiffusion test for species of origin.
  - 13) Blood grouping from stains of blood, semen, saliva and other body fluids by Absorption inhibition, Absorption-elution and mixed agglutination technique, determination of Secretor/ non-secretor status.
  - 14) Preparation of permanent slides by using maceration technique of various forensic material of Plant origin.
  - 15) To identify Birds from Feathers
- (Note: Minimum 5 practical should be conducted.)



**Reference Books -**

1. Forensic Science – An introduction to scientific and investigative techniques – Stuart H. James and Jon J. Nordby.
2. Faegri, K. Iverson, J. And Krzywinski, K. Textbook of Pollen Analysis 4th Edition, John Wiley & Sons, New York 1989.
3. Microbial Forensics by Roger Breeze, Bruce Budowle, Steven E. Schutzer, Elsevier Academic Press.
4. Forensic Science in Wildlife Investigations – Adrian Linacre Taylor and Francis, 2009.
5. The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature by Donna M. Jackson, Wendy Shattil, Bob Rozinski Universal Antheneum (Denver, CO, U.S.A.)
6. Forensic Entomolgy : The Utility of Arthropods in Legal Investigations – Jason H. Byrd, James L. Castner Taylor and Francis, 2009.
7. Forensic Entomology : An Introduction by Dorothy E. Gennard Wiley.
8. Forensic Palynology by Dallas Mildenhall, Patricia Wiltshire, Vaughn Bryant Elsevier, 2006.
9. Forensic Palynology : An in-depth look at its indispensable value – National University, San Diego, 2002.
10. Forensic Biology – Richard Li.
11. Fundamentals of Forensic DNA Typing – John M. Butler.
12. Scientific and Legal Applications of Bloodstain Pattern Interpretation – Stuart H. James.
13. DFSL Biology & Serology manual.

**Course Outcomes –**

After completion of the unit, Students will be able to:

1. Understand the Presumptive and Confirmatory test for Blood, Human Hair Morphology..
2. Understand the culture and identification of bacteria as forensic significance and Pollen grain examination
3. Understand the Identification of Birds from Feathers.

**BFSP 507: Practical of Applied Forensic Science,  
Applied Forensic Psychology and Digital & Cyber Forensic I**

**SECTION A: Applied Forensic Science I****Course Objectives: Students should**

- 1 Study the detection and decipherment of various questioned document.
- 2 Study the ink, paper, handwriting and signature examination.
- 3 Study the post-mortem findings of cadaver.
- 4 Study the different types of injury.

**Practicals -**

- 1 To study the detection and decipherment of secret document.
- 2 To study the detection and decipherment of charred document.
- 3 To study the different types of document forgery.
- 4 To study the different types of handwriting/signature forgery.
- 5 To study the stamp impression.
- 6 To perform the TLC of different ink samples.
- 7 To identify different types of document.
- 8 To conduct the preliminary examination of different types of document.
- 9 To study the different security documents.
- 10 To study the printed document.
- 11 To study the typewritten document.
- 12 To extract the characteristics features of handwriting.
- 13 To study the factors affecting handwriting.
- 14 Comparison of unknown handwriting samples.
- 15 Comparison of unknown signature sample.
- 16 To study post-mortem findings of a cadaver
- 17 To study the different types of injury.

**(Note: Minimum 5 practical should be conducted.)**

**Reference Books:-**

- 1 Ordway Hilton; “Scientific Examination of Questioned Documents”. Revised Edition, Elsevier, NY 1982.
- 2 Albert S. Osborn; “Questioned Documents”, 2nd Ed., universal Law Pub., Delhi 1998.
- 3 Albert S Osborn; “The Problem of Proof”, 2nd Ed., Universal Law Pub. Delhi 1998.
- 4 Wilson R. Harrison; “Suspect Documents Their Scientific Examination”, Universal Law Pub. Delhi Indian Reprint, 2001.
- 5 Working manual of VSC- 8000
- 6 Jan Seaman Kelly & Brian S Lindblom; “Scientific Examination of Questioned Documents”, Taylor Francis Group London and New York.
- 7 Richard L Brunelle& Robert W Reed; “Forensic Examination of Ink and Paper”, Charles C Thomas Springfield, Illinois, USA
- 8 Review of Forensic Medicine and Toxicology- Book by GautamBiswas.
- 9 Principles of Forensic Medicine and Toxicology- Book by Rajesh Bardale.

**Course Outcomes:**

After completion of the unit, Students will be able to:

- Detect and decipher various questioned document.
- Examine the paper, ink, handwriting and signature.
- Understand the post-mortem findings of cadaver.
- Know the different types of injury.

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**SECTION B: Applied Forensic Psychology - I****Course Objectives:****Students should:**

1. Learn to Conduct Personality Test to find out Personality Factors.
2. Study the Counseling Technique to Learn to Counsel the Subject.
3. Study & Learn to Conduct the Stress test on Subject.

**Practicals:**

- 1 Personality assessment using any projective test
- 2 Assessment of Self & Ideal Self using Semantic differential
- 3 NEO PI-R (FFI) test
- 4 Cattell's 16 P.F.
- 5 Personality assessment from Indian perspective (triguna, anashakti etc.)
- 6 Conducting counselling interviews
- 7 Educational counselling at secondary level
- 8 Assessment of Academic/ career related stress
- 9 Group counselling in school setting

**Note: Minimum 5 practical should be conducted.**

**Reference Books:**

- 1 Cervone, D. & Lawrence, P. A. (2013). Personality Psychology (ed. 12). New York: Wiley.
- 2 Cloninger S. C. (2012). Theories of Personality: Understanding Persons (6th Edition). Pearson Education
- 3 Feist, J. & Feist, G. J. (2009). Theories of personality. New York: McGraw Hill.
- 4 Friedman, H. S. & Schustack, M. W. (2003). Personality: Classic theory and modern research (2nd ed.). Singapore: Pearson Education.
- 5 Hall, G. C., Lindzey, G., & Campbell, J. C. (1998). Theories of personality (4th ed.). New York: Wiley.
- 6 Larsen, R. J., & Buss, D. M. (2013). Personality Psychology: Domains of knowledge about human nature (5th ed.). New York: McGraw Hill.
- 7 Mishra G, & Mohanty A. K. (2002). Perspectives on Indigenous psychology (edited). New Delhi: Concept Publishing Company.

- 8 Cormier, S., & Hackney, H. (2013) Counseling strategies and interventions (8th International Edition). London: Pearson.
- 9 Erford, B. (2013) Orientation to the counseling profession: Advocacy, ethics, and essential professional foundations (2nd Ed.). London: Pearson.
- 10 Fouad, N.A. (Ed) (2012) APA Handbook of counseling psychology. Washington: American Psychological Association
- 11 Gelso, C. J., & Fretz, B. R. (2000). Counselling psychology (2nd Ed). KY: Cengage Learning.
- 12 Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education.
- 13 Woolfe, R., Dryden, W., & Strawbridge, S. (Eds.) (2010). Handbook of counseling psychology (3rd Ed). London: Sage Publication Ltd.

### **Course Outcomes:**

After completion of the Practical, Students will be able to:

1. To find out Personality Factor of Subject by using Personality Test
2. Understand the Skills required to Conduct Counseling on Subject.
3. To measure Stress level by conducting Test.

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**(B) Forensic Speaker Identification****Course objectives :****Students Should :**

1. Understand signals in the form of waveform.
2. Study the conversion of analog speech signals in to digital one.
3. Study the different applications using in speaker identification.

**Practicals :**

1. To represent speech signal in the form of waveform and to resample the same.
2. To convert analog speech signal into digital one.
3. To segregate voice sample of a particular subject.
4. To form clue words of given speech sample of a subject.
5. To describe speech sample in terms of IPA.
6. To perform auditory analysis on a given set of speakers.
7. To study formant frequency in a given sound spectrograph.
8. To study pitch and intonation pattern in a given sound spectrograph.
9. To study LPC in a given sound spectrograph.
10. To perform pre-morgue analysis of a cadaver.
11. To study post-mortem findings of a cadaver.

**Reference Book:**

1. NCJRS Library collection, Best practices for seizing electronic evidence v.3: A Pocket Guide for First Responders, US department of Homeland Security.
2. Robert Moore. Cybercrime: Investigating High-Technology Computer Crime, 2nd edition, Routledge 2015
3. Special Report (2nd Edition), Electronic Crime Scene Investigation: A Guide for First Responders, NIJ publication.
4. Special Report, Forensic Examination of Digital Evidence : A Guide for Law Enforcement, NIJ Publication.
5. Sridhar S. (2011), Digital Image Processing, Oxford University Press.

- 6 Stern D.L. (1993), Preventing Computer fraud, Computing Mcgraw Hill.
- 7 Tewari R.K., Sastry P.K. and Ravikumar K.V. (2003), Computer Crime & Computer Forensics, Select Publisher, New Delhi.
- 8 Veerakumar T., Jayaraman S. and Esakkirajan S. (2009), Digital Image Processing, McGraw Hill.
- 9 Wold G.H. and Shriver R. (1993), Computer Crime techniques Prevention, New Delhi Galgotia Book Source.

**Course Outcomes:**

After completion of the unit, Students will be able to:

1. Perform conversion of analog speech signals into digital one.
2. Perform auditory analysis.
3. Work on LPC.
4. Perform post-mortem findings of a cadaver

**(C) Forensic Video Analysis****Course objectives:****Students should:**

- 1 Understand the potential of video evidence.
- 2 Study the technology behind CCTV.
- 3 Study the different applications used in video analysis.

**Practical's:**

- 1 Retrieval of video evidence from DVR.
- 2 Video analysis and detection of tampered video files using Video analyzing tool.
- 3 Extracting Facial Identification Evidence from CCTV image.
- 4 Enhancement of Vehicle Registration Number plate from CCTV image.
- 5 Source correspondence to CCTV camera from video file.
- 6 Source correspondence to video camera from video file.

**Reference Book:**

1. Kerman Kruggle; "CCTV Surveillance: Practices and Technology", Elsevier, 2007. Page | 124
- 2 Austerberg David; "The Technology of Video & Audio Streaming", Focal Press, 2013.
- 3 Millerson Gerald; "Video Camera Techniques", Focal Press, 2006.
- 4 Musburger, B. Robert & Michael R. Ogden; "Single Camera Video Production", Focal Press, 2014.
- 5 Brown Blain; "Cinematography: Theory and Practice Image making for Cinematographers and Directors", Routledge, 2016.
- 6 Wheeler, Paul; "Digital Cinematography", Focal Press, 2001.
- 7 Stan Z Li & Anil Kumar Jain; "Handbook of Face Recognition", 2nd Edition, Springer, 2011.
- 8 Michal Kawulok et al.; "Advances in Face Detection & Facial Image Analysis", Springer, 2016.
- 9 Qi Peter Li; "Speaker Identification", Springer, 2012.
- 10 Kittler Josef & Mark S. Nixon; "Audio and Video based Biometric Person Authentication", Springer, 2003.

**Course Outcomes:**

After completion of the unit, Students will be able to:

1. Work on analysis of video files.
2. Perform Extraction of facial identification evidence from CCTV image.
3. Work on several types video evidence.



**B.Sc.-III Semester-VI  
Syllabus Structure:**

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Title	Lectures per week	Credits
<b>Compulsory Papers</b>						
Applied Forensic Science II	BFST 601	3	2	BFSP 606	10	4
Applied Forensic Chemistry and Forensic Physics II	BFST 602	3	2			
Applied Forensic Biology & Applied Forensic Psychology II	BFST 603	3	2	BFSP 607+ Project 608	10	4
<b>Elective Papers (Any one)</b>						
Digital Data Analysis	BFST 604 A	3	2			
Cyber Crime and Cyber Law	BFST 604 B					
Operating system Forensic Analysis	BFST 604 C					
Entrepreneurship	BFST 605	2	1	BFSP 609	4	1

**BFST 601: Applied Forensic Science II**  
**45 Lectures of 48 minutes (36 Hours)**  
**Marks -50 (Credits: 02)**

**Course Objectives:**

**Students should :**

1. Study the history of fingerprint science, basics of fingerprint science and different fingerprint classification systems given by various scientists.
2. Learn the collection, taking, packaging and preservation of different types of fingerprint and development and comparison of different types of fingerprint
3. Study the criminal justice system in India and admissibility of expert testimony.
4. Understand the emerging trends in forensic science.

**UNIT I : 1.Fingerprint Science- I:**

**History of fingerprint science and its development & Basics of fingerprint (12)**

History and development of fingerprint in India and abroad, morphology and anatomy of dermal skin, Embryology of fingerprint- morphology of volar pad and configurational areas, development of volar pad, formation of friction ridges, Sweat glands- eccrine, sebaceous and apocrine, Definition of fingerprint, Theory and principles of fingerprint, Forensic significance of fingerprint. Case studies.

**Taking and collection of fingerprint :** Types of fingerprint- rolled, plain, chance, latent, patent and plastic, Collection of latent, patent and plastic fingerprint : methods, procedure, precautions, limitations, preservation and lifting of fingerprint, Taking of fingerprint: Taking fingerprints of living person- purpose, requirements, procedures , precaution, limitation and collection, Taking finger prints of dead bodies- purpose, requirements, procedures, precaution, limitation and collection(techniques of recording fingerprints of dead bodies of different stages, viz, immedia

**Unit : II****Fingerprint Science II: Fingerprint classification systems (11)**

Basic classification of fingerprint- arch, loop, whorl and composite, Rules for placing core and delta, counting and tracing of ridges, ridge density, Classification of identification of fingerprint- different system of classifications(Ivon, Vucetich, Purkinje, Francis Galton, Henry 10 digit, Henry FBI extension and Battley single digit classification) and their modification till date and their utilities.

**Development and comparison of fingerprint** : conventional methods- black powder, magnetic powder and fluorescent powder, chemical methods- silver nitrate, ninhydrine and its analogues, physical developer etc., fuming methods- iodine fuming, cyanoacrylate fuming, soot method, hydrogen fluoride fuming and metal deposition method.

**Comparison of fingerprint:** class and individual characteristics(minutia's), fundamentals of comparison- print to print, trace to record, trace to print, trace to trace, documentation of fingerprint, AFIS(Automated Fingerprint Identification System).

**UNIT III : Criminal justice system in India: (11)**

Introduction, Administration of civil and criminal justice system. Introduction to constitution of India- Indian Penal Code( IPC), Criminal Procedure Code (Cr.PC) and Indian Evidence Act (IEA).Expert Testimony: Admissibility of expert testimony,Expert Evidence fallacies, Definition & Value of Expert Testimony.

**Unit : IV Emerging trends in Forensic Science: (11)**

Introduction, scope and importance of emerging forensic disciplines: Forensic Engineering, Forensic Radiology, Forensic Accounting, Forensic Nursing, Forensic Nanotechnology, Forensic Archaeology, Forensic Arts, Computational Forensics, Nuclear Forensics, Forensic Journalism, Environmental Forensics, Forensic Pharmacology, and Forensic Biotechnology

**Reference Books -**

- 1 Advances in Finger Print Technology by Henry C. Lee and R. E. Gaensslen.
- 2 Embryology & Morphology of friction ridge skin - Kasey Werthien
- 3 The fingerprint, Source book- U. S. Department of Justice, Office of Justice Programs, National Institute of Justice.
- 4 Automated Fingerprint Identification systems (AFIS), Peter Komarinski
- 5 Classification & use of Finger Print, ER Henry
- 6 Friction Ridge Skin Comparison & Identification of Finger Prints, James P. Cowger
- 7 Finger Print Identification (Handbook), SurinderNath
- 8 Police Handbook.
- 9 Indian Constitution

**Course Outcomes: After completion, students are able to****UNIT - I**

1. Learn about the different types of fingerprint.
2. Learn the process of taking and collection of the fingerprint from live and dead person.
3. Learn about the history and development of fingerprint science.
4. Get knowledge about basics of fingerprint.

**UNIT - II**

1. Learn about the different development techniques of fingerprint.
2. Get knowledge about comparison of fingerprint.
3. Understand the different classification systems of fingerprint and its application.
4. Earn about AFIS- Automated Fingerprint Identification System.

**UNIT - III**

1. Understand the criminal justice system in India and admissibility of expert testimony.

**UNIT - IV**

1. Learn about the emerging trends in forensic science.

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**BFST-602 Applied Forensic Chemistry and Forensic Physics II**  
**45 Lectures of 48 minutes (36 Hours)**  
**Marks -50 (Credits: 02)**

**Course objectives:****Student should:**

- 1 Learn about the narcotic and psychotropic drugs and their adverse effect on human.
- 2 Learn about the legal aspects of narcotic drugs, their investigation and further proceedings.
- 3 Understand the elements of terminal ballistics.
- 4 Know Steps involving investigation of vehicular accidents.
- 5 Understand differentiate between Entrance wound and Exit wound.

**UNIT I****1. Narcotics Drugs and Psychotropic Substances (12)**

- Definition of narcotics drugs and psychotropic substances. Broad classification – Stimulants, depressants and hallucinogens, natural, synthetic and semi-synthetic narcotics, designer drugs.
- General characteristics and common example of each classification. Drug dependence and Drug abuse: Important definition- Drug, Medicine, Poison, drug addiction, drug dependence, drug habituation, drug tolerance, lethal dose etc.
- Drug addiction, Causes of drug addiction, Characteristics of drug addict and withdrawal symptoms, Relation between drug addiction and crime – Indian Scenario, Analysis of Narcotic drugs.
- Narcotic Drugs & Psychotropic Substances Act 1985 (Definition, Licit Opium Cultivation, Minimum and Commercial Quantity in Narcotic Drugs, Offences and Penalties),

**UNIT - II****Prevention of Illicit Trafficking in NDPS Act 1985 (Detention of a Person under the Act),**

Law and Regulations related to Forensic Chemistry(11)The Poisons Act, 1919, and Section 284 of IPC, 1860 (Negligent Conduct with respect to poisonous substance).

- Explosives Act 1984, (Definition, Powers of Central Govt. and Licensing Authority, Offences and Penalties) and Section 286 of IPC, 1860, (Negligent conduct with respect to explosive substance),
- Explosive Substances Act 1908, (Definition, Offences and Penalties) Prevention of Food Adulteration Act 1954 (Definition, Power of Food Inspector, Offences and Penalties),
- Drugs & Cosmetics Act 1945 (Definition, Adulterated, Misbranded, Spurious Drugs and Cosmetics, Offenses and Penalties).

**UNIT III : Terminal Ballistic (11)**

Introduction, Stopping power of bullet, Injuries and the quantity of energy of projectiles, Shock wave and cavitations effect, Wounding mechanism, Elements of wound Ballistics; Nature of target. Velocity of projectile, Constructional features of projectile, Entrance wound, Exit wound.

**UNIT IV : Causes and Investigation of Vehicular Accidents (11)**

Introduction, sources of information, eye witnesses, Tire and other mark, Pedestrian impacts and vehicle speed, vehicle condition, vehicle speed and damage, curved scuffmarks, Time and distance, reaction time, Photography and plans; Rail Accidents- Investigation of rail crash: criminal and safety investigation,

**Reference Books:**

1. F.G. Hofmann, A Handbook on Drug and Alcohol Abuse, 2nd Edition, Oxford University Press, New York (1983).
2. P. C. Dixit- Textbook of Forensic Medicine and Toxicology
3. Dr.K.S.Narayan Reddy – The essentials of Forensic Medicine and Toxicology
4. Nageshkumar G Rao- Textbook of Forensic Medicine and Toxicology.
5. DFS Manual of Chemistry, India.
6. Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology. CBS Pub. New Delhi (1999)
7. Bare act of The Poisons Act, 1919, Drugs & Cosmetics Act 1945, Drugs & Cosmetics Act 1945 etc.
8. Forensic Medical Investigation of Motor Vehicle Incidence By Michel P. Burke
9. Fire arms in criminal investigation and trials By B R Sharma
10. Laboratory Procedural Manual, Forensic Ballistics, DFS, New Delhi.
11. Laboratory Procedural manual, Physics Section, DFSL, Mumbai.
12. Handbook of Fire arm and ballistics By Brian J Heard.
13. Encyclopedia of Forensic Science, Volume one: Jay A Siegel, Pekka J Saukko, Geoffery Knupfer. Academic Press.

**Course Outcomes: After completion, students are able to****UNIT I:**

1. Know about the classification and basic concepts of narcotic drugs.
2. Determine the narcotic drugs by various instruments.
3. Know the legal aspects related to NDPS

**UNIT II:**

1. Know the legal aspects related to poisons act.
2. Know about the food adulteration and there prevention.

**UNIT III:**

1. Know difference between stopping power and lethality
2. Understand elements of wound ballistics

**UNIT IV :**

1. Know causes of the vehicular accidents
2. Learn steps involving in photography in case of accident.

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**BFST— 603 Applied Forensic Biology & Applied Forensic Psychology-II****45 Lectures of 48 minutes (36 Hours)****Marks -50 (Credits: 02)****Course Objectives:****Student should**

1. Understand the DNA profiling Forensic Entomology.
2. Understand the Forensic Anthropology and Odontology
3. Understand the Investigative Psychology.
4. Understand the Correctional Psychology.

**UNIT I : DNA PROFILING AND ITS FORENSIC SIGNIFICANCE [12]**

History of DNA fingerprinting, Human genetics – Heredity, Alleles, Mutations & Population Genetic, Molecular Biology of DNA. Forensic Application of recombinant DNA technology/ Forensic Biotechnology, Human Genome Project, Variations, Polymorphism in DNA **System** – DNA markers RELP, RAPD, VNTRs, SNP, Autosomal – STR, Y-STR, Mitochondrial DNA. Forensic Significance of DNA Profiling:- Application in disputed paternity cases, child Swapping.

**FORENSIC ENTOMOLOGY:**

Introduction & History, Identification of insects, Training required, Determination of Time elapsed since death, Dipterans Larval Development, Successional Colonization of Body, Determination of displacement and disturbance of the body, Presence and Position of wounds, Drugs consumption ante mortem Challenges in Entomology, Collection of entomological evidence

**UNIT - II : FORENSIC ANTHROPOLOGY & ODONTOLOGY [11]**

Introduction & History of Anthropology, Physical Anthropology & Numan Variability, Understanding Archeology & Osteology, Scene Processing, Examining remains – Human or Animal / Old or New, Issues involved in development of biological profile, Issues in Identification, Age estimation in childhood and adulthood, Sexual Dimorphism, Population Ancestry, Stature estimation, Individualization & Identification, Evidence for cause and manner of death from bones, Documentation & Expert Witness Testimony. Portrait Parle, Bertillon system, Facial reconstruction, Super-imposition techniques, Reconstruction based on craniometrical and somatoscopic methods. Importance of tissue depth to reconstruct various facial features. Introduction & History of Odontology. Forensic Significance of Bitemarks



**UNIT III : Investigative psychology [11]**

Criminal psychological profiling Nature, definition., Psychological tests used Criminal psychological profiling, Psychological autopsy, Forensic hypnosis, Narco analysis, Polygraph, Brain finger printing, Layered voice analysis, Stalking The Psychology of violence.

**UNIT - IV : Correctional Psychology Overview [11]**

Definition scope, nature and need of correctional psychology. Remand Homes & Correctional Homes – Indian Scenario Identification of correctional needs & risk assessment. Diagnosis and treatment of mental disorders in correctional setting

**Course Outcomes****UNIT - I**

1. Students will learn about the DNA Profiling and its forensic significance.
2. Students will get the knowledge about the forensic Entomology and Collection of entomological evidence.

**UNIT - II**

1. Students will able to understand the knowledge about the Forensic Anthropology and History of Forensic odontology.
2. Students will learn about the Portrait parley & Bertillon system.

**UNIT - III**

1. To Understand Personality Psychology & its traits.
2. To Understand the Personality & its Approaches Methods.
3. Applications of Personality Psychology for testing in Legal Proceedings.
4. To understand Role & Applications in Forensic Psychology.
5. To understand the Behaviour of Person by using various Personality approaches.
6. To identify Personality of Criminal as well as Person.
7. To identify the Personality traits.

**UNIT - IV**

1. To define and understand term of Counselling.
2. To Use of Counselling for Legal & Social Purposes.
3. To understand the methods & types of Counselling.
4. To identify or to define Area of Counselling

**Reference Books:**

- 1 M.Y. Iscan and S.R. Loth, The scope of forensic anthropology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
- 2 D. Ubelaker and H. Scammell, Bones, M. Evans & Co., New York (2000).
- 3 S.Rhine, Bone Voyage: A Journey in Forensic Anthropology, University of Mexico Press, Mexico (1998).
- 4 K. Smyth, The Cause of Death, Van Nostrand and Company, New York (1982).
- 5 M. Bernstein, Forensic odontology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
- 6 J. Dix, Handbook for Death Scene Investigations, CRC Press, Boca Raton (1999).
- 7 H.B. Baldwin and C.P. May in, Encyclopedia in Forensic Science, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).
- 8 V.J. Geberth, Practical Homicide Investigation, CRC Press, Boca Raton (2006).
- 9 T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).
- 10 W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
- 11 Bachhav, Aun M. (2012). Criminal Psychology. Chandralok Prakashan, Kanpur - 208021 Bharati, A. (2012).
- 12 Studies on Criminological Psychology. G.S. Rawat for Ceber Tech Publications. New Delhi- 110 002 Cohen, R.J., Swerdlik, M.E. (2005).
- 13 Psychological testing and assessment (6th ed.). Delhi: Tata McGraw-Hill. Gregory, R.J. (2005). Psychological Testing (4th ed.). Delhi: Pearson education Pte.Ltd. Suryanarayana, N.V.S, Himabindu Goteti, Neelima V. (2011).
- 14 Cyber Psychology. Sonali Publications, New Delhi- 110 002 Thou Teisi (2011).
- 15 Forensic Psychology. ABD Publishers, Jaipur-302018 Veereshwar, P. (2002).
- 16 Indian systems of psychotherapy. Delhi: Kalpaz publications Verma, L. (1990).
- 17 The management of children with emotional and behavioral difficulties. London: Routledge

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**Elective Papers: Applied Digital and Cyber Forensic II****BFST 604 A - Digital Forensic****Theory: 45 Lectures of 48 minutes (36 Hours)****Marks -50 (Credits: 02)****Course objectives:****Student should:****Learn about Data Recovery tool & Data Recovery Methods.**

- 1 Learn Role of Data Backups in Data Recovery.
- 2 Learn About to Learn Authentication of Digital Evidences in the case of Data Duplication.
- 3 Learn About to Learn Rules and types of evidence and General Procedure of Evidence Collection.
- 4 Learn about the Duplication and Preservation of Digital Evidence.

**UNIT I : Data Recovery [11]**

Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Hiding and Recovering Hidden Data.

**UNIT II : Evidence Collection and Data Seizure [11]**

Collection of Digital Evidence, Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure Collection and Archiving, Methods of Collection, Artifacts.

**UNIT III : Duplication and Preservation of Digital Evidence [11]**

Duplication and Preservation of Digital Evidence Preserving the Digital Crime Scene, Computer Evidence Processing Step. Computer Image Verification and Authentication Special Needs of Evidential Authentication, Practical Considerations.

**UNIT IV : Types of Evidence [12]**

Evidence Collection and Data Seizure, Why Collect Evidence, Collection Options, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts. Collection Steps, Controlling Contamination.

**The toolkit Requirements:**

- 1 Tableau T35e Write Blocker
- 2 Write Blockers FireWire to SATA/IDE Bridge
- 3 IDE Cable/Adapters
- 4 SATA Cable/Adapters
- 5 FireWire and USB Cable Adapters
- 6 One External Power Supply and power cable
- 7 Forensic Notebook Adapters (IDE/SATA)
- 8 Zero Force Insertion Module
- 9 1.8" Adaptor
- 10 2.5" Adaptor
- 11 Micro SATA Solid State Disk Adapter
- 12 Professional Storage Bag for Kit
- 13 Anti-static tweezers
- 14 Anti-static keyboard mat
- 15 USB 2.0 to IED adapter
- 16 Static Gloves (per pair)
- 17 Husky HD-74501 S Torx Screwdriver
- 18 Husky HD-74501 V Torx Screwdriver
- 19 SATA to IDE Connector
- 20 Platter swap straws
- 21 Handyman divider toolbox for tools
- 22 Custom Data Recovery Virtual Machines

**TEXT BOOKS:**

- 1 John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles, River Media, 2005 ISBN: 1584503890 , 9781584503897
- 2 Reference Books/Weblinks:
- 3 Christof Paar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners, 2nd Edition, Springer's, 2010
- 4 Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, 2009

- 5 Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series:Computer Forensics), 2010

**Course Outcomes:**

**UNIT I: After completion, students are able to**

1. Learn about the Data Recovery.
2. Understand the Data Backups & Hiding the Data.
3. Learn in detail about Data Recovery Process.

**UNIT - II : After completion, students are able to**

1. Understand & Learn Data Collection & Seizure Process.
2. Study about Methods of Collection of Digital Evidence.

**UNIT III: After completion, students are able to**

1. Learn about Basics of Computer Forensic Investigation Process.
2. Learn about Duplication & Preservation of Digital Evidence.

**UNIT IV : After completion, students are able to**

1. Learn about Rules of evidence Collection.
2. Study the Legal Process of Evidence Handling.
3. Understand the Artifacts Collection steps &controlling the Contamination

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**BFST-604 B : Cyber Crimes and Cyber Law****Theory: 45 Lectures of 48 minutes (36 Hours)****Marks -50 (Credits: 02)****Course objectives:****Student should:**

- 1 To Learn about E-Commerce & its Applications.
- 2 Learn about E-Business & its Applications.
- 3 About to Learn Cyber Law ITAA 2008 Obligation
- 4 To Understand about Electronic Documentation Authentication Process.
- 5 To Learn about the Intellectual Property Law Related to Cyber Crimes.
- 6 Understand about Miscellaneous issues related to Cyber Crimes & Cyber Security.

**UNIT I : Introduction of e-commerce related crimes [11]**

Electronic World: E-Governance, Introduction, IT and business, EDI, E-Business, E-Banking, Real Time Gross Settlement (RTGS), And Mobile Banking E-commerce: Concerns for E-commerce Growth, Concepts Electronic Communication, PCs and Networking, E-mail, Internet and intranets. EDI, EDI to Ecommerce, UN/EDIFACT Concerns for E-commerce Growth, Internet bandwidth, Technical issues, Security issues. India E-commerce Readiness, Legal issues, Credit Card Business Electronic Commerce providers. CyberCash, DigiCash, VeriSign Software Package: EDI software developed by NIC for Customs.

**UNIT II : Introduction to Cyber Law and Cyber Ethics [11]**

Introduction to Cyber Crimes and Ethical Issues in IT, Basic concepts of Law and Information Security, overview Of Information Security obligations under ITAA 2008, Privacy and data protection concepts. Law of Contracts applicable for Cyber Space transactions: introduction to Contract law, legal recognition of Electronic Documents, Authentication of Electronic Documents, Authentication of Electronic Documents, Cyber space contracts, Resolution of Contractual disputes, stamping of Contractual document.

**UNIT III : Intellectual Property Law for Cyber Space: [11]**

Concept of Virtual assets, nature of Intellectual property, Trademarks and domain names, copyright law, law of patents. Intellectual Property Law for Cyber Space: Concept of Virtual assets, nature of Intellectual property, Trademarks and domain names, copyright law, law of patents.

**UNIT - IV Miscellaneous Issues in Cyber Crimes and Cyber Security: [12]**

Cyber Crime Investigation and Prosecution, Digital evidence and Cyber forensics, Jurisdiction issues, Information Security Management in corporate Sector.

**Reference Books:**

1. Deborah G Johnson, Computer Ethics, Pearson Education Pub., ISBN: 81-7758593-
2. Earnest A. Kallman, J.P Grillo, and Ethical Decision making and Information Technology: An Introduction with Cases, McGraw Hill Pub.
3. John W. Rittenhouse, William M. Hancock, Cyber security Operations Handbook, Elsevier Pub.
4. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, 2nd Edition, Cengage Learning Pub.
5. Randy Weaver, Dawn Weaver, Network Infrastructure Security, Cengage Learning Pub

**Course Outcomes: After completion, students are able to****UNIT I**

1. Learn about E-Commerce & E-business.
2. Understand the Role of Cyber Cash & Digicash in E-Commerce.
3. Learn in detail about RTGS, Mobile Banking Services.
4. Understand & Learn Indian legal system, ITA 2000/2008, cyber security and related legal issues.
5. To interpret the cyber crime investigation and prosecution in depth.

**UNIT II**

1. Learn about to Classify the Types of contract law.
2. Understand about types of cyber properties.

**UNIT III**

1. Identify the Intellectual Property Rights for the concept developed
2. Apply the Cyber laws and to follow the ethics in the product development
3. Analyze the cyber crime rate and effective measures to minimize it.

**UNIT IV :**

1. Learn about cyber crime investigation process.
2. Learn about digital evidence and cyber forensic.
3. Understand and learn information security related to corporate sector.

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**BFST-604 C : Operating system Forensic Analysis****Theory: 45 Lectures of 48 minutes (36 Hours)****Marks -50 (Credits: 02)****Course objectives:****Student should:**

- 1 Learn about Windows Forensic Analysis.
- 2 Learn about Dumping & Analyzing Physical Memory.
- 3 Learn About the Learn Log Analysis & Keyword Searches.
- 4 Understand about Process of Port Mapping.
- 5 Learn about the Documenting Analysis of Images.

**UNIT I : Windows Forensic Analysis:****[12]**

Live Response: Data Collection- Introduction , Live Response- Locard's Exchange Principle, Order of Volatility , When to Perform Live Response , What Data to Collect- System Time, Logged-on Users , Open Files, Network Information , Network Connections , Process Information, Process-to-Port Mapping, Process Memory, Network Status, Nonvolatile Information, Live-Response Methodologies, Live Response: Data Analysis- Data Analysis, Agile Analysis, Windows Memory Analysis-Collecting Process Memory, Dumping Physical Memory, Alternative Approaches for Dumping Physical Memory, Analyzing a Physical Memory Dump.

**UNIT II : Registry analysis****[11]**

Registry Analysis- Inside the Registry, Registry Analysis- Reg Ripper, System Information, Autostart Locations, USB Removable Storage Devices, Mounted Devices, Portable Devices, Finding Users, Tracking User Activity, Redirection, Virtualization, Deleted Registry Keys, File Analysis-Log Files, Event Logs, Other Log files, Recycle Bin, XP System Restore Points, Vista Volume Shadow Copy Service, Prefetch and Shortcut files, File Metadata, File Signature Analysis, NTFS Alternate Data Streams, Alternative Methods of Analysis, Executable File Analysis- Static Analysis, Dynamic Analysis.



**UNIT III: Rootkits****[11]**

Rootkits, Rootkit Detection-Live Detection, GMER, Helios, MS Strider GhostBuster, F-Secure BlackLight, Sophos Anti-Rootkit, Postmortem Detection, Prevention, Case studies, Performing Analysis on a Budget-Documenting Your Analysis, Tools-Acquiring Images, Image Analysis, File Analysis, Network Tools, Search Utilities.

**UNIT - IV : Linux Forensic Analysis****[11]**

- Live Response Data Collection- Prepare the Target Media, Format the Drive, Gather Volatile Information, Acquiring the Image, Initial Triage and Live Response: Data Analysis- Log Analysis, Keyword Searches, User Activity, Network Connections, Running Processes, Open File Handlers, The Hacking Top Ten, Reconnaissance Tools, The /Proc File System- Introduction , Process IDs,

**Reference Books:**

1. Windows Registry Forensics: Advanced Digital Forensic Analysis of the Windows Registry - Harlan Carvey, SyngressInc, Feb 2011
2. File System Forensic Analysis- Brian Carrier, Addison Wesley, Edition 1, 2005
3. Handbook of Digital Forensics and Investigation- Eoghan Casey, Academic Press, 2009
4. Digital Forensics with Open Source Tools- Cory Altheide, Harlan Carvey, SyngressInc, Edition 1, April 2011

**The toolkit Requirements:**

- 1 SANS SFIT
- 2 Prodiscover
- 3 CAINE (Computer Aided Investigative Environment).
- 4 FTK
- 5 RegRipper
- 6 GhostBuster

**Suggested Readings:****Textbooks:**

1. Unix and Linux Forensic Analysis DVD ToolKit - Chris Pogue, Cory Altheide, Todd Haverkos, Syngress Inc. , 2008
2. Windows Forensic Analysis DVD Toolkit- Harlan Carvey, Edition 2, Syngress Inc. , 2009

**Course Outcomes:****UNIT I : After completion, students are able to**

1. Learn about Windows Forensic Analysis.
2. Study about Windows Memory Analysis, Data Analysis.
3. Learn in detail about Dump Analysis of Physical Memory.

**UNIT II : After completion, students are able to**

1. Understand & Learn Registry Analysis.
2. Learn about Files Analysis & its types.

**UNIT III : After completion, students are able to**

1. Learn about to Live Root kit Detection.
2. Study & Learn Tools used For Root kit Detection..
3. To learn & study the Anti Root kit Post-mortem Detection.

**UNIT IV : After completion, students are able to**

1. Learn about detail Analysis Linux Operating System.
2. Understand the Live & Triage response related to File analysis.

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**BFST 605: Entrepreneurship****Theory: 30 lectures, 48 minutes (24 Hours)****Course objectives:****Student should:**

1. Understand the dynamic role of entrepreneurship and small businesses
2. Understand Organizing and Managing a Small Business
3. Understand Financial Planning and Control
4. Understand Forms of Ownership for Small Business
5. Understand Strategic Marketing Planning
6. Understand New Product or Service Development
7. Understand Business Plan Creation.

**UNIT I: An Overview of Entrepreneurs and Entrepreneurship [15]**

- Basic principles and practices of management- Definition, concepts and application; Organization types, coordination, control and decision making in management
- Characteristics for being an entrepreneur in biotechnology, Case studies of successful and unsuccessful bio-entrepreneurs
- Core concept of Market: Identification and evaluation of market potential of various bio-entrepreneur sectors.

**UNIT : II Types of Enterprises and Ownership Structure [15]**

- Small scale, medium scale and large scale enterprises, role of small enterprises in economic development; proprietorship, partnership, Ltd. companies and co-operatives: their formation, capital structure and source of finance.
- Role of government and schemes, financial institutions in fostering Entrepreneurship
- Factors affecting biotech business: (finance, infrastructure, equipment, manpower, resources , project location, end product, quality issues, etc)

**Reference Books:**

- 1 Entrepreneurship Development, 2003, S Anil Kumar, New Age International (P) Ltd. Publishers (Unit I)
- 2 Entrepreneurship for Everyone: A Student Textbook, 2009, Robert Mellor, Sage Publication Ltd. (Unit I)
- 3 Exploring Entrepreneurship: Practices and Perspective, 1/e, 27 Jul 2011 Author(s): Richard Blundel & Nigel Lockett Oxford University Press (Unit II)
- 4 Entrepreneurial Development: Text and Cases, 1992- Entrepreneurship Sultan Chand & Sons. (Unit II)
- 5 Commercializing Successful Biomedical Technologies, 2008, Shreefal S. Mehta, Cambridge University Press (Unit II)

**Course Outcomes: After completion, students are able to****UNIT I**

1. Develop the business plan
2. Understand fundamentals of Management and Administration.
3. Understand Legal forms of the business for registration of the small scale industries, agencies for the registration of the companies

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**BFSP 606:****Practical of Applied Forensic Physics, Chemistry and Biology II****SECTION A: Applied Forensic Physics****Course objectives:****Students should:-**

- 1 Be able to identify firearm injury
- 2 Understand characteristics of the contact wounds
- 3 Know the examination of accidental vehicle
- 4 Be able to do velocity estimation from skid marks

**Practicals**

- 1 Identification of firearm injury.
- 2 Peripheral vision measurement.
- 3 To study the characteristics of Contact wounds
- 4 Analysis of accident scene photography
- 5 Physical examination of accidental vehicle.
- 6 Examination of tire / other marks.
- 7 Velocity estimation from skid marks.
- 8 Physical examination of tyre.
- 9 To study class characteristics of various tyres.

**(Note: Minimum 5 practical should be conducted.)**

**Reference Books:**

1. Forensic Medical Investigation of Motor Vehicle Incidence By Michel P. Burke
2. DFS manual
3. Laboratory Procedural manual, Physics Section, DFSL, Mumbai.

**Course outcomes : After completion, Students are able to:**

1. Examine accidental vehicle
2. Calculate velocity estimation from skid marks.
3. Understand class characteristics of the various tyres
4. Examine tyre marks.

**SECTION B: Applied Forensic Chemistry****Course objectives:****Students should:-**

1. Be able to identify Narcotic drugs
2. Understand characteristics of various poisons and drugs.
3. Know the examination NDPS drugs

**Practical's:**

1. Quantitative or qualitative study of drug opiates. (2 nos).
2. Chemical analysis of explosive materials.(Gun powder)- Colour test, Microscopic examination.(2 nos.)
3. Extraction methods of drugs, Poisons. (2 nos.)
4. Colour Tests for identification of poisons, drugs. (2 nos.)
5. Plant, animal, Metallic poison analysis. (2 nos.)
6. Separation of Sampling Material by TLC (drugs, poison etc.) (2 nos.)
7. Study of Steroids (separation by TLC).

**(Note: Minimum 5 practical should be conducted.)**

**Reference Books:-**

1. DFS manual
2. Forensic Chemistry and Toxicology by Reddy
3. Forensic Chemistry and Toxicology by P.C. Dixit
4. Forensic Chemistry and toxicology by J.P.Modi

**Course outcomes**

**After completion, Students are able to:**

1. Determine plant ,metallic , animal poison.
2. Determine .narcotic drugs.

**SECTION C: AppliedForensic Biology**

**Course Objectives: Students should:**

1. Study the Gender identification from Skull and Pelvis
2. Study the PCR machine thermo cycler
3. Study the Isolation of DNA from Blood and Examination of Diatom.

**Practical:**

- 1] To determine the age from Dentition.
- 2] To determine the sex from skull.
- 3] To determine sex from pelvis.
- 4] To investigate the differences between animal and human bones.
- 5] To estimate stature from long bone length.
- 6] Determination of age from skull sutures.
- 7] Demonstration of Polymerase Chain Reaction (PCR) machine – thermo cycler.
- 8] Identification of orders of insects and other arthropods of forensic importance.
- 9] To Isolate DNA from dried blood.
- 10] To Perform Gel Electrophoresis for separation of DNA
- 11] To Study Microscopic features of Fibers.
- 12] To study microscopically unicellular algae diatom.

**(Note: Minimum 5 practical should be conducted.)**

**Reference Books-**

1. M.Y. Iscan and S.R. Loth, The scope of forensic anthropology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
2. D. Ubelaker and H. Scammell, Bones, M. Evans & Co., New York (2000).
3. S.Rhine, Bone Voyage: A Journey in Forensic Anthropology, University of Mexico Press, Mexico (1998).
4. K. Smyth, The Cause of Death, Van Nostrand and Company, New York (1982).
5. M. Bernstein, Forensic odontology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
6. J. Dix, Handbook for Death Scene Investigations, CRC Press, Boca Raton (1999).
7. H.B. Baldwin and C.P. May in, Encyclopedia in Forensic Science, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).
8. V.J. Geberth, Practical Homicide Investigation, CRC Press, Boca Raton (2006).
9. T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).
10. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

**Course Outcomes: After completion of the unit, Students will be able to:**

1. Understand the Sex determination from Skull and Pelvis bone..
2. Understand the PCR Machine thermo cycler working.
3. Understand the Diatom examination.

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**BFSP 607: Practical Paper VI**  
**BFSP-509 Practical of Applied Forensic Science, Applied Forensic Psychology**  
**and Digital & Cyber Forensic II**

**SECTION A: Applied Forensic Science**

**Course objectives:**

**Students should:-**

- 1 Study processing of fingerprint evidence
- 2 Study ridge tracing, ridge counting and ridge density.
- 3 Study the examination of fingerprint
- 4 Understand the working of AFIS

**Practical:**

- 1 Taking of plain and rolled fingerprint.
- 2 Identification of patterns of fingerprint.
- 3 To study the characteristics of fingerprint.
- 4 To determine the ridge count of fingerprint.
- 5 Ridge tracing of fingerprint.
- 6 To calculate the ridge density of fingerprint.
- 7 Development of fingerprint on various surfaces by powder method.
- 8 Development of fingerprint on various surfaces by chemical method.
- 9 Lifting and preservation of developed fingerprint.
- 10 To compare the unknown fingerprint impressions.
- 11 To understand the working of AFIS.

**Note: Minimum 5 practical should be conducted.**

**Reference Books:**

- Advances in Finger Print Technology by Henry C. Lee and R. E. Gaensslen.
- Embryology & Morphology of friction ridge skin - Kasey Werthien
- The fingerprint, Source book- U. S. Department of Justice, Office of Justice Programs, National Institute of Justice.
- Automated Fingerprint Identification systems (AFIS), Peter Komarinski
- Classification & use of Finger Print, ER Henry
- Friction Ridge Skin Comparison & Identification of Finger Prints, James P. Cowger
- Finger Print Identification (Handbook), SurinderNath
- Police Handbook.

**Course Outcomes: After completion of the unit, Students will be able to:**

- Process the fingerprint evidence.
- Trace, count and measure the density of fingerprint.
- Examine the fingerprint evidence.
- Know the working of AFIS.

**SECTION B: Applied Forensic Psychology II****Course Objectives:****Students should**

1. Study the Lie Detection Technique.
2. Study the Intelligence Factor in detail.
3. Study the Aggression test.

**Practical:**

- 1 Lie Detection Test (Polygraph Testing).
- 2 Nonverbal test of intelligence by Dr. Nafde.
- 3 Standard progressive matrices by Raven./ Koh's Block test/Alexander Pass Along test
- 4 Differential aptitude test:
  - a Abstract reasoning

- b Numerical
  - c Spatial
  - d Verbal
  - e Clerical
  - f Mechanical
  - g Space & relation
5. Assessment of aggression  
( **Note: Minimum 5 Practical should be conducted**)

**Reference Books:**

- 1 Bachhav, Aun M. (2012). Criminal Psychology. Chandralok Prakashan, Kanpur - 208021 Bharati, A. (2012).
- 2 Studies on Criminological Psychology. G.S. Rawat for Ceber Tech Publications. New Delhi- 110 002 Cohen, R.J., Swerdlik, M.E. (2005).
- 3 Psychological testing and assessment (6th ed.). Delhi: Tata McGraw-Hill. Gregory, R.J. (2005). Psychological Testing (4th ed.). Delhi: Pearson education Pte.Ltd. Suryanarayana, N.V.S, Himabindu Goteti, Neelima V. (2011).
- 4 Cyber Psychology. Sonali Publications, New Delhi- 110 002 Thou Teisi (2011).
- 5 Forensic Psychology. ABD Publishers, Jaipur-302018 Veereshwar, P. (2002).
- 6 Indian systems of psychotherapy. Delhi: Kalpaz publications Verma, L. (1990).
- 7 The management of children with emotional and behavioral difficulties. London: Routledge

**Course Outcomes: After completion of the unit, Students will be able to:**

1. Understand the Lie Detection test & its Applications.
2. To measure Aptitude of Subject by using Aptitude Test.
3. To Assess the Aggression of Subject by using Aggression Test.

**SECTION C: Applied Digital and Cyber Forensic II****(A) Digital Data Analysis****Course objectives:****Students should:**

- 1 Be able to study Drive & Partition Recovery.
- 2 Be able to Learn the Live Analysis of Data.
- 3 Be able to learn to Create Disk image by using Specific Tools.
- 4 Be able to do Live Linux Data Recovery.

**Practical:**

- 1 Solid state drive recovery.
- 2 Logical Recovery of disabled hard drives
- 3 P-List and G-List recovery
- 4 Linux Data Recovery
- 5 Vista and Recovery of Shadow Copies
- 6 To create Disk image by using ProDiscover
- 7 To create Disk image by using FTK
- 8 To create Disk image by using Encase
- 9 To create Disk image by using SMART
- 10 To create Disk image by using X-Ways
- 11 To create Disk image by using iLookIX

**Course Outcomes : After completion of the unit, Students will be able to:**

- 1 Perform disk imaging by using several tools.
- 2 Perform P-list and G-list recovery using different tools.
- 3 Perform logical recovery.

## (B) Cyber Crime and Cyber Law

### Course Objectives:

#### Students should:

- 1 Understand E-Commerce and its pros and cons.
- 2 Study the technology behind online transaction.
- 3 Study data recovery concept.

### Practical:

- 1 E-Commerce (E-shopping of any product to understand the transaction and security issues).
- 2 Access Data e Discovery
- 3 Network Analysis by using N-map tool.
- 4 Data Recovery integrated with forensic technology.
- 5 Data recovery by using Recuva tool.
- 6 Data recovery by using Minitool tool.
- 7 Data Recovery by using EaseUs tool.
- 8 Email analysis by using OfficeRecovery'sMailRecovery.

### Course Outcomes: After completion of the unit, Students will be able to:

- 1 Access the E-Commerce website for purchasing or selling.
- 2 Analyze networks by using N-map tool
- 3 Perform data recovery from different sources on multiple applications.

**(C) Operating System Forensic Analysis****Course Objectives:****Students should:**

- 1 Understand Ubuntu platform.
- 2 Study the Linux platform.
- 3 Understand different types of O.S

**Practical:**

- 1 Working on Ubuntu by using SANS SFIT.
- 2 Working on Linux By using CAINE (Computer Aided Investigative Environment).
- 3 Working on Window by using FTK.
- 4 Windows registry analysis by using RegRipper.
- 5 Working on Microsoft MS Strider Ghost Buster (Root kit).
- 6 Analysis of File System activity by using Filemon.
- 7 Analysis of Registry data in Real time by using Regmon.
- 8 Perform Live Acquisition of windows Capturing RAM by using MandiantMemoryze.
- 9 Study the Working of Virtual Box.
- 10 Capturing an image with FTK data Imager lite.

**Course Outcomes: After completion of the unit, Students will be able to:**

- 1 Perform on Forensic tool kit.
- 2 Perform registry analysis using Regmon
- 3 Perform Live data acquisition.

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**BFSP-609: Project Work**  
**Project Proposal Writing/Preparation of entrepreneurship Proposal and**  
**Presentation/ Industrial Visits.**

**Revised Scheme of Practical Examination for B. Sc. Part-III**

- 1 Practical examinations are conducted semesterwise.
- 2 There are two practical groups for each semester.
- 3 Every candidate should perform one experiment from each Practical Paper.
- 4 Practical examination are conducted for 1.5 days per batch (No. of Students =12)
- 5 The examinations are conducted in two sessions per day and each session are of three hours duration.
- 6 Study tour is compulsory.
- 7 At least 80% practical's must be completed by the student.
- 8 Scheme of marking for practical examination B.Sc.III Semester V/VI

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