

CURRICULUM for B.Voc in Forensic Science Techniques

The curriculum will be updated on regular basis in consultation with the Industry.

S = Skill-based paper; E = Education-based paper

Students will undertake internship in vacations intervening Semesters II & III and Semesters IV & V.

Number of seats: 50

Eligibility: Class XII or equivalent with 55% marks and English as one of the subjects.

Merit list will be based on aggregate of PCM (Physics + Chemistry + Mathematics) or PCB (Physics + Chemistry + Biology/Biotechnology), whichever is higher.

Preamble

The Universal Declaration of Human Rights directs the member nations to create such conditions under which the ideals of free human beings, enjoying civil and political freedom from fear and want, can be achieved. The Constitution of India, through its various articles, strives to ensure security and safety to citizen in accordance with the principles of universal Declaration of Human Rights. However, crime is a violation of these principles. If we have to create conditions conducive to harmonious development, we must mitigate the crime rate. This can best be achieved by relying on the support of forensic science system. Unfortunately, in our country, forensic science is not viewed as a core investigative skill in crime detection. In fact, there is a lack of understanding of the forensic process itself. It is for this reason that less than 10% of the police cases are, at present, being referred for forensic examination. Therefore, in order to ensure speedier detection of evidence, the application of forensic science in modern law enforcement has a rich potential.

In view of this, the B.Voc. (Forensic Science Technique) course will cater to the following objectives:

1. To emphasize the importance of scientific methods in crime detection.
2. To disseminate information on the advancements in the field of forensic science.
3. To highlight the importance of forensic science for perseverance of the society.
4. To review the step necessary for achieving highest excellence in forensic science.
5. To generate talented human resource, commensurating with latest requirement of forensic science.
6. To provide a platform for students and forensic scientist to exchange views, chalk out collaborative program and work in a holistic manner for the advancement of forensic science.

B.Voc. in Forensic Science Techniques

Paper Code	Paper Name	Credits
Semester I : Basic Forensic Science		
BVFS11(S)	Introduction to Forensic Science	6
BVFS12(S)	Forensic Science Set-up in India	6
BVFS13(S)	Criminology	6
BVFS14(E)	Communication and Reporting	6
BVFS15(E)	Basics of Photography and Videography	6
TOTAL SEMESTER CREDITS		30
Semester II: Techniques of Crime Scene Processing		
BVFS21(S)	Fingerprints	6
BVFS22(S)	Crime Scene Management	6
BVFS23(S)	Forensic Photography	6
BVFS24(E)	Duties of First Responders to Crime	6
BVFS25(E)	Basics of Computers, File Formats and Basic Word Processing	6
TOTAL SEMESTER CREDITS		30
Semester III: Chemical Techniques in Forensic Science		
BVFS31(S)	Forensic Investigation of Arson	6
BVFS32(S)	Forensic Investigation of Explosions	6
BVFS33(S)	Soft Skills	6
BVFS34(E)	Basics of Drugs of Abuse	6
BVFS35(E)	Basics of Forensic Toxicology	6
TOTAL SEMESTER CREDITS		30
Semester IV: Life Science Techniques in Forensic Science		
BVFS41(S)	Wildlife Forensics	6
BVFS42(S)	Forensic Importance of Body Fluids	6
BVFS43(S)	DNA Typing	6
BVFS44(E)	Death Investigations	6
BVFS45(E)	Entrepreneurship	6
TOTAL SEMESTER CREDITS		30
Semester V: Forensic Science and Business		
BVFS51(S)	Forensic Engineering and Forensic Intelligence	6
BVFS52(S)	Role of Media on Crime and National Security	6
BVFS53(S)	Computer Crimes	6
BVFS54(E)	Forensic Accountancy	6
BVFS55(E)	Statistical Analysis of Indian Crime Data	6
TOTAL SEMESTER CREDITS		30
Semester VI: Forensic Science and Society		

BVFS61(S)	Forensic Investigation of Accidents	6
BVFS62(S)	Biometrics	6
BVFS63(E)	Forensic Archaeology	6
BVFS64(E)	Basics of Forensic Psychology	6
BVFS65(S)	Dissertation/Project Work	6
TOTAL SEMESTER CREDITS		30
TOTAL B.Voc. CREDITS		180

SEMESTER I: Basic Forensic Science

PAPER BVFS11(S): Introduction to Forensic Science

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The significance of forensic science to human society.*
- *The operational principles of forensic science.*
- *The functions of forensic science.*

Unit 1: Basic Concepts

Definitions and concepts in forensic science. Historical aspects of forensic science. Scope of forensic science. Need of forensic science. Basic principles of forensic science. Forensic science as a multidisciplinary subject.

Unit 2: Operational Principles

Tools and techniques in forensic science. Branches of forensic science. Forensic science in international perspectives. Frye case and Daubert standard. Importance of comparative study in forensic science. Data depiction in forensic science.

Suggested Readings

1. W.G. Eckert and R.K. Wright in *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).
2. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
3. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, *Fisher's Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

PAPER BVFS12(S): Forensic Science Set-up in India

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The divisions in a forensic science laboratory.*
- *The working of the forensic establishments in India and abroad.*

Unit 1: Forensic Science Organizations

Hierarchical set up of central forensic science laboratories and state forensic science laboratories. Government examiners of questioned documents, Central fingerprint bureau. National crime records bureau. State fingerprint bureaus. Police & detective training schools. Bureau of police research & development. Mobile crime laboratories. Police academies. Comparison with overseas forensic organizations.

Unit 2: Services Rendered by Forensic Science Organizations

Services of crime laboratories: Basic services and optional services. Directorate of forensic science service. Technical and non-technical police units. Public-police relationships. Crime and Crime Tracking Network and System. Anti-riot cells. Anti-terrorist cells. Police dogs.

Suggested Readings

1. B.B. Nanda and R.K. Tiwari, *Forensic Science in India: A Vision for the Twenty First Century*, Select Publishers, New Delhi (2001).
2. M.K. Bhasin and S. Nath, *Role of Forensic Science in the New Millennium*, University of Delhi, Delhi (2002).

PAPER BVFS13(S): Criminology

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The importance of criminology.*
- *The causes of criminal behavior.*
- *The significance of criminal profiling to mitigate crime.*

Unit 1: Basic Concepts

Concept and definition of crime. Causes of crime. Social changes and crime.

Aim and scope of criminology and criminal anthropology.

Theory of criminal behaviour. Organized crime and public disorder.

Unit 2: Criminology as Aid to Combating Crime

Control and prevention of crime. Criminal profiling. Understanding modus operandi.

Investigative strategy. Police's power of investigation. Filing of criminal charges.

Suggested Readings

1. J.L. Jackson and E. Barkley, *Offender Profiling: Theory, Research and Practice*, Wiley, Chichester (1997).
2. D.E. Zulawski and D.E. Wicklander, *Practical Aspects of Interview and Interrogation*, CRC Press, Boca Raton (2002).
3. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
4. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).

PAPER BVFS14(E): Communication and Reporting

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The importance of report writing in crime cases.*
- *The significance of criminal record analysis.*

Unit 1: Report Writing

Report writing in criminal justice. Report writing in law enforcement. Executive summary writing in police stations. Maintenance of records: statements of witnesses, interviews, media reports. Importance of notes writing at crime scenes. National Crime Record Bureau reports. Crime data depiction: Bar diagrams, pie charts, excel format, line graph.

Analysis of criminal record. Case studies of forensic science laboratories, fingerprint bureaus, narcotic control bureau, etc. Templates for crime scene management. Filing of FIR: Offline and on line.

Unit 2: Communication in Criminal Justice System

Communication with diverse cultural groups. Communication with minority groups. Communication with immigrants. Hostage negotiations. Interviewing and interrogating juvenile suspects. Communication in trial cases.

Suggested Readings

1. W.G. Eckert and R.K. Wright in *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).
2. B.B. Nanda and R.K. Tiwari, *Forensic Science in India: A Vision for the Twenty First Century*, Select Publishers, New Delhi (2001).
3. M.K. Bhasin and S. Nath, *Role of Forensic Science in the New Millennium*, University of Delhi, Delhi (2002).
4. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
5. R.E. Grubb and K.V. Hemby, *Effective Communication in Criminal Justice*, SAGE Publications, Inc. London (2018).

PAPER BVFS15(E): Basics of Photography and Videography

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The fundamentals of photography.*
- *The fundamentals of videography.*

Unit 1: Photography

Camera Basics, Operating a Camera, Types of Film, Exposure, Aperture & Shutter Speeds, TTL Light Meter, Depth of Field, Type Lenses, Choosing Lenses for shoot, Lighting, Flash photography, Filters, Steady Shooting, Enhancing photographs, Organizing the picture.

Unit 2: Videography

Introduction to Basic Video camera, Camera movements, basics of exposure, white balance, and camera operation of a DSLR

Hands-on on phonetography and videography.

Suggested Readings:

1. B. Peterson, *Understanding Photography*, Amphoto Books, Toronto (2010).
2. S. Sontag, *On Photography*, Farrar, Straus and Giroux, New York (2011).

SEMESTER II: Techniques of Crime Scene Processing

PAPER BVFS21(S): Fingerprints

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The fundamental principles on which the science of fingerprinting is based.*
- *Fingerprints are the most infallible means of identification.*
- *The physical and chemical techniques of developing fingerprints on crime scene evidence.*

Unit 1: Biological Aspects of Fingerprints

Formation of ridge details. Sweat glands. Fundamental principles of fingerprints. Fingerprint patterns. Fingerprint types. Fingerprint characters: core and delta. Preliminary idea of pores. Rolled and flat prints. Fingerprinting the deceased.

Unit 2: Detection of Fingerprints

Latent prints. Constituents of sweat residue. Detection of fingerprints by powder method, ninhydrin method, iodine method, silver nitrate method, small particle reagent method. Application of light sources in fingerprint detection. Preservation of developed fingerprints. Digital imaging for fingerprint enhancement. Developing fingerprints on gloves.

Suggested Readings

1. J.E. Cowger, *Friction Ridge Skin*, CRC Press, Boca Raton (1983).
2. D.A. Ashbaugh, *Quantitative-Qualitative Friction Ridge Analysis*, CRC Press, Boca Raton (2000).
3. C. Champod, C. Lennard, P. Margot and M. Stoilovic, *Fingerprints and other Ridge Skin Impressions*, CRC Press, Boca Raton (2004).
4. Lee and Gaensleen's, *Advances in Fingerprint Technology*, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

PAPER BVFS22(S): Crime Scene Management

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The methods of securing, searching and documenting crime scenes.*
- *The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.*
- *The legal importance of chain of custody.*

Unit 1: Crime scene processing

Crime scene investigations. Protecting and isolating the crime scene. Searching the crime scene. Indoor and outdoor crime scenes. Primary and secondary crime scenes. Documentation of crime scene by photography, sketching and field notes. Procedures of walk through at the crime scene.

Unit 2: Crime Scene Evidence

Types, significance and classification of physical and trace evidence. Collection and care of evidence. Packaging of evidence. Fragile evidence. Submission of evidence. Chain of evidence. Reconstruction of crime scene.

Significance of density, conductivity, refractive index and particle size in analyzing the trace evidence. Evidence pertaining to tool marks, glass, paint, fibre and soil.

Suggested Readings

1. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
2. T.J. Gardener and T.M. Anderson, *Criminal Evidence*, 4th Ed., Wadsworth, Belmont (2001).
3. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

PAPER BVFS23(S): Forensic Photography

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The usefulness of photography for recording the crime scenes.*
- *The significance of videography in archiving the crime scenes.*

Unit 1: Photography at Crime Scenes

Basic principles and applications of photography in forensic science. Working of DSLR digital camera. Essential skills of forensic photography: Shutter speed, exposure values, white balance. Use of filters.

3D photography. Photographic evidence. Infrared and ultraviolet photography. Digital photography. Close-up, medium-range and long-range shots. Maintenance of photo log.

Unit 2: Videography at Crime Scenes

Basic video terminology, Forensic value of crime scene video, camera speed and position. Camera distance and angles. Close-up and overview recording. Videography as a supplementary tool to photography. Videography at arson, homicide and motor vehicle accident sites.

Suggested Readings

1. D.R. Redsicker, *The Practical Methodology of Forensic Photography*, 2nd Edition, CRC Press, Boca Raton (2000).
2. R.C. Shaler, *Crime Scene Forensics*, CRC Press, Boca Raton (2012).
3. E. Robinson, *Crime Scene Photography*, 3rd Edition, Elsevier, Amsterdam (2016).

PAPER BVFS24(E): Duties of First Responders to Crime

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The importance of cordoning off the crime scenes.*
- *The importance of preserving fragile evidence at the crime scene.*
- *The importance of identifying the suspect and witnesses at the crime scene.*

Unit 1: Approaching the Crime Scene

Obtaining first hand information from the caller. Rendering medical assistance to the victim, if alive. Protecting life. Recording dying declaration. Identifying witnesses and, if possible, suspect. Interviewing onlookers and segregating possible witnesses. Suspect in custody – initial interrogation and searching for evidence. Miranda warning card. Equipment checklist.

Unit 2: Processing the Crime Scene

Assessing the crime scene: Indoor, outdoor; major crime, minor crime. Cordoning the crime scene. Identifying and collecting fragile evidence. Request for forensic team. Importance of command post and log book. Management of crowd and media. Importance of taking notes. Items to be a part of noting.

Suggested Readings

1. J. Dix, Handbook for Death Scene Investigations, CRC Press, Boca Raton (1999).
2. 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).
3. V.J. Geberth, Practical Homicide Investigation, CRC Press, Boca Raton (2006).

PAPER BVFS25(E): Basics of Computers, File Formats and Word Processing

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The basics of computer science.*
- *The fundamentals of file formats.*
- *The significance of word processing.*

Unit 1: Fundamentals of Computers

Basics of Computers: Operating systems, application software, basics of O.S set-up. File formats: Files, folders and directories, creating short cuts, Common file related commands and utilities.

Unit 2: Word Processing

Basic Word Processing: Opening and closing of documents, text creation and manipulation, formatting of text, table handling, Spell check, language setting and thesaurus, printing of word document. Hands-on for basic ICT skills.

Suggested Readings

1. P.K. Sinha, *Computer Fundamentals*. BPB Publications, New Delhi (2004).
2. R. Thareja, *Fundamentals of Computers*, Oxford University Press, New Delhi (2014).

SEMESTER III: Chemical Techniques in Forensic Science

PAPER BVFS31(S): Forensic Investigation of Arson

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The chemistry of combustion.*
- *The hostile conditions prevailing at arson crime scenes.*
- *Procedures for analyzing arson scene evidence.*

Unit 1: Chemistry of Fire

Combustion reactions. Combustion products. Heat release rates. Heat flux. Fire tetrahedron. Ignition temperature, flash point, flame point. Fire types. Fire seat. Properties of flame. Common types of fuels: Solid, liquid and gaseous.

Unit 2: Arson Crime Scene

Hostile conditions at crime sites. Special safety measures at arson sites. Personal protective equipment requirements at arson scenes. Recognition of type of fire.

Location of point of ignition. Fire scene patterns. Information from smoke staining.

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.

Suggested Readings

1. J.D. DeHaan, *Kirk's Fire Investigation*, 3rd Edition, Prentice Hall, New Jersey (1991).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4th Edition, The Foundation Press, Inc., New York (1995).
3. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).

PAPER BVFS32(S): Forensic Investigation of Explosions

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The classification of explosives, including the synthesis and characterization of representative analogs.*
- *The significance of bomb scene management.*
- *The techniques of locating hidden explosives.*

Unit 1: Types of Explosives

Classification of explosives: Primary, secondary, tertiary. Homemade explosives. Military explosives. Blasting agents. Blasting caps. Boosters. Explosion train.

Synthesis of TNT, PETN and RDX. Explosion process. Blast waves.

Unit 2: Explosion Scene Management

Searching the scene of explosion. Mechanism of explosion. Post blast residue collection and analysis. Blast injuries. Detection of hidden explosives.

Suggested Readings

1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4th Edition, The Foundation Press, Inc., New York (1995).
2. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
3. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).
4. S. Ballou, M. Houck, J.A. Siegel, C.A. Crouse, J.J. Lentini and S. Palenik in *Forensic Science*, D.H. Ubelaker (Ed.), Wiley-Blackwell, Chichester (2013).

PAPER BVFS33(S): Soft Skills

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The importance of personality development.*
- *The significance of oratory skills.*

Unit 1: Personality Development

Introduction to Personality, Personality Definition and Theories, How do personalities develop, Multiple theories in psychology, Stages of Development, Basic Personality Traits, Moral Development, Personality and Career Choice, Changing Your Personality, Personal Growth.

Unit 2: Oratory Skills

Introduction of Oratory skills, voice modulation, Public speaking. Group discussion. Presentation of content. Art of interviewing. Art of interrogation.

Hands-on for recording audio for e-content and presenting in front of camera.

Suggested Readings

1. N.V. Peale, *The Power of Positive Thinking*, Fireside, New York (2016).
2. B.K. Mitra, *Personality Development and Soft Skills*, Oxford University Press, New Delhi (2016).

PAPER BVFS34(E): Basics of Drugs of Abuse

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The classification and characteristics of the drugs of abuse.*
- *The methods of identifying and analyzing the drugs of abuse.*

Unit 1: Types of Illicit Drugs

Natural and synthetic drugs of abuse. Drug dependence: Physiological and psychological effects. Classification of drugs of abuse: Narcotics, hallucinogens, depressants, stimulants and anabolic steroids. Designer drugs. Clandestine drug laboratories.

Unit 2: Drug Evidence

Collection and packaging of drug evidence. Preservation of drug evidence. Field and laboratory tests of drugs of abuse. Microcrystalline testing of drugs of abuse. Instrumental methods of drug analysis;

Isolation techniques for purifying drugs of abuse – thin layer chromatography, gas-liquid chromatography and high performance liquid chromatography. Presumptive and screening tests for drugs of abuse.

Suggested Readings

1. F.G. Hofmann, *A Handbook on Drug and Alcohol Abuse*, 2nd Edition, Oxford University Press, New York (1983).
2. S.B. Karch, *The Pathology of Drug Abuse*, CRC Press, Boca Raton (1996).
3. A. Poklis, Forensic Toxicology in, *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
4. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).

PAPER BVFS35(E): Basics of Forensic Toxicology

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The significance of toxicological studies in forensic science.*
- *The classification of poisons.*
- *The forensic identification of illicit liquors.*

Unit 1: Fundamentals of Toxicology

Significance of toxicological findings. Techniques used in toxicology. Toxicological analysis and chemical intoxication tests. Postmortem Toxicology. Human performance toxicology. Dose-response relationship. Lethal dose 50 and effective dose 50.

Unit 2: Poisons and Beverages

Classification of poisons. Physico-chemical characteristics and mode of action of poisons. Accidental, suicidal and homicidal poisonings. Animal poisons. Snake venom. Mode of action. Carbon monoxide poisoning.

Beverages. Alcoholic and non-alcoholic illicit liquors. Analysis and identification of ethyl alcohol.

Suggested Readings

1. F.G. Hofmann, *A Handbook on Drug and Alcohol Abuse*, 2nd Edition, Oxford University Press, New York (1983).
2. 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).
3. A. Poklis, Forensic Toxicology in, *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

SEMESTER IV: Life Science Techniques in Forensic Science

PAPER BVFS41(S): Wildlife Forensics

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The significance of wildlife forensics.*
- *Investigation of illegal trading in wildlife items.*

Unit 1: Basic Aspects

Fundamentals of wildlife forensic. History of wildlife forensics. Significance of wildlife forensic. Enforcement of wildlife forensic policies. 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 pug marks of various animals.

Unit 2: Forensic Aspects

Recovering evidence at poaching sites. Identification of physical evidence pertaining to wildlife forensics. Wildlife forensic pathology. Wildlife poisoning by insecticides. Wildlife poisoning by rodenticides. Morphology of animal hair.

Suggested Readings

1. S. Chowdhuri, *Forensic Biology*, BPRD, New Delhi (1971).
2. R. Saferstein, *Forensic Science Handbook*, Vol. III, Prentice Hall, New Jersey (1993).
3. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
4. J.E. Huffman and J.R. Wallace, *Wildlife Forensics*, Wiley-Blackwell, Chichester (2012).

PAPER BVFS42(S): Forensic Importance of Body Fluids

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The importance of biological fluids – blood, urine, semen, saliva and sweat in crime investigations.*
- *Significance of bloodstain patterns in homicide cases.*

Unit 1: Forensic Importance of Blood

Common body fluids. Composition and functions of blood. Collection and preservation of blood evidence. Distinction between human and non-human blood. Determination of blood groups. Antigens and antibodies.

Forensic characterization of bloodstains. Typing of dried stains. Blood enzymes and proteins.

Unit 2: Forensic Importance of Other Body Fluids

Semen. Forensic significance of semen. Composition, functions and morphology of spermatozoa. Collection, evaluation and tests for identification of semen. Individualization on the basis of semen examination.

Composition, functions and forensic significance of saliva, sweat and urine. Tests for their identifications.

Suggested Readings

1. G.T. Duncan and M.I. Tracey in *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
2. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
3. T. Bevel and R.M. Gardner, *Bloodstain Pattern Analysis*, 3rd Edition, CRC Press, Boca Raton (2008).

PAPER BVFS43(S): DNA Typing

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The basic principle of DNA analysis.*
- *The forensic significance of DNA typing.*

Unit 1: Basic Aspects

DNA as biological blueprint of life. Extraction of DNA for analysis. Quantitation of DNA – yield gel quantitation and slot blot quantitation. Mitochondrial DNA – sequence analysis.

Unit 2: Forensic Aspects

Collection of specimens. Polymerase chain reaction – historical perspective, sequence polymorphisms, individualization of evidence. Principles of heredity. Genetics of paternity. DNA testing in disputed paternity.

Suggested Readings

1. W.G. Eckert and S.H. James, *Interpretation of Bloodstain Evidence at Crime Scenes*, CRC Press, Boca Raton (1989).
2. R. Saferstein, *Forensic Science Handbook*, Vol. III, Prentice Hall, New Jersey (1993).
3. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
4. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, *Introduction to Forensic Sciences*, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

PAPER BVFS44(E): Death Investigations

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The duties of the first responding officer who receives a call on homicide or suicide case.*
- *The steps involved in processing the death scene.*

Unit 1: Homicide Investigations

Documenting the death scene. Processing evidence: At scene and on body. Evaluation of injuries. Importance of canvass form. Indexing the death investigation. Homicide made to appear as suicide or accidental death. Special considerations involving homicide scene search and sketching. Estimating the time since death. Establishing identity of deceased. Sex related homicides. Drugs-related homicides.

Handling buried body cases – search for buried bodies, methods of exhumation.

Unit 2: Suicide Investigations

Suicide cases – evaluating the type of injuries. Gauging the psychological state of victim, prior mental disease. Recognized warning signs in suicides: Emotional symptoms, cognitive symptoms, motivational symptoms, somatic symptoms. Suicide notes. Case study on *Final Exit*.

Suggested Readings

1. K. Smyth, *The Cause of Death*, Van Nostrand and Company, New York (1982).
2. M. Bernstein, Forensic odontology in, *Introduction to Forensic Sciences*, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
3. J. Dix, *Handbook for Death Scene Investigations*, CRC Press, Boca Raton (1999).
4. 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).
5. V.J. Geberth, *Practical Homicide Investigation*, CRC Press, Boca Raton (2006).

PAPER BVFS45(E): Entrepreneurship

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The importance and attributes of entrepreneurship in society.*
- *The driving force behind creativity and innovations.*

Unit 1: Basics of Entrepreneurship

Concept of an entrepreneur. Evolution of entrepreneurship. Attributes of entrepreneurs. Core elements of entrepreneurship. Entrepreneurship in a Developing economy. Factors affecting Entrepreneurship development.

Unit 2: Business Strategies

Generation of ideas: Methods and process of generating ideas, sources of ideas and screening process. Assessing opportunities: Challenges, pitfalls and critical factors of new venture; Business and Entrepreneurial development organizations. Determining and acquiring required resources (Financial, Physical and Human): Search for entrepreneurial capital- Debt vs. Equity; Venture Capital Market; Angel Financing and Alternative sources of finance for Entrepreneurs. Business Plan.

Creativity: Concept and process of creativity; role and importance of creativity and mental blocks to creativity.

Innovation: Meaning and importance of innovation. Types of innovation. Methods of protecting innovation and creativity: branding, trademarks, patents, copyrights and registered design protection.

Suggested Readings

1. C.B. Gupta and S.S. Khanka, *Entrepreneurship and Small Business Management*, Sultan Chand Publications, New Delhi (2014).
2. S. Taneja and S.L. Gupta, *Entrepreneur Development*, 2nd Edition, Galgotia Publishing Co., New Delhi (2017).

SEMESTER V: Forensic Science and Business

PAPER BVFS51(S): Forensic Engineering and Forensic Intelligence

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The role of engineering science in combating crime.*
- *Role of forensic intelligence.*

Unit 1: Tools and Techniques in Forensic Engineering

Steps involved in forensic engineering. Commonly used methods of investigation. Primary and secondary defects involved in failure of structure. Hypothesis testing for engineering aspects of forensic cases. Role of mechanical, electronics and computer engineers in forensic science. Accident investigations. Failure of signaling and control systems. Ergonomics. Applications of animations, simulations and digital imaging in solving crime cases. Episodes involving fire engineering. Improving engineering designs after forensic engineering investigations.

Unit 2: Tools and Techniques in Forensic Intelligence

Origin of forensic intelligence. Forensic intelligence in policing. Police intelligence models. Role of information technology in forensic intelligence. Role of forensic intelligence in crime analysis. Intelligence features of crime evidence types. Crime pattern analysis. Innocence Project.

Suggested Readings

1. J.F. Brown and K.S. Obenski, *Forensic Engineering – Reconstruction of Accidents*, C.C. Thomas, Springfield (1990).
2. K. Noon, *Introduction to Forensic Engineering*, CRC Press, Boca Raton (1992).
3. R. Milne, *Forensic Intelligence*, CRC Press, Boca Raton (2012).

PAPER BVFS52(S): Role of Media on Crime and National Security

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *Role of media in criminal cases.*
- *Role of media in national security.*

Unit 1: Media and Crime

History of media and crime. Social media, crime and justice. Media portraits of the criminal justice system. 21st Century Crimes in the Developing World – Orientation on Crimes against Women and Children, Sex and Human Trafficking, White-Collar Crimes and Cyber crimes. Construction of crime news. Role of internet in crime and deviance. Role of media in crime prevention.

Unit 2: Media and Security

Media's role in countering International Terrorism. Interacting with terrorist groups. Reporting on investigations. Covering a terrorist attack.

Strategic issues and concerns in India's National Security – geopolitical interests, nuclear deterrence, cross-border terrorism and counter-insurgency, energy security.

Suggested Readings

1. J.P. Marthoz, *Terrorism and the Media: A Handbook for Journalists*, UNESCO, Paris (2017).
2. S. Ganguly, M. Pardesi and N. Blarel (Eds.), *The Oxford Handbook of India's National Security*, Oxford University Press, New Delhi (2018).

PAPER BVFS53(S): Computer Crimes

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The basics of computer forensics.*
- *The cases which fall under the purview of computer crimes.*
- *The types of computer crimes.*

Unit 1: Basics of Computer Crimes

Definition and types of computer crimes. Distinction between computer crimes and conventional crimes. Reasons for commission of computer crimes. Breaching security and operation of digital systems.

Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs.

Unit 2: Types of Computer Crimes

Computer stalking, pornography, hacking, crimes related to intellectual property rights, computer terrorism, hate speech, private and national security in cyber space.

An overview of hacking, spamming, phishing and stalking.

Suggested Readings

1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, *Computer Crimes and Computer Forensics*, Select Publishers, New Delhi (2003).
2. C.B. Leshin, *Internet Investigations in Criminal Justice*, Prentice Hall, New Jersey (1997).
3. E. Casey, *Digital Evidence and Computer Crime*, Academic Press, London (2000).
4. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).

PAPER BVFS54(E): Forensic Accountancy

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The basics of forensic accountancy.*
- *The basics of forensic auditing.*

Unit 1: Basic Concepts

Fundamentals of accountancy and auditing. Forensic accountancy and forensic auditing. Accounting cycles. Types of frauds. Internal controls. Employee thefts. Payroll frauds. Fraudulent billing scheme. Management thefts.

Unit 2: Investigation Process

Organized crime and business. Money laundering. Valuation of economic losses. Document collection. Document organization. The process of proof. Analysis tools. Inferential analysis. Documenting and presenting the case.

Suggested Readings

1. J. Reiman, *The Rich get Richer and the Poor get Prison*, Allyn & Bacon, Boston (1998).
2. Indian Audit and Accounts department, *Audit of Fraud, Fraud Detection and Forensic Audit*, 2007.
3. T.W. Singleton and A.J. Singleton, *Fraud Auditing and Forensic Accounting*, 4th Edition, John Wiley, New Jersey (2010).
4. G.A. Manning, *Financial Investigation and Forensic Accounting*, 3rd Edition, CRC Press, Boca Raton (2011).

PAPER BVFS55(E): Statistical Analysis of Indian Crime Data

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The basics of analyzing crime data.*
- *The methodology of depicting the crime data.*

Unit 1: Basics of Statistical Analysis

Statistical analysis of data. Choosing and using statistical tests. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit.

Unit 2: Crime Data

Statistical analysis of (a) cases registered under various sections of Indian Penal Code and special/local laws; and (b) persons arrested for various offences, with reference to age, gender and states. Presentation of data in graphical, chart, tabular and map

formats. Prison statistics in India. Plausible modalities for tackling crime on basis of statistical data.

Suggested Readings

1. *Prison Statistics (India)*, National Crime Records Bureau, New Delhi (2015).
2. *Crime Statistics in India*, National Crime Records Bureau, New Delhi (2016).

SEMESTER VI: Forensic Science and Society

PAPER BVFS61(S): Forensic Investigation of Accidents

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- a. *The management of vehicular accident scene.*
- b. *The importance of impression evidence in motor vehicle evidence.*

Unit 1: Evidence on vehicle

Accident scene. Sources of forensic information. Eyewitness accounts. Extent of vehicle damage. Visibility conditions. Photographs of accident site. Estimation of speed. Tire marks, skid marks, scuff marks. Maintenance of vehicles. Abandoned vehicles. Importance of air bags. Railway accidents. Forensic significance of tachograph data. Recovery of digital tachograph data.

Unit 2: Evidence on Person

Road traffic fatalities. Types of injuries resulting from accident. Biomechanics of injuries. Hit and run investigations. Trace evidence at accident sites. Autopsy and toxicological findings.

Suggested Readings

1. T.S. Ferry, *Modern Accident Investigation and Analysis*, Wiley, New York (1988).
2. D. Lowe, *The Tachograph*, 2nd Edition, Kogan Page, London (1989).
3. T.L. Bohan and A.C. Damask, *Forensic Accident Investigation: Motor Vehicles*, Michie Butterworth, Charlottesville (1995).
4. S.C. Batterman and S.D. Batterman in *Encyclopedia of Forensic Sciences*, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).
5. J. Dix, *Investigation of Road Traffic Fatalities: An Atlas*, CRC Press, Boca Raton (2000).

PAPER BVFS62(S): Biometrics

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The classification of biometric systems.*
- *The performance measures used in biometric systems.*

Unit 1: Biometric Systems

Definition, characteristics and operation of biometric system. Classification of biometric systems – physiological and behavioral. Strength and weakness of physiological and behavioral biometrics. Biometric functionalities: Verification and identification. Multimodal biometrics. Key biometric processes – enrollment, identification and verification. Positive and negative identification. Performance measures used in biometric systems – FAR, FRR, GAR, FTA, FTE and ATV. Biometric versus traditional technologies.

Unit 2: Applications of biometrics

Fingerprint recognition: Feature extraction, ridge detail matching.

Palm prints: Features and recognition.

Face recognition: Psychology of face recognition, facial features, image acquisition.

Iris recognition: Iris normalization, iris coding, iris quality..

Additional traits: Handwriting, signatures, keystrokes, hand geometry, gait, ear and voice.

Suggested Readings

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. A.K. Jain, A.A. Ross and K. Nandakumar, *Introduction to Biometrics*, Springer, New York (2011).

PAPER BVFS63(E): Forensic Archeology

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The basics of forensic archeology.*
- *The fundamentals of forensic entomology.*
- *The significance of facial reconstruction.*

Unit 1: Basic Concepts

Role of forensic archeology. Searching the archeological site. Methods of digging the burial site. Recovery of remains. Documenting the recovered material. Preservation of remains.

Unit 2: Complementary Disciplines

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

Forensic odontology: Scope and role of forensic odontology in archeology. Types of teeth and their comparative anatomy.

Facial reconstruction: Portrait Parle/ Bertillon system. Photofit/identi kit. Facial superimposition techniques. Importance of tissue depth in facial reconstruction. Genetic and congenital anomalies – causes, types, identification and their forensic significance.

Suggested Readings

1. E.W. Killam, *The Detection of Human Remains*, C.C. Thomas, Springfield (1990).
2. M. Bernstein, Forensic odontology in, *Introduction to Forensic Sciences*, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
3. S. Rhine, *Bone Voyage: A Journey in Forensic Anthropology*, University of Mexico Press, Mexico (1998).

PAPER BVFS64(E): Basics of Forensic Psychology

CREDITS: 6

Learning Outcomes: After pursuing this paper the students will know –

- *The overview of forensic psychology and its applications.*
- *The legal aspects of forensic psychology.*

Unit 1: Basic Concepts

Definition and fundamental concepts of forensic psychology and forensic psychiatry. Psychology and law. Ethical issues in forensic psychology. Criminal profiling. Psychology in the courtroom, with special reference to Section 84 IPC. Juvenile delinquency – theories of offending (social cognition, moral reasoning).

Unit 2: Psychology and Criminal Behavior

Psychopathology and personality disorder. Psychological assessment and its importance.

Serial murderers. Psychology of terrorism.

Biological factors and crime – social learning theories, psycho-social factors, abuse.

Use of media and intelligence for commission of crime.

Suggested Readings

1. J.C. DeLadurantey and D.R. Sullivan, *Criminal Investigation Standards*, Harper & Row, New York (1980).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4th Edition, The Foundation Press, Inc., New York (1995).

3. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).

PAPER BVFS65(S): Dissertation/Project Work

CREDITS: 6

Learning Outcomes: After pursuing this work the students will know –

- *The significance of research work in forensic science/criminology.*
- *The fundamentals of research methodologies in forensic science /criminology.*

The dissertation or the project work will be based on a research topic in Forensic Science/Criminology. The topic will be assigned in consultation with police and forensic science establishments, giving due consideration to the problem areas faced by these institutions. The students will be expected to undertake extensive field work for this exercise.