

COURSE CURRICULUM

FIRST SEMESTER

Course code	Course name	L	T	P	C
FRS21001	INTRODUCTION TO CRIME AND CRIMINOLOGY	2	1	0	3

Course Objective:

1. To Introduce the students to the basic concepts and theories of Criminology.
2. To Introduce students with different Crime typologies.
3. To Introduce students to different types of punishments in society.
4. To Introduce students with different types of crime against women and different types of crimes committed by youth.

Course outcome: After completion of this course students will be able to

CO1: Define the basic concepts of forensic science.

CO2: Develop knowledge about criminal justice system.

CO3: Maximize knowledge about penology.

CO4: Build knowledge about different crime against women and youth crimes.

CO5: Illustrate different crime typologies.

Course contents:

Module I: Introduction to Forensic Science

Introduction, history, and development of Forensic Science, basic principles and significance, organizational structure of Forensic Science laboratories, utilization of Forensic Science at the crime scene and in the court, role, qualities and importance of an investigating officer and a forensic scientist at the scene of crime.

Module II: Introduction to Crime and Criminology

Definition and scope of crime and criminology, types of crime (economic offences, organized crime, white collar crime, occupational crime, crime against women) elements and cause of crime, correlates and theories of crime.

Victimology: definition of victim and victimization, types of victimization. Punishment: definition, types, controversy regarding death penalty.

Module III: Punishment

Definition, Concept & Scope of the study of Penology, Theories of Punishment- Retributive, Reformative, Preventive & Deterrent, type of punishment, controversy regarding death penalty, Probation & Parole – Meaning & scope.

Module IV: Youth and crime

Trends and characteristics of crime among the youth, genesis of youth crime, typology of youth criminals, explanation of crime amongst youth.

Text & References:

- B. Caddy, Forensic Examination of glass and paints analysis and interpretation, ISBN 078405749 2001.
- Bengold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons, USA, 1999.
- C.E. O 'Hara and J.W. Osterburg, An Introduction to Criminalistic, Indiana University Press, Blomington, 1972.
- Denis Shaw, Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17, 1976.
- Carper, K. (ed.), Forensic Engineering, 2ndEdn. CRC Press, Boca Rida, Florida, 2001.
- Field, J., and Carper, K., Construction Failure, 2ndEdn. John Wiley and Sons, New York, 1996.
- James, S.H. and Nordby, J.J. Eds., Forensic Science An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
- Nickolls, L.C., Scientific Investigation of Crime, Bulterwest, London, 1956.
- Philip Rose, Forensic Speaker Identification, Taylor & Francis Forensic Science series, London 2001.
- R. Saferstein, Forensic Science Handbook, Vols. I, II, (Ed), Prentice Hall, Eaglewood Cliffs, NJ; 1988.
- Raymond C Murray and John C.F Tendrew, Forensic Geology, Prentice Hall, New Jersey, 1991. Working Procedure Manual: Physics BPR&D Publication, 2000.

Course code	Course name	L	T	P	C
FRS21002	CRIME SCENE INVESTIGATION	2	1	0	3

Course objective:

1. To introduce the students to forensic science and its role in the investigative system
2. To introduce the different sections of IPC, CrPC and Indian Evidence Act
3. To train the students in crime scene management process
4. To introduce students to different crime scene investigation methods.
5. To introduce the different types of physical evidences and their handling.

Course outcome: After completion of this course students will be able to

- CO1: Build knowledge about forensic science and its role in the investigative system
- CO2: Develop knowledge of various techniques to investigate a scene of crime
- CO2: Appraise their knowledge about criminal justice system and different sections of IPC, CrPC and IEA.
- CO3: Execute handling and analysis of different physical evidences at crime scene
- CO4: Perceive an idea of criminal justice system.

Course contents:

Module I: Introduction to Crime Scene Investigation

definition and types of crime scene, principles of Forensic Science, experts team composition, role of first responding officer, physical evidences. Introduction, definition, types and their collection, preservation, packaging, transporting and forwarding, various techniques used for handling, physical and trace evidences, crime scene tool kits and equipment's etc. Ethics in crime scene investigation.

Module II: Criminal Justice System

Structure of police organizations, Introduction to IPC, CrPC (section 291, 292, and 293). Indian Evidence Acts – Introduction and sections (32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, and 159). FIR, Cognizable and Non-cognizable offences, investigation of cognizable offences- burglary, theft, murder, hit and run cases, and rape.

Module III: Crime Scene Management

Crime terminology, types of crime scene, protection and recording of crime scene, searching of physical evidences, crime scene survey, photography, recording, documentation and presentation in the court, processing and reconstruction of the crime scene

Module IV: Physical evidences and Investigative techniques

Definition, types and importance of physical evidences, collection, preservation, packing and forwarding of different types of evidences to the laboratories. Blood splattering analysis.

Investigative techniques: portrait parley, polygraphy, narcoanalysis, brain fingerprinting.

Text & References:

- Bodziak, W., Footwear Impression Evidence (2nd Edn.) CRC Press, Boca Raton, Florida, 2000.
- DeForest, P., Gaensslen, R., and Lee, H., Forensic Science - An Introduction to Criminilastics, McGraw Hill, New York, 1983.
- Fisher, B., Techniques of Crime Scene Investigation (6thEdn.) CRC Press, Boca Raton, Florida, 2000.
- James, S., and Eskerc, W., Interpretation of Blood Stain Evidence at Crime Scenes, (2ndEdn) CRC Press, Boca Raton, Florida, 1999.
- James, S.H., and Nordby, J.J., (Eds), Forensic Science; An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
- The Indian Evidence Act (1872), Amendment Act (2002), Universal Law Pub. Co. (2003)
- The Code of Criminal Procedure (1973) Amendment Act, (2001), Universal Law Pub. Co. (2002)
- Rattan Lal & Dhiraj Lal; The Indian Penal Code, 28th Ed. Wadhwa & Co. Nagpur (2002)
- Nanda, B.B. and Tewari, R.K; Forensic Science in India- A vision for the twenty first century, Select Publisher, New Delhi (2001)
- Saferstein: Criminalistics – An Introduction to Forensic Science, Prentice Hall Inc. USA (1995)

Course code	Course name	L	T	P	C
FRS21003	QUESTIONED DOCUMENTS	2	1	0	3

Course objective:

1. To introduce the different types of questioned documents and handling process.
2. To introduce different characteristics of handwriting and their identification.
3. To introduce different types of forgery and their detection methods.
4. To introduce different types of typewritten documents and their examination methods.

Course outcome: After completion of this course students will be able to

CO1: Define different types of questioned documents and their handling.

CO2: Build knowledge about different characteristics of handwriting and their Identification

CO3: Identify different types of forgery and typewritten documents.

CO4: Examine different types of forgeries and type-written documents.

Course contents:

Module I: Introduction to Questioned Documents

Nature and problems of document examination, classification of documents, procurement of standard admitted/ specimen writings, care, handling, preservation and making of documents, preliminary examination of documents, instruments and material used to prepare document.

Module II: Handwriting

Basis of handwriting identification – individuality of handwriting, natural variations, process of comparison, various types of documents – genuine and forged documents, holographic documents, various writing features and their estimation, general characteristics of handwriting, individual characteristic of handwriting, basic tools needed for forensic documents examination and their use.

Module III: Methods of forgery

Disguised writing and anonymous letters – identification of writer, examination of signatures – characteristics of genuine and forged signatures, examination of alterations, erasers, overwriting,

additions and obliterations, decipherment of secret, indented and charred document, examination of seal impression and other mechanical impressions

Module IV: Examination of different types of documents

Determination of age of documents by examination of signatures – paper, ink and writing/signatures etc. Examination of computer printout, identification of dot-matrix, ink-jet and laser printers, electronic typewriter, credit cards, Forensic stylistics, Forensic linguistics, e – documents, digital signatures. Opinion writing, reasons for opinion.

Text & references:

- Albert, S. Osborn, Questioned Documents, Second Ed., Universal Law Publishing, Delhi, 1998.
- Albert, S. Osborn, The Problem of Proof, Second Ed., Universal Law Publishing, Delhi, 1998.
- Charles, C. Thomas, I.S.Q.D. Identification System for Questioned Documents, Billy Prior Bates, Springfield, Illinois, USA, 1971.
- Charles C. Thomas, Typewriting Identification I.S.Q.D.; Billy Prior Bates; Springfield, Illinois, USA, 1971.
- Hard less, H.R., Disputed Documents, handwriting and thumbs – print identification: profusely illustrated, Low Book Co., Allahabad, 1988.
- Kurtz, Sheila, Graphotypes a new plant on handwriting analysis, Crown Publishers Inc., USA, 1983.
- Lerinson, Jay, Questioned Documents, Acad Press, London, 2001.
- Morris, Ron, N., Forensic handwriting identification, Acad Press, London, 2001.
- Ordway Hilton, Scientific Examination of Questioned Documents, Rev. ED., Elsevier, New York, 1982.
- Wilson, R., Harrison, Suspect Documents – Their Scientific Examination; Universal Law Publishing, Delhi, 1997.

Course code	Course name	L	T	P	C
FRS21004	FINGER PRINTS AND OTHER IMPRESSIONS	2	1	0	3

Course objective:

1. To introduce basics of fingerprint.
2. To introduce different patterns of fingerprints.
3. To introduce different fingerprint classification systems.
4. To teach the recording and examination of fingerprints and court room presentation.

Course outcome: After completion of this course students will be able to

CO1: Describe history and development of fingerprints system.

CO2: Identify different class and individual characteristics of fingerprint.

CO3: Classify fingerprint patterns.

CO4: Examine fingerprint evidences and other impressions.

Course contents:

Module I: History and classification of fingerprints

History and development of fingerprints, formation of ridges, pattern types, pattern areas, classification of fingerprints- henry system of classification, single digit classification, extension of henry system, search of fingerprints, fingerprint bureau.

Module II: Types of fingerprints and methods of developing fingerprints

Chance fingerprints, latent & visible fingerprints, plastic fingerprints, composition of sweat, development of latent fingerprints, conventional methods of development of fingerprints– fluorescent method, magnetic powder method, fuming method, chemical method etc.,

Module III: Comparison and analysis of fingerprints

Taking of finger prints from living and dead persons, preserving and lifting of fingerprints, photography of fingerprints, digital transmission, comparison of fingerprints, basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics, automatic fingerprint identification system.

Module IV: Other impressions

Foot prints – importance, gait pattern, casting of footprints in different medium, electrostatic lifting of latent footprints, taking of control samples.

Tyre marks/prints and skid marks, taking of control samples.

Lip prints – nature, location, collection and evaluation.

Bite marks – forensic significance, photography, lifting and preservation of bite marks and evaluation.

Ear prints - forensic significance, location, collection and evaluation

Text & references:

- David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press (1999)
- E. Roland Menzel; Fingerprint Detection with Lasers, 2nd Ed., Marcel Dekker, Inc. USA (1999)
- James F. Cowger; Friction Ridge skin, CRC Press London, (1993)
- Mehta, M.K; Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay (1980)
- Moenssens; Finger Prints Techniques, Chitton Book Co. Philadelphia, NY (1975)
- Chatterjee S.K.; Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata (1981)
- Cowger, James F; Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY (1993)
- Cook Nancy; Classifying Finger Prints, Innovative learning pub. Mento Park (1995)
- Cossidy M.J; Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada (1980)
- J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press (2000)
- Smith B.C, Holland MM, Sweel DL & Dizinno. A; DNA &Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA (1995)
- Hillison, S; Dental Anthropology, Cambridge Univ. Press, UK (1996)
- Kasprzak J; Possibilities of Cheiloscopy in Forensic Science(1980)

Course code	Course name	L	T	P	C
FRS21005	FORENSIC BIOLOGY	2	1	0	1

Course objective:

1. To introduce the importance of biological evidences in forensic Science.
2. To introduce the examination of different body fluids.
3. To introduce the examination of hair in forensic science.
4. To introduce the determination of age, sex and race from human skeleton
5. To introduce about wild life forensics and different wildlife/environment protection acts.
6. To introduce the examination of pollen grain and diatoms.
7. To introduce the importance of forensic entomology in estimation of time since death.

Course outcome: After completion of this course students will be able to

CO1: Draw the importance of biological evidences.

CO2: Identify different forensic entomological evidences.

CO3: Extend knowledge about different wildlife/Environment protection act.

CO4: Examine different body fluids, pollen grain and Diatoms.

CO5: Differentiate between human and animal hair.

CO6: Detect age, sex and race of human bone.

Course contents:

Module I: Introduction to Forensic Biology, Hair, Fibre, Diatoms and Pollens

Introduction to forensic biology, morphology and biochemistry of human and animal hair, and its microscopic examination, determination of origin race, sex, site. Fibre types, forensic aspects of fibre examination- fluorescent, optical properties, refractive index, birefringence, dye analysis etc., identification and comparison of man-made and natural fibre.

Forensic significance of diatoms in drowning cases and their isolation and examination, study and identification of pollen grains.

Module II: Introduction to Serology

Introduction to various types of body fluids, examination of blood stains –physical, biochemical, microscopic method, identification of seminal stains – physical, biochemical and microscopic

examination, morphological structure of spermatozoa of human and animals, confirmatory test for a spermic semen- p-30, identification and examination of other body fluids/stains-vaginal secretions, saliva, urine, sweat.

Module II: Forensic Anthropology and Odontology

Determination of age, sex, race, stature from bones, forensic anthropometry, Forensic Facial reconstruction: 2-dimensional reconstruction, 3-dimensional reconstruction, skull-photo superimposition technique.

Forensic odontology: dentition pattern, types and structure of teeth, age determination from teeth, sex determination from teeth, various dental anomalies and their significance in personal identification.

Module III: Wild life Forensic

Introduction and importance of wild life, protected and endangered species of animals and plants, identification and examination of physical evidence like ivory, horn, nails by conventional and modern methods, identification of pug marks of various animals, Wildlife protection act.

Module IV: Forensic Entomology

General entomology significance of terrestrial and aquatic insects in forensic investigations and their role in crime detection, insect's succession and its relationship to determine time since. Impact of ecological factors on insect's development.

Text & References:

- Albert's, B. Bray, D, Lewis, J, Roberts K & Watson, J. D., Molecular Biology of Cell, 2nd Ed Garland Pub., New York, 1989.
- Pandey, B. P., Plant Anatomy; S. Chand, New Delhi, 1998.
- Simon, Ball, Environment Law – The Law and policy relating to protection of environment, Universal Law Pub Co, Delhi, 1991.
- Biology Methods manual, Metropolitan Police Forensic Science Laboratory, London, 1978.
- Byrd, J. H. & Castner, J. L., Forensic Entomology, The Utility of Arthropods in legal Investigation, CRC Press, USA, 2000.
- Catts, E.P & Haskell N.H., Entomology and death: A procedural guide, Joyce's Print Shop, 1990.
- Clifford, B.J., The examination and typing of Bloodstains in the Crime Laboratory, US Court Printing Press, 1971.
- Gardner, E. J., Simmons, M. J. and Snustad, D.P., Principles of Genetics, John Wiley, New York, 1991.

- Mc Caney, Edwin, H., Human Genetics, The Molecular Revolution, Jones& Bartlett Pub. London, 1993.
- Greenish, H. G., & Collin, E., An anatomical Atlas of vegetable Powders, J&A Churchill, London, 1904.
- Mauersberger , Herbert R., & Mathews, Textile Fibres – Their physical, Microscopic and chemical properties, John Wiley, New York, 1954.
- Kimball, John W; Biology; Arvind Publishing Co. New Delh (1974)
- Lewis, B Gene IV, OxfordUniversityPress, England (1980)
- Morrison, Robert D; Environmental Forensics Principles and Applications, CRC Press, Boca Raton, New York, (2000)
- Oates, D W, Brown, C W & Weigel, D L; Blood and tissue identification of selected birds and mammals; JPR study Projects Lincoln NE Nebraska Gome and Perks Commission (1974)
- P. L. Williams and R. Warwick; Gray's anatomy; Churchill Livingston, London; (1980)
- Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice – Hall, Englewood Cliff, New jersey; (1982)
- Smith; DGV; A manual of Forensic Entomology Ithaca New York Camstock Univ. Press, USA, (1986)
- Morrison, Robert D; Environmental Forensics Principles and Applications, CRC Press, Boca Raton, New York, (2000)
- P. L. Williams and R. Warwick; Gray's anatomy; Churchill Livingston, London; (1980)
- Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice – Hall, Englewood Cliff, New jersey; (1982)

Course code	Course name	L	T	P	C
FRS21006	FORENSIC SEROLOGY & DNA PROFILING	2	1	0	3

Course objective:

1. To introduce the basic concepts of genetics, immunology and serology
2. To introduce the determination of origin of species using various body tissues and body fluids.
3. To introduce some of the important genetic markers.
4. To introduce DNA Fingerprinting techniques.
5. To introduce significance of DNA fingerprinting in different criminal and civil cases.

Course outcome: After completion of this course students will be able to

CO1: Explain the basic concepts of genetics, immunology and serology.

CO2: Describe different DNA fingerprinting techniques.

CO3: Determine the origin of species of various tissues and body fluids.

CO4: Classify different genetic markers.

CO5: Evaluate the significance of DNA fingerprinting in different civil and criminal cases.

Course contents:

Module I: Blood

Blood and its composition, haemoglobin and its variants, theories and biochemical tests for identification of blood, determination of species of origin from blood. Blood group typing-‘ABO’ typing from wet and dried stains (absorption-inhibition, mixed agglutination and absorption elution) of blood, blood group specific ABH substances, determination of secretor/ non secretor status, other blood group antigens- ‘Rh’ subtype, MN, Lewis antigen etc.

Module II: Other body fluids

Composition of semen and its forensic examination, determination of species of origin from seminal fluid. Composition of other body fluids like urine, sweat, saliva, vaginal secretions and faeces and their forensic examination.

Module III: Basics of Forensic DNA Analysis

Chemical structure of DNA and RNA, procedure for collection and preservation of biological samples for DNA analysis, techniques for DNA isolation from body fluids, tissues & bones and quantification of DNA.

Module IV: Basic Methodology in Forensic DNA Analysis

DNA separation techniques, introduction to Polymerase chain reaction and its application, introduction to mitochondrial DNA and its forensic significance, Y-STR analysis and its forensic significance, DNA databases.

Text & References:

- Celledine, C.R., Understanding DNA: The molecule and How it works, Acad, Press London, 1992.
- Hartl, D.L., Friedfelder, D. and Synder L. A., Basic Genetics, Jones and Bartlet, Boston, USA, 1988.
- Glover, D.M., and Hames, B.D., DNA cloning, Vols. 1 to 4, Oxford University Press, Oxford, UK, 1995.
- Freidfielder, David, Molecular Biology; Narosa, USA, 1995.
- Simon, Eastal, DNA profiling, Principles, pitfalls and potential, Harwood Acad. Publishers, 1992.
- Gardner, Eldon J, Human Heredity, John Wiley and sons, USA, 1983.
- Burns, George V., The science of Genetics – An Introduction to heredity, Macmillan, 1980.
- Jorg T. Epplen Thomas Lubjumhin, DNA Profiling and DNA Fingerprinting; BirkhauserVerlag, Basel,1995.
- K.C. Malhotra, Statistical Methods in Human Population Genetics, Indian Statistical Institute, Calcutta, 1988.

Course code	Course name	L	T	P	C
FRS22007	CRIME SCENE INVESTIGATION LAB	0	0	4	2

Course objective:

1. To introduce the different Crime Scene Sketching methods.
2. To introduce the collection, packaging and forwarding of different evidences.
3. To introduce the Crime Scene management and reconstruction process of hit and run cases.
4. To introduce Blood stain spatter analysis.
5. To introduce crime scene photography.

Course outcome:

CO1: Apply different sketching methods in outdoor and indoor Crime Scenes.

CO2: Choose different Collection, packaging and forwarding of different evidences.

CO3: Perform photography of crime scene.

CO4: Analyse different blood stain splatters.

CO5: Reconstruct the hit and run cases

Course contents:

Practical's will be done in the Forensic Science laboratory of the department. The student is expected to complete all the experiments in the lab under the guidance of the faculty member. He/she will be required to write details of the practical conducted by him or her in a practical notebook. The write-up of each practical should contain the title of the practical; the conduction of the practical, the tools required and used, the conduction procedure, the results obtained and interpretation. Where needed, diagrams should be presented in the practical notebook should also be presented and where photographs are available the same should be pasted.

1. Investigation and sketching of the indoor crime scene.
2. Investigation and sketching of the outdoor crime scene.
3. Collection, packaging and forwarding of different physical evidences.
4. Crime scene management and reconstruction in hit and run cases
5. Blood splatter analysis
6. Photography of the scene of crime

Course code	Course name	L	T	P	C
FRS22008	QUESTIONED DOCUMENTS & FINGERPRINTS LAB	0	0	4	2

Course objective:

1. To introduce preliminary examination of documents.
2. To introduce identification of handwriting characteristics in normal and disguised writing.
3. To introduce the identification of different types of forgeries.
4. To introduce the examination of currency notes.
5. To introduce decipherment of secret and intended writing.
6. To introduce the ink analysis by TLC.
7. To introduce different class and individual characteristics of fingerprint.
8. To introduce different methods of fingerprint classification and development.

Course outcome:

CO1: Define different characteristics of handwriting and fingerprint.

CO2: Classify different fingerprint patterns.

CO3: Examine counterfeit currency notes and other documents

CO4: Detect different types of forgeries

CO5: Perform TLC for ink analysis

Course contents:

1. Preliminary examination of documents.
2. Identification of normal/disguise writing.
3. Detection of forgeries including traced and simulated forgery and built-up documents.
4. Decipherment of indented writings and secret writings.
5. Examination of currency notes.
6. Examination of ink by TLC.
7. To perform 10-digit classification of fingerprints.
8. To perform ridge tracing and ridge counting.
9. To identify and compare ridge characteristics.
10. To develop latent fingerprints with physical and chemical methods.

COURSE CODE	COURSE NAME	L	T	P	C
FRS22009	FORENSIC BIOLOGY & SEROLOGY LAB	0	0	4	2

Course objective:

1. To examine hair and fiber samples.
2. To do examination of diatoms.
3. To introduce examination of blood stain splatter.
4. To introduce the examination of pollen grains and Diatoms & different types of body fluids.
5. To introduce the different bones of human skeleton.
6. To introduce sex determination, age and stature determination from bones and teeth.
7. To introduce DNA isolation purification and quantification methods.

Course outcome:

CO1: Identify different hair, fiber, diatoms and pollen grain samples.

CO2: label different parts of human skeleton.

CO3: Determine age, sex and stature from bone.

CO4: Examine different body fluids.

CO5: Calculate age from skull and teeth.

CO6: Isolate DNA from different body fluids.

List of Practicals :

- Morphological & Microscopic Examination of hair and fibres.
- Examination of bloodstains (Microscopic test, Colour test)
- Identification of Diatoms
- Identification of pollen grains
- Identification of human bones: long bones, pelvis, skull.
- Determination of Age from skull & teeth
- Determination of sex from skull & pelvis
- Examination of seminal stains: crystal tests, chemical, biochemical, microscopical methods
- Examination of saliva, Urine and sweat
- Grouping of blood
- DNA – Isolation from blood – purification and quantifications.

SECOND SEMESTER

Course code	Course name	L	T	P	C
FRS21010	FORENSIC PHYSICS	2	1	0	3

Course objective:

1. To introduce different characteristics and properties of glass, soil and paint.
2. To introduce the different method of examination of glass, soil and paint.
3. To introduce the different types of tool marks normally encountered at crime scene.
4. To introduce the different methods of speaker identification

Course outcome:

CO1: Define different methods of examination of glass, soil and paint.

CO2: Build knowledge about different methods of speaker identification.

CO3: Maximize knowledge about different examination methods of glass, soil and paint.

CO4: Compare different types of tool marks.

Course contents:

Module I: Glass

Types of glass and their composition, forensic examination of glass fractures under different conditions, determination of direction of impact: cone – fracture, rib marks, hackle marks, backward fragmentation, color and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis, interpretation of glass evidence.

Module II: Soil & Paint

Formation and types of soil, composition and color of soil, particle size distribution, turbidity test, microscopic examination, density gradient analysis, ignition loss.

Types of paint and their composition, macroscopic and microscopic studies, pigment distribution, micro-chemical analysis- solubility test, instrumental methods.

Module III: Tool marks

Types of tool marks: compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks,

photographic examination of tool marks and cut marks on clothes and walls etc. Restoration of erased & obliterated marks, method of marking-cast, punch, engrave; methods of obliteration, method of restoration.

Module IV: Speaker identification and authentication

Voice production theory – vocal anatomy, speech signal processing and pattern recognition – basic factors of sound in speech, acoustic characteristics of speech signal, Fourier analysis, fast Fourier transform analysis

Text & References:

- B. Caddy, Forensic Examination of glass and paints analysis and interpretation, ISBN 078405749 2001.
- Bengold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons, USA, 1999.
- C.E. O 'Hara and J.W. Osterburg, An Introduction to Criminalistic, Indiana University Press, Blomington, 1972.
- Denis Shaw, Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17, 1976.
- Carper, K. (ed.), Forensic Engineering, 2ndEdn. CRC Press, Boca Rida, Florida, 2001.
- Field, J., and Carper, K., Construction Failure, 2ndEdn. John Wiley and Sons, New York, 1996.
- James, S.H. and Nordby, J.J. Eds., Forensic Science An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
- Nickolls, L.C., Scientific Investigation of Crime, Bulterwest, London, 1956.
- Philip Rose, Forensic Speaker Identification, Taylor & Francis Forensic Science series, London 2001.
- R. Saferstein, Forensic Science Handbook, Vols. I, II, (Ed), Prentice Hall, Eaglewood Cliffs, NJ; 1988.
- Raymond C Murray and John C.F Tendrew, Forensic Geology, Prentice Hall, New Jersey, 1991.
- Working Procedure Manual: Physics BPR&D Publication, 2000.

Course code	Course name	L	T	P	C
FRS21011	FORENSIC BALLISTICS	2	1	0	3

Course objective:

1. To introduce various types of firearms and weapons and their operations.
2. To introduce different types ammunition and its components.
3. To introduce the significance of forensic ballistics.
4. To introduce different phenomena of shooting case.
5. To introduce terminal ballistics and various types of firearm injuries.

Course outcome:

CO1- Define mechanism of different firearms and weapons.

CO2- Discuss about ammunitions and its components.

CO3- Explain the forensic significance of ballistics.

CO4- Identify various wounds and injuries caused due to firearm

CO5- Estimate the range of fire

Course contents:

Module I: Introduction to Ballistics

Definition, branches of ballistics, history and background of firearms, classification characteristics and firing mechanism of smooth bored firearms and rifled firearms, country-made firearms. Ammunition: classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, various types of bullets and compositional aspects, arms and explosives act,

Module II: Internal and External ballistics

Internal ballistics: definition, General principles of internal ballistics - ignition of propellants, shape and size of propellants, manner of burning etc.

External ballistics: definition, vacuum trajectory, effect of air resistance on trajectory, base drag, yaw, shape of projectile and stability, coefficient of reduction and sectional density, recoil velocity, Ricochet and heat problem encountered.

Module III: Terminal & Wound ballistics

Definition, interaction and penetration of various types of projectiles in various tissues, factor affecting wound ballistics, Various aspects of wound ballistics, nature of wounds of entry & exit, Evaluation of firearm injuries caused due to shot-gun, and rifle firearms handguns and country made firearms, post-mortem and anti-mortem firearm injuries.

Module V: Identification of firearms and ammunition

Principles and practice of identification of firearms, different types of marks produced during firing process on cartridge-firing pin marks, breech face marks, chamber marks, extractor and ejector marks, Different types of marks produced during firing process on bullet-number/direction of lands and grooves, striation marks on lands and grooves. GSR (Gun Shot Residue) and its analysis

Text & References:

- Brain J. Heard; Hand book of Firearms and Ballistics; John Willey, England; (1997)
- Gary J. Ordog, Management of Gunshot Wounds; Elsevier, New York; (1983)
- Hatcher, Jury and Weller; Firearms Investigation, Identification and Evidence; Stackpole Books, Harrisburg, PA; (1977)
- I.V. Hogg; The Cartridges Guide – A small arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, PA (1982)
- J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols, 1,2 & 3; Springfield, Illinois; (1973)
- Karl G. Sellier et al; Wound Ballistics and The Scientific Background; Elsevier, London; (1994)
- M. Johari, Identification of Firearm, Ammunition and Firearms Injuries; BPR&D, New Delhi (1980)
- TA. Warlow; Firearms, The Law and Forensic Ballistics; Taylor and Francis, London; (1996)
- Vincent Di Maio, Gunshot Wounds; CRC Press, Washington, DC; (1999)

Course code	Course name	L	T	P	C
FRS21012	FORENSIC CHEMISTRY	2	1	0	3

Course objective:

1. To introduce different methods to investigate the case of arson.
2. To introduce about different preliminary test used in forensic chemistry.
3. To introduce various examination methods of volatile poisons and different beverages.
4. To introduce Drug of abuse, commonly abused substances, their sign and symptoms.
5. To introduce about different types of explosives.

Course outcome:

CO1: Develop knowledge about different methods to investigate the case of arson

CO2: Demonstrate different preliminary tests used in forensic chemistry

CO3: Identify Drug of abuse, commonly abused substances, their sign and symptoms

CO3: Determine with different types of volatile poisons and beverages.

CO4: Examine different petroleum products

CO5: Classify different types of explosives

Course contents:

Module I: Examination of volatile poisons and alcoholic beverages

Forensic chemistry: Introduction, types of cases/exhibits, preliminary screening tests.

Analysis of methanol, acetone, chloroform, phenol. Examination procedures involving standard methods and instrumental techniques, analysis of beverages: alcoholic and non-alcoholic, country made liquor, illicit liquor and medicinal preparations containing alcohol and drugs as constituents.

Module II: Drugs in sports

Introduction, classification of drugs of abuse, drugs of abuse in sports and doping, narcotics drugs and psychotropic substances, designer's drugs and their forensic examination, Drugs and Cosmetic act, Excise act, NDPS act.

Module III: Arson

Arson: chemistry of fire, investigation and evaluation of the clue material, analysis of arson exhibits by instrumental methods: management of arson cases. Examination of petroleum products: distillation and fractionation, various fractions and their commercial uses, standard methods of analysis of petroleum products for adulteration.

Module IV: Explosives

Classification, composition and characteristics of explosives, pyrotechnics, IEDs, explosion process and affects, types of hazard, effect of blast wave on structures, human etc., specific approach to scene of explosion, post-blast residue collection, reconstruction of sequence of events, evaluation and assessment of scene of explosion, systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques in the laboratory and interpretation of results.

Text & References:

- A Burger; Medicinal Chemistry, Vol. II, Wiley Interscience, New York; (1970)
- A.I Vogel; Textbook of Practical Organic Chemistry including Qualitative Organic Analysis; ELBS, Essex (1971)
- Boudreau, JE et al – Arson & Arson Investigation, Surevey& Assessment National Institute of Law Enforcement, U.S Deppt of Justice, US Govt. Printing Press (1977)
- D.A. Skoog, D.M. West and F.J. Holler; Analytical Chemistry: An Introductin; SaundersCollege Publishing, Philadephia, USA, (1994)
- Dettean, J D; Kirk's Fire Investigation, 5thed, Prentice Hall, Eaglewood Cliffs, N.J (2002)
- F. Waltch; Principles and Methods of Chemical Analysis, 2nd Ed.; Prentice Hall; (1966)
- I.L. Finar; Organic Chemistry Vol. II; Longmans, Essex; (2003)
- J. Bassett, et.al; Vogel's Textbook of Quantitative Inorganic Analysis, 4thed: Longman, Exxex; (1978)
- R.T. Morrison and R.N. Boyd; Organic Chemistry, (3rd Ed.); Prentice Hall, New Delhi; (1977)
- Working Procedure Manual: Chemistry, Explosives and Narcotics, BPR&D Pub (2000)
- Y. Lyalikov; Physiochemical Analysis; Mir, Moscow, USSR, (1968)

COURSE CODE	COURSE NAME	L	T	P	C
FRS21013	FORENSIC TOXICOLOGY	2	1	0	3

Course objective:

1. To introduce basic concepts and terminologies of toxicology.
2. To introduce various types of drugs and toxic substances encountered in investigation.
3. To introduce different poisons and drugs
4. To introduce the various techniques by which these toxic substances can be isolated and analyzed.

Course outcome:

CO1: Develop knowledge of toxicology and toxins

CO2: Build knowledge about the various drugs and toxic substances encountered in an investigation.

CO3: Appraise their knowledge about different poisons, drugs and their medicolegal aspects

CO4: Choose various techniques by which these toxic substances can be isolated and then analysed to determine their type.

Course contents:

Module I: Introduction to Toxicology and Toxins

Introduction to toxicology, classification of poisons (according to mode of action), medico legal classification of poisons, action of poisons and factors modifying its action, modes of administration of poisons, routes of elimination. Introduction to poisoning by drugs (barbiturates, amphetamine, LSD, cocaine, benzodiazepines, Insecticides (organochloride, organophosphorus, and carbamates)

Module II: Isolation techniques of toxins

Isolation methods of chemical substances from viscera and other relevant materials- non-volatile organic poisons: - stas-otto method, ammonium sulphate method, tungstate and acid digest method, toxic cations (metals)- dry Ashing and wet digestion methods, toxic anions, dialysis methods, total alcoholic extract

Module III: Heavy metal poisoning and corrosive poisons

Introduction to heavy metal poisoning (Pb, As, Hg), sign and symptoms. Corrosive poisons: mineral acids (nitric acid, hydrochloric acid, sulphuric acid) strong base (potassium hydroxide, sodium hydroxide)

Module IV: general study and analysis of vegetable and animal poison

Introduction to poisoning by vegetable poisons (*Abrus Precatorius*, *Calotropis Gigantia*, *Croton*, *Castor*, *Opium*, *Cannabis*, *Dhatura*, *Marking Nut*, *Nux Vomica*, *Oleander*, *Aconite*, *Ergot*, *Digitalis*).
Introduction to poisoning by animal poisons (snake venom, cantharides, scorpions),

Text & References:

- Albert's, B. Bray, D, Lewis, J, Roberts K & Watson, J. D., Molecular Biology of Cell, 2nd Ed Garland Pub., New York, 1989.
- Pandey, B. P., Plant Anatomy; S. Chand, New Delhi, 1998.
- Simon, Ball, Environment Law – The Law and policy relating to protection of environment, Universal Law Pub Co, Delhi, 1991.
- Biology Methods manual, Metropolitan Police Forensic Science Laboratory, London, 1978.
- Byrd, J. H. & Castner, J. L., Forensic Entomology, The Utility of Arthropods in legal Investigation, CRC Press, USA, 2000.
- Catts, E.P & Haskell N.H., Entomology and death: A procedural guide, Joyce's Print Shop, 1990.
- Clifford, B.J., The examination and typing of Bloodstains in the Crime Laboratory, US Court Printing Press, 1971.
- Gardner, E. J., Simmons, M. J. and Snustad, D.P., Principles of Genetics, John Wiley, New York, 1991.
- Mc Caney, Edwin, H., Human Genetics, The Molecular Revolution, Jones & Bartlett Pub. London, 1993.
- Greenish, H. G., & Collin, E., An anatomical Atlas of vegetable Powders, J&A Churchill, London, 1904.
- Mauersberger, Herbert R., & Mathews, Textile Fibres – Their physical, Microscopic and chemical properties, John Wiley, New York, 1954.
- Kimball, John W; Biology; Arvind Publishing Co. New Delh (1974)
- Lewis, B Gene IV, Oxford University Press, England (1980)

- Morrison, Robert D; Environmental Forensics Principles and Applications, CRC Press, Boca Raton, New York, (2000)
- Oates, D W, Brown, C W & Weigel, D L; Blood and tissue identification of selected birds and mammals; JPR study Projects Lincoln NE Nebraska Game and Perks Commission (1974)
- P. L. Williams and R. Warwick; Gray's anatomy; Churchill Livingstone, London; (1980)
- Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice – Hall, Englewood Cliff, New jersey; (1982)
- Smith; DGV; A manual of Forensic Entomology Ithaca New York Camstock Univ. Press, USA, (1986)

COURSE CODE	COURSE NAME	L	T	P	C
FRS21014	INSTRUMENTAL METHODS	2	1	0	3

Course objective:

1. To introduce various instruments used in the analysis of different substances encountered during a criminal investigation.
2. To introduce forensic application and methods of sample analysis
3. To introduce different types of detectors used for detecting the various substances
4. To introduce different spectrophotometric, chromatographic and electrophoretic techniques

Course outcome:

- CO1: Build knowledge of the various instruments used in the analysis of different substances encountered during criminal investigation.
- CO2: Develop knowledge of various types of instrumentation, their Forensic application.
- CO3: Apply different spectrophotometric, chromatographic, electrophoretic Techniques in sample analysis.
- CO4: Choose most suitable type of detectors used for detecting the various substances in various techniques.

Course contents:

Module I: UV- Visible, Infrared Spectrophotometry

UV-Visible: types of sources and stability, wavelength selection, filters-cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection.

IR Spectrophotometry: types of sources, instrumentation, comparison of luminescence and UV-Visible absorption methods, dispersive and Fourier transform spectrophotometry

Module II: Spectroscopy and X-ray

Atomic Absorption Spectrometry: Instrumentation and techniques, interference in AAS, background correction methods, quantitative analysis.

X-ray spectroscopy: X-ray absorption and fluorescence methods, x-ray diffraction.

Nuclear magnetic resonance spectroscopy: basic principles, theory and instrumentation

Mass Spectroscopy: Sample flow, ionization methods, mass analyser, vacuum systems, data handling, correlation of mass spectra and molecular structure.

Module III: Chromatographic Techniques - I

General principles, paper chromatography, column chromatography, TLC, adsorption chromatography, gas chromatography, gas-liquid chromatography, ion-exchange chromatography, affinity chromatography. HPLC, HPTLC, GC-MS

Module IV: Electrophoretic Techniques

General principles, factors affecting electrophoresis, low voltage thin sheet electrophoresis, high voltage electrophoresis, sodium dodecylsulphate (SDS) polyacrylamide gel electrophoresis, isoelectric focusing (IEF), Isoelectrophoresis, preparative electrophoresis, horizontal and vertical electrophoresis.

Text & References:

- Jacobson, B.H.E., Ray, Sidney, Attridge G. G., The Manual of Photography; Focal Press, London, 1988.
- Baker, D.R., Capillary – Electrophoresis, New York, 1995.
- Chapmen, J.R., Practical Organic Mass spectrometry, A Guide for Chemical and Biochemical Analysis, Wiley, New York, 1993.
- Lide, D.R., Handbook of Chemistry & Physics C.R.C. 75th ed. CRC Press WashingtonD.C., 1994.
- Dollisth, F.R., Fateley, W. G. & Bentley, F. F., Characteristic Roman frequencies of organic compounds, Wiley, New York, 1974.
- Friebolin, H. Berik, One- & Two-Dimensional NMR spectroscopy; WeinheimGermany, VCH 1991.
- Stout G.H., & Jensten, L.H., X-ray Structure Determination – A practical Guide, 2nd Ed., Wiley, New York, 1989.
- Gchristian, Gray D and Fredric J. Feldman, Atomic Absorption Spectroscopy; Wiley-Interscience, London, 1970.
- Willard, H.H. et al, Instrumental Methods of Analysis, CBS Publishers and Distributors, Delhi 1986.
- Henry Horeustein, Colour Photography A working Manual, Little Brown Company, Boston, 1995.

- Bassett, J., et al, Vogel's Text Book of Quantitative Inorganic Analysis including Elementary Instrumental Analysis (Fourth Ed.), Long man Essex, 1978.
- Sneddon, J., Advances in Atomic Spectroscopy, Vol. I & II, JNIPress 1992 & 1994.
- Jahne B., Digital Image Processing, Heidelberg Springer, 1996.
- Jarris, K.E., Gray, A.L., & Hock, R.S., EDS, Handbook of Inductively Coupled Plasma Mass Spectrometry, Glasgow Blockie, 1992.
- Azaroff, L.V., Elements of X-Ray Crystallography, McGraw Hill, New York, 1968.
- Lin – Vien, D & Other – Infrared & Raman Characteristics frequencies of organic molecules; San Diego Acad, Press 1991.

Course code	Course name	L	T	P	C
FRS21015	DIGITAL AND CYBER FORENSICS	2	1	0	3

Course objective:

1. To introduce basic concepts and terminologies of computer
2. To introduce cyber laws
3. To introduce basics of digital forensics and cyber crimes
4. To introduce different types of computer network
5. To introduce different digital forensic tools used in investigation

Course outcome:

- CO1: Build knowledge about computer system
- CO2: Discuss different cyber laws
- CO3: Extend their knowledge about digital forensic and cyber crimes
- CO4: Differentiate different types of computer networks
- CO5: Choose appropriate digital forensic tool for investigation

Course contents:

Module I: Fundamental of computer and cyber law

Introduction to computer and its components, computer memory, windows and Unix file storage, operating system. Introduction to hardware and software, key terms, number systems, boot process, file types and signature.

cyber laws, concept of jurisdiction, cyber jurisdiction, overview of Indian legal system, introduction to it act 2000, amendments in it act.

Module II: Basics of digital and cyber forensics

Introduction to digital forensics, branches of digital forensics, phases of digital forensics investigation, digital evidences and handling at crime scene as per standards, collection and preservation of digital evidences, processing and analysis and reporting.

Definition and types of cybercrimes, reasons for commission of cybercrimes. Types of Cybercrimes – 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, computer virus.

Module III: Malware analysis

Introduction to malware, types of malwares – virus, worm, trojan, backdoor, ransomware, the goals of malware analysis, malware analysis techniques, basic static techniques: hashing, finding strings, packed and obfuscated malware, portable executable file format, linked libraries and functions, pe file header and sections, virtual machines for malware analysis.

Module IV: Digital analysis tools

portable devices and mobile phone forensics, functioning of mobile phone and their operating. Search, seizure, packaging and transporting of the digital evidence from the scene of crime. Use of forensic tool, FTK, access data forensic tool kit and preparation of the search of computer evidence to preparing courtroom testimony based upon the examination. Password recovery tools.

Text & References:

- Robert C. Newman, computer forensics: evidence collection and management auerbach publications.
- Eoghan Casey, handbook of computer crime investigation: forensic tools and technology, academic press
- Clark, Franklin, and Diliberto, Ken, (1996). Investigating computer crime, CRC press, boca raton, Florida, uUSA
- Tewari, R,K, Sastry, P.K. And Ravikumar, K.V. (2003): computer crime and computer forensics, select publisher, New Delhi.
- Lang, David l., (2002). Introduction to computer forensics, CRC press Boca Raton, Florida, USA

Course code	Course name	L	T	P	C
FRS22016	FORENSIC PHYSICS & BALLISTICS LAB	0	0	4	2

Course objectives

1. To teach the examination of different tool marks and obliterated marks
2. To introduce the examination of paint, glass and soil samples.
3. To introduce the examination of cement
4. To teach examination of firearm and comparison of fired bullets and cartridge case.
5. To teach the examination of GSR with chemical tests.

Course Outcomes

CO1: Identify different types of tool marks and obliterated marks

CO2: Examine paint, soil and glass evidences.

CO3: Perform examination of Cement

CO4: Compare fired bullet and cartridge case

CO5: Apply walker's test to identify GSR particles

Course content

- Examination of tool marks
- Examination of paint
- Restoration of obliterated marks
- Examination of glass fragments
- Examination of soil samples
- Examination of cement/mortar
- Identification of fired cartridge cases.
- Identification of fired bullet
- Determination of range and time of firing.

Course code	Course name	L	T	P	C
FRS22017	FORENSIC TOXICOLOGY AND FORENSIC CHEMISTRY LAB	0	0	4	2

Course objectives

1. To teach the examination of different tool marks and obliterated marks
2. To introduce the examination of paint, glass and soil samples.
3. To introduce the examination of cement
4. To teach examination of firearm and comparison of fired bullets and cartridge case.
5. To teach the examination of GSR with chemical tests.

Course Outcomes

CO1: Identify different types of tool marks and obliterated marks

CO2: Examine paint, soil and glass evidences.

CO3: Perform examination of Cement

CO4: Compare fired bullet and cartridge case

CO5: Apply walker's test to identify GSR particles

Course contents:

1. Detection of metallic poisons.
2. Detection and determination of insecticides and pesticides by spot colour tests, chromatographic methods.
3. Detection and determination of narcotic drugs.
4. Detection and determination of psychotropic substances
5. Analysis of alcohol and other volatile poisons.
6. Analysis of plant poisons
7. Spot test of nitrates, nitrites, carbonates, sulphates, sulphites.
8. Instrumental analysis of drugs or toxic substances using UV-visible spectrophotometer and colorimeter.
9. Examination of petroleum products such as petrol, kerosene, diesel
10. Analysis of phenolphthalein (qualitative) in bribe trap cases

Course code	Course name	L	T	P	C
FRS22018	DIGITAL & CYBER FORENSICS LAB	0	0	4	2

Course Objective

1. To teach Investigation of e-mail- finding senders IP address of received e- mail
2. To teach Breaching security and operation of digital systems treatment of exhibits
3. To teach recovery of concealed data in the form of altered data viz. Renamed files, manipulated file system, data hidden on NTFTs
4. To teach taking images from various storage media
5. To teach practical use of encase and FTK
6. To teach Creating bit stream of the original media.

Course Outcomes

CO1: Perform Investigation of e-mail- finding senders IP address of received e- mail

CO2: Show Breaching security and operation of digital systems treatment of exhibits

CO3: recover concealed data in the form of altered data viz. Renamed files, manipulated file system, data hidden on NTFTs

CO4: Demonstrate image taking from various storage media

CO5: Practice encase and FTK

CO6: Create bit stream of the original media

Course contents:

1. Investigation of e-mail- finding senders IP address of received e- mail
2. Breaching security and operation of digital systems – treatment of exhibits.
3. To recover concealed data in the form of altered data viz. Renamed files, manipulated file system, data hidden on NTFTs
4. To take images from various storage media.
5. Practical using encase.
6. practical using FTK
7. Creating bit stream of the original media.

Course code	Course name	L	T	P	C
FRS24019	SEMINAR AND CRIME SCENE REPORTING	0	0	0	2

Course objective:

The objective of this course is to enhance the skills like, court room presentation, group discussion and learn crime scene reporting.

Course outcome:

CO1: Develop effective ways of presentation at different scientific forum.

CO2: Enhance their overall personality as well as better learning to their respective courses.

THIRD SEMESTER

Course code	Course name	L	T	P	C
FRS21020	FORENSIC MEDICINE AND PATHOLOGY	2	1	0	3

Course objective:

1. To introduce legal procedures followed in a medical profession.
2. To introduce the various parameters of personal identification and the procedures followed in autopsy.
3. To introduce about the cause manner and mechanism of death and the types of asphyxial deaths.
4. To introduce the different patterns of injuries
5. To introduce different types of sexual offences, infanticide and Abortion.
6. To introduce different types of psychological disorders prevalent within an offender leading to causation of crime.

Course outcome:

CO1: Define legal procedures followed in a medical profession.

CO2: Infer cause and mode of death and prepare autopsy report.

CO3: Distinguish the type and degree of injuries present on a victim.

CO4: Point out Sexual offence cases, infanticide and abortion cases.

CO5: Conclude psychological disorders in human beings that lead to violent criminal behaviour.

Course contents:

Module I: Medical jurisprudence, Medico legal autopsy & death

Introduction and legal procedure, law and medicine, law in relation to the medical profession, definition of autopsy, objectives, requirements, precautions, external examination, internal examination, collection and preservation of different viscera for analysis, Postmortem report, Death: Definition, cause, manner and mechanism of death, determination of time since death, medico legal aspects of death investigation

Module II: Personal Identification

Identification of bones and determination of side, Age determination from skeletal remains, General considerations, classification of bones, suture closure in skull and ossification in other bones. Sex

determination from skeletal remains: skull, Pelvis, and other bones. Estimation of stature from skeletal remains with special reference to long bones.

Module III: Asphyxia

Definition, asphyxial deaths- hanging, ligature strangulation, throttling, suffocation, drowning, death from starvation, cold and heat, anaphylactic deaths.

Module IV: Injuries

Mechanism of injury, types of injuries: abrasions, bruises, lacerations, incised wounds, stab wounds, firearm injuries, defence wounds, self-inflicted wounds, injury patterns, medico legal aspects of injuries, ante-mortem and post-mortem injuries, aging of injury, artificial injury; thermal injuries- burns, dowry deaths, scalds, electricity, lightning, explosions

Module V: Sexual Offences & Infanticides

Natural sexual offences-rape, incest, examination of the victim, examination of the accused. Unnatural sexual offences- sodomy, buccal coitus, tribadism, bestiality. Sexual perversions.

Infanticide: definition, still-born and dead born child, Postmortem examinations, causes of death in the new born.

Text & references:

- Sharma, B.R., Forensic Science in Criminal Investigation and Trials (3rdEdn.) Universal Law Publishing Co. Ltd. New Delhi
- Modi, Jaishing P, Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Pub. 2001.
- Parikh, Textbook of Medical Jurisprudence & Toxicology, 2001.

Course code	Course name	L	T	P	C
FRS24021	INTERNSHIP	0	0	0	3

Course objective:

1. To provide internship for students of Forensic Science at FSL, CFSL, court, mortuary, pharmaceutical laboratory or testing laboratory for four weeks.
2. To give opportunity to students to observe the expert on his job as to how the investigations, are done, analysis is made and interpreted.
3. To give opportunity to the student to learn how to write the report in addition to learning the methodologies of presenting the evidence in the court.

Course outcome:

CO1: Develop methodologies of presenting the evidence in the court

CO2: Handle various equipment for their analytical work pertaining to research

CO3: Appraise their knowledge of field work carried out on the area of Forensic science.

Examination scheme:

Work done during the internship period:	50
Internship report:	25
Viva voce:	25
Total:	100

SPECIALIZATION

A: SPECIALIZATION IN FORENSIC PHYSICAL SCIENCES

Course code	Course name	L	T	P	C
FRS21022	ADVANCE FORENSIC PHYSICS	2	1	0	3

Course objective:

1. To introduce different characteristics and properties of glass, soil and paint.
2. To introduce the different method of examination of glass, soil and paint.
3. To introduce different about different types of tool marks normally encountered at crime scene.
4. To introduce the methods of accident investigation
5. To introduce the different methods of speaker identification
6. To introduce basics of forensic engineering

Course outcome:

CO1: Define different methods of examination of glass, soil and paint

CO2: Develop knowledge about different types of tool marks

CO3: Build knowledge about different methods of speaker identification.

CO4: Maximize knowledge about characteristics of glass, soil and paint.

CO5: Investigate Accident cases

CO6: Evaluate the quality of cement, stones etc with the help of forensic engineering

Course contents:

Module I: Forensic Physics

Definition, scope, significance of forensic physics.

Glass evidence – collection, packaging, analysis. Matching of glass samples by mechanical fit and refractive index measurements. Analysis by spectroscopic methods. Fracture analysis and direction of impact.

Paint evidence – collection, packaging and preservation. Analysis by destructive and non-destructive methods. Importance of paint evidence in hit and run cases.

Soil evidence – importance, location, collection and comparison of soil samples

Module II: Examination of Tool Marks

Tool marks: types of tool marks: compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks. Physical, chemical and instrumental methods of examination of strings/ropes, fibers, threads and fabrics, wires/cables, seals, counterfeit coins, physical match of broken objects.

Restoration of erased/obliterated marks in different surfaces.

Module III: Forensic Engineering

Introduction to forensic engineering, ISI/code of building construction, structural failures, static loads, dynamic loads, causes of structural collapse, types of cement and their composition, determination of adulterants by physical, chemical and instrumental methods, examination of brick, analysis of bitumen & road materials, analysis of cement mortar and cement concrete & stones, forensic examination of electrical appliances installations.

Module IV: Accidental Investigation

Motor vehicle accidents accident scene, sources of forensic information, eyewitness accounts, extent of vehicle damage, visibility conditions, photographs of accident site, maintenance of vehicles, abandoned vehicles, importance of air bags, estimation of speed, railway accidents.

Pre-crash movement, post-crash movement, collision model, gauging driver's reaction, occupant's kinematics, types of injuries resulting from accident, biomechanics of injuries, hit and run investigations, trace evidence at accident sites.

Module V: Forensic Speaker Identification

Forensic speaker identification: speaker identification and tape authentication: voice production theory, speech signal processing and pattern recognition, acoustic parameters of sound, Fourier analysis, frequency and time domain representation of speech signal, analogue to digital conversion-sampling and quantization, Fast Fourier transform, speech enhancement, authentication of audio-video signal.

Text & References:

- B. Caddy, Forensic Examination of glass and paints analysis and interpretation, ISBN 078405749 2001.
- Bengold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons, USA, 1999.
- C.E. O 'Hara and J.W. Osterburg, An Introduction to Criminalistic, Indiana University Press, Blomington, 1972.
- Denis Shaw, Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17, 1976.
- Carper, K. (ed.), Forensic Engineering, 2ndEdn. CRC Press, Boca Rida, Florida, 2001.
- Field, J., and Carper, K., Construction Failure, 2ndEdn. John Wiley and Sons, New York, 1996.
- James, S.H. and Nordby, J.J. Eds., Forensic Science An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
- Nickolls, L.C., Scientific Investigation of Crime, Bulterwest, London, 1956.
- Philip Rose, Forensic Speaker Identification, Taylor & Francis Forensic Science series, London 2001.
- R. Saferstein, Forensic Science Handbook, Vols. I, II, (Ed), Prentice Hall, Eaglewood Cliffs, NJ; 1988.
- Raymond C Murray and John C.F Tendrew, Forensic Geology, Prentice Hall, New Jersey, 1991.
- Working Procedure Manual: Physics BPR&D Publication, 2000.

Course code	Course name	L	T	P	C
FRS21023	ADVANCE FORENSIC BALLISTICS	2	1	0	3

Course objectives

1. To introduce various types of firearms and weapons and their operations.
2. To introduce different types ammunition and its components.
3. To introduce the significance of forensic ballistics.
4. To introduce different phenomena of shooting case.
5. To introduce terminal ballistics and various types of firearm injuries.

Course Outcomes

CO1- Define mechanism of different firearms and weapons.

CO2- Discuss about ammunitions and its components.

CO3- Explain the forensic significance of ballistics.

CO4- Identify various wounds and injuries caused due to firearm

CO5- Estimate the range of fire

Module I: Forensics Ballistics

Introduction to internal ballistics, ignition of propellants, shape and size of propellants, manner of burning, pressure space curve, shot start pressure. Various factors affecting the internal ballistics, muzzle velocity, factors affecting muzzle velocity.

Introduction to external ballistics, trajectory drop in the flight of the projectiles force of gravity air resistance-base drag, yaw, shape of bullet, effective range, extreme range.

Introduction to terminal ballistics, behaviour of various type of bullets on the target, remaining velocity, stopping power, ricochet. Ballistics parameters, post-mortem and anti-mortem.

Module 2: Firearms and Ammunitions

Firearms, definition, history, classification and characteristics of firearms. Examination and identification of fire arms. Identification of origin, improvised/ country-made/ imitative firearms and their constructional features, velocity and pressure characteristics under different conditions; various types of bullets and compositional aspects, latest trends in their manufacturing and design

Module 3: Determination of range of fire and GSR analysis

Burning, scorching, blackening, tattooing and metal fouling, shots dispersion and GSR distribution, time of firing – different methods employed, and their limitations.

Mechanism of formation of GSR, source and collection, spot test, chemical test, identification of shooter and instrumental methods of GSR analysis.

Module 4: Identification of firearms and ammunition

Matching of crime & test bullets and cartridge cases in regular firearms, identification of bullets, pellets & wads fired from improvised country made firearms. Automated method of cartridge case and bullet comparison.

Principles and practice of identification of firearms, ammunition and their components, different types of marks produced during firing process on cartridge-firing pin marks, breech face marks, chamber marks, extractor and ejector marks.

Module 5: Firearm Injuries

Ballistic aspect of firearm injuries, nature, effect of target, velocity, constructional features and range on the wounding, identification of firearm injuries. Evaluation of firearm injuries, reconstruction: accident, suicide, murder and self-defence.

Text & References:

- Brain J. Heard; Hand book of Firearms and Ballistics; John Willey, England; (1997)
- Gary J. Ordog, Management of Gunshot Wounds; Elsevier, New York; (1983)
- Hatcher, Jury and Weller; Firearms Investigation, Identification and Evidence; Stackpole Books, Harrisburg, PA; (1977)
- I.V. Hogg; The Cartridges Guide – A small arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, PA (1982)
- J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols, 1,2 & 3; Springfield, Illinois; (1973)
- Karl G. Sellier et al; Wound Ballistics and The Scientific Background; Elsevier, London; (1994)
- M. Johari, Identification of Firearm, Ammunition and Firearms Injuries; BPR&D, New Delhi (1980)
- TA. Warlow; Firearms, The Law and Forensic Ballistics; Taylor and Francis, London; (1996)
- Vincent Di Maio, Gunshot Wounds; CRC Press, Washington, DC; (1999).

Course code	Course name	L	T	P	C
FRS21024	ADVANCE DIGITAL AND CYBER FORENSICS	2	1	0	3

Course Objective:

1. To introduce basic terminologies of digital and cyber forensics
2. To introduce imaging / acquisition and data recovery
3. To introduce Cyber security management
4. To introduce networking and different types of malwares and their detection
5. To introduce different types of cases encountered under cyber forensics

Course Outcome:

- CO1: Develop knowledge about digital and cyber forensic
- CO2: Extend their knowledge about software used in imaging acquisition.
- CO3: Appraise their knowledge about cyber security management.
- CO4: Categorise different types of networking, malwares and detection
- CO5: Solve different cases under cyber forensic

Course contents:

Module I: Introduction to Digital and Cyber Forensics

Introduction to digital forensics, branches of digital forensics, types of digital evidence, chain of custody, types of cybercrime, types of cyber criminals, crime scene management, evidence collection techniques - switched off system, live system, live response and triage-based acquisition techniques, order of volatility.

Module II: Imaging / Acquisition and Data recovery

Imaging and cloning of digital device, acquisition of stand-alone machine, peripheral device, other storage media, CCTV, systems (both physical and logical), acquisition or triage collection of live system, acquisition of mobiles, PDAs, tablets, navigation systems etc., acquisition over the network i.e., remote acquisition, understanding of various acquisition software/hardware device, details of various image file formats of forensic file, deleted data recovery techniques. Different mobile forensic software, computer forensic software and DVR/NVR software.

Module III: Cyber Security Management and Incident Response

Principles of security, cybersecurity safeguards, CIA triad, confidentiality, the principle of confidentiality, protecting data privacy, copyright, need for data integrity checks, availability. Introduction to incident response, need for incidents response, incident response plan, incident response and handling process, incident management team, incident response team, roles and responsibilities.

Module IV: Advance networks and malware forensics

End-point authentication, securing e-mail, securing TCP connections: SSL/TLS network-layer security: network security architecture, IPsec and virtual private networks, securing wireless LAN, IDS, IPS, firewall, types of firewalls, DMZ, UTM.

Executing malware analysis in safe environment, monitoring with process monitor, viewing processes with process explorer, faking a network, packet sniffing with Wireshark. Debugging: source level vs assembly level debuggers, kernel vs user mode debugging, using debugger, exceptions, modifying execution with debugger.

Module V: Social Media Forensics

Case studies, open-source tools or social media analytics, safety on social media. Detection and characterization of spam, phishing, frauds, hate crime, abuse and extremism via online social media, data collection and analysis, fake news and content on social media. Legal issues in world social media, information technology (intermediary guidelines and digital media ethics code) rules, 2021.

Text Books & References:

- Cyber Law in India by Farooq Ahmad- Pioneer Books
- Information Technology Law and Practice by Vakul Sharma- Universal Law Publishing Co. Pvt. Ltd.
- The Indian Cyber Law by Suresh T. Vishwanathan- Bharat Law House NewDelhi
- Guide to Cyber and E- Commerce Laws by P.M. Bukshi and R.K. Suri- Bharat Law House, New Delhi
- Guide to Cyber Laws by Rodney D. Ryder- Wadhwa and Compney, Nagpur
- The Information technology Act, 2000- Bare Act- Professional Book Publishers, New Delhi.
- Computer Forensics: Principles and Practices by Linda Volonino, Reynaldo
- Anzaldua and Jana Godwin -Pearson Prentice-Hall 2007.

- First Responder's Guide to Computer Forensics by Richard Nolan et al.- Carnegi Mellon, 2005.
- Digital Evidence and Computer Crime, 2nd ed. By Eoghan Casey- Academic Press, 2004.
- The Regulation of Cyberspace by Andrew Murray, 2006- Routledge – Cavendish.
- Scene of the Cybercrime: Computer Forensics Handbook by Syngress.
- Security and Incident Response by Keith J. Jones, Richard Bejtlich and Curtis
- Introduction to Forensic Science in Crime Investigation By Dr.(Smt) Rukmani
- Krishnamurthy
- Tiwari, R.K. and Ravikumar, K.V. (2003): Computer Crime & Computer Forensics, Selective publication, New Delhi.
- Stern, D.L. Preventing Computer Frauds.

Course code	Course name	L	T	P	C
FRS22027	ADVANCE FORENSIC PHYSICS AND BALLISTICS LAB	4	0	4	2

Course objective:

1. To teach density measurement of glass and soil
2. To teach restoration of erased identification marks
3. To teach comparison of glass by measuring refractive index and physical matching
4. To teach physical examination of paint
5. To teach comparison of tool marks
6. To teach examination and comparison of firearm, bullet and cartridge case
7. To teach the determination of number of shots, weight of shots and identification of propellant.
8. To teach examination of GSR.

Course outcome:

CO1: Measure density of glass and soil

CO2: Restore the erased identification marks

CO3: Determine the number of shots

CO4: Examine different tool marks

CO5: Compare glass by different methods like RI, physical matching

CO6: Compare bullet, cartridge case and different type of fire arms used in crime

Course contents:

- Density gradient analysis of soil samples.
- Determination of density of glass by specific gravity bottle method
- Restoration of erased identification marks.
- Determination of refractive index of glass and liquid.
- Comparison of broken glass bangles.
- Physical matching of broken pieces of different objects.
- Physical examination of paint samples by microscopic method

- Comparison of tool marks.
- Characteristics of Firearms-Caliber, Choke, Trigger pull, and Proof marks.
- Examination and comparison of fired bullet with reference to caliber, rifling characteristics, and identification of firearm
- Examination and comparison of fired cartridge case with reference to caliber, firing pin, breech face, chamber indentations, extraction, and ejector marks by comparison microscope
- Chemical tests for powder residue and barrel wash
- Instrumental examination of GSR

Course code	Course name	L	T	P	C
FRS22028	ADVANCE DIGITAL AND CYBER FORENSICS LAB	0	0	4	2

Course Objective

1. To teach Imaging of hard disc, restoration of deleted files, password cracking, e-mails tracking
2. To teach use of Apache Web Server Logs, Hard Disk Forensics, windows registry forensics.
3. To teach Investigation of e-mail- finding senders IP address of received e- mail
4. To teach breaching security and operation of digital systems treatment of exhibits
5. To teach to recover concealed data in the form of altered data viz. Renamed files, manipulated file system, data hidden on NTFTs
6. To teach making images from various storage media
7. To teach practical use of FTK, encase and creating bit stream of the original media.

Course Outcomes

CO1: Perform tasks like Imaging of hard disc, restoration of deleted files, password cracking, e-mails tracking

CO2: Use Apache Web Server Logs, Hard Disk Forensics, windows registry forensics, FTK, encase and creating bit stream of the original media.

CO3: Breach security and operation of digital systems treatment of exhibits

CO4: Find senders IP address of received e- mail

CO5: Recover concealed data in the form of altered data viz. Renamed files, manipulated file system, data hidden on NTFTs

CO6: Make images from various storage media

Course contents:

- Imaging of hard disc, restoration of deleted files, password cracking, e-mails tracking
- Forensics of Apache Web Server Logs.
- Practical based on Hard Disk Forensics.
- Practical based on windows registry forensics.
- Investigation of e-mail- finding senders IP address of received e- mail
- Breaching security and operation of digital systems – treatment of exhibits.

- To recover concealed data in the form of altered data viz. Renamed files, manipulated file system, data hidden on NTFTs
- To take images from various storage media.
- Practical using encase.
- practical using FTK
- Creating bit stream of the original media.

Course code	Course name	L	T	P	C
FRS21032	ADVANCE FORENSIC BIOLOGY	2	1	0	3

Course Objectives

1. To introduce the basic morphology, anatomy and examination of hair
2. To introduce microscopic examination of hair
3. To introduce types of fibers and examination of fibers
4. To introduce different types of wood, timber, leaves and different botanical evidences.
5. To introduce Forensic significance and examination of diatoms

Course Outcomes

- CO1: Define the morphology, anatomy and examination of hair
- CO2: Identify different types of fibres and botanical evidences.
- CO3: Examine different hair samples, fibers and botanical evidences
- CO4: Apply different examination methods to identify diatoms

Course contents:

Module I: Hair

Introduction and forensic evidential value; morphology, anatomy, chemistry of hair; the scene of occurrence; collection, sampling and preservation of hair; human hair characteristics, Examination of human hair, Differences between animal and human hair

Module II: Fibers

Fiber -types of fibers, forensic aspects of fiber examination fluorescent, optical properties, refractive index, birefringence, dye analysis etc. Identification and comparison of man-made and natural fibres. Fibre examination microscopic, temporary mount, physical methods (twist on drying, floatation method, burning test) and microscopic examination.

Module III: Forensic botany

Introduction, types, location, collection evaluation and identification and matching of fungi and various types of woods, timbers, seeds and leaves various types of wood, timber varieties, seeds and leaves and their forensic significance.

Module IV: Diatoms

Various types of planktons and diatoms and their forensic importance diatoms types morphology, methods of isolation from different tissue, identification of starch grains, powder and stains of spices etc.; paper and paper pulp identification, microscopic and biochemical examination of pulp material.

Module V: Palynology

Study of spore, powdered minerals and pollens of forensic importance, Use of pollen grains & spores in criminal or civil investigation, Applications of Forensic Palynology.

Text & References:

- Albert's, B. Bray, D, Lewis, J, Roberts K & Watson, J. D., Molecular Biology of Cell, 2nd Ed Garland Pub., New York, 1989.
- Pandey, B. P., Plant Anatomy; S. Chand, New Delhi, 1998.
- Simon, Ball, Environment Law – The Law and policy relating to protection of environment, Universal Law Pub Co, Delhi, 1991.
- Biology Methods manual, Metropolitan Police Forensic Science Laboratory, London, 1978.
- Byrd, J. H. & Castner, J. L., Forensic Entomology, The Utility of Arthropods in legal Investigation, CRC Press, USA, 2000.
- Catts, E.P & Haskell N.H., Entomology and death: A procedural guide, Joyce's Print Shop, 1990.
- Clifford, B.J., The examination and typing of Bloodstains in the Crime Laboratory, US Court Printing Press, 1971.
- Gardner, E. J., Simmons, M. J. and Snustad, D.P., Principles of Genetics, John Wiley, New York, 1991.
- Mc Caney, Edwin, H., Human Genetics, The Molecular Revolution, Jones& Bartlett Pub. London, 1993.
- Greenish, H. G., & Collin, E., An anatomical Atlas of vegetable Powders, J&A Churchill, London, 1904.
- Mauersberger, Herbert R., & Mathews, Textile Fibres – Their physical, Microscopic and chemical properties, John Wiley, New York, 1954.
- Kimball, John W; Biology; Arvind Publishing Co. New Delhi (1974)
- Lewis, B Gene IV, Oxford University Press, England (1980)

Course code	Course name	L	T	P	C
FRS21033	FORENSIC ANTHROPOLOGY & ODONTOLOGY	2	1	0	3

Course Objective

1. To introduce basic structure of human skeleton
2. To introduce basic knowledge about age, sex and race estimation from skeleton
3. To introduce personal identification techniques in living and dead person.
4. To introduce the basic concepts of personal identification from teeth
5. To introduce the importance of bite mark analysis in forensic cases

Course Outcomes

CO1: Understand the basic structure of human skeleton.

CO2: Perform personal identification from teeth

CO3: Apply different techniques of personal identification in living and dead person

CO4: Illustrate the importance of bite marks in forensic science

CO5: Estimate age, sex and race estimation from skeleton

Module I: Forensic Anthropology

definition scope and problems, human skeleton, comparative skeletal anatomy of human and non-human. Bones- identification, classification and determination of site, morphological and anatomical characteristics.

Module II: Skeletal age, sex and race

skeletal age (earlier years): prenatal ossification. Postnatal appearance and union of centres ossification. Differences due to race. Skeleton age (later years): cranial suture closure, pubic symphysis. Sexing skeletal remains: general consideration and age factors. Sex differences in skull, pelvis and long bones. Calculation of stature of long bones: studies on stature reconstruction in various population groups. Use of fragmentary long bones in stature reconstruction. Racial differences in human skeleton.

Module III: Personal identification techniques

Introduction and forensic importance; personal identification of living & dead- identification through Somatometry and somatoscopy observation, nails, occupation marks, scars, tattoo marks and deformities. Portrait parle/Bertillon system, facial reconstruction, super imposition technique.

Module IV: Forensic odontology

Definition and Scope of Forensic Odontology, Types of dentitions, Basic structure of human teeth, types of teeth & their morphology, and determination of age from teeth using various methods, dental anomalies and their role in Personal Identification.

Module V: Bite marks

Types & forensic importance; collection and preservation of samples, analysis of bite marks, presentation of bite mark evidences in court of law; role of forensic odontology in mass disaster victim identification; dental charting; comparison of ante-mortem and post-mortem dental records.

Text & References:

- 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).
- D. Ubelaker and H. Scammell, Bones, M. Evans & Co., New York (2000).
- S. Rhine, Bone Voyage: A Journey in Forensic Anthropology, University of Mexico Press, Mexico (1998).
- Beals, R.L. and Hoizir, H. (1985): An Introduction to Anthropology, Macmillan, New Delhi.
- Krogman, W.M. And Iscan, M. (1986): Human Skeleton in Forensic Medicine, Charles C. Thomas, U.S.A.
- El Najjar and McWilliams (1978) : Forensic Anthropology
- Comas, J.A. (1960): A Manual of Physical Anthropology, Charles C. Thomas U.S.A.
- Whitaker, D.K. and MacDonald, D.U. (1989): Forensic Dentistry, Wolfe Medical Publications Ltd. Robert A. Jensen: Mass fatality and Casualty incidents: A field guide
- Taylor (2000) : Forensic Art and Illustrations CRC Press.
- Singh, I.P. and Bhasin M. K. (1968): Anthropometry, Kamla-Raj Publications, Delhi
- Hooton, E.A. (1946): Up from the Ape, Macmillan, New York.
- Whitaker, D.K. and MacDonald, D.U. (1989): Forensic Dentistry, Wolfe Medical Publication Ltd
- . Nath, S. (1987): An Introduction to Forensic Anthropology. Gian Publishing House, New Delhi.
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Course code	Course name	L	T	P	C
FRS21034	ADVANCE BIOLOGICAL INSTRUMENTATION	2	1	0	3

Course Objectives:

1. To introduce basics of electrophoretic techniques and types of electrophoresis used for biological samples
2. To introduce basic concepts of chromatography and its types.
3. To introduce different types of microscopic techniques for analyzing biological samples
4. To introduce various techniques used in the analysis of biological samples.

Course Outcomes:

CO1: Maximize their knowledge about different electrophoretic techniques

CO2: Build their knowledge about different chromatographic techniques

CO3: Develop their knowledge about different microscopic techniques used for biological Samples

CO4: Appraise their knowledge about various techniques used in the analysis of biological samples (ELISA, PCR, RFLP etc)

Course Content

Module I: Electrophoretic Techniques

General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis, Sodium dodecyl sulphate (SDS) polyacrylamide gel electrophoresis (PAGE), Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical Electrophoresis

Module II: Chromatographic Methods

Chromatographic methods. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography, liquid chromatography, HPLC, HPTLC, Mass spectroscopy and liquid chromatography–mass spectrometry, Ion chromatography, Capillary electro migration separation techniques, MALDI-TOF mass spectrometry.

Module III: Microscopic techniques

Concept of Absorption, emission and scattering, Optical microscopy: Simple microscope, compound microscope & comparison microscope, Fluorescence microscope, Electron microscopy: Scanning Electron Microscope, Transmission electron microscope.

Module IV: Other techniques

Enzyme-linked immunosorbent assay (ELISA), co-immunoprecipitation, Double-stranded RNA-mediated interference (RNAi), Polymerase Chain Reaction (PCR), Restriction Fragment Length Polymorphism (RFLP), Fixation and staining techniques, Transfections.

Text & References:

- Jacobson, B.H.E., Ray, Sidney, Attridge G. G., The Manual of Photography; Focal Press, London, 1988.
- Baker, D.R., Capillary – Electrophoresis, New York, 1995.
- Chapmen, J.R., Practical Organic Mass spectrometry, A Guide for Chemical and Biochemical Analysis, Wiley, New York, 1993.
- Lide, D.R., Handbook of Chemistry & Physics C.R.C. 75th ed. CRC Press Washington D.C., 1994.
- Dollisth, F.R., Fateley, W. G. & Bentley, F. F., Characteristic Roman frequencies of organic compounds, Wiley, New York, 1974.
- Friebolin, H. Berik, One- & Two-Dimensional NMR spectroscopy; Weinheim Germany, VCH 1991.
- Stout G.H., & Jensten, L.H., X-ray Structure Determination – A practical Guide, 2nd Ed., Wiley, New York, 1989.
- Gchristian, Gray D and Fredric J. Feldman, Atomic Absorption Spectroscopy; Wiley-Interscience, London, 1970.
- Willard, H.H. et al, Instrumental Methods of Analysis, CBS Publishers and Distributors, Delhi 1986.
- Henry Horeustein, Colour Photography A working Manual, Little Brown Company, Boston, 1995.
- Bassett, J., et al, Vogel's Text Book of Quantitative Inorganic Analysis including Elementary Instrumental Analysis (Fourth Ed.), Long man Essex, 1978.
- Sneddon, J., Advances in Atomic Spectroscopy, Vol. I & II, JNI Press 1992 & 1994.
- Jahne B., Digital Image Processing, Heidelberg Springer, 1996.
- Jerrys, K.E., Gray, A.L., & Hock, R.S., EDS, Handbook of Inductively Coupled Plasma Mass Spectrometry, GlasgowBlockie, 1992.

Course code	Course name	L	T	P	C
FRS22036	ADVANCE FORENSIC BIOLOGY LAB	0	0	4	2

Course Objective

1. To teach examination of hair
2. To teach examination of fibers
3. To teach examination of different types of wood
4. To teach examination of pollen grain
5. To teach identification and comparison of diatoms

Course Objective

CO1: Identify human and animal hair

CO2: Differentiate between different types of fiber

CO3: Examine of different types of wood

CO4: Perform examination of pollen grain

CO5- Compare different diatoms

Course content :

- Microscopic examination of hairs – identification of species origin.
- Microscopic examination of hair- scale casting.
- Microscopic examination of natural and man-made fibers
- Examination of fibers: - floating and burning method
- Microscopic examination of different types of wood
- Microscopic characterization of different pollen grains.
- Identification and comparison of diatoms.

Course code	Course name	L	T	P	C
FRS22037	FORENSIC ANTHROPOLOGY & ODONTOLOGY LAB	0	0	4	2

Course Objectives

1. To teach Side and site determination from long bones
2. To teach Stature estimation from bones
3. To teach Sex determination from various bones
4. To teach age determination from Skull and teeth
5. To teach Bite mark analysis
6. To teach Protocol of handling different bone sample and maintaining their chain of custody

Course Outcomes

- CO1:** Determine side and site from long bone
CO2: Estimate stature from bones
CO3: Identify sex from long bones
CO4: Calculate age from skull and teeth
CO5: Analyze bite marks
CO6: Maintain the protocol of handling sample and chain of custody

Course Content

- Side and site determination from long bones.
- Stature estimation from bones.
- Sex determination from various bones.
- Age determination from Skull.
- Age estimation from teeth.
- Bite mark analysis.
- Protocol of handling different bone sample and maintaining their chain of custody

SPECIALIZATION IN CHEMICAL SCIENCES

COURSE CODE	COURSE NAME	L	T	P	C
FRS21038	ADVANCE FORENSIC CHEMISTRY	2	1	0	3

Course objective:

1. To introduce basic concepts of forensic chemistry
2. To introduce bribe trap cases and its detection methods
3. To introduce the different techniques used in analysis of beverages
4. To introduce examination of petroleum products
5. To introduce examination of arson cases

Course outcome:

CO1: Build knowledge about basic concepts of forensic chemistry

CO2: Develop knowledge about different detection methods used in bribe trap cases

CO3: Appraise their knowledge about different techniques used in analysis of beverages

CO4: Examine petroleum products

CO5: Analyse arson cases

Course contents:

Module I: Introduction to Forensic Chemistry

Introduction, Types of cases which require chemical analysis, Limitations of forensic samples, conventional methods of chemical analysis, presumptive tests (colour/spot tests), Microcrystal tests, Examination of contact Traces: Introduction to cosmetics and detective dyes, collection, sampling and analysis.

Module II: Bribe trap Cases

Mechanism of colour reaction, factor affecting the colour, detection of phenolphthalein and alkali used, method of detection of degraded product on conversion of pink colour to colourless solution by TLC and UV visible spectrophotometer. Photo and videography and voice recording as supporting evidence.

Module III: Analysis of Beverages

Alcoholic and non-alcoholic beverages and their composition, Analysis of alcoholic beverages as per BIS and PFA Act, Detection and determination of ethanol, furfural, organic acids, aldehydes, chloral hydrate, methanol and ethylene glycol in liquors by color tests, TLC, GC, and GC-MS methods, Distinction between licit and illicit liquors.

Module IV: Examination of Petroleum Products

Analysis of petroleum products and residues: Distillation and fractionation, Various fractions and their commercial uses, Standards/methods of commercial analysis of petroleum products as per ASTM and BIS, Analysis of traces of petroleum products in forensic exhibits, Comparison of petroleum products, Adulteration of petroleum products, Characterization of petroleum products in oil spills, Application of conventional and Modern Techniques in the analysis of petroleum products.

Module V: Arson

Introduction, chemistry of fire, Scientific approach to fire investigation, need and presumption of accidental causes, Pattern of fire, evaluation of clue material, Determination of origin and cause of fire, Methods of flammable oil residues detection from debris, analysis of arson exhibits by instrumental method, Evidence collection, preservation Reporting procedures and conclusion

Text & References:

- A Burger; Medicinal Chemistry, Vol. II, Wiley Interscience, New York; (1970)
- A.I Vogel; Textbook of Practical Organic Chemistry including Qualitative Organic Analysis; ELBS, Essex (1971)
- Boudreau, JE et al – Arson & Arson Investigation, Survey & Assessment National Institute of Law Enforcement, U.S Dept of Justice, US Govt. Printing Press (1977)
- D.A. Skoog, D.M. West and F.J. Holler; Analytical Chemistry: An Introduction; Saunders College Publishing, Philadelphia, USA, (1994)
- Dettean, J D; Kirk's Fire Investigation, 5thed, Prentice Hall, Eaglewood Cliffs, N.J (2002)
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- J. Bassett, et.al; Vogel's Textbook of Quantitative Inorganic Analysis, 4thed: Longman, Exxex; (1978)
- R.T. Morrison and R.N. Boyd; Organic Chemistry, (3rd Ed.); Prentice Hall, New Delhi; (1977).

Course code	Course name	L	T	P	C
FRS21039	ADVANCE FORENSIC TOXICOLOGY	2	1	0	3

Course Objective

1. To introduce basic concepts of forensic toxicology
2. To introduce collection, preservation & isolation of viscera
3. To introduce Extraction, Isolation & Identification of drugs
4. To introduce plant and animal poison
5. To introduce metabolism and excretion of poison

Course Outcome

CO1: Build knowledge about basic concepts of forensic toxicology

CO2: Perform collection, preservation & isolation of viscera

CO3: Perform Extraction, Isolation & Identification of drugs

CO4: Appraise their knowledge about plant and animal poison

CO5: Appraise their knowledge about metabolism and excretion of poison

Module I: Introduction to Forensic Toxicology

Introduction to toxicology, history, scope and applications, types of toxicology principle of toxicology. Poisons—definition, classification of poison and methods of administration of poison, mode of action of poison, medico-legal aspects in poisoning case.

Module II: Collection, Preservation & isolation techniques

Collection and preservation of biological evidences (viscera and /or body fluids) and circumstantial evidences in fatal and survival cases. Submission of samples to the laboratory, Postmortem examination, specific analysis plan / approach to toxicological examinations of poisoning samples. Classification of matrices. Isolation and Extraction of poison/ drug by various classical and modern methods using instrumental techniques

Module III: Extraction, Isolation & Identification of drugs

Systematic Extraction, Isolation, Identification, Estimation of following poisons from viscera, blood and urine

- (i) Common narcotics (as poisons): opium and its derivatives.

- (ii) Barbiturates, Benzodiazepines derivatives, Amphetamines.
- (iii) Insecticides/ Pesticides: Organochloro, organophosphorus and carbamates.
- (iv) Common inorganic poisons, salts of Arsenic, Mercury, Lead and Cyanides.

Module IV: General Study of Plant and Animal Poison

Plant poisons: Nature, type, mode of action, extraction, isolation, Identification of the following:

- (i) Poisonous seeds: *Abrus precatorius*, *Atropa belladonna*, *Argemone mexicana*, *Cerbera thevetia*, *Croton tiglium*, *Datura fastuosa*, *Ricinus communis*.
- (ii) Poisonous fruits: *Semicarpus anacardium*, *Urginea scilla*.
- (iii) Poisonous roots: *Digitalis*, *Aconitum napellus*, *Plumbago rosea*.

Animal Poisons: Snake venom, composition, site of action, mode of action, effect on the body as a whole, and tests for identifications.

Module V: Metabolism and excretion of poisons

Introduction, pathways of drug-metabolism-non synthetic pathway or phase- i reactions like oxidation, hydroxylation, n-and -o dealkylation and sulphoxide formation, synthetic pathways or phase ii reactions like conjugation, acetylation, methylation of drugs/poisons (alcohols, barbiturates, amphetamines and opiates)

Text Books & References:

- Khan, JaVed I., Ho, Mat H. Analytical Methods in Forensic Chemistry. New York: Working Procedure Manua Chemistry/Toxicology/Explosives/Narcotics, DFS Pub. New Delhi
- Kennedy, Thomas J., Christian, Jr., Donnell Basic Principles of Forensic Chemistry, Springer
- Saferestein, Criminalistics: An Introduction to Forensic Science. Prentice Hall
- Maudham.B.et.al; Vogel's Textbook of Quantitative Chemical. Analysis, Longman
- John D. De Haan; Kirk's Fire Investigation, Prentice Hall Eaglewood Cliffs, N.J
- Yinon J; Modern Methods & Application in Analysis of Explosives, John Wiley.
- C.A. Watson; Official and standardized Methods of Analysis. Royal Society of Chemistry, UK.
- Goutam, M. P. and Goutam S Analysis of Plant Poison, Selective & Scientific Books.
- Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi.
- Curry A.S; Analytical Methods in Human Toxicology, Part II, CRC Press Ohio

Course code	Course name	L	T	P	C
FRS21041	FORENSIC DRUG CHEMISTRY	2	1	0	3

Course Objective

1. To introduce basics of forensic drug chemistry
2. To introduce Classification of Drugs commonly encountered
3. To introduce analysis of drugs
4. To introduce Instrumental analysis of Narcotic drugs, Depressants, Barbiturates, Methaqualone, Benzodiazepines, Stimulants etc.
5. To introduction Laws related to forensic interest

Course Outcomes

CO1: Build their knowledge of basic concepts of forensic drug chemistry

CO2: Define classification of drugs commonly encountered

CO3: Explain analysis of drugs

CO4: Appraise their knowledge about different Instrumental analysis methods of Narcotic drugs, Depressants, Barbiturates, Methaqualone, Benzodiazepines, Stimulants etc

CO5: Appraise their knowledge about Laws related to forensic interest

Course Content

Module I: Introduction to Forensic Drug Chemistry

Introduction, Classification and characterization of NDPS drugs, Search & Seizure, Sampling procedure, Forwarding of sample to FSL, Sample preparation and extraction for analysis, Reporting of drug cases, Drug abuse, Drug addiction and its problems.

Module II: Classification of Drugs commonly encountered

Narcotics, Depressants, Stimulants, Hallucinogens, Designer drugs, Club drugs and Date rape drugs, their active principles, signs and symptoms of various drugs, their fatal dose and fatal period.

Module III: Analysis of Drugs

Narcotic drugs, Depressants, Barbiturates, Methaqualone, Benzodiazepines, Stimulants, Hallucinogens, Designer Drugs, Club drugs, date rape drugs and precursors by Field test kits for drugs and precursors using colour test and Thin layer chromatography.

Module IV: Instrumental analysis

Narcotic drugs, Depressants, Barbiturates, Methaqualone, Benzodiazepines, Stimulants, Hallucinogens, Designer Drugs, Club drugs, date rape drugs and precursors by HPTLC, UV-Vis spectrophotometry, Gas Chromatography, HPLC, GC-Mass Spectrometry and LC-Mass Spectrometry, Raman Spectroscopy and FTIR.

Module: Laws related to forensic interest

Common terminology and NDPS Act, Small quantity and commercial quantity and extent of punishment.

Text & References:

- Kennedy, Thomas J., Christian, Jr., Donnell Basic Principles of Forensic Chemistry, Springer
- Saferstein, Criminalistics: An Introduction to Forensic Science. Prentice Hall
- Maudham.B.et.al; Vogel's Textbook of Quantitative Chemical. Analysis, Longman
- John D. DeHaan ; Kirk's Fire Investigation, Prentice Hall Eaglewood Cliffs, N.J
- Yinon J; Modern Methods & Application in Analysis of Explosives, John Wiley.
- C.A. Watson; Official and standardized Methods of Analysis. Royal Society of Chemistry, UK.
- Goutam, M. P. and Goutam S Analysis of Plant Poison, Selective & Scientific Books, New Delhi.
- A Burger; Medicinal Chemistry, Vol. II, Wiley Interscience, New York; (1970)
- A.I Vogel; Textbook of Practical Organic Chemistry including Qualitative Organic Analysis; ELBS, Essex (1971)
- Boudreau, JE et al – Arson & Arson Investigation, Surevey& Assessment National Institute of Law Enforcement, U.S Dept of Justice, US Govt. Printing Press (1977)
- D.A. Skoog, D.M. West and F.J. Holler; Analytical Chemistry: An Introductin; SaundersCollege Publishing, Philadephia, USA, (1994)
- Dettean, J D; Kirk's Fire Investigation, 5thed, Prentice Hall, Eaglewood Cliffs, N.J (2002)
- F. Waltch; Principles and Methods of Chemical Analysis, 2nd Ed.; Prentice Hall; (1966)
- I.L. Finar; Organic Chemistry Vol. II; Longmans, Essex; (2003)

Course code	Course name	L	T	P	C
FRS22043	ADVANCE FORENSIC CHEMISTRY AND TOXICOLOGY LAB	0	0	4	2

Course objective:

1. To teach detection of metallic poisons
2. To teach detection and determination of insecticides and pesticides, narcotics and psychotropic substances by spot colour tests, chromatographic methods
3. To teach Analysis of illicit liquor alcohol
4. To teach analysis of volatile, non-volatile poisons and vegetable poisons
5. To teach Instrumental analysis of drugs or toxic substances using uv-visible spectrophotometer and colorimeter
6. To teach Examination of petroleum products such as petrol, kerosene, diesel
7. To teach Analysis of phenolphthalein (qualitative) in bribe trap cases.

Course outcome

CO1: Detect metallic poisons

CO2: Perform detection and determination of insecticides and pesticides, narcotics and psychotropic substances by spot colour tests, chromatographic methods

CO3: Perform Analysis of illicit liquor alcohol

CO4: Analyse volatile, non-volatile poisons and vegetable poisons

CO5: Apply different Instrumental analysis method of drugs or toxic substances using UV-visible spectrophotometer and colorimeter

CO6: Examine petroleum products such as petrol, kerosene, diesel

CO7: Investigate bribe trap cases by phenolphthalein method.

Course contents:

- Detection of metallic poisons (arsenic and mercury)
- Detection and determination of insecticides and pesticides by spot colour tests, chromatographic methods.
- Detection and determination of narcotic drugs spot colour tests and chromatographic methods.
- Detection and determination psychotropic substances by spot colour tests and chromatographic methods.

- Analysis of illicit liquor alcohol.
- Analysis of volatile and non-volatile poisons.
- Analysis of vegetable poisons
- Instrumental analysis of drugs or toxic substances using uv-visible spectrophotometer and colorimeter.
- Examination of petroleum products such as petrol, kerosene, diesel
- Analysis of phenolphthalein (qualitative) in bribe trap cases.

Course code	Course name	L	T	P	C
FRS22045	FORENSIC DRUG CHEMISTRY LAB	0	0	4	2

Course Objective:

1. To teach Detection and Systematic identification of Narcotics drugs
2. To teach Detection and determination psychotropic substances by spot colour tests and chromatographic methods
3. To teach use of UV-Visible Spectrophotometry of Narcotic Drugs and Psychotropic substances (opiates, and barbiturates, benzodiazepines and amphetamines)
4. To teach use of GC-MS analysis of Narcotic Drugs and Psychotropic substances (opiates, cannabis and barbiturates, benzodiazepines and amphetamines)
5. To teach use of Gas chromatography analysis of Cannabis

Course Outcome

CO1: Detect Narcotics drugs

CO2: Detect psychotropic substances by spot colour tests and chromatographic methods.

CO3: Apply the practical knowledge of UV-Visible Spectrophotometry to identify Narcotic Drugs and Psychotropic substances (opiates, barbiturates benzodiazepines and amphetamines)

CO4: Perform GC-MS analysis of Narcotic Drugs and Psychotropic substances (opiates, cannabis and barbiturates, benzodiazepines and amphetamines)

CO5: Perform Gas chromatography analysis of Cannabis

Course content

- Detection of opiates, cannabis and barbiturates, benzodiazepines and amphetamines by spot colour tests.
- Detection and Systematic identification of Narcotics drugs.
- Detection and determination psychotropic substances by spot colour tests and chromatographic methods.
- To perform UV-Visible Spectrophotometry of Narcotic Drugs and Psychotropic substances (opiates, and barbiturates, benzodiazepines and amphetamines)
- To perform GC-MS analysis of Narcotic Drugs and Psychotropic substances (opiates, cannabis and barbiturates, benzodiazepines and amphetamines)
- To perform Gas chromatography analysis of Cannabis.

FOURTH SEMESTER

COURSE CODE	COURSE NAME	L	T	P	C
FRS21046	RESEARCH METHODOLOGY & QUALITY MANAGEMNET	2	1	0	3

Course objective:

1. To introduce the nature and classification of research design and the types of research
2. To introduce the history of research, types of research
3. To introduce how to apply research methods in forensic science
4. To introduce sample analysis and hypothesis testing.
5. To introduce the evaluation of data and its uses.

Course outcome:

CO1: Remember the nature and classification of research design and the types of research

CO2: Understand history of research, types of research

CO3: Apply research methods in forensic science.

CO4: Analyze sampling concept and concepts of testing hypothesis such as chi square, ANOVA, factorial design and learn to apply it

CO5: Evaluate the data - uses, advantages, disadvantages, types and sources and types of measurement scales and create skillful research reports

Course contents:

Module I: Research & Research design

Meaning of research, objectives of research, motivation in research, types of research.

Research design: need for research design, features of a good design, different research designs.

Sampling: principles, methods, types of sampling

procedures in research: identification of the problem, literature survey, reference collection, familiarity with ideas and concept of investigation, qualitative and quantitative analysis, results writing a research paper and thesis.

Module II: Data collection and analysis

types of data, collection of data, double blind procedures, incidence and prevalence studies, data analysis: measures of central tendency, measures of dispersion, measures of asymmetry, methods of correlation, types of correlation (pearson rand rho); regression analysis.

Module III: Hypothesis and statistics

Hypothesis testing: problems and hypothesis, variables and type of variables, parametric and nonparametric statistics; level of significance, the various nonparametric tests with one sample, two samples and k-samples, chi square analysis, analysis of variance (anova).

Module IV: Quality Management

Management requirements- General requirements for the competence of testing and calibration laboratories, quality system, document control, internal audit, corrective and preventive actions.

Module V: Technical requirements

Test and calibration methods, equipment, measurement traceability, sampling and handling of test and calibration items, assuring the quality of tests and calibration results, reporting of results, LIMS, validation and safety equipment.

Text books & References:

- Kerlinger, F., Foundations of Behavioural Research, Surjeet Publications, Delhi, 1983.
- Rajamanickam, M., Statistical Methods in Psychological and Educational Research, Concept Publishing Co. New Delhi, India, 1983.
- Smith, Jonathan, A. (Ed.), Qualitative Psychology: A Practical Guide to Research Methods, Sage Publications, 2003.
- Woodworth and Schlosberg, Experimental Psychology, Methuen and co. ltd, London, 1971.

Course Code	Course Name	L	T	P	C
FRS24047	PROJECT WORK	0	0	0	

Course Objective:

1. To design research-oriented project on particular topic.
2. To search scientific literature on selected research-oriented project work.
3. To identify/search the recent advances in current research.
4. To conduct experiment scientifically with safety

Course Outcome:

- CO1: Plan an independent and sustained critical investigation and evaluation of chosen topic.
- CO2: Demonstrate the necessary skills to become productive, ethical, and independent.
- CO3: Apply qualitative and/or quantitative evaluation processes to original data
- CO4: Demonstrate proficiency in laboratory techniques necessary
- CO5: Apply ethical standards of conduct in the collection and evaluation of data.

Course Contents:

The students will be required to undertake a research project in the field of the forensic sciences and in the area of interest to the student. This should be done in consultation with the faculty supervisor and agency supervisor under whom he / she is getting trained. The project report will be around 100 pages and contain chapters as follows:

Chapter I: Introduction

Chapter II: Review of Literature

Chapter III: Methodology

Chapter IV: Data Analysis and Results

Chapter V: Discussion of Results

Chapter VI: Summary and Conclusion

The research should be original and should be action oriented in that the results should be able to throw light on some of the important unexplored areas that would be of practical use to the forensic experts.

Students are expected to decide on the specific project area and title, and carry out substantial portion of the literature survey during the end of their 3rd semester. After the end of their 3rd semester TEEs, a presentation will be made to the Student Project Monitoring Committee constituted by the HOD. The Project Work may be a work based on theoretical analysis, modelling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, etc. or a combination of these. The final project report will be evaluated by a panel of examiners consisting of HOD, Guide and Co-guide (wherever applicable) and an External Examiner. An oral examination for the same will be conducted.

The following weightage is assigned at each stage of Student Project evaluation.

Activity	Weightage	Remarks
1 st Review (acceptance of project title)	5%	To be held after the completion of 3 rd semester TEEs
2 nd Review	40%	To be part of the continuous assessment during the IV semester
3 rd Review (Final)	50%	To be scheduled during the TEE period as Viva Voce examination
Submission of Project Report to the Department	5%	Two weeks before the viva-voce exam

Course code	Course name	L	T	P	C
FRS21025	ADVANCE QUESTIONED DOCUMENT	2	1	0	3

Course objective:

1. To introduce the different types of questioned documents and handling process.
2. To introduce different characteristics of handwriting and their identification.
3. To introduce different types of forgery and their detection methods.
4. To introduce different types of typewritten documents and their examination methods.

Course outcome: After completion of this course students will be able to

CO1: Define different types of questioned documents and their handling.

CO2: Build knowledge about different characteristics of handwriting and Identification

CO3: Identify different types of forgery and typewritten documents.

CO4: Examine different types of forgeries and type-written documents

Course contents:

Module I: Questioned Documents

Definition, nature and history of document examination, classification of documents-admitted, request and typescript specimens, holographic documents, care and handling of documents, examination of documents, basic tools needed for forensic document examination - hand lens, stereo microscope, electrostatic detection device (EDD), video spectral comparator (VSC)

Module II: Handwriting

Introduction, principle, class & individual characteristics; factors that causes changes in handwriting, examination of handwriting, natural variations in handwriting range of variations (consistency), fundamental divergences in handwriting. Interpretation of these two in relation of identification of handwriting, individual characteristics, significant individual characteristics, relative weightage of characteristics of handwriting, consideration of various writing instruments used in writing.

Module III: Forgeries and their detection

Various types of forgeries, examination of genuine handwriting, examination of alterations, erasers, overwriting, additions, obliterations and disguised writing, decipherment of secret, indented and charred document.

Module IV: Examination of signatures

characteristics of genuine & forged signatures, examination of buildup of documents, identification of writer of forged writings/signatures. Importance of tremor in identification of writings and signatures, difference between tremors of fraud and genuine tremors in writings and signatures, hesitations, factors responsible for variations (under threat, while travelling, illness, old age, mental state, etc.)

Module V: Examination of type writings and other documents

Identification of type writings – identification of typist, identification of printed matter – various types of printing of security documents, printing of currency notes, examination of counterfeit currency notes, passports, visa, stamp papers, postal stamps, computer printout, identification of dot-matrix, ink-jet and laser printers, examination of seal and other mechanical impressions.

Text & References:

- Huber, A. R. and Headride, A.M. (1999) : Handwriting identification : facts and fundamental CRC LLC
- Ellen, D (1997) : The scientific examination of Documents, Methods and techniques. 2nd ed., Taylor & Francis Ltd.
- Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principles)
- Madinger J. and Zalopany, A.R. (1999) : Money Laundering CRC Press.
- Manning, C.A (1999) : Financial Investigations and Forensic Accounting CRC Press.
- Harrison, W.R. : Suspect Documents & their Scientific Examination, 1966, Sweet & Maxwell Ltd., London.
- Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsevier North Holland Inc., New York.
- Brewster, F. Contested Documents and Forgeries, The Eastern Law House, Calcutta. 1932.
- Ames: Ames on Forgery, 1900, Ames Rellingson Co., New York.
- Conway, J.V.P. Evidential Documents, 1959, Charles C. Thomas, Illinois.

Course code	Course name	L	T	P	C
FRS21026	ADVANCE FINGERPRINT EXAMINATION	2	1	0	3

Course Objectives:

1. To introduce basics of fingerprint.
2. To introduce different patterns of fingerprints.
3. To introduce different fingerprint classification systems.
4. To teach the recording and examination of fingerprints and court room presentation.
5. To introduce Automatic Fingerprint identification system.

Course outcome: After completion of this course students will be able to

CO1: Describe history and development of fingerprints system.

CO2: Discuss AFIS

CO2: Identify different class and individual characteristics of fingerprint.

CO3: Classify fingerprint patterns.

CO4: Examine fingerprint evidences and other impressions.

Module I: Introduction & history

History and development of finger prints as a science for personal, identification, structure of ridged skin, factor affecting alignment of ridges, transition of configuration, types, and variations in finger prints: Causes and genetics, population variations.

Module II: Classification of Fingerprints

Classification of finger Prints, pattern types, pattern area, Henry system of classification (Primary to tertiary and key classification) extension of Henry system searching of finger prints, classification system, single finger print, Finger Prints Bureau. Basics of taking inked prints, taking inked prints of living and dead: Plain and rolled prints, other devices and material for recording prints.

Module III: Development of fingerprints

Development of latent fingerprints, conventional methods of development of fingerprints– fluorescent method, magnetic powder method, fuming method, chemical method. Digital imaging and

enhancement of fingerprints, application of laser and other radiations to develop latent fingerprints, metal deposition method and development of latent prints on skin.

Module IV: Examination of fingerprint

Systematic approach to latent print processing, preserving and lifting of finger prints. Photography of Finger Prints, comparison of finger prints: basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics Presentation of expert evidence on finger prints in court.

Module V: Automated Fingerprint Classification Systems

History of pattern recognition-development of fingerprint classification system, Automated Finger Print Identification system (AFIS) and its variants, digital Image processing of finger prints and their enhancement Mathematical model of fingerprint topology, Fingerprint verification system, Fingerprint representation, Fingerprint matching. Transition of configuration.

Text & references:

- David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press (1999)
- E. Roland Menzel; Fingerprint Detection with Lasers, 2nd Ed, Marcel Dekker, Inc. USA (1999)
- James F. Cowger; Friction Ridge skin, CRC Press London,(1993)
- Mehta, M.K; Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay (1980)
- Moenssens; Finger Prints Techniques, Chitton Book Co. Philadelphia, NY (1975)
- Chatterjee S.K.; Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata (1981)
- Cowger, James F; Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY (1993)
- Cook Nancy; Classifying Finger Prints, Innovative learning pub. Mento Park (1995)
- Cossidy M.J; Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada (1980)
- J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press (2000)
- Smith B.C, Holland MM, Sweel DL & Dizinno. A; DNA &Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA (1995)
- Hillison, S; Dental Anthropology, Cambridge Univ. Press, UK (1996)
- Kasprzak J; Possibilities of Cheiloscopy in Forensic Science (1980)
- Iannarelli, A V; Ear Identification, Forensic Identification series, Paramount (1989).
- Henry C. Lee & R. E. Ganesslen; Advances in Finger Print Technology, CRC Press, London (1991)

Course code	Course name	L	T	P	C
FRS22029	ADVANCE QUESTIONED DOCUMENT AND FINGERPRINT LAB	0	0	4	2

Course objective:

1. To teach identification of handwriting characteristics in normal and disguised writing.
2. To teach the identification of different types of forgeries.
3. To teach examination alterations-additions, overwriting and obliteration in the documents
4. To teach examination of erasures-mechanical and chemical erasures
5. To teach decipherment of secret, intended writing and charred document
6. To teach the ink analysis by TLC.
7. To teach different class and individual characteristics of fingerprint.
8. To introduce different methods of fingerprint classification and development of latent prints

Course outcome:

CO1: Define different characteristics of handwriting and fingerprint.

CO2: Classify different fingerprint patterns.

CO3: Examine alterations-additions, overwriting and obliteration and use of erasures-mechanical and chemical erasures on documents

CO4: Detect different types of forgeries

CO5: Perform TLC for ink analysis

Course contents:

- Identification of normal/disguise writing.
- Detection of forgeries including traced and simulated forgery.
- Examination alterations-additions, overwriting and obliteration in the documents.
- Examination of erasures-mechanical and chemical erasures.
- Decipherment of indented writings, secret writings and charred documents.
- Examination of ink by TLC and spectrophotometry.
- To perform 10-digit classification of fingerprints
- To perform ridge tracing and ridge counting
- To identify and compare ridge characteristics
- To develop latent fingerprints with physical and chemical methods.

SPECIALIZATION IN BIOLOGICAL SCIENCE

Course code	Course name	L	T	P	C
FRS21030	ADVANCE FORENSIC SEROLOGY	4	0	0	4

Course Objectives:

1. To introduce basic concepts and terminologies of immunology
2. To introduce to composition, function, collection of blood and blood group systems
3. To introduce different method of ABO blood grouping
4. To introduce methods of identification of blood and analyze blood stain patterns
5. To introduce Morphology and identification of semen evidence

Course Outcomes:

CO1: Define basic concepts and terminologies of immunology

CO2: Discuss the composition, function, collection of blood and blood group systems

CO3: Illustrate the different method of ABO blood grouping

CO4: Identify seminal stains.

CO5: Analyse Blood stain patterns

Course contents:

Module I: Immunology

Immune system, immune response, innate and acquired immunity, antigens, antibodies, haptenes and adjuvants, immunoglobulin- types, physico-chemical properties and function, raising of anti-sera, lectins - their forensic significance.

Module II: Blood

composition and functions, collection and species identification, structure and function of serum proteins, Haemoglobin and its variants, haptoglobins. **Blood groups** – history, biochemistry and genetics of abo, rh, Mn and other systems. Identification of blood, chemical test for blood identification, species origin determination in blood stains.

Module III: Body fluids

Methods of abo blood grouping (absorption-inhibition, mixed agglutination and absorption elution) from blood stains and other body fluids/stains viz. Menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail. Secretors and non-secretors. Blood groups that make racial distinctions.

Module V: Forensic identification of biological fluids and stains

composition of semen and morphology of spermatozoa, identification of semen, qualitative assays of seminal fluids: acid phosphatase, microscopic identification of spermatozoa, oligospermia and azoospermia. Identification of azoospermia semen stains, prostate specific antigen (PSA, p30) as an indicator of semen. Saliva: composition, identification tests.

Module IV: Blood pattern analysis

Introduction, history of bloodstain pattern interpretation, properties of human blood, size, shape and directionality of bloodstains, spattered blood, other bloodstain patterns, interpretation of bloodstain on clothing and footwear.

Text & References:

- Fraser, Roberts J.A (1965): An introduction to Medical Genetics.
- Chatterjee, C. C- (1975): Human Physiology.
- Boorman, K. E: Blood Group Serology, Churchill, and Lincoln, P. J. (1988)
- Race, R. R. and Sangar, R. (1975): Blood Groups in Man. Blackwell Scientific, Oxford.
- Saferstein, R. (1982): Science Handbook, Vol. I, II and III, Prentice Hall, New Jersey.
- Barris, H. and Hopkinson, D. A. (1976): Handbook of Enzyme, Electrophoresis, Elsevier, North, Holland, New York.
- Gilblet, E. (1969): Marker's in Human Blood, Davis, Pennsylvania.
- Culliford, B. E. (1971), The examination and Typing of Blood Stains, US Deptt. of Justice, Washington. Chowdhuri, S. (1971): Forensic Biology, B P R & D, Govt. of India.
- Dunsford, I. and Bowley, C. (1967): Blood Grouping Techniques, Oliver & Boyd, London.
- Eckert, W. G. & James, S.H. (1989): Interpretation of Blood Stain, Evidence,

Course code	Course name	L	T	P	C
FRS21031	DNA FINGERPRINTING	2	1	0	3

Course Objective

1. To introduce to the molecular structure of DNA
2. To introduce the basic concepts of DNA fingerprint
3. To introduce evaluation of STR profiling
4. To introduce the significance of DNA fingerprinting in Forensic Science
5. To introduce the new emerging technologies in the area of DNA profiling

Course Outcomes:

- CO1: Define the molecular structure of DNA
- CO2: Discuss the basic concepts of DNA fingerprint
- CO3: Explain the significance of DNA fingerprinting in Forensic Science
- CO4: Appraise their knowledge about new emerging technologies in DNA Profiling
- CO5: Evaluate STR profiles

Course content:

Module I: Human genetics

Heredity, alleles, concept of genetics, Chemical structure of DNA and RNA, Overview of DNA replication, transcription and translation, sources of DNA, Procedure for collection and preservation of biological sample for DNA analysis.

Module II: DNA Profiling

Introduction, History of DNA fingerprinting, molecular biology of DNA, variations and polymorphism.

DNA extraction: Organic and inorganic extraction methods, Commercial kit

DNA typing system- RFLP analysis, PCR amplifications, sequence of polymorphism, Analysis of SNP, Y-STR, Mitochondrial DNA, Evaluation of results

Module III: DNA statistics

Frequency estimate calculation, interpretations, allele frequency determination, Paternity/ Maternity index, Sibling index, Probability of match.

Human Genome project: Introduction, History, Goal, Benefits, Social, Ethical and legal issues, DNA forensic databases, issues associated with DNA data banking, Potential benefit of DNA data banking.

Module IV: Forensic Significance of DNA Profiling

DNA profiling applications in disputed paternity cases, child swapping, missing person's identity, civil immigration, veterinary, wild life and agriculture cases. legal perspectives – legal standards for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad.

Module V: Advancement in DNA Profiling

limitations of DNA profiling. Population databases of DNA markers –STRs, Mini STRs, SNPs. New & Future technologies: Analysis of SNP, DNA chip technology- Microarrays Cell-free DNA, Synthetic DNA, Touch DNA, LCN DNA.

Text & References:

- Celledine, C.R., Understanding DNA: The molecule and how it works, A cad, Press London, 1992.
- Hartl, D.L., Friedfelder, D. and Synder L. A., Basic Genetics, Jones and Bartlet, Boston, USA, 1988.
- Glover, D.M., and Hames, B.D., DNA cloning, Vols. 1 to 4, Oxford University Press, Oxford, UK, 1995.
- Freid fielder, David, Molecular Biology; Narosa, USA, 1995.
- Simon, Easteal, DNA profiling, Principles, pitfalls and potential, Harwood Acad. Publishers, 1992.
- Gardner, Eldon J, Human Heredity, John Wiley and sons, USA, 1983.
- Burns, George V., The science of Genetics – An Introduction to heredity, Macmillan, 1980.
- Jorg T. Epplen Thomas Lubjumhin, DNA Profiling and DNA Fingerprinting; Birkhauser Verlag, Basel,1995.
- K.C. Malhotra, Statistical Methods in Human Population Genetics, Indian Statistical Institute, Calcutta, 1988.
- Kirby, Lorne T, DNA Fingerprinting: An Introduction, W.H Freeman & Co. New York, 1990.
- Krawczak, M., and Schmidtke, J., DNA Finger Printing, Bios Scientific, Oxford, UK, 1995.
- Daniel, W.W., Biostatistics, John Wiley & Sons, USA, 1995.
- Working Procedure Manual: DNA, BPR&D Publication, 2000

Course code	Course name	L	T	P	C
FRS22035	ADVANCE SEROLOGY AND DNA TYPING LAB	4	0	4	2

Course Objectives:

1. To teach blood group determination from fresh and dried blood
2. To teach confirmatory test for blood identification
3. To teach cross over electrophoresis
4. To teach analysis of bloodstain pattern
5. To teach preparation of gel plates
6. To teach DNA extraction, quantitation and PCR.

Course Outcomes

- CO1: Identify blood group from fresh and dried blood
- CO2: Perform confirmatory test for blood identification
- CO3: Perform cross over electrophoresis
- CO4: Analyse blood stain pattern
- CO5: Prepare gel plates for electrophoresis
- CO6: Perform DNA extraction, quantitation and PCR

Course contents:

- To determine blood group from blood samples.
- to carry out the crystal test on a blood sample.
- To identify blood samples by chemical tests.
- To carry out cross-over electrophoresis.
- To study the correlation between impact angle and shape of bloodstain.
- To identify the point of convergence from the bloodstain patterns.
- Organic extraction of DNA from blood.
- Extraction of DNA from saliva.
- Extraction of DNA from other body fluids.
- Isolation of DNA from hairs.
- Quantification of DNA

Course code	Course name	L	T	P	C
FRS21040	EXPLOSIVE ANALYSIS AND POST-BLAST INVESTIGATION	2	1	0	3

Course Objective

1. To introduce explosives and its classification
2. To introduce mechanism of explosion
3. To introduce Processing of scene of crime of explosion
4. To introduce Analysis of explosives
5. To introduce Laws related to Forensic interest

Course Outcomes

- CO1: Define explosives and its classification
- CO2: Explain mechanism of explosion
- CO3: Apply their knowledge in Processing of scene of crime of explosion
- CO4: Appraise their knowledge about Analysis of explosives
- CO5: Appraise their knowledge about Laws related to Forensic interest

Module I: Introduction to Explosive and Explosion

Classification of explosives- primary, secondary explosive, Detonators, initiating devices Safety fuse, Pyro technique, IEDs and firing mechanism of IEDs.

Module II: Mechanics of Explosion

The generation of shock wave and the effect of fragmentation, Types of explosions, Laws related to Explosive and Explosion.

Module III: Processing of scene of crime of explosion

Role of forensic scientist in post-blast investigation, documentation of bomb scene, collection of post blast residue, evaluation and assessment of explosion site and reconstruction of sequence of events.

Module IV: Analysis of explosives

Methods for extraction of explosive from post blast material/ debris, Qualitative analysis of explosives and explosion residue by colour test and instrumental techniques.

Module V: Laws related to Forensic interest

Explosive Act, 1884 and Explosive Substance Act 1908.

Text Books & References:

- Alexander Beveridge. Forensic Investigation of Explosives, CRC Press, 2nd edition, 2011
- Explosive Substances Act, 1908
- J. Akhavan. The Chemistry of explosives, RSC Publishing, 2015
- J. Yinon, S. Zitrin. Modern Methods and Applications in Analysis of Explosives, Wiley Publishers 1996
- Working Procedure Manual-Explosives

Course code	Course name	L	T	P	C
FRS21042	ADVANCE ANALYTICAL INSTRUMENTATION	2	1	0	3

Course Objective

1. To introduce fundamental principle of spectroscopy methods
2. To introduce X- ray spectrometry technique
3. To introduce Analytical separation & Chromatographic Methods
4. To introduce microscopic techniques

Course Outcomes

- CO1: Define fundamental principle of spectroscopy methods
- CO2: Explain X- ray spectrometry technique
- CO3: Develop knowledge about Analytical separation & Chromatographic Methods
- CO4: Appraise their knowledge about microscopic techniques

Course Content

Module I: Spectroscopy methods

Fundamental principles and forensic applications of Ultraviolet-visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy, atomic emission spectroscopy and mass spectroscopy, Colorimetric analysis and Lambert-Beer law, Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and Instrumentation.

Module II: X- ray spectrometry

Fluorescence, energy Dispersive X-ray analysis (EDX), wavelength Dispersive X-ray analysis (WDX), X-ray diffraction, Augur effect, XRF (X-ray fluorescence), Small Angle X-ray Scattering (SAXS), Fourier Transform spectrophotometry (FTIR).

Module III: Analytical separation & Chromatographic Methods

Chromatographic methods. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography, liquid chromatography, HPLC, HPTLC, Mass spectroscopy and liquid chromatography–mass spectrometry,

Module IV: Microscopic techniques

Concept of Absorption, emission and scattering, Optical microscopy: Simple microscope, compound microscope & comparison microscope. Electron microscopy: Scanning Electron Microscope, Transmission electron microscope, Energy Dispersive X- ray Spectroscopy (EDAX).

Text & References:

James w. Robinson; Atomic Spectroscopy, 2nd ed. Revised & Expanded, Marcel Dekkar, inc. NY, (1996).

V.B. Patania; Spectroscopy, Campus Books International, (2004)

Jerry Workman, Jr, Art Springsteen; Applied Spectroscopy- A compact reference for practitioners, Academic Press (1997) 4. N. Subrahmanyam & Brij Lal; A text book of Optics, S. Chand & co. (2004) Gurdeep R. Chatwal & Sham k. Anand; Instrumental Methods of Chemical Analysis, Himalaya Pub. House (2004)

Hobert H. Willard, Lynne L. Merrett Jr, Jhon A Dean Frank A. Settle Jr; Instrumental Methods of Analysis, 7th ed. CBS Pub & Distributors (1986)

R.S. Khandpur; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi (2004)

John A Dean; Analytical Chemistry Handbook, Tata McGraw Hill Inc. (1995)

K.C. Thompson & R.j. Renolds; Atomic Absorption Fluorescence & Flame Emission Spectroscopy, A practical approach, 2nd ed. Charles Griffin & co. (1978)

Robert M. Silverstein & Francis X Webster; Spectrometric Identification of organic Compounds, 6th ed. John Wiley & Sons, Inc (1997)

Course code	Course name	L	T	P	C
FRS22044	EXPLOSIVE ANALYSIS & POST BLAST INVESTIGATION LAB	0	0	4	2

Course Objective:

1. To teach analysis of low explosives by chemical/color test
2. To teach analysis of high explosives by color test
3. To teach analysis of high explosives by TLC
4. To teach analysis of low explosives and of high explosives using Instrumental techniques

Course Outcome

CO1: Identify low explosives by chemical/ color test

CO2: Perform color test for high explosive

CO3: Analyse high explosives by TLC

CO4: Analyse low and high explosives with different instrumental techniques

Course Content

- Analysis of low explosives by chemical/color test.
- Analysis of high explosives by color test.
- Analysis of high explosives by TLC.
- Analysis of low explosives using Instrumental techniques.
- Analysis of high explosives using Instrumental techniques.