

B.Sc. (H) Forensic Science

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

BSCF-PEO1	Graduates will have successful careers in academia, research organizations and different Government, Non-Government sectors.
BSCF-PEO2	Develop approaches with a concern for accuracy and precision in significance to science and technology.
BSCF-PEO3	Identify, formulate and solve scientific problems based on design, experiment, data interpretation and analysis of results
BSCF-PEO4	Investigate various problems and ways to solve which will be very beneficial to society.

PROGRAM OUTCOMES (POs)

At the end of the program the student will be able to:

PO1	Apply theoretical knowledge of principles and concepts of Forensic Science to practical problems.
PO2	Develop approaches with a concern for accuracy and precision in significance to science and technology.
PO3	Identify, formulate and solve scientific problems based on design, experiment, data interpretation and analysis of results
PO4	Investigate various problems and ways to solve which will be very beneficial to society.
PO5	Show ability in using modern tools for design and analysis.
PO6	Work in teams on multi-disciplinary projects in research organizations and industries.
PO7	Build up communication skills, both written and oral, to specialized and non-specialized audiences.
PO8	Demonstrate the ability to undertake a major, individual, Forensic-related project and reporting the results in a full scientific report and oral and poster presentation
PO9	Develop the ability to critically evaluate theories, methods, principles, and applications of pure and applied science.

FIRST SEMESTER

Course: Introduction to Forensic Science (FRS11001)

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Unit I: Development and growth of forensic science

Introduction to Forensic science –Definition, nature, need and function; Laws and Principles, basics of Forensic Science; Historical development and scope of Forensic Science in India; Branches of Forensic Science, its utilization at the scene of crime and in the courts

Unit II: Forensic Science Laboratory

Forensic Science Laboratory – Growth of Forensic Science Laboratories in India – Central and State level laboratories, Services and functionalities provided by various FSLs, Various divisions in the FSL – Ballistics, Biology, Chemistry Documents, Physics, Psychology, Serology, Toxicology; Mobile forensic science laboratory: its functions and utility.

Unit III: Law of Evidence

The law of evidence, testimonial and real evidence and admissibility of scientific evidence in the court of Law; Law related to interrogation and interviewing of the criminals; First Information Report, types of cognizable and non-cognizable offences; mental disorder and acceptance of evidence in court; child witness and acceptance of evidence in the court.

Unit IV: Criminal Justice System

Introduction to Criminal Justice System; Different agencies involved in crime detection: Police, Medico-legal expert, Judicial officers.

Introduction to IPC (Indian Penal Code) and Cr.P.C – sections 291, 292 and 293. Indian Evidence Act – Introduction and Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 159. Court Testimony- admissibility of expert testimony, Court Procedure: Examination in chief, Cross Examination and Re-examination; Ethics in Forensic Science. International Justice System – an overview.

References:

- Bodziak, W., Footwear Impression Evidence (2ndEdn.) CRC Press, Boca Raton, Florida, 2000.
- DeForest, P., Gaensslen, R., and Lee, H., Forensic Science; an Introduction to Criminalistics, McGraw Hill, New York, 1983.
- Fisher, B., Techniques of Crime Scene Investigation (6thEdn.) CRC Press, Boca Raton, Florida, 2000.
- James, S. H. And Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
- James, S., and Eskerc, W., Interpretation of Blood Stain Evidence at Crime Scenes, (2ndEdn) CRC Press, Boca Raton, Florida, 1999.
- Saferstein, Richard, Criminalistics, An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
- Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rdEdn) Universal Law Publishing Co. Ltd. New Delhi, 2001.

Course: Biology - I (FRS11002)

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Unit I: The Cell

History of cell, Cell theory, Cell Structure, Function and Organization of Prokaryotes and Eukaryotes. Unicellular and Multicellular organisms, Structure of DNA and RNA. Cell cycle- mitosis and meiosis.

Unit II: Genetics

Mendelian Principles, Mendel's Laws, Sex linked inheritance, sex determination and crossing over – Karyotyping analysis, Chromosomal mapping,

Unit III: Human Physiology - I

Integumentary System, Respiratory System, Cardiovascular System, Musculoskeletal System

Unit IV: Human Physiology – II

Digestive system. Nervous System, Endocrine System, Reproductive System, Excretory System

Unit V: Biochemistry

Nutrition - BMR, Calorie value, Types of micronutrients and macronutrients in the body. Balanced diet, obesity
Proteins - structure, properties and functions. Carbohydrates - structure, properties and functions. Lipids – structure, properties and functions.

References:

- A.K. Jain. Textbook of Physiology (Volumes I and II) (7th ed.). Avichal Publishing Company, 2017.
- B.P. Pandey. Botany for Degree Students. S Chand & Co Ltd. New Delhi, 2010.
- B.P. Pandey. Plant Anatomy. S Chand Publishing, New Delhi, 2001.
- Gerard J. Tortora & Bryan Derrickson. Principles of Anatomy And Physiology (12th ed.). John Wiley & Sons Inc., 2008.
- N.M. Muthayya. Human Physiology. Jaypee Brothers Medical Publishers Private Limited, 2010.
- P.C. Trivedi & Aparna Pareek. Plant Morphology and Anatomy. RBD publisher, New Delhi. P.S. Verma & V.K. Agarwal. Environmental Biology (Principles of Ecology). S Chand Publishing, New Delhi, 2015.
- Priti Shukla, Shital P. Misra. An Introduction to Taxonomy of Angiosperms. Stosius Inc. Richard Crang, Sheila Lyons-Sobaski & Robert Wise. Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants. Springer International Publishing, 2018.
- S.N Pandey & P.S Trivedi. A Textbook of Botany Volume-I (12th ed). S Chand, 2015.
- S.S Bhojwani, S.P Bhatnagar & P.K Dantu. The Embryology of Angiosperms. Vikas Publication, 2014
- V. N. Naik. Taxonomy of Angiosperms. McGraw-Hill Higher Education, 1985

Course: Chemistry – I (FRS11003)

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Unit I: Some Basic Concepts of Chemistry

Dalton's atomic theory: concept of elements, atoms and molecules, Atomic and Molecular masses, Isotopes and isobars, Mole concept and molar mass, Percentage composition and empirical and molecular formula, Chemical reactions, stoichiometry and calculations based.

Unit II: Atomic Structure-I

Discovery of Electrons, protons and neutrons, Thomson's model and its limitations, Rutherford's model and its limitations and Bohr's model and limitations. Concept of shells and sub-shell, dual nature of matter and light, de Broglie relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals -Aufbau principle, Pauli exclusion principle and Hund's rule, electronic configuration of atoms, stability of Hund's rule.

Unit III - Atomic Structure-II

Radioactivity, Types of Radiations, Properties of radiations, Detection and measurement of radioactivity, Types of radioactive decay, The Group Displacement Law, Radioactive disintegration series, Rate of radioactive decay, half-life, Nuclear Reactions (Fission and fusion reactions), Mass defect, Carbon dating.

Unit IV- Introduction of inorganic chemistry

Types of bonds, Hybridisation and shape of simple molecules and ions, Valence Bond Theory and its limitations, Molecular Orbital theory, Coordination complexes and their nomenclature.

Unit V - Introduction of Organic Chemistry

Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper-conjugation, Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions (substitution and addition reactions), Markonikov's rule, anti-Markonikov's rule.

List of Books:

1. Darrell D. Ebbing, Steven D. Gammon, (2009) General Chemistry, 9th edition, Cengage Learning,
2. W.R. Robinson, J.D. Odom, and H.F. Holtzclaw, Jr., (1997) General Chemistry, Houghton Mifflin Co., 10th Ed, Boston.
3. J. R. Partington 1969 A History of Chemistry, Volume 2, Macmillan
4. Eding Darrel D, 1970 Introductory Chemistry
5. Odian George, 1990 General, Organic and Biological Chemistry

Course: Physics – I (FRS11004)

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Unit I: Calculus

Basic ideas of Limits, continuity, differentiation. Plotting functions.

Differential equations of first order, separation of variables and homogeneous equations, Linear Differential equation, Bernoulli's equation, Second order differential equation, Partial derivatives, exact and inexact differentials.

Unit II: Vector Analysis

Properties of vectors, Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Vector Operators. Gradient of a scalar field. Divergence and curl of a vector field.

Unit III: Mechanics, Elasticity & Fluid Dynamics

Motion, position and displacement, average velocity, average speed, acceleration, freely falling body, projectile motion, uniform circular motion, relative motion in one and two dimensions.

Newton's laws of motion, Interpretation and applications, Inertial and non-inertial frames and Pseudo forces. Centre of mass, Kepler laws. Elastic collision in Laboratory and C.M. system.

Energy, kinetic energy, work, work done by gravitational force, work done by spring force, power, work and potential energy, conservation of energy.

Rotation: The rotational variable, rotation with constant angular acceleration, relating linear and angular variables, kinetic energy of rotation.

Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, Poisson's ratio. Pascal's law and its applications. Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, critical velocity, Surface energy and surface tension, angle of contact, capillary rise.

Unit IV: Sound Waves

Simple harmonic motion, energy of a Simple Harmonic Oscillation. Compound pendulum. Decay of free vibrations due to damping, types of damping.

Types of waves, transverse and longitudinal waves, wavelength and frequency, speed of travelling wave, the wave equation, sound waves, speed of sound, intensity and sound level, the Doppler effect, shock waves. Production of ultrasonic waves.

List of Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
2. Mathematical Physics, H. K. Dass, S Chand Publisher
3. Mathematical Methods for Physics and Engineering, K. F. Riley, M. P. Hobson, S. J. Bence, Cambridge University Press.
4. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
5. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
6. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.

Course: Biology – I Lab (FRS12005)

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LIST OF PRACTICALS:

1. Qualitative analysis of sugar, proteins, lipids and nucleic acids.
2. Study of Enzyme (Amylase), study of the effect of substrate concentration on Enzyme activity.
3. Estimation of protein by Lowry method.
4. Staining Techniques, Simple, Negative staining, Gram Staining.
5. Study of aseptic techniques-preparation of cotton plugs for test tubes and pipettes, wrapping of Petri- plates and pipettes, transfer of media and inoculums.
6. Staining of bacteria.
 - a. Simple staining.
 - b. Gram's staining.

Course: Chemistry – I Lab (FRS12006)

1. Quantitative Analysis: Volumetric Analysis:

a) To determine the strength of a given solution of sodium hydroxide by titrating it against the standard solution of oxalic acid

(b) Determination of acetic acid in commercial vinegar using NaOH.

(c) Determination of alkali content – antacid tablet using HCl.

(d) Estimation of calcium content in chalk as calcium oxalate by permanganometry.

2. Qualitative inorganic analysis Analysis of simple salt containing one anion and cation from the following

Anions: Carbonate, sulphate, chloride, bromide, acetate, nitrate, borate, phosphate. cations: Lead, copper, iron, aluminum, zinc, manganese, nickel, calcium, strontium, barium, potassium and ammonium.

To prepare lyophobic and lyophilic sols for the following- (1) Fe(OH)_2 (2) As_2S_3 (3) Al(OH)_3 (4) Starch

Course: Physics – I Lab (FRS12007)

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List of Experiments:

1. Determination of rigidity modulus by dynamic method.
2. Determination of Young's Modulus by Flexure method.
3. Determination of coefficient of viscosity by Poiseuille's capillary flow method.
4. To determine the value of 'g' using Compound Pendulum.
5. Determination of frequency of a tuning fork by using a Sonometer.
6. Study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations) using objects of various geometrical shapes but of same mass.
7. To set up CRO for Sine and Square wave and to find their frequency and amplitude.
8. To study Lissajous Figures by using electrical circuit.

SECOND SEMESTER

Course: Crime Scene Investigation (FRS11008)

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Unit I: Crime Scene

Defining a crime scene, Importance, location and processing of crime scene. Types of Crime Scene: Indoor and outdoor, Primary and secondary and crime scenes based on size of evidence.

Unit II: Crime Scene Management

Crime scene Management – initial response, role of first responding officer, duty management; Role and qualities of an Investigating officer, Role of forensic scientists, forensic doctors, fire brigade and judiciary Securing and Recording the Crime Scene.

Protecting a scene of crime – various steps involved, contamination issues. Recording a crime scene: Crime Scene Survey, Forensic Photography, sketching, field notes, handling clues, modern aids. Crime Scene Reconstruction and its utility, case studies for reconstructing a crime scene with physical evidences; chain of custody.

Unit III: Crime Scene Evidence

Classification of crime scene evidence – physical and trace evidence, Definition, importance and types of physical evidences; Search, Collection and preservation of physical evidences, packing and forwarding of evidences to the Forensic Laboratory in crimes like murder, theft, extortion, explosion etc.

Unit IV: Forensic Examination of Fiber

Classification of fibers, Collection and preservation of fiber evidence. Preliminary examination, Identification and comparison of manufactured fibers (Microscopic examination, Dye composition, Chemical composition, other properties for examination), Significance of match.

Unit V: Recent Tools and techniques in Forensic Science

Recent techniques provided in forensic Science laboratories, introduction to digital and cyber-crime detection and analysis, portrait parley, Basics of Narco analysis, Brain Mapping and Lie Detection.

List of Books:

1. Bodziak, W., Footwear Impression Evidence (2ndEdn.) CRC Press, Boca Raton, Florida, 2000.
2. DeForest, P., Gaensslen, R., and Lee, H., Forensic Science; An Introduction to Criminalistics, McGraw Hill, New York, 1983.
3. Fisher, B., Techniques of Crime Scene Investigation (6thEdn.) CRC Press, Boca Raton, Florida, 2000.
4. James, S. H. And Nordby, J. J. (Eds) Forensic Science - An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
5. James, S., and Eskerc, W., Interpretation of Blood Stain Evidence at Crime Scenes, (2ndEdn) CRC Press, Boca Raton, Florida, 1999.

Course: Biology – II (FRS11009)

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Unit I: Genetics

Chromosomes: Discovery, morphology and structural Organization. Special types of chromosomes; Salivary gland and Lampbrush chromosomes. Mutations and Mutagens: Definition and Types of mutations.

Unit II: Immunology

Immunity and Immune System, Structure and interaction of antigens and antibody, B cell / T cell development, diversity and recognition, Immunoglobulin structure and types, immune system disorders.

Unit III– Plant Morphology and Anatomy-I

Principles of Taxonomy and systems of classification of angiosperms (Bentham and Hooker) and Gymnosperms (Chamberlain), Mechanical and conducting tissue systems in plants

Unit IV– Plant Morphology and Anatomy-II

Morphology of root, leaf, stem, flowers and their modifications. Anatomy of mono and dicot roots, leaves and stems, secondary growth, growthrings, calculation of life of wood.

Unit V: Microbiology and Biotechnology

Basics of Microbiology and Broad classification of micro-organisms, concepts of pure culture techniques. Recombinant DNA technology and its application in Heath and Diseases, Western, and Southern Blot techniques

List of Books:

1. B.D Singh. Fundamentals of Genetics. Kalyani Publishers, 2009.
2. B.K. Prasad & B.D. Singh. Objective Genetics. Kalyani Publishers , 2009.
3. Eldon John Gardner, Michael J. Simmons & D. Peter Snustad. Principles of Genetics (8th ed). John Wiley & Sons, 1991.
4. M.G. Sequeira, K.K. Kapoor, K.S. Yadav & P. Tauro. An Introduction to Microbiology. New Age International Publishers, 2018.
5. Michael Pelczar Jr., ECS Chan & Noel R. Krieg. Microbiology (5th ed). McGraw Hill Education, 2001.
6. Monroe W. Strickberger. Genetics (3rd ed). Pearson Education India, 2015.
7. P. D. Sharma. Microbiology. Rastogi Publications, 2010.
8. Reba Kanungo. Ananthanarayan and Paniker's Textbook of Microbiology (10th ed). Universities Press, 2017.
9. Susan Elrod, William Stansfield & G Bhowmik. Genetics (4th ed). McGraw Hill Edu, 2017.

Course: Chemistry – II (FRS11010)

L	T	P	C
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Unit I: Chemical Thermodynamics

Concepts of system, types of systems, surroundings, work, heat, energy, extensive and intensive properties, state functions. First law of thermodynamics – internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH , Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution. Introduction of entropy as a state functions, second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium, carnot cycle, derivation of entropy for carnot cycle, physical significance of entropy.

Unit II: Electrochemistry

Introduction, Electrochemical cells, Cell Potential or emf, calculating the emf of a cell, relation between emf and free energy, Determination of emf of a half cell, The Nernst Equation, Calculation of half-cell potential, Calculation of cell potential, calculation of equilibrium constant for the cell reaction, Calomel and Glass Electrode.

Unit III: Chemical Kinetics

Chemical Kinetics, Reaction Rate, Units of Rate, Rate laws, Molecularity and Order of a Reaction, Zero order reaction, first order reaction, second order reaction, third order reaction, pseudo order reactions, Units of rate constant, Half-life of a reaction, Collision Theory of Reaction Rates, Effect of Increase of Temperature on Reaction Rate.

Unit IV: Liquid State

Inter molecular forces in liquids, Free volume of liquid and density measurement, physical properties of liquid, vapour pressure, surface tension, surfactants, viscosity, molar refraction, Acid base concept, indicators, Strong acid-weak base titration, weak acid –strong base titration, vapour pressure, distillation, fractional distillation, vacuum distillation, colligative properties.

Unit V: Introduction of Analytical Technique

Introduction of gravimetric analysis and volumetric analysis, Chromatographic separation, liquid chromatography (paper, column and TLC), flame photometry, Atomic absorption spectroscopy.

List of Books:

Principles of Physical Chemistry and Puri, Sharma and Pathania
Essentials of Physical Chemistry, Arun Bahl, B.S. Bahl, G.D. Tuli
Instrumental Analysis by Skoog, Holler and Crouch

Course: Physics – II (FRS11011)

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Unit I: Optics

Reflection & Refraction: Introduction to Reflection & Refraction, Lenses: Terminology & application. Optical instruments: Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

Interference: Introduction to Interference, Young's experiment; intensity distribution Fresnel's Bi-prism, Interference in Thin films, Newton's rings. Diffraction: Fresnel and Fraunhofer class, explanation of rectilinear propagation of light; Single slit, double slit diffraction pattern, Plane transmission grating (qualitative). Rayleigh criterion and Resolving power of optical instruments. Polarization: Production and detection of plane polarized light by different methods, Brewster and Malus Laws. Double refraction.

Fiber Optics: Optical fibers, Propagation of light through optical fiber, Angle of acceptance and numerical aperture, losses.

Unit II: Electrostatics and Magnetostatics and Current Electricity

Electric field and Potential: Electrostatic Field, Lines of force, Electric flux. Gauss' Law and its applications. Electrostatic Potential. Laplace's and Poisson equations.

Magnetostatics: Biot Savart's Law and its applications. Ampere's Circuital law and its application. Divergence and curl of B. Hall effect, Vector potential, Current density and its variation with magnetic field at a current sheet. Faraday's Law and EM induction and few related problems

Behaviour of various substances in magnetic field. Definition of M and H. Permeability and susceptibilities and their inter-relationship.

Steady current: Ohm's law, Kirchhoff's Law; Wheatstone bridge its sensitivity (qualitative discussion only). Study of L-R, L-C-R circuits.

Alternating current: Operation of L-R, C-R, and L-C-R circuits in sinusoidal e.m.f.; power factor; resonance in series and parallel circuits; Q-factor; Andersons Bridge, Transformer, Rotating magnetic field; induction motor.

Unit III: Electromagnetic Theory

Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Wave Equations, Plane EM waves through vacuum, transverse nature of plane EM waves, Propagation through conducting media, relaxation time, skin depth. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density.

List of Books:

1. Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill.
2. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
3. Optics, B. Ghosh
4. Electricity and Magnetism, Rakshit and Chattopadhyay, New Age Publisher
5. Foundations of Electricity and Magnetism, B. Ghosh
6. Electricity and Magnetism, D. C. Tayal, S. Chand Publisher
7. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edition, 1998, Benjamin Cummings.
8. Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.

Course: Crime Scene Investigation Lab (FRS12012)

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Contents:

1. Investigation and sketching of indoor and outdoor scene of crime using triangulation method.
2. Investigation and sketching of indoor and outdoor scene of crime using baseline method.
3. Collection, packing and forwarding of different types of evidences.
4. Crime scene management and reconstruction in Hit and run cases
5. Analysis of different types fibres.
6. Microscopic study of structure of hair
7. Identification of human and animal hair.

Course: Biology-II Lab (FRS12013)

L	T	P	C
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Contents:

1. Study of different stages of Cell Division i.e. mitosis and meiosis
2. To study the structure of cheek cells
3. To study the structure of plant cells
4. Study of morphology of red blood cells
5. Studying the morphology of different plant parts
6. Studying the modifications of different plant parts.

Course: Chemistry – II Lab (FRS12014)

L	T	P	C
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List of Experiments:

1. Detection of special elements (N, Cl, S) by Lassaigne's test B. Solubility and Classification (solvents: H₂O, 5% HCl, 5% NaHCO₃, 5% NaOH) C.

Detection of the following functional groups by systematic chemical tests: Aromatic amino (-NH₂), aromatic nitro (-NO₂), Amide (-CONH₂, including imide), Phenolic -OH, Carboxylic acid (-COOH), Carbonyl (>C=O); only one test for each functional group is to be reported.

2. To crystallize the pure compound from an impure sample of any one of the following-Alum, Copper sulphate, Benzoic acid

Course: Physics – II Lab (12015)

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List of Experiments:

1. Determination of wavelength of a light by LASER diffraction method
2. Familiarization with: Schuster's focusing; determination of angle of prism.
3. Adjustment of the Spectrometer for parallel rays by Schuster's method and to determine the refractive index of the material of a prism by spectrometer from ($i-\delta$) curve.
4. To determine the wavelength of a monochromatic light by Newton's ring method.
5. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances and (e) Checking electrical fuses.
6. To measure the resistance per unit length of the wire of a bridge and to determine an unknown resistance by Carey Fosters bridge.
7. (a) To study response curve of a Series LCR circuit and determine its (i) Resonant frequency, (ii) Impedance at resonance, (iii) Quality factor Q, and (iv) Band width.
8. Determine self-inductance of a coil by Anderson's bridge.

THIRD SEMESTER

Course: Fingerprints Examination (FRS11016)

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Unit I: History of Fingerprinting

History and Development of fingerprints; important figures in the field of fingerprint, Principles of Fingerprints, Importance, nature and location, Fingerprints as evidence: Its recognition, Collection and Preservation.

Unit II: Introduction to Fingerprints and its Patterns

Biological significance of skin pattern, Ridge formation, Composition of Sweat, Fingerprint patterns, Pattern Areas, General and Individual characteristics of fingerprints;

Unit III: Classification of Fingerprints

Classification of fingerprints- Henry System of classification, Single digit Classification, Fingerprint Bureau.

Unit IV: Recording and Examination of Fingerprints

Ridge Counting and tracing, filing and searching. Taking fingerprints from living and dead persons.

Unit V: Latent Fingerprints

Latent fingerprint and Chance Fingerprints in criminal investigation, investigating latent fingerprints, various methods of development of fingerprints: physical and chemical methods, florescent method, laser method, lifting of latent fingerprints. Photography of latent traces and presentation of fingerprint evidence in court.

List of Books:

1. Bridges, B. C., Vollmar, A. Monir, M., Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting, Expert Testimony Opinion Evidence, The University Book Agency, Allahbad, 2000.
2. James, S. H. and Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientific and Investigation Techniques, CRC Press, London, 2003.
3. Nanda, B. B., and Tewari, R. K., Forensic Science in India. Select Publishers, New Delhi, 2001.
4. Saferstein, Richard, Criminalistics, An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
5. Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rdEdn) Universal Law Publishing Co. Ltd. New Delhi, 2001.
6. Speculation in Fingerprint Identification By Chatterjee S. K.

Course: Forensic Biology (FRS11017)

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Unit I: Botany

Identification of Plant specimen; Techniques for dating specimens using plant material, Algal colonization, Application of plant ecology; Different botanical evidences of forensic significance: Leaves, seeds, etc. Diatoms: Classification, basic structure and morphology, Isolation of diatoms from various samples and its forensic significance

Unit II: Wild Life Forensics

Introduction and importance of wild life, Protected and endangered species of Animals and Plants. Identification of wild life materials such as skin, fur, bones, nails, horn, teeth, flowers and plants by conventional and modern methods. Identification of Pug marks of various animals, census of wild life population.

Unit III: 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.

Unit IV: Entomology

Basic Principle of Insect Biology, Life Cycle, Estimation of Time of Death, Preservation of Sample

Unit V: Hair

Importance, nature, location, collection, evaluation; Human & Animal Hair morphology and its biochemical properties, Phases of hair growth, types of hair. Differences between animal and human hair, Forensic examination of different types of hair

List of Books:

1. Adrian Linacre & Shanan Tobe. Wildlife DNA Analysis: Applications in Forensic Science. Wiley-Blackwell, 2013.
2. Adrian Linacre. Forensic Science in Wildlife Investigations. CRC Press, 2009.
3. Bruce Budowle, Steven E. Schutzer & Roger G. Breeze. Microbial Forensics (1st ed). Academic Press, 2005.
4. David O. Carter, Jeffery K. Tomberlin, M. Eric Benbow & Jessica L. Metcalf. Forensic Microbiology. Wiley, 2017
5. Dorothy Gennard. Forensic Entomology: An Introduction. Wiley-Blackwell, 2012.
6. James R Robertson. Forensic examination of Hair. CRC Press, 2002.
7. Jan Bundschuh. Wildlife Forensic: Investigation, Principles & Practice, 2018.
8. Jane E. Huffman & John R. Wallace. Wildlife Forensics: Methods and Applications. Wiley, 2011.
9. Jason H. Byrd & James L. Castner. Forensic Entomology: The Utility of Arthropods in Legal Investigations. CRC Press, 2009.
10. Jeffery Keith Tomberlin & M. Eric Benbow. Forensic Entomology: International Dimensions and Frontiers. CRC Press, 2015.
11. John E Cooper & Margaret E Cooper. Wildlife Forensic Investigation: Principles and Practice. CRC Press, 2013.
12. Richard Li. Forensic Biology. CRC Press, 2015.

Course: Forensic Chemistry (FRS11018)

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Unit I: Interaction of radiation with matter:

Reflection, absorption, transmission, fluorescence, phosphorescence and their forensic applications, radiation filters
Detection of radiations; photographic detectors, thermal detectors, photoelectric detectors etc.

Unit II: Atomic spectra:

Introduction to Atomic spectra, energy levels, quantum numbers and designation of states, selection rules, qualitative discussions of atomic spectra.

Unit III: Atomic Spectroscopy

What is spectroscopy, electromagnetic spectrum, sources of radiation; their utility and limitations- conventional sources for UV, visible and infrared rays, sources for shorter wavelength radiations (X-ray tubes) radioactivity, types of rays.

Unit IV: Elements of X- ray spectrometry:

Fluorescence, energy Dispersive X-ray analysis (EDX), wavelength Dispersive X-ray analysis (WDX), X-ray diffraction, Augur effect.

Unit V: Forensic Chemistry

Petroleum and Types of Petroleum Products, different petroleum fractions. Chemical and Instrumental Analysis of petroleum products, Adulteration in petroleum Products

Fire and Arson: Chemistry of fire, Fire triangle, difference between Arson and Fire, cause of fire and origin of fire
Material and Chemicals use in initiating fire and arson. Forensic investigation of Arson cases

Book List:

1. D.R Lide; Handbook of Chemistry & Physics C.R.C. 75th ed. CRC Press WashingtonD.C., (1994)
2. R.M. Silverstein, G.C. Baster & T.C. Morsill; Spectrometric identifications of Organic Compounds, 4thEdn., Wiley, New York; (1981)
3. Dollisth, F.R., W.G. Fateley& F.F. Bentley; Characteristic Roman frequencies of organic compounds, Wiley, New York (1974)
4. Lin – Vien, D & Other – Infrared & Raman Characteristics frequencies of organic molecules; San Diego Acad, Press (1991)
5. Friebolin, H. Berik; One & Two Dimensional NMR spectroscopy; WeinheimGermany, VCH (1991)
6. Senders, I & B Hunter; Modern Spectroscopy- A center for Chemists; 2nd ed. Oxford Univ. Press, UK, (1993)
7. L.V. Azaroff; Elements of X-Ray Crystallography, McGraw Hill, New York, (1968)
8. G.H. Stout & L.H. Jensten; X-ray Structure Determination – A practical Guide; 2ndEdn., Wiley, New York, (1989)
9. J Sneddon; Advances in Atomic Spectroscopy, Vol. I & II, JNI Press (1992 & 1994)
10. S.J. Haswell; Atomic Absorption spectrometry; Elsevier, Amsterdam, (1992).
11. Lindsay, S.; High Performance Liquid Chromatography, New York, Wiley (1992)
12. Baker, D.R.; Capillary – Electrophoresis, New York (1995)
13. Marcel Dekker; Handbook of TLC, 2nded, New York (1995)
14. Jarris, K.E., A.L. Gray & R.S. Hock, EDS, Handbook of Inductively Coupled Plasma Mass Spectrometry; GlasgowBlockie,(1992)
15. ChatwalAnand, Instrumental Analysis

Course: Forensic Physics (FRS11019)

L	T	P	C
4	0	0	4

Unit I: Optics

Refractive index, birefringence; other optical properties of crystalline material. Brief idea on electromagnetic spectrum. General idea of instruments used in forensic physics like microscopy, spectroscopy, densitometer etc.

Unit II: Thermodynamics

Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, Extensive and intensive Variables, Thermodynamic Equilibrium. First Law, Work Done during Isothermal and Adiabatic Processes, 2nd Law of Thermodynamics. Heat Engines, & Carnot's Cycle. Third Law of Thermodynamics. Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy, First and second order Phase Transitions with examples.

Unit III: Electronics

Fundamentals of Semiconductor Devices. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. n-p-n and p-n-p Transistors.

Classification of Class A, B, AB & C Amplifiers, Positive and Negative Feedback on Input and Output Impedance.

Digital Electronics: Decimal to Binary and Binary to Decimal Conversion. AND, OR, NOT Gates. NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.

Unit IV: 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.

Fibre evidence – artificial and man-made fibres. Collection of fibre evidence. Identification and comparison of fibres.

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

Cloth evidence – importance, collection, analysis of adhering material. Matching of pieces.

Toolmark evidence.

Classification of toolmarks. Forensic importance of tool marks. Collection, preservation and matching of toolmarks.

Restoration of erased serial numbers and engraved marks.

List of Books:

1. Thermal Physics, Roy and Gupta
2. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
3. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
4. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
5. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
6. Solid State Electronic Devices, B.G.Streetman & S.K.Banerjee, 6th Edn.,2009, PHI Learning
7. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
8. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw

Course: Fingerprints Examination Lab (FRS12020)

L	T	P	C
0	0	4	2

List of Experiments:

1. Making of fingerprints on fingerprint cards and identifying the pattern
2. Development of fingerprints using physical methods
3. Development of fingerprints using chemical methods
4. Classification of fingerprints
5. Lifting and identification of latent fingerprints

Course: Forensic Biology - Lab (FRS12021)

L	T	P	C
0	0	4	2

List of Experiments:

1. Study of pollen grains of forensic significance.
2. Study of life cycle of blowflies
3. To prepare slides of scale patterns of human hair.
4. To examine human hair for cortex and medulla.
5. To examine Barr bodies from hair root.
6. Examination of hair of different domestic animals as cat, dog, cow, horse and goat.

Course: Forensic Chemistry – Lab (FRS12022)

L	T	P	C
0	0	4	2

1. To determine the enthalpy of neutralization of reaction between 1 M HCl and 1 M NaOH.
2. To study the separation of pigments from extracts of leaves and flowers by paper chromatography and determination of R_f values.
3. To separate the constituents present in an inorganic mixture containing two cations only (Cu⁺⁺, Cd⁺⁺) using the technique of chromatography.
4. Conductometry: HCl-AcOH mixture; dibasic acid.
5. Potentiometry: Halide ion.
6. pH-metry: HCl-AcOH mixture; dibasic acid.
7. To study the effect of temperature on the rate of the reaction between sodium thiosulphate and hydrochloric acid.
8. To study the effect of variation of concentration on the rate of reaction between sodium thiosulphate and hydrochloric acid.

Course: Forensic Physics –Lab (FRS12023)

L	T	P	C
0	0	4	2

List of Experiments:

1. Examination of glass fragments.
2. Determination of thermal conductivity of a bad conductor of heat by Lee's and Charlton's method.
3. Determination of thermoelectric power at a certain temperature of the given thermocouple.
4. To study V-I characteristics of PN junction diode, and Light emitting diode.
5. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
6. Examination of Tool Marks.
7. Design and verify the truth table for logic gates: AND, OR, NOT, NOR and NAND gates.
8. Design and the truth table of Half Adder and Full Adder.

FOURTH SEMESTER

Course: Questioned Documents (FRS11024)

L	T	P	C
4	0	0	4

Unit I: Questioned Documents Types

Definition of documents, questioned documents and the type of cases encountered; Importance, nature and problems of documents, Location, collection, handling and presentation of documents, adequacy of exemplars and standards.

Unit II: Methods of Detection

Detection and deciphering of indented writing, charred documents, invisible/secret writing; Ink Examination
Composition of major types of writing inks (carbon ink, fountain pen ink, ballpoint pen ink, rolling ball marker inks, fiber or porous tips pen ink, analysis of writing inks and ink dating, Pencil lead examination.

Unit III: Paper analysis

Physical characteristics, water mark examination, fiber analysis, chemical and trace elemental analysis; Equipment required: Camera, Microscope, Reference standards, TLC and HPLC.

Unit IV: Examination of documents

Examination of alterations, erasures, overwriting, additions and obliterations. Examination, Determination of age of the documents, Instruments and equipment used for examination of fraudulent documents; Identification and comparison of typescripts

Unit V: Handwriting & Signature Identification

Principle of handwriting, individual and class handwriting characteristics. Identification, External, internal and physical characteristics affecting the handwriting of a person. Signatures: Authentic signatures, forged signatures, disguised signatures, traced signatures and their characteristics. Factors affecting the signature of individuals.

List of Books:

1. James, S. H. And Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
2. Saferstein, Richard, Criminalistics - An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
3. Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rd Ed) Universal Law Publishing Co. Ltd. New Delhi, 2001.
4. O'Hara & Osterburg: Introduction to Criminalistics, 1949, The MacMillan Co., 1964.
5. Katherine M Koppenhaver, Forensic Document Examination, Principles and Practice
6. B S Nabar, Forensic Science in Crime Investigation

Course: Forensic Serology (FRS11025)

L	T	P	C
4	0	0	4

Unit 1: Forensic Importance of Body fluids

Common body fluids. Composition and functions of blood. Collection and preservation of blood evidence. Distinction between human and non-human blood. Determination of blood groups. Antigens and antibodies. Forensic characterization of bloodstains. Typing of dried stains. Blood enzymes and proteins. Semen. Forensic significance of semen. Composition, functions and morphology of spermatozoa. Collection, evaluation and tests for identification of semen. Individualization on the basis of semen examination. Composition, functions and forensic significance of saliva, sweat, milk and urine. Tests for their identifications.

Unit 2: Genetic Marker Analysis

Cellular antigens. ABO blood groups. Extracellular proteins and intracellular enzymes. Significance of genetic marker typing data. Sexual assault investigations.

Unit 3: Bloodstain Pattern Analysis

Bloodstain characteristics. Impact bloodstain patterns. Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails. Bloodstain drying times. Documentation of bloodstain pattern evidence. Crime scene reconstruction with the aid of bloodstain pattern analysis.

List of Books:

1. W.G. Eckert and S.H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton (1989).
2. G.T. Duncan and M.I. Tracey in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).

Course: Forensic Anthropology (FRS11026)

L	T	P	C
4	0	0	4

Unit 1: Significance of Forensic Anthropology

Scope of forensic anthropology. Study of human skeleton. Nature, formation, and identification of human bones. Determination of age, sex, stature from skeletal material.

Unit 2: Personal Identification – Somatoscopy and Somatometry

Somatoscopy – observation of hair on head, forehead, eyes, root of nose, nasal bridge, nasal tip, chin, supra-orbital ridges, circumference of head. Scar marks and occupational marks.

Somatometry – measurements of head, face, nose, cheek, ear, hand and foot, body weight, height.

Indices - cephalic index, nasal index, cranial index, upper facial index.

Unit 3: Facial Reconstruction

Portrait Parle/ Bertillon system. Photofit/identity kit. Facial superimposition techniques.

Cranio facial super imposition techniques – photographic super imposition, videosuperimposition, Roentgenographic superimposition. Use of somatoscopic and

craniometric methods in reconstruction. Importance of tissue depth in facial reconstruction.

Genetic and congenital anomalies – causes, types, identification and their forensic significance.

List of Books:

1. M.Y. Iscan and S.R. Loth, The scope of forensic anthropology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
2. D. Ubelaker and H. Scammell, Bones, M. Evans & Co., New York (2000).
3. S.Rhine, Bone Voyage: A Journey in Forensic Anthropology, University of Mexico Press, Mexico (1998).

Course: Forensic Psychology (FRS11027)

L	T	P	C
4	0	0	4

Unit 1: Basics of Forensic Psychology

Definition and fundamental concepts of forensic psychology and forensic psychiatry. Psychology and law. Ethical issues in forensic psychology.

Assessment of mental competency. Mental disorders and forensic psychology.

Psychology of evidence – eyewitness testimony, confession evidence. Criminal profiling.

Psychology in the courtroom, with special reference to Section 84 IPC.

Unit 2: Psychology and Criminal Behavior

Psychopathology and personality disorder. Psychological assessment and its importance.

Serial murderers. Psychology of terrorism.

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

Juvenile delinquency – theories of offending (social cognition, moral reasoning),

Child abuse (physical, sexual, emotional), juvenile sex offenders, legal controversies.

Unit 3: Detection of Deception

Tools for detection of deception – interviews, non-verbal detection, statement analysis, voice stress analyzer, hypnosis.

Polygraphy – operational and question formulation techniques, ethical and legal aspects, the guilty knowledge test.

Narco analysis and brain electrical oscillation signatures – principle and theory, ethical and legal issues.

List of Books:

1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).
2. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
3. J.C. DeLadurantey and D.R. Sullivan, Criminal Investigation Standards, Harper & Row, New York (1980).
4. J. Niehaus, Investigative Forensic Hypnosis, CRC Press, Boca Raton (1999).
5. E. Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).

Course: Questioned Documents Lab (FRS12028)

L	T	P	C
0	0	4	2

List of Experiments:

1. Examination and detection of fraudulent documents
2. Examinations of alterations in documents.
3. Identification of Indented writing
4. Identification of Invisible writing
5. Identification of class and individual characteristics in handwriting.
6. Identification of security features in currency notes.
7. TLC of different ink samples
8. Photography of documents
9. Quantitative analysis using Spectrophotometer.
10. Electrophoretic separation of different compounds.

Course: Forensic Serology Lab (FRS12029)

L	T	P	C
0	0	4	2

List of Experiments:

- To determine blood group from fresh blood samples.
2. To determine blood group from dried blood sample.
3. To carry out the crystal test on a blood sample.
4. To identify blood samples by chemical tests.
5. To identify the given stain as saliva.
6. To identify the given stain as urine.
7. To carry out cross-over electrophoresis.
8. To study the correlation between impact angle and shape of bloodstain.
9. To identify the point of convergence from the bloodstain patterns.

Course: Forensic Anthropology Lab (FRS12030)

L	T	P	C
0	0	4	2

- 1 To determine of age from skull and teeth.
2. To determine of sex from skull.
3. To determine sex from pelvis.
4. To study identification and description of bones and their measurements.
5. To investigate the differences between animal and human bones.
6. To perform somatometric measurements on living subjects.
7. To carry out craniometric measurements of human skull.
8. To estimate stature from long bone length.

Course: Forensic Psychology Lab (FRS12031)

L	T	P	C
0	0	4	2

1. To cite a crime case where legal procedures pertaining to psychic behavior had to be invoked.
2. To prepare a report on relationship between mental disorders and forensic psychology.
3. To review a crime case involving serial murders. Comment on the psychological traits of the accused.
4. To cite a crime case involving a juvenile and argue for and against lowering the age for categorizing an individual as juvenile.
5. To study a criminal case in which hypnosis was used as a means to detect deception.
6. To prepare a case report on thematic appreciation test.
7. To prepare a case report on Minnesota multiphasic personality inventory test.
8. To prepare a case report on thematic appreciation test.
9. To prepare a case report on word association test.
10. To prepare a case report on Bhatia's battery of performance test of intelligence.
11. To cite a criminal case in which narco analysis was used as a means to detect deception.

FIFTH SEMESTER

Course: DNA Typing (FRS11032)

L	T	P	C
4	0	0	4

Unit I: Introduction

Definition, importance in Forensic Science; collection and types of evidences for DNA fingerprinting, Genetic basis of DNA Fingerprinting, Chromosomes, DNA, Nuclear DNA and Mitochondrial DNA

Unit II: Techniques of DNA Fingerprinting

Isolation, southern blots, radioactive probe, Hybridization reaction, visualization, FTA cards for isolation of DNA

Unit III: Types of DNA Fingerprinting

Single locus DNA fingerprinting, multi – locus DNA Fingerprinting, Mini satellite, micro-satellite, VNTR, HLA-DQ α , STRs, RFLP

Unit IV: Polymerase Chain Reaction

Instrumentation, principle, significance in forensic case samples. Denaturation, annealing and extension, Detection of PCR products.

Unit V: Practical application of DNA Fingerprinting

Paternity and maternity testing, personal identification, criminal identification and Forensic importance; DNA databank, limitations of DNA Fingerprinting, legality of DNA Fingerprinting in India

List of Books

1. Norah Rudin and Keith Inman, (2nd Ed): An Introduction to Forensic DNA Analysis, CRC Press, New York, 2002.
2. Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rdEdn) Universal Law Publishing Co. Ltd. New Delhi, 2001.
3. John M. Butler, Forensic DNA Typing

Course: Digital Forensics (FRS11033)

L	T	P	C
4	0	0	4

Unit I: Introduction

Details about Windows, Windows accessories and other applications, Data storage and memory allocation, history of operating systems, various operating systems, Modern application softwares.

Unit II: Networking and internet

Concept of internet, fundamentals of storage devices, file system, concepts of Operating, System software, its review and major functions (DOS, UNIX, WINDOWS), Networking and its protocol, Fundamentals of Mobile communications

Unit III: Fundamentals and Concepts

Fundamentals of computers Hardware and accessories – development of hard disk, physical construction, CHS and LBA addressing, encoding methods and formats. Memory and processor. Methods of storing data. Operating system. Software. Introduction to network, LAN, WAN and MAN.

Unit IV: Fundamentals and Concepts

Definition and types of computer crimes. Distinction between computer crimes and conventional crimes, Reasons for commission of computer crimes. Breaching security and operation of digital systems, Types of computer crimes – computer stalking, pornography, hacking, crimes related to intellectual property rights, computer terrorism, hate speech, private and national security in cyber space.

An overview of hacking, spamming, phishing and stalking, Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs.

Unit V: Computer Forensics Investigations

Seizure of suspected computer. Preparation required prior to seizure, Protocol to be taken at the scene. Extraction of information from the hard disk.

Treatment of exhibits. Creating bit stream of the original media. Collection and seizure of magnetic media. Legal and privacy issues. Examining forensically sterile media. Restoration of deleted files, Password cracking and E-mail tracking. Encryption and decryption methods. Tracking users.

List of Books

1. Anita Goel. Computer Fundamentals. Pearson (India), 2010.
2. Bill Nelson, Amelia Phillips & Christopher Steuart. Guide to Computer Forensics and Investigations (6th ed). Cengage Learning, 2018.
3. Eoghan Casey. Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet. Academic Press, 2011.
4. Eoghan Casey. Handbook of Computer Crime Investigation: Forensic Tools and Technology (1st ed). Academic Press, 2001.
5. Eoghan Casey. Handbook of Digital Forensics and Investigation (1st ed). Academic Press, 2009.
6. Keval Ukey. Cyber Forensic: A Legal Perspective of Data Protection and E-Commerce. Selective & Scientific Books, New Delhi, 2018.
7. Marjie T. Britz. Computer Forensics and Cyber Crime: An Introduction (3rd ed). Pearson, 2013.

Course: Technological Methods in Forensic Science (FRS11034)

L	T	P	C
4	0	0	4

Unit 1: Instrumentation

Sample preparation for chromatographic and spectroscopic evidence.

Chromatographic methods. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography.

Spectroscopic methods. Fundamental principles and forensic applications of Ultraviolet-visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy, atomic emission spectroscopy and mass spectroscopy. X-ray spectrometry. Colorimetric analysis and Lambert-Beer law.

Electrophoresis – fundamental principles and forensic applications.

Neutron activation analysis – fundamental principles and forensic applications.

Unit 2: Microscopy

Fundamental principles. Different types of microscopes. Electron microscope. Comparison Microscope. Forensic applications of microscopy.

Unit 3: Forensic photography

Basic principles and applications of photography in forensic science.

3D photography. Photographic evidence. Infrared and ultraviolet photography. Digital photography. Videography. Crime scene and laboratory photography.

List of Books:

1. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6th Edition, Saunders College Publishing, Fort Worth (1992).
2. W. Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, Hampshire (1991).
3. J.W. Robinson, Undergraduate Instrumental Analysis, 5th Edition, Marcel Dekker, Inc., New York (1995).
4. D.R. Redsicker, The Practical Methodology of Forensic Photography, 2nd Edition, CRC Press, Boca Raton (2000).

Course: DNA Typing Lab (FRS12035)

L	T	P	C
0	0	4	2

Course Contents:

1. To prepare gel plates for electrophoresis.
2. Organic extraction of DNA from blood.
3. Extraction of DNA from other body fluids.
4. Quantification of DNA
5. PCR for DNA samples

Course: Digital Forensics Lab (FRS12036)

L	T	P	C
0	0	4	2

Course Contents:

- Breaching security and operation of digital systems
- Treatment of exhibits. Creating bit stream of the original media.

**Course: Technological Methods in Forensic Science-
Lab (FRS12037)**

L	T	P	C
0	0	4	2

Content:

1. To determine the concentration of a colored compound by calorimetry analysis.
2. To carry out thin layer chromatography of ink samples.
3. To carry out separation of organic compounds by paper chromatography.
4. To identify drug samples using UV-Visible spectroscopy.
6. To take photographs of crime scene exhibits at different angles.
7. To record videography of a crime scene.

References:

1. T. Pradeep, —*Nano: The Essentials*l, McGraw – Hill education, (2007).
2. Challa, S.S.R. Kumar, Josef Hormes, Carola Leuschaer, *Nanofabrication Towards Biomedical Applications, Techniques, Tools, Applications and Impact*l, Wiley – VCH, (2005).
Bharat Bhushan, *Springer Handbook of Nanotechnology*, Barnes & Noble (2004).
3. Neelina H. Malsch (Ed.), *Biomedical Nanotechnology*, CRC Press (2005)

SIXTH SEMESTER

Course: Forensic Toxicology (FRS11040)

L	T	P	C
4	0	0	4

Unit I: Forensic Toxicology

Introduction and concept of toxicology: LD 50, LC 50, Lethal dose, lethal period, Fatal period and its forensic significance; Poisons: classification of poisons, types of poisoning, Absorption, Metabolism and Extraction of toxins, collection and preservation of toxicological exhibits in fatal and survival cases, medico-legal aspects.

Unit II: Insecticides

Organophosphorus compounds, Organochloro Compounds and Carbamates- Nature, administration, symptoms, post-mortem findings, isolation, detection, estimation and medico-legal aspects.

Unit III: Volatile, Metallic & industrial poisons

Methyl alcohol, Chloroform, Ethyl alcohol, Acetone; Nature, administration, symptoms, post-mortem findings, isolation, detection and estimation, medico-legal aspects, Arsenic, Mercury, Lead, Cadmium: Nature, administration, symptoms, postmortem findings, Detection and medicolegal aspects; Mineral Acids: HCl, H₂SO₄, HNO₃; Alkalies: hydrates and carbonates of Sodium and potassium, NaOH, KOH

Unit IV: Toxicology of Alcohol

Introduction, definition of alcohol and illicit liquor, Proof spirit, absorption, de-toxification and excretion of alcohol, Breath test instruments, field sobriety testing, analysis of blood for alcohol. Analytical techniques in the analysis of alcohol Cases of drunken driving

Unit V: Animal and Vegetable Poisons

Animal poisons: Snake, scorpions and Cantharides; Vegetable Poisons: Dhatura, Oleander, Madar, Abrusprecatrious, Castor, Cannabis, Nux vomica, cyanide, etc. Nature, administration, symptoms, post-mortem findings, isolation, detection and medico-legal aspects.

List of Books:

1. Benjamin, D. M., Forensic Pharmacology. In Forensic Science Handbook (vol – 3), Saferstein, R. (Ed.), Prentic-Hall, Englewood Cliffs, New Jersey, 1993.
2. Caplan, Y. H., The Determination of Alcohol in Blood and Breath, In Forensic Science Handbook (vol – 3), Saferstein, R. (Ed.), Prentice Hall, Englewood Cliffs, New Jersey, 1982.
3. James, S. H. and Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
4. Karch, S. B., The Pathology of Drug Abuse. (2ndEdn.) CRC Press, Boca Raton, Florida, 1996.

Course: Forensic Ballistics (FRS11041)

L	T	P	C
4	0	0	4

Unit I: Fire Arms

Introduction, brief history of fire arms, weapon types and their operations, proof marks.

Unit II: Ammunition

A brief history of ammunition, ammunition components, types of propellants and their composition primers and its composition, head stamp marking on ammunition. Bullet comparisons, cartridge case examination, class and individual characteristics of identification.

Unit III: Ballistics

Definition, Forensic Importance; Nature of firearms, parts of a firearm, classification of firearm, types of ballistics: internal, external and terminal ballistics. Velocity recoil, theory of recoil, barrel pressure measurement, ballistic coefficient, angle of elevation of the barrel, Ricochet. Legal Aspect: Arms Act, 1950, (Licensing, Offenses and Penalties).

Unit IV: Range of Fire

Muzzle pattern, scorching, blackening, tattooing, wad distribution, pellet patterns, GSR analysis, and primer residues. Reconstruction of the sequence of events in a shooting case. Presentation of evidence in the court.

Unit V: Wound / Terminal Ballistics

Introduction, Injuries and the quantity of energy of projectiles, Shock wave and cavitation effect, Elements of wound Ballistics; Nature of target, Velocity of projectile, Constructional features of projectile. Contact Range, Point blank range, near range, chips range, distant range. Penetration of shots in different regions of the body

List of Books:

1. James, S. H. And Nordby, J. J. (Ed), Forensic Science - An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
2. Modi, A Text Book of Medical Jurisprudence & Toxicology.
3. Saferstein, Richard, Criminalistics - An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
4. Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rdEdn) Universal Law Publishing Co. Ltd. New Delhi, 2001.
5. Handbook of Firearms and Ballistics, Examining and Interpreting Forensic Evidence: Brain J. Heard, John Wiley & Sons.
6. Saxena& Gaur, Law of Arms and Explosives, 2002

Course: Crime and Society (FRS11042)

L	T	P	C
4	2	0	6

Unit 1: Basics of Criminology

Definition, aims and scope. Theories of criminal behaviour – classical, positivist, sociological. Criminal anthropology.

Criminal profiling. Understanding modus operandi. Investigative strategy.

Role of media.

Unit 2: Crime

Elements, nature, causes and consequences of crime. Deviant behaviour. Hate crimes, organized crimes and public disorder, domestic violence and workplace violence.

White collar crimes

Victimology. Juvenile delinquency. Social change and crime.

Psychological Disorders and Criminality. Situational crime prevention.

Unit 3: Criminal Justice System

Broad components of criminal justice system. Policing styles and principles. Police's power of investigation.

Filing of criminal charges. Community policing. Policing a heterogeneous society. Correctional measures and rehabilitation of offenders.

Human rights and criminal justice system in India.

List of Books:

1. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
2. D.E. Zulawski and D.E. Wicklander, Practical Aspects of Interview and Interrogation, CRC Press, Boca Raton (2002).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. J.L. Jackson and E. Barkley, Offender Profiling: Theory, Research and Practice, Wiley, Chichester (1997).
5. R. Gupta, Sexual Harassment at Workplace, LexisNexis, Gurgaon (2014).

Course: Forensic Toxicology Lab (FRS12043)

L	T	P	C
0	0	4	2

Course Contents:

1. Analysis of metallic poisons.
2. Analysis of volatile and non-volatile poisons.
3. TLC of insecticides and pesticides.
4. TLC of Barbiturates and other drugs
5. Analysis of vegetable poisons

Course: Forensic Ballistics Lab (FRS12044)

L	T	P	C
0	0	4	2

Course Contents:

- Study of ammunitions (Bullet and cartridge)
- Chemical analysis of explosive materials
- Study of various parts of the firearms: - barrel, action, stock, caliber, choke etc.