

Appendix - B

B.Sc. Forensic Science

Semester I

Teaching and Examination Scheme

S.No.	Paper	Subject	Teaching Scheme			Examination Scheme									
			Theory + Tutorial (Periods)	Practical (Periods)	Total Periods	Theory					Practical				
						Duration Hours	Max Marks Theory Paper	Max Marks Internal	Total Marks	Minimum Passing Marks	Duration Hours	Max Marks Practical	Max Marks Internal	Total Marks	Minimum Passing Marks
1.	1T1	Basics of Forensic Science	4	3	7	3	40	10	50	20	-	-	-	-	-
2.	1T2	Basics of Forensic Chemistry	4	3	7	3	40	10	50	20	-	-	-	-	-
3.	1T3	Basics of Forensic Physics	4	3	7	3	40	10	50	20	-	-	-	-	-
4.	1T4	Basics of Forensic Biology	4	3	7	3	40	10	50	20	-	-	-	-	-
5.	1T5	Basics of Forensic Psychology	4	3	7	3	40	10	50	20	-	-	-	-	-
6.	1T6	Basics of Digital and Cyber Forensics	4	3	7	3	40	10	50	20	-	-	-	-	-
<p>1. Minimum marks for passing will be 40% of the total marks (External + Internal combined) allotted to that paper / practical.</p> <p>2. Candidate has to pass theory papers and practical separately.</p>															
Grand Total of Semester I: 300															

Appendix - C

B.Sc. Forensic Science

Semester II

Teaching and Examination Scheme

S.No.	Paper	Subject	Teaching Scheme			Examination Scheme									
			Theory + Tutorial (Periods)	Practical (Periods)	Total Periods	Theory				Practical					
						Duration Hours	Max Marks Theory Paper	Max Marks Internal	Total Marks	Minimum Passing Marks	Duration Hours	Max Marks Practical	Max Marks Internal	Total Marks	Minimum Passing Marks
1.	2T1	Basics of Forensic Science	4	3	7	3	40	10	50	20	6	40	10	50	20
2.	2T2	Basics of Forensic Chemistry	4	3	7	3	40	10	50	20	6	40	10	50	20
3.	2T3	Basics of Forensic Physics	4	3	7	3	40	10	50	20	6	40	10	50	20
4.	2T4	Basics of Forensic Biology	4	3	7	3	40	10	50	20	6	40	10	50	20
5.	2T5	Basics of Forensic Psychology	4	3	7	3	40	10	50	20	6	40	10	50	20
6.	2T6	Basics of Digital and Cyber Forensics	4	3	7	3	40	10	50	20	6	40	10	50	20
<p>1. Minimum marks for passing will be 40% of the total marks (External + Internal combined) allotted to that paper / practical.</p> <p>2. Candidate has to pass theory papers and practical separately.</p>															
Grand Total of Semester II: 600															

Appendix - D

B.Sc. Forensic Science

Semester III

Teaching and Examination Scheme

S.No.	Paper	Subject	Teaching Scheme			Examination Scheme									
			Theory + Tutorial (Periods)	Practical (Periods)	Total Periods	Theory				Practical					
						Duration Hours	Max Marks Theory Paper	Max Marks Internal	Total Marks	Minimum Passing Marks	Duration Hours	Max Marks Practical	Max Marks Internal	Total Marks	Minimum Passing Marks
1.	3T1	Advanced Forensic Science	4	3	7	3	40	10	50	20	-	-	-	-	-
2.	3T2	Advanced Forensic Chemistry	4	3	7	3	40	10	50	20	-	-	-	-	-
3.	3T3	Advanced Forensic Physics	4	3	7	3	40	10	50	20	-	-	-	-	-
4.	3T4	Advanced Forensic Biology	4	3	7	3	40	10	50	20	-	-	-	-	-
5.	3T5	Advanced Forensic Psychology	4	3	7	3	40	10	50	20	-	-	-	-	-
6.	3T6	Advanced Digital and Cyber Forensics	4	3	7	3	40	10	50	20	-	-	-	-	-
<p>1. Minimum marks for passing will be 40% of the total marks (External + internal combined) allotted to that paper / practical.</p> <p>2. Candidate has to pass theory papers and practical separately.</p>															
Grand Total of Semester III: 300															

Appendix - E

B.Sc. Forensic Science

Semester IV

Teaching and Examination Scheme

S.No.	Paper	Subject	Teaching Scheme			Examination Scheme										
			Theory + Tutorial (Periods)	Practical (Periods)	Total Periods	Theory				Practical						
						Duration Hours	Max Marks Theory Paper	Max Marks Internal	Total Marks	Minimum Passing Marks	Duration Hours	Max Marks Practical	Max Marks Internal	Total Marks	Minimum Passing Marks	
1.	4T1	Advanced Forensic Science	4	3	7	3	40	10	50	20	6	40	10	50	20	
2.	4T2	Advanced Forensic Chemistry	4	3	7	3	40	10	50	20	6	40	10	50	20	
3.	4T3	Advanced Forensic Physics	4	3	7	3	40	10	50	20	6	40	10	50	20	
4.	4T4	Advanced Forensic Biology	4	3	7	3	40	10	50	20	6	40	10	50	20	
5.	4T5	Advanced Forensic Psychology	4	3	7	3	40	10	50	20	6	40	10	50	20	
6.	4T6	Advanced Digital and Cyber Forensics	4	3	7	3	40	10	50	20	6	40	10	50	20	
<p>1. Minimum marks for passing will be 40% of the total marks (External + Internal combined) allotted to that paper / practical.</p> <p>2. Candidate has to pass theory papers and practical separately.</p>																
Grand Total of Semester IV: 600																

Appendix - F

B.Sc. Forensic Science

Semester V

Teaching and Examination Scheme

S.No.	Paper	Subject	Teaching Scheme			Examination Scheme										
			Theory + Tutorial (Periods)	Practical (Periods)	Total Periods	Theory				Practical						
						Duration Hours	Max Marks Theory Paper	Max Marks Internal	Total Marks	Minimum Passing Marks	Duration Hours	Max Marks Practical	Max Marks Internal	Total Marks	Minimum Passing Marks	
1.	5T1	Applied Forensic Science	4	3	7	3	40	10	50	20	-	-	-	-	-	
2.	5T2	Applied Forensic Chemistry	4	3	7	3	40	10	50	20	-	-	-	-	-	
3.	5T3	Applied Forensic Physics	4	3	7	3	40	10	50	20	-	-	-	-	-	
4.	5T4	Applied Forensic Biology	4	3	7	3	40	10	50	20	-	-	-	-	-	
5.	5T5	Applied Forensic Psychology	4	3	7	3	40	10	50	20	-	-	-	-	-	
6.	5T6	Applied Digital and Cyber Forensics	4	3	7	3	40	10	50	20	-	-	-	-	-	
<p>1. Minimum marks for passing will be 40% of the total marks (External + internal combined) allotted to that paper / practical.</p> <p>2. Candidate has to pass theory papers and practical separately.</p>																
Grand Total of Semester V: 300																

Appendix - G

B.Sc. Forensic Science

Semester VI

Teaching and Examination Scheme

S.No.	Paper	Subject	Teaching Scheme			Examination Scheme										
			Theory + Tutorial (Periods)	Practical (Periods)	Total Periods	Theory				Practical						
						Duration Hours	Max Marks Theory Paper	Max Marks Internal	Total Marks	Minimum Passing Marks	Duration Hours	Max Marks Practical	Max Marks Internal	Total Marks	Minimum Passing Marks	
1.	6T1	Applied Forensic Science	4	3	7	3	40	10	50	20	6	40	10	50	20	
2.	6T2	Applied Forensic Chemistry	4	3	7	3	40	10	50	20	6	40	10	50	20	
3.	6T3	Applied Forensic Physics	4	3	7	3	40	10	50	20	6	40	10	50	20	
4.	6T4	Applied Forensic Biology	4	3	7	3	40	10	50	20	6	40	10	50	20	
5.	6T5	Applied Forensic Psychology	4	3	7	3	40	10	50	20	6	40	10	50	20	
6.	6T6	Applied Digital and Cyber Forensics	4	3	7	3	40	10	50	20	6	40	10	50	20	
<p>1. Minimum marks for passing will be 40% of the total marks (External + internal combined) allotted to that paper / practical.</p> <p>2. Candidate has to pass theory papers and practical separately.</p>																
Grand Total of Semester VI: 600																

Appendix – H

Guidelines for Internal Assessment, Theory Paper Pattern and Practical

1. Each semester shall comprise of minimum 90 teaching days.
2. Every subject in each semester will comprise
 - a) One theory paper – 40 Marks with 10 marks internal assessment, Total 50 marks each.
 - b) One internal assessment based on the theory papers for 10 Marks each.
 - c) One practical / laboratory work – 40 marks with 10 marks internal assessment, Total 50 Marks.

Internal Assessment:

3. The internal assessment shall be done by the College at least 15 days prior to the final examination of each semester. The Marks shall be sent to the University immediately after the Assessment in the prescribed format.
4. Guidelines for Internal Assessment are appended herewith.
 - a) The internal assessment marks assigned to each theory paper as mentioned in Appendix B – G shall be awarded on the basis of assignments like class test, attendance, project assignments, seminar, study tour, industrial visits, visit to educational institutions and research organizations, field work, group discussions or any other innovative practice / activity.
 - b) There shall be one / two assignments (as described above) per Theory paper.
 - c) There shall be no separate / extra allotment of work load to the teacher concerned. He/ She shall conduct the Internal assessment activity during the regular teaching days / periods as a part of regular teaching activity.
 - d) The concerned teacher / department / college shall have to keep the record of all the above activities until six months after the declaration of the results of that semester.
 - e) At the beginning of each semester, every teacher shall inform his / her students unambiguously the method he / she proposes to adopt and the scheme of marking for internal assessment.
 - f) Teacher shall announce the schedule of activity for internal assessment in advance in consultation with HOD / Principal.
 - g) Final submission of internal marks to the University shall be before the commencement of the University Theory Examinations.

Theory Papers:

6. All Theory papers shall be divided into four units.
7. The theory question papers shall be of 3 hours duration and comprise of 5 questions with equal weightage to all units.
8. The pattern of question papers is appended herewith.
 - a) Each theory paper will be of 40 marks each.
 - b) All questions are compulsory and will carry equal marks.
 - c) Question paper for any theory paper will comprise of five questions of 8 marks each.
 - d) Question No. 1 to 4 will be from four units respectively with an internal choice.
 - e) Question No. 5 shall be compulsory with eight questions of very short answer type from two each from four units having 1 mark each.

- f) In case of Languages, the question paper will be as per Rashtrasant Tukadoji Maharaj Nagpur University B.Sc. I Pattern.

Practical:

9. Practical exam shall be of 6 to 8 hours duration for one or two days, depending on subject and number of students.
10. The Practical Record of every student shall carry a certificate as shown below, duly signed by the teacher-in-charge and the Head of the Department.
11. If the student fails to submit his / her certified Practical Record duly signed by the Teacher-In-Charge and the Head of the Department, he / she shall not be allowed to appear for the Practical Examination and no Marks shall be allotted to the student.
12. The practical examination shall comprise of one long experiment question of 20 marks and one short experiment question of 10 marks. Practical Record shall carry 5 marks and viva-voce shall carry 5 marks. 10 marks shall be for Internals.
13. The certificate template shall be as follows:

CERTIFICATE

Name of the College / Institution _____

Name of the Department: _____

This is to certify that this Practical Record contains the bonafide record of the Practical work of Shri / Kumari / Shrimati _____ of _____ Semester ____ during the academic year _____.

The candidate has satisfactorily completed the experiments prescribed by Rashtrasant Tukadoji Maharaj Nagpur University for the subject _____.

Dated ___/___/___

Signature of the teacher who taught the examinee

1. _____

2. _____

Head of the Department

Appendix I

Syllabus

Semester I

&

Semester II

B.Sc. Forensic Science Semester - I

1T1: Basics of Forensic Science

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Introduction to Forensic Science and its Historical Development.

Forensic Science: Definition, Nature, need and functions. Basic Principles and Laws of Forensic Science: Locard's Principle of Exchange, Law of Progressive Change, Law of Individuality, Law of Circumstantial Fact, Principle of Analysis, Law of Probability, and Law of Comparison. Corpus Delicti, Modus Operandi, Signature.

Historical development in India and world, Specific contribution of scientists in the field of Forensic Science. Scope of Forensic Science in India and world.

Unit II: Crime Scene Investigation and Management

Types and classification of Crime Scene, Crime Scene Management, Initial response, Securing the scene of crime, Various crime scene search methods, Various methods of preservation of crime scene: Photography, Sketching, Videography, Voice Recording, Notes taking. Collection methods and labelling, packing and forwarding of evidences, documentation and chain of custody, Role of First Responding Officer and Investigating officer.

Unit III: Introduction to Crime and Crime Typologies

Introduction to Crime, Criminalistics and their Historical perspectives. Factors of Crime, Types of Crime and their causes: Organized crime, Occupational Crime, Professional Crime, Political Crime, Crime against women, Property crime, Cybercrime. Juvenile Delinquency: Nature and its characteristics, Classification and its types, Factors of Juvenile Delinquency, Correctional Institutions for Delinquents, Preventive Programs of juvenile delinquency.

Unit IV: Agencies for Crime Detection

Different agencies involved in crime detection and prevention Indian Police System – State & Central level, Medico-legal experts, First Information Report, Non-cognizable Report, case diary, Search and Seizure, Panchnama and its types, and Scientific reports (Medical certificate, Injury report, MLC, post- mortem reports) in the suspected case of murder, rape, dacoity, hit and run, and suicide. Role of Police Officers and Judiciary in Criminal and Civil Investigations. Prevention of crime and various preventive Forensics programs.

B.Sc. Forensic Science Semester - I

1T2: Basics of Forensic Chemistry

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit	Content	Scope	Lect
Unit I Organic Chemistry	Structure and Bonding	Introduction, hybridization, nature of chemical bonding, polarization, hydrogen bonding, Van-der Waals forces, elementary ideas of Inductive effect, Electromeric effect, Resonance effect, Hyperconjugation.	5
	Mechanism of Organic Reactions	Types of organic reactions: Addition, substitution, elimination and rearrangement reaction. Reactive intermediates: Formation, geometry, and stability of carbocations, carbanions, free radicals and carbenes.	7
Unit II Inorganic Chemistry	Atomic structure	Introduction, Heisenberg's uncertainty principle. Schrodinger wave equation (No derivation), Quantum numbers, shapes of s, p, and d orbitals. Aufbau principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity. Electronic Configuration of elements and ions (Z = 1 to 30)	7
	Periodic Table	Periodic Properties: Atomic and ionic radii, ionization energy, electron affinity and electronegativity - Definition, trends in periodic table. Factors affecting ionization potential. Pauling's and Muliken's scale of electronegativity.	5
Unit III Physical Chemistry	Surface Chemistry and Catalysis	A) Adsorption: Introduction, types, factors affecting adsorption and applications of adsorption. B) Catalysis: Introduction, homogeneous and heterogeneous catalysis, action of Promoters and Inhibitors, enzyme catalysis, autocatalysis.	5
	Chemical Kinetics	Introduction, reaction rate, factors affecting the rate of a reaction, Order and molecularity, rate expression for zero and first order reactions. Half life of reactions, activation energy. Transition state theory and Collision theory.	7
Unit IV Analytical Chemistry	Errors in Chemical Analysis	Introduction, Random and Systematic errors, Accuracy, Precision, Uncertainty, Absolute & Relative errors, Mean, Median, Average and Standard deviations, Significant figures.	4
	Gravimetric and Volumetric Analysis	A) Principle, theory and types of Gravimetric analysis, properties of precipitates and precipitating agents, application of gravimetric methods B) Principle, theory and types of volumetric analysis, Acid-base, complexometric, redox and precipitation titrations, applications of volumetric analysis.	8

B.Sc. Forensic Science Semester - I

1T3: Basics of Forensic Physics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Mechanics

Newton's Law of Motion: Newton's First and Second Law and Their Explanation, Working with Newton's First and Second Law, Newton's Third Law of Motion and Its Explanation, Projectile Motion (Range, Time of Flight, Maximum Vertical Height, Angle of Elevation, Trajectory).

Rotational Motion, Centripetal Force, Centrifugal Force, Coriolis-force and its applications.

Work and Energy: Kinetic Energy, Work and Work-Energy Theorem, Conservative and Non-Conservative Forces, Potential Energy and Conservation of Mechanical Energy, Change in Potential Energy in Rigid Body Motion, Mass-Energy Equivalence.

Unit II: Properties of Matter

Elasticity: Introduction, Hooke's Law, Young's Modulus, Bulk Modulus & Modulus of Rigidity and Relation between them, Poisson's Ratio, Elastic Limit, Work Done in Stretching a Wire, Bending of Beam, Cantilever Supported at One End and at Both Ends, Torsional Pendulum.

Viscosity: Streamline and Turbulent Flow, Coefficient of Viscosity, Equation of Continuity, Euler's Equation, Bernoulli's Theorem and Its Applications (Lift of an Airplane, Atomizer, Venturimeter), Poiseuille's Formula, Reynolds Number, Terminal Velocity, Stokes Law by the Method of Dimension, Variation of Viscosity with Temperature.

Unit III: Optics

Geometric Optics: Introduction, Thin and Thick Lenses, Lens Equation, Lens Maker's Formula, Cardinal Points of an Optical System, Combination of Two Thin Lenses (Equivalent Lenses) (Including Derivation for Focal Length and Cardinal Points).

Aberrations: Achromatic and Chromatic Aberration, Types of Achromatic Aberration and their Reduction: Spherical Aberration, Coma, Astigmatism, Curvature of Field, Distortion, Types of Chromatic Aberration: Achromatism (Lenses in Contact and Separated by Finite Distance).

Unit IV: Electrostatics & Magnetism

Electrostatics: Coulombs Law in Vacuum, Force between Two Charges, Electric Field Intensity, Electric Potential, Electric Field Intensity due to a Point Charge. Gauss Law, Concept of Capacitance, Parallel Plate Capacitor without and with Dielectric. Electromagnetic Induction, Faradays Law, Lenz's Law, Self and Mutual Induction.

Magnetism: Concept of Magnetic Field, Lorentz Force Equation, Biot- Savarts Law, It's Applications (Magnetic Field due to Steady Current in a Long Straight Wire, Magnetic Field along the Axis of Circular Coil), Ampere's Law, It's Applications (Magnetic Field for a Solenoid, a Toroid).

B.Sc. Forensic Science Semester - I

1T4: Basics of Forensic Biology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I:

The science of biology; definition and characteristics of life, levels of organization in biological world. Origin of life: brief history of earth, geological time scale, Oparin- Haldane hypothesis, Miller's experiment. Five kingdom system of classification. Theories of evolution; Lamarckism, Darwinism, mutation theory, Neo-Darwinism. Brief introduction to chemistry in the biological world: structure of atom, types of chemical bonds- covalent and non-covalent interaction, role of isotopes in biological research. Water: properties of water, ionization of water- H-H equation, p^H scale and its importance, importance of water in evolution of life.

Unit II:

Carbohydrates: definition, types, stereoisomerism and optical isomerism of sugars, reactions of aldehydes and ketone groups, ring structure and anomeric forms, importance of carbohydrates.

Lipids: definition, types, Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, saponification value, acid value, rancidity of fats, Reichert-Meissel number, importance of lipids.

Unit III:

Amino acids & Proteins: definition, structure and classification of amino acids, reactions of amino acids, isoelectric pH, structure of proteins-primary, secondary, tertiary and quaternary. Importance of amino acids and proteins. Enzymes: definition, types, mechanism of action (Lock and key and induced fit model), enzyme kinetics- M-M equation, enzyme inhibition, allosteric enzymes, Isozymes, multienzyme, polymorphic enzymes.

Unit IV:

Mendel's laws of inheritance, mitochondrial inheritance.

Genetic material: Griffith's experiment, Avery, McCleod and McCarty, Harshe and Chase experiment, RNA as genetic material; experimental proof. Structure of DNA: X-ray crystallography, Chargaff's rule, Watson-Crick's double helical model of DNA, types of DNA.

Types of RNA.

B.Sc. Forensic Science Semester - I

1T5: Basics of Forensic Psychology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

UNIT I: The Science of Psychology

- What is Psychology: definitions, goals, types of psychological professions
- Historical perspectives in psychology: Structuralism, functionalism, Gestalt, and Psychoanalysis
- Modern perspectives in psychology: Behavioural, Humanistic, Bio-psychological, and cognitive
- Scientific methods: Steps in scientific methods, Descriptive methods (observation, case study, survey, correlations), experimental methods (laboratory experiments and field experiments).
- Application of psychology to everyday life: use critical thinking – Does astrology work?

UNIT II: Biological Foundation of Behaviour

- Neuron: Structure, function, synapse, and neurotransmitters
- Central Nervous System
 - A. Brain: (i) Structure and function of brain; (ii) Cerebral hemispheres
 - B. Spinal cord: (i) Structure and function of brain
- Peripheral Nervous System: Structure and function
 - A. Autonomic Nervous System
 - B. Somatic Nervous system
- Glandular system

Sensation and Perception

- Definition
- Perceptual constancy (size, shape, and constancy)
- Gestalt principles of perception
- Perceptual illusions (geometrical, movement)
- Application: Difference between male and female brains

UNIT III: Learning

- Learning: Definition
- Classical Conditioning: Pavlov's experiment, extinction, spontaneous recovery, generalization, discrimination, higher-order conditioning.
- Operant Conditioning: Thorndike's Laws of learning, Skinner's experiment, positive reinforcer, negative-reinforcer, schedules of reinforcement, shaping.
- Cognitive Learning Theories Tolman's Latent Learning, Kohler's Insight Learning
- Bandura's Observation Learning Theory.
- Application of classical and operant and classical conditioning to everyday life

UNIT IV: Memory

- Memory: definition and Process
- The information-processing model: Three stages of memory
 - (i) Sensory
 - (ii) Short-term
 - (iii) Long term
- Types of long term memory- Procedural, Declarative (episodic, semantic), Explicit and implicit
- Levels of processing theory
- Forgetting: Course of forgetting (Ebbinghaus' forgetting curve) Causes of forgetting (encoding failure, decay of memory traces, interference, motivated forgetting).
- Physical aspects of memory
- Application: Enhance your academic performance by improving memory - Keyword techniques are, method of loci, encoding specificity, organization of test material, organization of lecture, notes, practice and rehearsal.

B.Sc. Forensic Science Semester - I

1T6: Basics of Digital and Cyber Forensics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Computer Fundamentals

1. Introduction to Computers
 - 1.1. Characteristics of Computers
 - 1.2. Computer Generations
2. Basic Computer Organization
 - 2.1. Input Unit
 - 2.2. Output Unit
 - 2.3. Storage Unit
 - 2.4. Arithmetic Logic Unit
3. Input and Output Devices
 - 3.1. Input Devices
 - 3.2. Output Devices
4. Processor and Memory
 - 4.1. Central Processing Unit
 - 4.1.1. Arithmetic Logic Unit (ALU)
 - 4.1.2. Control Unit (CU)
 - 4.2. Types of Memory(RAM and ROM and Their types)
 - 4.3. Volatile and Non Volatile Memory
 - 4.4. Cache Memory
 - 4.5. Virtual Memory
5. Secondary Storage Devices
 - 5.1. Magnetic Tapes
 - 5.1.1. Types of Magnetic Tapes
 - 5.2. Magnetic Disks
 - 5.2.1. Types of Magnetic Disks
 - 5.2.2. Types of Hard Disks
 - 5.2.3. Internal structure of Hard Disks
 - 5.3. Optical Disks
 - 5.3.1. Types of Optical Disks
 - 5.4. Memory Storage Devices
 - 5.4.1. Flash Drive (Pen Drive)
 - 5.4.2. Memory Cards
 - 5.4.2.1. Types of Memory Cards
6. Memory Hierarchy
7. Computer Languages
8. Classification of Computers
9. Application Software and System Software

Unit II: Number Systems and Binary Arithmetic

1. Introduction
2. Various number systems
 - 2.1. Binary Number System
 - 2.2. Octal Number System
 - 2.3. Decimal Number System
 - 2.4. Hexadecimal Number System
3. Conversion of Number Systems
 - 3.1. Conversion from Decimal to other systems
 - 3.1.1. Decimal to Binary
 - 3.1.2. Decimal to Octal
 - 3.1.3. Decimal to Hexadecimal
 - 3.2. Conversion from binary to other systems
 - 3.2.1. Binary to Decimal
 - 3.2.2. Binary to Octal
 - 3.2.3. Binary to Hexadecimal

- 3.3. Conversion from octal to other systems
 - 3.3.1. Octal to Decimal
 - 3.3.2. Octal to Binary
 - 3.3.3. Octal to Hexadecimal
- 3.4. Conversion from hexadecimal to other system
 - 3.4.1. Hexadecimal to Binary
 - 3.4.2. Hexadecimal to Decimal
 - 3.4.3. Hexadecimal to Octal

- 4. Binary Arithmetic
 - 4.1.1. Binary Addition
 - 4.1.1.1. Sum and carry
 - 4.1.1.2. Addition of large binary numbers
 - 4.1.2. Binary Subtraction
 - 4.1.2.1. Subtraction and borrow
 - 4.1.2.2. Subtraction of larger binary numbers
 - 4.1.3. Binary Multiplication
 - 4.1.4. Binary Division
 - 4.1.5. 1's Complement of Binary Number
 - 4.1.6. 2's Complements of Binary Numbers
 - 4.1.7. Binary subtraction using 1's and 2's complements
- 5. Binary Coded Decimal (BCD) Codes
- 6. ASCII Codes

Unit III: Introduction to Operating System

- 1. Understanding Computer Operating Systems
- 2. Understanding the Role of the Operating System Software
- 3. Types of Operating Systems
 - 3.1. Multitasking
 - 3.2. Multiprogramming
 - 3.3. Distributed OS
 - 3.4. Multiprocessing
 - 3.5. Multithreading
 - 3.6. Network OS
- 4. Proprietary and Open Source Operating Systems
- 5. An Overview of Commonly Used Operating Systems
 - 5.1. Understanding DOS
 - 5.2. Windows 1.x Through 3.x
 - 5.3. Windows 9x (95, 95b, 95c, 98, 98SE, and ME)
 - 5.4. Windows NT
 - 5.5. Windows 2000
 - 5.6. Windows XP
 - 5.7. Windows 7
 - 5.8. Windows 8
 - 5.9. Windows 10
 - 5.10. UNIX / Linux and its variants
 - 5.11. Smart phone Operating Systems
- 6. File Systems
 - 6.1. Introduction to File Systems
 - 6.2. Types of File System
 - 6.2.1. FAT12
 - 6.2.2. FAT16
 - 6.2.3. FAT32
 - 6.2.4. NTFS
 - 6.2.5. Ext, Ext2, Ext3, Ext4
 - 6.2.6. Other File Systems

Unit IV: Computer Networks and Internet

- 1. Introduction to Networking
- 2. Network topologies
 - 2.1. Star
 - 2.2. Bus

- 2.3. Ring
- 2.4. Mesh
- 2.5. Hybrid
3. Types of Network (LAN, MAN, WAN etc.)
4. Client Server and Peer to Peer Network Architecture
5. Networking Devices (Switches, hub, bridge, Router, Modem etc.)
6. OSI Reference Model
7. TCP/IP Model
8. IP Addressing
 - 7.1. IPv4
 - 7.1.1. Classes of IPv4 Addresses
 - 7.2. IPv6
9. World Wide Web (URL, HTTP, HTTPS, FTP etc.)
10. Web Browsers
11. E-mails
12. Chatting
13. Search Engines

B.Sc. Forensic Science Semester - II

2T1: Basics of Forensic Science

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Development of Forensic Science

Educational setup of Forensic Science in India, Services and functionalities provided by various FSLs, Structure of the FSLs, Various divisions in the FSL – General Analytical and Instrumentation, Ballistics, Biology, Chemistry Documents, Physics, Psychology, Serology, Toxicology, Cyber Forensic, Tape Authentication and Speaker Identification (TASI), DNA division. Mobile Forensic Science Laboratories.

Growth and development of Forensic Science Laboratories in India – Central and State level, GEQDs, Eminent scientists and Forensic Experts in India and their contributions to the field.

Unit II: Physical Evidences

Definition, Types of Evidences and physical evidences and their importance in criminal investigation. Collection and preservation of physical evidences: Toxicological Evidences, Biological Evidences. Petroleum products, trace items, Entomological Evidences, Dental Evidences, bones, Fingerprint, questioned document, diatoms, tool marks.

Unit III: Crime Scene Reconstruction

Steps involved (Recognition of evidence, Documentation of evidence, Collection of evidence, Evaluation of evidence, Hypothesis, Testing, Reconstruction), various crime scenes and scenarios (like Hit and Run, Accidents, Hanging, Shooting, Burglary, etc.). Digital Aids in Reconstruction (3-D Photography/Videography, Computer aided Reconstruction).

Unit IV: Investigation Agencies and Society

Working of Police officers, Limitations on their power, Custodial Crimes, Interview & Interrogation, Role of Police officers in crime investigation. Society and Social control, Concept of punishment.

Prison: Structure of prison and prison management, Prison reforms, Self-image of socialization within prison wall, open prisons, Constitutional and statutory rights of prisoners.

Structure, role and functions of CID, CBI, IB, RAW, NCRB, BPR&D, DFS, DFSS, and NICFS . Techniques of interview and interrogation (Polygraph, Brain mapping, and Narco-analysis and other modern techniques).

2P1: Practicals based on Basics of Forensic Science (Semester I & II)
Max. Marks: 40 (Practical) + 10 (Internal)

1. To conduct mock 'Crime Scene Investigation'.
2. Sketching of an Indoor Crime Scene using Triangulation method.
3. Sketching of a Crime Scene using Baseline method.
4. Preliminary examination of suspected bloodstains at the scene of crime.
5. Preliminary examination of suspected saliva stains.
6. Forensic Photography of various types of crime scene.
7. Collection and Preservation of toxicological samples.
8. Collection and Preservation of entomological evidences.
9. Collection and Preservation of Petroleum and other samples in a case of Arson.
10. Collection and Preservation of evidences in a case of Murder.
11. Collection and Preservation of Hit and run crime scene samples.

B.Sc. Forensic Science Semester - II

2T2: Basics of Forensic Chemistry

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit	Content	Scope	Lect
Unit I Forensic Chemistry	Mole concept and methods of expressing concentration	Introduction, mole, equivalent weight, normality, molarity, molality, percentage, mole fraction, ppm, ppb, etc.	5
	Petroleum products	Definition, classification, distillation and fractionation of petroleum. Commercial uses of different petroleum fractions, nature and purpose of dyes used in petroleum products, adulteration of petroleum products.	7
Unit II Forensic Toxicology	Basics of Toxicology	Definition of poison, Classification of poisons, characteristics and mode of action of poisons, types of poisoning. Significance of toxicological findings. Techniques used in toxicology. Fatal dose and fatal period, signs and symptoms of common poisoning and their antidotes.	12
Unit III Spectroscopy	Electromagnetic spectrum and Electronic spectroscopy	A) Electromagnetic radiation, Absorption, emission, fluorescence, phosphorescence, Jablonski Diagram, Molecular and atomic spectroscopy B) Absorption laws (Beer Lambert law), molar absorptivity, Types of electronic transitions, Ultraviolet spectroscopy (Principle, theory and instrumentation and applications), Effect of conjugation, Concept of chromophores and auxochromes, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts.	12
Unit IV	Chromatography	Principle, theory, stationary phases, mobile phases, retardation factor and applications of Paper Chromatography, Column chromatography, TLC, HPTLC, etc	7
	Spectroscopy	Principle, instrumentation, working, application of FAES, AAS.	5

2P2: Practicals based on Basics of Forensic Chemistry (Semester I & II)

Max. Marks: 40 (Practical) + 10 (Internal)

1. To determine the density of given liquid.
2. To determine relative viscosity of given organic liquids by viscometer.
3. To determine the surface tension of given liquid by Stalgnometer.
4. To study kinetics of acid catalyzed ester hydrolysis.
5. Determination of hardness of water from a given sample of water by EDTA method.
6. Organic qualitative analysis. - 04
7. To determine strength of given acid.
8. To standardize the given NaOH solution & find the strength of given HCl solution.
9. Paper Chromatography of toxic metal ions. - 02
10. Thin Layer Chromatography of Organic poisons. - 02
11. Identification of toxic metal ions in given solution by colour tests.- 02
12. Identification of adulteration in petrol using density method. - 02
13. Iodometric estimation of copper.

*** Note – Minimum 12 experiments should be conducted.**

Suggested Readings

1. Organic Chemistry-6h Ed. Morrison and Boyd Prentice Hall of India Pvt Ltd, New Delhi-2001.
2. Reactions, rearrangements and reagents – S N Sanyal
3. Physical Chemistry by P.W. Atkin 4th edition
4. Principles of physical chemistry by Puri, Sharma and Pathania
5. Concise Inorganic Chemistry by J. D. Lee
6. Analytical Chemistry by G.D. Christian, sixth edition
7. Vogel's textbook of Quantitative Analysis, sixth edition
8. Instrumental Methods of Chemical Analysis by G.R. Chatwal and S. K. Anand
9. Introduction to Forensic Science in Crime Investigation By Dr.(Mrs.) Rukmani Krishnamurthy
10. Forensic Science in Criminal Investigation and Trial, 4th ed. By B.R. Sharma
11. Text Book of Medical Jurisprudence, Forensic Medicine and Toxicology by Parikh C.K.
12. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed. by Stuart H. James

B.Sc. Forensic Science Semester II

2T3: Basics of Forensic Physics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Thermodynamics

Thermodynamic Variables, Thermal Equilibrium and Temperature, Zeroth Law of Thermodynamics, Thermodynamic Processes (Reversible and Irreversible), Indicator Diagram, First Law of Thermodynamics, Carnot's Cycle and Its Efficiency, Carnot's Theorem, Entropy, Second Law of Thermodynamics.

Two Stroke and Four Stroke Engine Principles and their Comparison. Types of Engines: Petrol, Diesel And CNG.

Unit II: Optics

Interference: Interference of Thin Films, Interference by Division of Amplitude, Interference by Wedge Shaped Film: Interference due to Reflected Light and Transmitted Light, Colours of Thin Films.

Diffraction: Introduction to Fresnel's Diffraction and Fraunhofer's Diffraction, Plane Diffraction Grating, Rayleigh's Criterion for Resolution, Resolving Power of a Grating.

Unit III: Wave Motion

Oscillations: Definition of Linear and Angular S.H.M., Differential Equation of S.H.M. and Its Solution, Interference of Waves, Beats, Composition of Two Perpendicular Linear S.H.Ms. for Frequencies 1:1 And 1:2 (Analytical Method), Lissajous's Figures and Its Uses, Applications (Mechanical, Electrical and Optical).

Wave Motion: Differential Equations of Wave Motion in Continuous Media, Equations for Longitudinal Waves and its Solution (One Dimension Only), Equation for Transverse Waves and Its Solution (One Dimension Only), Energy Density and Intensity of a Wave, Discussion of Seismic Waves, Wave Motion in Strings and Organ Pipes.

Unit IV: Electronics

Active and Passive Components (Resistors, Capacitors, Inductors, Diodes, Transistors), IC's and IC packages, Identification Techniques of Components, Basics of LCR Circuits, Rectifier Circuits, Timer Circuits (using IC 555 &UJT), Introduction to OPAMP (Inverting & Non-inverting Amplifier) and Applications.

Active Filters: Low Pass, High Pass, Band Pass.

Waveform Generators: Working Principle of Oscillators, Waveform Generators; Sine (Phaseshift and Wien Bridge), Square, Triangular, Sawtooth.

2P3:Practicals based on Basics of Forensic Physics (Semester I & II)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Study of Laws of Motion
2. Determination of Moment of Inertia of Flywheel
3. Determination of Young's Modulus by Vibration
4. Determination of Young's Modulus by Bending of Beam
5. Coefficient of Viscosity by Poiseuille's Method
6. Demonstration of Terminal Velocity and Coefficient of Viscosity by Falling Sphere.
7. Determination of Angle of Prism using Spectrometer
8. Determination of Wavelength of Light using Plane Transmission Grating
9. Determination of Radius of Curvature of Plano-Convex Lens by Newton's Rings
10. Determination of Thickness of Thin Film using Air Wedge
11. Measurement of Sound Intensity
12. Study of Ultrasonic Interferometer
13. Determination of Frequency of AC Mains using Sonometer
14. Study of Electrical Components
15. Study of Lissajous Figures using CRO
16. Study of OP-AMP as Adder and Subtractor
17. Study of Load Regulation using Bridge Rectifier

18. Study of Transistor Characteristics
19. Study of FET Characteristics
20. Study of LCR Resonance

Suggested Readings

1. Mechanics; D. S. Mathur
2. Mechanics & Properties of Matter; J. C. Upadhyaya
3. Applied Fluid Mechanics; Mott Robert, Pearson Benjamin Cummir
4. Properties of Matter; D. S. Mathur
5. Optics; E. Hecht, A. R. Ganesan
6. A Text book of Optics; N.Subhramanyam, Brijlal, M. N. Avadhanulu
7. Physical Optics; A.K.Ghatak
8. Fundamental of Optics; F.A.Jenkins, H.E.White
9. Principles of Optics; D.S. Mathur
10. Electricity and Magnetism; K. K. Tewari
11. Electricity and Magnetism; D. C. Tayal
12. Introduction to Electrodynamics; D. J. Griffiths
13. Heat, Thermodynamics and Statistical Physics; Singhal, Agrawal
14. Heat and Thermodynamics; Brijlal, Subramanyam
15. Waves and Oscillations; Stephenson
16. The Physics of Waves and Oscillations; N. K. Bajaj
17. Fundamentals of Vibration and Waves; S. P. Puri
18. A Text Book of Sound; Subramanyam and Brijlal
19. Basic Electronics; Bernrad Grob
20. Electronics Principles; Malvino, Bates
21. Basic Electronics; B. L. Theraja
22. Principles of Electronic Devices and Circuits; B. L. Theraja
23. Principles of Electronics; V. K. Mehta
24. Op Amp and Linear Integrated Circuits; Ramakant Gaikwad
25. Integrated Electronics; Millman, Halkias
26. Elements of Electronics; M. K. Bagde, S. P. Singh, K Singh
27. Fundamentals of Physics; Halliday, Resnick, Walker
28. Concepts of Physics; H. C. Verma
29. A Textbook of Engineering Physics; Avadhanalu, Kshirsagar
30. University Physics; Sears and Zeemansky
31. Physics for Degree Students; Arora, Hemne
32. B. Sc. Practical Physics; C. L. Arora
33. Advanced Practical Physics; S. P. Singh

B.Sc. Forensic Science Semester II

2T4: Basics of Forensic Biology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I:

Cell biology: structure of prokaryotic and eukaryotic cell, cytoskeleton.

Plasma membrane: chemical composition, fluid mosaic model, membrane transport-active and passive, functions of plasma membrane. Composition of cytoplasm.

Study of cell organelles-nucleus, Endoplasmic reticulum, Golgi Complex, Lysosomes, peroxisomes, glyoxysomes, ribosomes, mitochondria.

Cell division- cell cycle, mitosis, meiosis.

Unit II:

Principles of taxonomy general scheme

Systematics- Linnean hierarchy, Binomial nomenclature.

Salient features and classification up to classes of –Protozoa with reference to malaria, Platyhelminthes, Aschehelminthes, Arthropoda, Vertebrata.

Plant diversity: salient features and morphological characteristics of algae, fungi, gymnosperms and angiosperms up to class level, Bentham and Hooker system of classification, classification of animal kingdom up to class level.

Unit III:

Morphology and Anatomy of root stem leaf and flower in monocots and dicots.

Plant tissues: Ground tissues: parenchyma, chlorenchyma, collenchyma, and sclerenchyma.

Vascular tissues: xylem, phloem. Secretory tissues: laticiferous, glandular.

Secondary growth in plants. Growth rings and their role in age estimation of plants.

Types of animal tissues structure and function.

Palynology: structure of pollen grains, isolation and identification. Pollination.

Unit IV:

Microscopy: Numerical aperture & its importance, Resolving power, Parts of microscope, compound microscope, Principles and applications of Dark field, Phase contrast, Fluorescence microscopy. Electron microscopy: Principle, polarisation microscope, stereo microscope.

Stains: types and classification, simple and differential staining.

2P4:Practicals based on Basics of Forensic Biology (Semester I & II)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Introduction to instrument and Glassware of the laboratory
2. To Study the calibration of laboratory equipment
3. To study laboratory safety practices
4. Qualitative analysis of sugar, proteins, lipids and nucleic acids
5. Study of plant-material (wild and cultivated from families, magnoniaceae, combretaceae, amaranthaceae, convolvalacea)
6. Study of Microscope and its parts
7. Study of conducting tissue, xylem and phloem elements in angiosperms and Gymnosperms as seen in L.S. and T. S from monocot and dicot root and stem
8. Study of morphological types of red blood cells
9. Microscopic study of Mitosis and Meiosis
10. Determination of pH of any fluid and iso-electric point of protein
11. Determination of saponification value and rancidity of fats
12. Microscopic study of cell organelles
13. Identification of parts of flower and isolation along with identification of pollen grain
14. Determination of GOD /POD activity in serum/plasma
15. Separation of amino acids and Protein or sugar using paper Chromatography techniques (Radial/Ascending)

16. Visit to autopsy center at mortuary, Forensic Science Laboratory, Pathology Laboratory, Veterinary Center, Biodiversity and wildlife Center.

Suggested Readings

1. Origin of species-Charles Darwin
2. Evolution: the modern synthesis-Julian Huxley
3. Biology: Raven, Johnson, Singer
4. Evolution: Donald Prothero
5. Biology: Taylor
6. Biochemistry: Berg, Tymoczko, Stryer
7. Lehninger Principles of Biochemistry: Nelson and Cox.
8. Molecular cell biology: Lodish, Berk, Zipursky, Matsudaira, Baltimore, Darnell.
9. Biochemistry: Voet and Voet
10. Instant Notes in Biochemistry: Hames, B. D.
11. Principles and techniques of biochemistry and molecular biology: Wilson and Walker.
12. Textbook of Biochemistry with clinical correlations: Thomas M. Devlin
13. Genetics: Principles and analysis: Hartl and Jones
14. Principles of genetics: Snustad and Simmons
15. Concepts of genetics: Klug and Cummins
16. Genetics: from genes to genomes: Hartwell, Hood, Goldberg, Reynolds, Silver
17. Genetics: a conceptual approach: Benjamin Pierce
18. Genetics: analysis and principles: Robert Brooker
19. Textbook of Plant taxonomy: Manoj Kumar singh
20. A textbook of botany: Singh, Pande and Jain
21. An introduction to microscopy: Suzanne Bell and Keith Morris
22. Molecular biology of the cell: Alberts, Bray, Lewis, Raff, Roberts, Watson
23. Cell biology: Gerald Carp
24. The cell: a molecular approach: Cooper

B.Sc. Forensic Science Semester II

2T5: Basics of Forensic Psychology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

UNIT I: Introduction to Psychological Testing

- What is psychological test?
- Characteristics of psychological tests
- Types of reliability and Validity of psychological tests
- Types and uses of psychological tests
- Measurement of intelligence
 - (i) Individual test: Stanford-Binet Scale, Wechsler's Intelligence Scale for Children (WISC)
 - (ii) Group tests: SPM, Cattell's Culture Fair Test
- Concept of Aptitude
- Aptitude Tests: DAT, GATB
- Interest Tests: The strong Cambell Interest Inventories, Kuder preference Record.
- Application: Use of Psychological tests in career selection

UNIT II: Motivation and Emotions

- Definition of motivation,
- Types of motives
 - (i) Physiological: hunger, thrust, sleep and sex
 - (ii) Social: achievement, affiliation, power, and aggression.
- Approaches to motivation: instinct approach, drive reduction approach, arousal approach, incentives approach, and humanistic approach (Maslow's hierarchy of needs)
- Frustration and conflict
- Definition of emotion
- Elements of emotion
- Theories of emotions: James-Lange's theory, Cannon-Bard's theory, Schachter-Singer's theory, cognitive appraisal theory
- Application to everyday life: use of incentives to motivate the employees to work hard.

UNIT III: Theories of Personality

- Definition of personality
- Theories of personality
 - (i) Sigmund Freud's Psychoanalytic theory
 - (ii) Behavioral Model
 - (iii) Social Cognitive model: Bandura's reciprocal determinism and self-efficacy
 - (iv) Humanistic Model; Carl Roger and self-concept
 - (v) Trait theories of Personality: Allport's Theory, Cattell's Theory
 - (vi) The Big Five Model
 - (vii) Biological Model
- Assessment of Personality
 - (i) Behavioural assessment (Observation, Rating scales)
 - (ii) Personality inventories (16 PF, MMPI, NEO-PI)
 - (iii) Projective techniques (TAT, Rorschach Ink Blot Test, Sentence Completion Test)
 - (iv) Applying psychology to everyday life: Parents as a role models for children and film stars as role models for adolescents

UNIT IV: Cognition: Attention, Thinking and Intelligence

- What is attention
- Factors influencing Attention
- Types of Attention
- Thinking: mental images, concepts, prototypes
- Problem Solving and Decision Making,
- Problems with Problem Solving.
- Definition of Intelligence

- Measuring Intelligence
(i) concepts in measuring intelligence (C.A., M.A., I.Q),
- Theories of intelligence: Spearman, Gardner, Sternberg
- Individual Differences in Intelligence (mental retardation, giftedness)
- Application: Early childhood intervention: a mean for boosting intelligence.

2P5: Practicals based on Basics of Forensic Psychology (Semester I & II)
Max. Marks: 40 (Practical) + 10 (Internal)

1. Serial learning
2. Recall and Recognition
3. Habit interference
4. Muller-lyre Illusion
5. Reaction Time
6. Retroactive and proactive inhibition
7. Retention for meaningful and non-meaningful material
8. Maze learning
9. Type A/B behaviour pattern – Upinder Dhar & Jain M.
10. Rotters Locus of control Scale
11. Assertiveness Test
12. Sinha's Comprehensive Anxiety Scale: A.K.P. Sinha& L.N.K. Sinha
13. Problem Solving scale

*** Note – Minimum 8 tests should be conducted.**

Suggested Readings

1. Psychology, (2006) Ciccarelli, S. K. & Meyer G. E. New Delhi; Perason Education
2. Introduction to Psychology, (1986) Morgan C.T., King R.A., Weisz J.R., Schopler J., McGraw-Hill Book Co.
3. Principles of General Psychology,3rd ed. Kimble G.A, Garnezy, , New York.
4. Psychology, (2001), Baran R.A. New Delhi; Person Education Pvt.Ltd.
5. Psychological Testing', Anne Anastasi, Susana Urbina, Edition 7th, 2010, PHI Learning PRI. LTD, New Delhi
6. Cognitive Psychology Mind and Brain', Edward E. Smith, Stephen M. Kosslyn, New Delhi, Pearson Education.
7. Invitation to Psychology, Parameswaran, E.G., BeenaC.Tata McGraw-Hil, New Delhi.
8. Manashatra-EkParichay, (2004), Dr. PadhyeV.S.Aurangabad; RenukaPrakashan.
9. Psychology-An Introduction, Thakkar P., Dr. Ambekar A.,

B.Sc. Forensic Science Semester - II
2T6: Basics of Digital and Cyber Forensics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Cyber Crimes
<ol style="list-style-type: none">1. Cyber Forensic and Computer Crimes<ol style="list-style-type: none">1.1. Introduction Conventional Crime Cyber Crime1.2. Reasons for Cyber Crime.1.3. Distinction between Conventional and Cyber Crime.1.4. Cyber Criminal Mode and Manner of Committing Cyber Crime.1.5. Computer crime prevention measures2. Types of Cyber Crimes<ol style="list-style-type: none">2.1. Crimes targeting Computers<ol style="list-style-type: none">2.1.1. Unauthorized Access2.1.2. Packet Sniffing2.1.3. Malicious Codes including Trojans, Viruses, Logic Bombs, etc3. Online based Cyber Crimes<ol style="list-style-type: none">3.1. Phishing and its variants3.2. Web Spoofing and E-mail Spoofing3.3. Cyber Stalking3.4. Web defacement3.5. Financial crimes ,ATM and Card Crimes etc3.6. Money Laundering Fraud3.6. Software and Hardware Piracy & Cheating4. Other Cyber Crimes
Unit II: Digital Evidence
<ol style="list-style-type: none">1. Digital Evidence<ol style="list-style-type: none">1.1 Introduction1.2 Types of Digital Evidence1.3 Admissibility of Digital Evidence1.4 Order of volatility of digital evidence1.5 Why is Volatile Data Important?2. Digital Evidence Vs. Physical Evidence3. Nature of Digital Evidence4. Volatile and Non-Volatile Digital Evidences5. Identification of Digital Evidences6. Best practices in digital evidence collection7. Digital devices and Potential evidences<ol style="list-style-type: none">6.1. Hard Disks6.2. Smart Cards6.3. Handheld Devices (PDA's, Smart Phones, etc.)6.4. Removable Storage media6.5. SIM Cards6.6. Servers6.7. Routers, Hub, Switches, etc.8. Precautions while dealing with digital evidence9. Slack Space , Swap Space
Unit III: Computer Forensics
<ol style="list-style-type: none">1. Introduction to Computer/Cyber Forensic2. Cyber Forensic Steps (Identification, Seizure, Acquisition, Authentication, Presentation, Preservation)3. Who is Computer Forensic Expert4. The Goal of the Forensic Investigation5. Why Investigate (Internet usage exceeds norm, Using email inappropriately, Use of Internet, email, or PC in a non-work-related manner, Theft of information, Violation of security policies or procedures, Intellectual property infractions, Electronic tampering)6. Establishing a Basis or Justification to Investigate7. Determine the Impact of Incident8. Auditing V/s Cyber Forensic Investigations
Unit IV: Incidence Response

1. Introduction to Incident Response Process
2. Role of First Responder
3. Common First Responder Mistakes
4. (What is Computer Security Incident, What are the goals of Incident Response, Who is involved in Incident Response Process, Incident Response Methodology, Formulate a Response Strategy, Investigate the Incident.)
5. Preparing For Incident Response
6. Overview of Preincident Preparation
7. Identifying Risk
8. After Detection of an Incident.

2P6:Practicals based on Basics of Digital and Cyber Forensics (Semester I & II)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Identification and study of components of computer
2. Study of DOS Commands.
3. Working with windows file (creation, modification, deletion, attributes) folder (creation, nesting, attributes)
4. Study of LINUX Commands
5. Use of internet- visiting websites with given URL, searching information using search engine.
6. Use of E-mail, creating e-mail, sending and receiving e-mails with attachments.
7. Working with external storage devices using windows- Reading and writing data on floppy, CD, DVD, USB thumb drive.
8. Working with external storage devices using Linux-reading writing data on floppy, CD, DVD, USB, thumb drive.
9. Networking commands- like ping, Ipconfig, netstat, tracert, pathping, ftp, route, arp, nslookup, getmac, etc.
10. Study of various Networking devices (Switch, server, router, hub, gateway, firewall, bridge, NIC,modem).
11. Tracing E-mail, finding senders IP address, of received email, tracing route of email received using tool available on internet, e.g. Visual Trace Route etc.
12. Study of various Linux security Distro's. (Kali Linux, Parrot Security OS, CAINE, DEFT, etc).
13. Formatting NTFS and EX2, EX3.

Suggested Readings

1. Computer Fundamentals P.K.Sinha BPB Publication
2. Computer Fundamentals, Architecture & Organisation By B. Ram
3. Computer Fundamentals By Larry Long
4. Digital Electronics: Principles, Devices and Applications By Anil K. Maini
5. Digital Electronics: A Modern Approach By B. K. Jain
6. Forensic Computing: A Practitioner's Guide By Anthony Sammes, Brian Jenkinson
7. Computer Networks, By Andrew S. Tanenbaum
8. TCP/IP Protocol Suite, By Forouzan
9. Computer Networks: A Systems Approach By Larry L. Peterson, Bruce S. Davie
10. File System Forensic Analysis By Brian Carrier
11. Computer Forensics: Investigating Network Intrusions and Cybercrime (CHFI) By EC-Council
12. Incident Response & Computer Forensics By Mandia
13. Scene of the Cyber Crime Computer Forensic Handbook By Debra, LittleJohn Shinder, Ed Tittel.
14. First Responder's Guide to Computer Forensics by Richard Nolan et al.- Carnegie Mellon, 2005.
15. Digital Evidence in the Courtroom: A Guide for Law Enforcement and Prosecutors U.S. Department of Justice Office of Justice Programs National Institute of Justice
16. Electronic Crime Scene Investigation: A Guide for First Responders, U.S. Department of Justice Office of Justice Programs National Institute of Justice

**Semester III
&
Semester IV**

B. Sc. Forensic Science Semester - III

3T1: Advanced Forensic Science

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Fingerprints

Fingerprint as an Identification Tool: History and Formation of Fingerprint, Primary and Secondary ridge formation Composition of Sweat, Types of Fingerprints, Patterns of Fingerprints, and Characteristics of Fingerprints (Ridge Counting, Ridge Tracing, and Minutiae). Lifting & preservation of Fingerprint from various surfaces.

Methods of taking fingerprint from living person: Rolled & Plain. Methods of taking fingerprint from dead person in various conditions like: in case of setting-in of rigor mortis, drowning, burning and shrinking of phalanges.

Classification of Fingerprint: Primary, Secondary and Single digit/Batley's classification system.

Various methods of development of latent fingerprints: Physical, Chemical and Instrumental.

Unit II: Questioned Document

Definition of Document and Electronic Record, Questioned Document, Classification of various forensic documents, Collection of questioned, Specimen and Requested handwriting. Characteristic features in Handwriting: Basic Principle of handwriting Comparison, Class and Individual Characteristic of Handwriting, Variation in Genuine Handwritings, Basic Tools required for document analysis. Forgeries and their detection: Definition of Forgery, Types of Forgeries, Examination of Forgery.

Unit III: Blood Spatter Pattern Analysis

History of Bloodstain pattern interpretation, Properties of human blood, Size, Shape, and Directionality of bloodstains, Spattered Blood, other Bloodstain Patterns, Collection and packing of bloodstains on various surfaces. Interpretation of bloodstain on clothing and footwear. Documentation and Photography for bloodstain pattern analysis. Conditions affecting blood spatter pattern formation. Information that may be obtained by Blood spatter analysis.

Unit IV: Criminal Proceedings and Testimony-I

Stages in criminal proceedings: FIR, Zero FIR, Investigation, Prosecution, Trial stage, Remand and bail process. Court Testimony types and procedure.

Indian Penal Code (IPC) - Introduction, definitions, general exceptions, relevant sections. Indian Penal Code pertaining to offences against persons – Sections 120B, 121A, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362, 420. Sections 375.376 & 377 and their amendments.

B.Sc. Forensic Science Semester - III
3T2: Advanced Forensic Chemistry

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit	Content	Scope	Lect
Unit I Organic Chemistry	Aromaticity	Conditions for aromaticity, Hückel rule, aromatic ions (cyclopentadienyl cation and cycloheptatrienyl cation), Antiaromatic, Non aromatic, Homoaromatic Compounds	5
	Other functional groups	Alkanes, alkenes, alkynes, alcohols, amines, acids, esters, amides, etc. and their structures, nomenclatures, preparations, reactions. Chemistry of Heterocyclic compounds	7
Unit II Inorganic Chemistry	Chemistry of s & p - block elements	s Block Elements : Properties, Electronic configuration, Atomic and ionic radii, Ionization potential, oxidation states, Magnetic properties, etc.	5
		p Block Elements : Properties, Electronic configuration, Atomic and ionic radii, Ionization potential, Variable oxidation states, Magnetic properties, Complex formation, etc.	7
Unit III Physical Chemistry	Electrochemistry	Introduction, types of electrodes, Electrode potential, cell potential, types cells, Nernst equation, etc.	5
	Thermodynamics	Introduction, Types of system, first law of thermodynamics, Internal Energy, enthalpy, free energy, entropy, spontaneity, state function, etc	7
Unit IV Analytical Chemistry	Electrochemical methods	Introduction, Principle, working, applications and limitations of Potentiometry, pH metry and Conductometry, Titrimetric Methods.	7
	Solvent Extraction	Introduction, Principle, theory, Factors influencing extraction, Applications and limitations	5

B.Sc. Forensic Science Semester - III

3T3: Advanced Forensic Physics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Nuclear Radiations

Introduction to Nuclear Radiations and Origin, Review of Nuclear Composition, Mass Defect, Nuclear Properties and Half-Life, Radioactive Decay Schemes (α , β , γ Decay), Nuclear Reactions, Conservation Laws in Nuclear Reactions, Q-value of Nuclear Reaction. Applications of Radio Isotopes, Radiometric Dating, Radiation Hazards, Radiation Levels of Safety, Biological Effects of Nuclear Radiation, Radiation Protection Methods, Nuclear Disasters, Nuclear Waste Disposal, Radiation Damage, Roentgen and Roentgen Equivalent Physical (Rep) and Man (Rem), Radiation Dose, Shielding of Radioactive Sources.

Unit II: Digital Electronics & Signal Processing

Logic Gates and Their Applications, Flip Flops, Shift Registers and Counters (Asynchronous, Synchronous and Decade).

Signal Converters: Analog to Digital Converters (Dual Slope & Successive Approximation), Digital to Analog Converters (Weighted Resistors & R-2R Ladder).

Wave Shaping Circuits: Wave Clipping, Clamping Circuits.

Unit III: Optics

Polarization: Introduction, Types of Polarization- Plane, Circular, Elliptical, Polarization by Reflection of Light, Brewster's Law, Law of Malus, Polarization by Double Refracting Uniaxial Crystals, Linear Polarizer (Polaroid), Fabrication of Linear Polarizer by Nicol Prism.

Optical Instruments: Simple Microscope and Compound Microscope, Telescopes, Reflection and Transmission Type of Telescope, Eyepieces: Huygens's Eyepiece, Ramsden's Eyepiece, Gauss's Eyepiece, Constant Deviation Spectrometer, Michelson Interferometer, Resolving Power and Magnifying Power of Microscope and Telescope.

Unit IV: Sound

Generation of Sound, Definition of Sound Intensity, Loudness, Pitch, Quality and Timber, Acoustic Intensity Level Measurement, Acoustic Pressure and Its Measurement, Reverberation Time and Reverberation of a Hall, Sabine's Formula (without Derivation), Stroboscope.

Ultrasonic: Introduction, Properties, Production and Detection of Ultrasonic Waves, Piezoelectric Effect & Piezoelectric Generator, Magnetostriction Effect and Oscillators, Applications of Ultrasonic Waves (Measurement of Depth of Sea, SONAR System and Medical Science).

B.Sc. Forensic Science Semester - III
3T4: Advanced Forensic Biology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Human Physiology

Digestive system: BMR, calorific value, obesity, mechanism of digestion.

Excretory system: structure and functions of kidney.

Nervous system: structure and types of neurons, generation and conduction of nerve impulse, synapse, synaptic transmission, neuromuscular junction.

Muscles: types and physiology of muscle contraction.

Respiratory system: mechanism of respiration.

Unit II:

Composition of blood, plasma proteins, Coagulation of blood, Structure of hemoglobin and its functions, forensic significance, biochemistry of ABO blood group.

Reproductive biology: male and female reproductive system, anatomy of testis and ovary, spermatogenesis and oogenesis, menstrual cycle, structure of sperm and ovum.

Endocrine system: exocrine and endocrine glands, hormones and their classification.

Unit III: Microbiology

Methods of classification of microorganisms (bacteria).

Pure culture techniques-spread, streak and pour plate methods.

Growth rate and generation time, growth curve, synchronous cultures, continuous cultures- Chemostat, Turbidostat, Measurement of growth- Total cell count and viable cell count method, Factors affecting microbial growth, microbial control.

Unit IV: Virology and Immunology

General structure and classification viruses, lytic and lysogenic life cycle, structure and life cycle of HIV, Ebola, and Influenza.

Immune system: - Organs & cells of the immune system, Active & Passive Immunity, immunoglobulins: structure, types, function and forensic significance, antigen, hapten, criteria for antigenicity and epitope. Complement pathways.

B.Sc. Forensic Science Semester - III
3T5: Advanced Forensic Psychology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

UNIT I: Content of Forensic Psychology

- Definition of forensic psychology
- Historical development of forensic psychology
- Forensic psychology in India
- Scope of forensic psychology
 - (i) Police psychology
 - (ii) Psychology of crime and delinquency
 - (iii) Victimology and victims services
 - (iv) Legal services
 - (v) Correctional psychology
- Functions and roles of Forensic Psychologist
 - (i) As a researcher
 - (ii) As a consultant to law enforcement
 - (iii) As a trial consultant
 - (iv) As a evaluator and expert witness
 - (v) As a counsellor or psychotherapist

UNIT II: Assessment and Evaluation in Forensic Psychology

- Difference between clinical and forensic evaluation
- Forensic assessment
 - (i) Clinical interview
 - (ii) Mental Status examination
 - (iii) Psychological Tests: Intelligence, Achievement and Aptitude tests, Personality tests (projective techniques and inventories)
 - (iv) Neuropsychological Tests.
- Application of psychology tests to civil and criminal proceedings

UNIT III: Legal Aspects of Forensic Psychology

- What is criminal Justice System/process
- Introduction to Civil and Criminal court
- Stages of Judicial Process: Pretrial stage, Trial stage, Disposition stage, Appellate stage
- Characteristic of Judges, Jurors, and defenders.
- Trial Consultation
 - (i) Jury selection
 - (ii) Witness preparation
 - (iii) The Voir Dire
- Eye-witness testing: Problems & Solutions
- Effect of pre-trial publicity

UNIT IV: Stress and Health

- Definition of stress
- Lazarus cognitive Appraisal Model of stress
- Sources of stress
- The General Adaptation Syndrome
- Immune system and stress
- Personality and Stress: Type A, Type B, and Type C
- Stress and coping: Emotion focused and problem Focused
- **Social Psychology**
 - Attitudes:
 - (i) Definition
 - (ii) ABC model of attitude
 - (iii) Attitude formation
 - Stereotypes
 - Prejudices, and discrimination: meaning, and origin
 - Cognitive and social biases

B.Sc. Forensic Science Semester - III
3T6: Advanced Digital and Cyber Forensics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Introduction to 'C' Programming

1. Problem Solving using Computers
 - 1.1 Problem-Solving
 - 1.2 Writing Simple Algorithms
 - 1.3 Algorithms
 - 1.4 Flowcharts
2. Programming Languages as Tools
 - 2.1 Machine language
 - 2.2 Assembly language ...
 - 2.3 High level languages
 - 2.4 Compilers and Interpreters
3. Introduction to C
 - 3.1 History
 - 3.2 Structure of a C program
 - 3.3 Functions as building blocks
 - 3.4 Application Areas
 - 3.5 C Program development life cycle
 - 3.6 Sample programs
4. C Tokens
 - 4.1 Keywords
 - 4.2 Identifiers
 - 4.3 Variables
 - 4.4 Constants – character, integer, float, string, escape sequences
 - 4.5 Data types – built-in and user defined
 - 4.6 Operators and Expressions Operator types (arithmetic, relational, logical, assignment, bitwise, conditional, other operators), precedence and associativity rules.
 - 4.7 Simple programs using printf and scanf

Unit II: Problem Solving Using C Programming

1. Input and Output
 - 1.1 Character input and output
 - 1.2 String input and output
 - 1.3 Formatted input and output
2. Control Structures
 - 2.1 Decision making structures If, if-else, switch
 - 2.2 Loop Control structures While, do-while, for
 - 2.3 Nested structures
 - 2.4 break and continue
3. Functions in C
 - 3.1 What is a function
 - 3.2 Advantages of Functions
 - 3.3 Standard library functions
 - 3.4 User defined functions :Declaration, definition, function call, parameter passing (by value), return keyword,
 - 3.5 Scope of variables, storage classes
 - 3.6 Recursion
4. Arrays
 - 4.1 Array declaration, initialization
 - 4.2 Types – one, two and multidimensional
 - 4.3 Passing arrays to functions

Unit III: Introduction to DBMS and SQL

1. Overview
 - 1.1 File system Vs DBMS
 - 1.2 Structure of DBMS
 - 1.3 Users of DBMS
 - 1.4 Advantages of DBMS
2. Conceptual Design of DBMS (E-R model)
 - 2.1 Overview of DB design
 - 2.2 ER data model (entities , attributes, entity sets, relations, relationship sets)
 - 2.3 Additional constraints (Key constraints, Mapping constraints, Strong & Weak entities, aggregation / generalization)
3. Introduction to SQL
 - 13.1 Basic structure
 - 13.2 Set operations
 - 13.3 Aggregate functions
 - 13.4 Null values
 - 13.5 Nested Sub queries
 - 13.6 Modifications to Database
 - 13.7 DDL commands with examples
 - 3.8 Examples on SQL (case studies)

Unit IV: Cyber Forensics Tools and Utilities

1. Introduction
2. Examining a Breadth of Products
3. Cyber Forensic Tools
4. Good, Better, Best: What's the Right Incident Response Tool for Your Organization?
5. Tool Review
 - 5.1 Coroner's Toolkit
 - 5.2 EnCase Forensic
 - 5.3 Forensic Toolkit
 - 5.4 Mandiant First Response
 - 5.5 Net Witness
 - 5.6 ProDiscover Incident Response
 - 5.7 Sleuth Kit and Autopsy Browser
 - 5.8 Wireshark
 - 5.9 elcomsoft password recovery bundle

B.Sc. Forensic Science Semester - IV
4T1: Advanced Forensic Science

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Impressions and Prints:

Footprint and Footwear Impressions: Types, methods of collection from different surfaces. Naked footmarks: Margins, Toe marks, Crease marks. Gait pattern Analysis. Forensic Significance.

Tyre and Skid Marks: Collection, preservation and Forensic significance.

Lip Prints: Nature, Type, Collection, classification, evaluation and Forensic Significance.

Bite Marks: Nature, location, collection, classification, evaluation and Forensic Significance. **Ear Prints:** Types of Ears. Nature, location, classification, collection, evaluation and Forensic Significance.

Unit II: Forensic Science in Victim Identification

Forensic Odontology: Primary Dentition, Secondary Dentition, Body Identification by Dental Means, Post-mortem and ante mortem Dental records. ABFO Guidelines.

Forensic Dentistry: Collection, Packing, record comparison and Reporting of dental evidences in Mass Disaster, Physical Assault, Abuse, and Kidnapping etc. Role of Odontologist, Independent Medical Examination and Court Appearance. Role of Forensic Anthropology.

Unit III: Forensic Analysis of Evidences

Forensic analysis and significance of Biological evidences, Chemical evidences, Physical evidences, Toxicological evidences, Digital evidences, Micro evidences, Trace evidences and other evidences encountered on the scene of crime.

Unit IV: Criminal Proceedings and Testimony-II

Criminal Procedure Code (CrPC) – Introduction, definitions, FIR, NCR, Complaint, Non-bailable and bailable offenses, powers of courts, Summons, sub-poena, warrant, relevant sections (CrPC Sec 154, 155, 174, 175, 291, 292, 293).

Indian Evidence Act – Introduction and relevant Sections (Sec 32, 45, 46, 47, 57, 58, 60, 65, 65B, 73, 135, 136, 137, 159). Admissibility of expert testimony.

Probation and Parole: Origin and development of probation, Responsibilities of Probation Officers, Effectiveness of Probation, Objection to probation. Rule of Parole in India, Prison Act of 1894 section 5 (A), 5(B). Furlough.

4P1:Practicals based on Advanced Forensic Science (Semester III & IV)
Max. Marks: 40 (Practical) + 10 (Internal)

1. To take Plain and Rolled inked fingerprints and to identify the patterns.
2. To develop Latent fingerprints with Iodine and Powder method.
3. Lifting of Fingerprints from different surfaces.
4. To perform ridge tracing and ridge counting.
5. To identify ridge characteristics in the latent and patent fingerprints
6. Comparison of Fingerprints.
7. To study the impact of height, angle and movement on bloodstain pattern.
8. Study of primary and secondary dentition.
9. Identification of an individual on the basis of dental records.
10. Document and Fingerprint Photography.
11. Identification of Handwriting (General and individual characteristics.)
12. Identification of minutiae of lip prints.
13. Comparison of Ear prints
14. Analysis of Gait pattern of an individual.
15. Reconstruction of various types of crime scene.
16. To study the various anthropometric measurements in humans.
17. To estimate stature from long bone length.

B.Sc. Forensic Science Semester - IV
4T2: Advanced Forensic Chemistry

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit	Content	Scope	Lect
Unit I Forensic Chemistry	Fire and Arson	Chemistry of fire, fire triangle, Classes of fire and their extinguishers, fire behaviour. Location of point of ignition. Searching the fire scene. Collection and preservation of arson evidence.	6
	Explosives	Classification of explosives – low explosives and high explosives. Homemade explosives. Military explosives. Blasting agents. Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Blast waves.	6
Unit II Forensic Chemistry	Food adulteration	Definition of food and food adulteration, food additives and food adulterants, Prevention of Food Adulteration Act, Detection of common adulterants used in food products by physical and chemical methods	5
	Dyes , Paints, Pesticides and Insecticides	Nature, classification, composition, uses and significance in forensic science	7
Unit III Spectroscopy	IR Spectroscopy	Principle, theory, types of vibration, instrumentation, working, Applications, Limitations	6
	Raman Spectroscopy	Principle, theory, types of vibration, instrumentation, working, Applications, Limitations	6
Unit IV Analytical Chemistry	Chromatographic Techniques	Principle, Instrumentation, working, applications and limitations of HPLC and GC	7
	Thermal methods of analysis	DSC, TGA, DTA (Principle, Working, Applications and Limitations)	5

4P2:Practicals based on Advanced Forensic Chemistry (Semester III&IV)
Max. Marks: 40 (Practical) + 10 (Internal)

1. Conductometric Titration - 02
 2. pH- metric Titration - 01
 3. Potentiometric Titration – 02
 4. Titration – Complexometric (EDTA titration)
 5. Inorganic qualitative analysis – 04
 6. Solvent extraction technique.
 7. Identification of organic compounds. - 02
 8. Estimation of Aspirin from a given tablet.
 9. Detection of explosive ions from explosion residues by colour tests. (Simulated Sample)
 10. Detection of adulteration in the given food sample.
 11. TLC analysis of a given dye. – 02
 12. TLC analysis of a given pesticide. – 02
 13. Qualitative analysis of gun powder.
 14. Report on one day Industrial / Laboratory educational visit.
- * Note – Minimum 12 experiments should be conducted.**

Suggested Readings

1. Organic Chemistry by Clayden, Greeves, Warren and Wothers (Oxford Press)
2. A guide book to reaction Mechanism by Peter Sykes 6th Edn.
3. Introduction Spectroscopy by Pavia
4. Spectroscopic identification of organic molecules by Silverstein
5. Concise Inorganic Chemistry by J.D. Lee - 5th edition.
6. Inorganic Chemistry, - D.F. Shriver & P.W. Atkins- C.H. Longford ELBS – 2nd edition
7. Basic Inorganic Chemistry, - F.A. Cotton and G. Wilkinson, Wiley Eastern Ltd 1992
8. Essentials of Physical Chemistry by B.S. Bahl, G.D. Tuli and Arun Bahl Edition 2000 S. Chand and Company Ltd
9. Physical Chemistry by P.W. Atkins 4th edition
10. Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel
11. Instrumental Methods of Chemical Analysis- Chatwal and Anand
12. Basic Concept of Analytical Chemistry- 2nd edition S.M. Khopkar
13. Introduction to Forensic Science in Crime Investigation By Dr.(Smt) Rukmani Krishnamurthy
14. Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology, CBS Publications New Delhi (1999)
15. Casarett & Doll Toxicology, The basic Science of Poisons
16. Forensic Science in Criminal Investigation and Trial, 4th ed. By B.R. Sharma

B.Sc. Forensic Science Semester - IV

4T3: Advanced Forensic Physics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Spectroscopy

Basic Concepts of Atomic and Molecular Spectroscopy, Blackbody Radiation, Planck's Radiation Law, Wave Particle Duality, De Broglie's Hypothesis, Stark Effect, Zeeman Effect, Compton Effect. Electromagnetic Spectrum, Principles of Generation of Radiations, Their Utility and Limitations. Conventional Sources for UV, Visible and Infrared Rays, Sources of Radiations for X-Rays, α -Rays, β -Rays and γ -Rays, Laser (Ruby, He-Ne, CO₂, Dye Laser, Semi-Conductor Laser).

Unit II: Transducers

Strain Gauge, Resistance Thermometer, Thermocouple, Thermistors and its Applications, Integrated Circuit Temperature Transducers, Speedometers, Microphone & Loudspeaker. Variable Inductance Transducers, Linear Variable Differential Transducers and Applications, Uses of LVDT, Capacitive Transducers, Piezo-Electric Transducers, Photo-Electric Transducers, Mechanical Flow Meter.

Unit III: Ballistics

Fire Arms: Early Fire Arms, Hand Cannons, Matchlock, Wheel Lock, Snaphaunce, Flintlock, Percussion System, Cartridge System, Centre Fire System, Dreyse Needle, Smooth Bore Firearms, Rifling, Revolver, Pistols, Actions of Firearms, Shotgun, Sub Machine Gun, Machine Gun, Improvised Firearms.

Ammunitions: Propellants- Black Powder, Smokeless Powders, Primers- Berdan Primer, Boxer Primer, Primer Cap Types- Rim Fire, Centre Fire, Pin Fire. Caseless, Blank Ammunition, Tear Gas, Grenade Launcher, Dummy, Cartridge Cases - Rimless, Semi Rimmed, Rimmed, Belted. Bullets and Its Types, Components of Shotgun Ammunition.

Unit IV: Sound

Fundamentals of Speech Recognition: Disciplines Involved in Speech Recognition, Paradigm for Speech Recognition, Speech Production and Perception in Human Beings, Speech Production Process, Presenting Speech in the Time and Frequency Domain, Speech Sounds and Features, Approaches to Automatic Speech Recognition (ASR) by Machine (Acoustic-Phonetic, Pattern Recognition, Artificial Intelligence), Neural Networks and their Application and Advantages in Speech Recognition.

Signal Processing and Analysis Methods for Speech Recognition- Introductory Idea about Spectral Analysis Model, Linear Predictive Coding Model, Vector Quantization, Auditory based Spectral Analysis Model. Various Voice Identification Software. Collection of Samples and Forensic Importance of Voice Analysis.

4P3: Practicals based on Advanced Forensic Physics (Semester III & IV)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Study of Thermistor/Thermocouple Characteristics
2. Thermal Analysis of Given Sample using DSC/TGA
3. Gravimetric Analysis (Density Measurement of Given Sample)
4. Study of V-I characteristics of Solar Cell
5. Study of LDR characteristics and Photosensitive relay using LDR
6. Study of LASER Parameters
7. Determination of Resolving Power of Microscope
8. Determination of Magnification of Microscope
9. Study of Logic Gates
10. Study of NAND and NOR Gates as Universal Building Blocks
11. Study of De Morgan's Theorem
12. Study of Analog to Digital Converter
13. Study of Digital to Analog Converter
14. Study of Digital Counter
15. Study of Timer Circuit using IC 555

16. Study of Active Filters
17. Study of Clipping and Clamping Circuits
18. Study of Segregation of Speech Sample
19. Examination of Fire Arm according to Arms Act
20. Classification and Measurements of Bullets

Suggested Readings

1. Nuclear Physics; S. N. Ghoshal
2. Nuclear Physics: An Introduction; S. B. Patel
3. Nuclear Forensic Analysis; Kenton J. Moody
4. Modern Physics; Arthur Beiser
5. Atomic Physics; J. B. Rajam
6. Optics; E. Hecht, A. R. Ganesan
7. Physical Optics; A.K.Ghatak
8. Fundamental of Optics; F.A.Jenkins, H.E.White
9. Lasers and Non-Linear Optics; B. B. Laud
10. Lasers: Theory and Application; Thyagrajan
11. Introduction to Lasers; Avadhanulu, Hemne
12. Optoelectronics Devices and Circuits; Amar K. Ganguly
13. Simplified Course in Waves, Vibrations and Sound – C. L. Arora
14. A Text Book of sound; Khanna ,Bedi
15. Fundamental of Acoustics; Kinsler
16. Basic Acoustics; D. E. Hall
17. The Physics of Speech; D. B. Fry
18. Applied Speech and Audio Processing; Ian Mcloughlin
19. Fundamentals of Speech Recognition; Lawrence Rabiner and Biing- Hwang Juang
20. Modern Spectroscopy; J. Michael Hollas
21. Electronics Principles; Malvino, Bates
22. Basic Electronics; B. L. Theraja
23. Principles of Electronic Devices and Circuits; B. L. Theraja
24. Principles of Electronics; V. K. Mehta
25. Integrated Electronics; Millman, Halkias
26. Digital Principles and Applications; Malvino, Leach
27. Digital Design; Morris Mano
28. Measurements, Instrumentation and Experiment Design in Physics and Engineering; Michael Sayer
29. Instrumental Analysis; Skoog, Holler and Crouch
30. Transducers and Instrumentation; D. V. S. Murty
31. Hand book of Firearms and Ballistics; Brain J. Heard
32. Firearm in criminal investigation and trials; B. R. Sharma
33. Firearms and Forensic Ballistics; S. N. Gaur, B. C. Jauhari
34. Fire Arms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence; S. N. Gaur
35. Criminalistics: An Introduction to Forensic Science; Richard Saferstein
36. Engineering Physics by Gaur and Gupta
37. A Textbook of Engineering Physics; Avadhanalu, Kshirsagar
38. Physics for Degree Students; Arora, Hemne
39. Advanced Practical Physics; S. P. Singh

B.Sc. Forensic Science Semester - IV

4T4: Advanced Forensic Biology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I:

Chromosome: structure and types. Nucleosome: organization of histone octamer, 10 nm and 30 nm fibre, Structure of chromatin-heterochromatin and euchromatin, C-value and C-value paradox, Cot-curve, repetitive and non-repetitive DNA sequences, chromosomal mapping and karyotyping. Eukaryotic genetics: replication, transcription and translation in brief. Chromosomal mutations.

Unit II:

Skin: structure and function (human and animal).
Hair: structure, cycle and types (human vs animal).
Osteology: structure, characteristics, types and function of bone, human skeleton-axial and appendicular with reference to skull, pelvis and long bones, centres of ossification, pre-natal and post-natal ossification, types of sutures.

Unit III: Wildlife 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. Birds flight and means of locomotion, Strikes and collisions, Quarantine issues, Crime Scenes, Confiscated Bird products, Anthropological Arte facts, Applications of Forensic Ornithology, Feather structure and topography, Blood Grouping – Human & Non-human. Ecology: biogeochemical cycles, ecosystem-components, structure and function.

Unit IV: Forensic Entomology

Introduction & History of forensic entomology, Identification of insects, insect growth and life cycle, Dipterans Larval Development, Successional Colonization of Body, Determination of displacement and disturbance of the body, Presence and Position of wounds, Determination of Time elapsed since death, Drugs consumption ante mortem, Human & Animal neglect or abuse, Collection and preservation of insects, Challenges encountered in Entomology, Report Submission, Testifying in Court. Pollution-air, water, radioactive, noise and soil, Green house effect.

4P4:Practicals based on Advanced Forensic Biology (Semester III & IV)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Microscopic Comparison of a. Animal Hair b. Human Hair
2. Study of muscle types
3. Study of neurons
4. Preparation and identification of pugmarks
5. ABO Grouping & Rhesus Factor
6. Study of forensically important insects
7. Rearing of forensically important insects
8. DNA Extraction & Quantification by colorimetric methods.
9. Study of skeletal system of human
10. Isolation of microorganism by streak, spread, pour plate method.
11. Study of growth curve of microorganism
12. Measurement of growth of microorganism by standard plate count method
13. To study factors affecting growth of microorganism – pH, temperature
14. Separation of serum protein by agarose gel electrophoresis
15. Visit to autopsy center at mortuary, Forensic Science Laboratory, Pathology Laboratory, Veterinary Center, Biodiversity and wildlife Center.

Suggested Readings

1. Microbiology: an introduction: Tortora, Funke, Case
2. Textbook of microbiology: Ananthanarayan and Pannikar
3. Microbiology: Black
4. Clinical microbiology and infectious diseases: John Spicer
5. Perscott's microbiology: Willey, Sherwood and Woolverton
6. Microbiology: Pelczar, Chan and Krieg
7. Microbiological applications: laboratory manual in general microbiology: Brown and Smith
8. Cellular and molecular immunology: Abbas, Lichtman and Pillai
9. Kuby immunology: Goldsby, Kindt, Osborne
10. Roitt's essential immunology: Delvis, Martin, Burton and Roitt
11. An introduction to immunology: C. V. Rao
12. Fundamental immunology: William Paul
13. Understanding immunology: Peter Wood

B.Sc. Forensic Science Semester - IV
4T5: Advanced Forensic Psychology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

UNIT I: Psychology and Juvenile & Civil Court

- Juvenile assessment: overview
- Child Custody evaluation
- Child sexual Abuse
 - (i) Evaluating the child
 - (ii) Assessing competency to testify
 - (iii) Preparing the child to testify
 - (iv) Testifying as an expert
- Decisional competency
 - (i) Testamentary capacity
 - (ii) Competency to consult the treatment
- Employment Compensation and Personal Injury Claim

Unit II: Psychology and Criminal Court

- Mentally ill in the court,
- Competency to stand the trial
- Insanity Evaluation: Mc Naughten's rule
- Risk assessment
- Assessment of Malingering
- Sentencing Evaluation/Mensrea, Actus Reus

UNIT III: VICTIMOLOGY

- Victimization: Definition, meaning
- Multiculturalism & victimization
- Legal rights of Victims
- Types of Victimization:
 - (i) Child Abuse
 - (ii) Intimate partner Violence
 - (iii) Sexual assault Victimization
 - (iv) Homicide Victimization
 - (v) Hate or Bias Crime Victimization
- Psychological impact of Criminal Victimization
 - (i) PTSD
 - (ii) Psychological impact of Sexual assault
 - (iii) Psychological impact of Child Sexual abuse
 - (iv) Reactions of homicide co-victims (family members)

UNIT IV: POLICE PSYCHOLOGY

- Selection & recruitment of police officers
- Fitness for the duty evaluation
- Stress & stress management
 - (i) Sources of stress
 - (ii) Reaction to stress
 - (iii) Management of stress
- Police suicide

4P5: Practical based on Advanced Forensic Psychology (Semester III&IV)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Bell Adjustment Inventory (Indian adaptation): Sharma L
2. Standard Progressive Metrics
3. Bhatia Battery of Intelligence
4. Emotional Intelligence Scale
5. Social Adjustment Inventory: R.C. Deva
6. Life Satisfaction Scale: Q.G. Alam, Ramji Shrivastava
7. Emotional Maturity Scale
8. Self-confidence Inventory: Dr. Rekha Agnihotri
9. State Trait anxiety Inventory
10. Achievement Motivation: Deo Mohan
11. House-Tree-Person Test
12. Level of Aspiration

* Note - Minimum 8 tests should be conducted.

Suggested Readings

1. Handbook of Forensic Psychology', Prof Dr. Vimala Veeraraghwan, Edition 1st, 2009, Selective and Scientific Books Publications, New Delhi.
2. 'Introduction to Forensic Psychology-Research and Application', Curt R. Bartol, Anne M. Bartol, Editon 2nd, 2008, Sage Publication.
3. 'Handbook of Forensic Psychology', Irving B. Weiner, Allen K. Hiss, Edition 3rd, 2006, Wiley Publication.
4. 'Forensic Psychology', Solomon M. Fulero & Lawrence S. Wrightsman, Third edition, 2009, Wadsworth, Cengage learning publication, United States of America.
5. 'Forensic and Criminal Psychology', Dennis Howitt, 2002, Pearson Education LTD, England.
6. E., Tett, R. P., Vandecreek, L. (2003). Psychological testing and the selection of police officers: A National Survey. *Criminal Justice and Behavior*, 30(5), 511-537.
7. Psychology, (2006) Ciccarelli, S. K. & Meyer G. E. New Delhi; Perason Education
8. 'Social Psychology', Robert A. Baron & Nyla R. Branscombe, Pearson Edcation, India.
9. Barlow & Durand. V. M. (2005) Abnormal Psychology, 6th Ed. New Jercy
10. Criminology', Digumarti Bhaskara Rao, First Edition 1st, 2012, Discovery Publication House PVT. LTD., New Delhi.
11. 'Human Aggression-theory, research and intervention', Sunil Saini, Nilam Goyal, Edition 1st Global Vision Publication House, New Delhi.
12. 'Psychological Testing', Anne Anastasi, Susana Urbina, Edition 7th, 2010, PHI Learning PRI. LTD, New Delhi
13. Test, Measurement and research methods in behavioral science by A.K Singh
14. 'Applied Criminology-Concept, Theories and Applications', Joseph Ronald, Edition 1st, 2013, Cyber Tech publications, New Delhi.
15. 'Criminology and Penology', Mittal S., Saxena S. K., [2012], Commonwealth Publishers Pvt. Ltd., New Delhi.
16. 'Forensic Criminology', Petherick W. A., Turvey B. E., Ferguson C. E., [2010], Elsevier Inc.
17. 'Psychological Interventions of Mental Disorders', S. K. Shrivastava, Nayanika Singh, Shivani Kant, Edition 1st, 2013, Sarup Book Publishers, PVT. LTD.
18. Principles of Social Psychiatry', Craig Morgan, Dinesh Bhugra, Edition 2nd, 2010, Wiley-Blackwell Publication.

B.Sc. Forensic Science Semester - IV
4T6: Advanced Digital and Cyber Forensics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Evidence Collection and Analysis Tools
<ol style="list-style-type: none">1. Introduction2. Using Data from Operating Systems<ol style="list-style-type: none">2.1 Non-Volatile Data2.2 Basic Input or Output System (BIOS)2.3 Volatile Data3. Collecting Operating System Data<ol style="list-style-type: none">8.1 Collecting Volatile Operating System Data8.2 Types of Volatile Operating System Data8.3 Prioritizing Data Collection8.4 Collecting Non-Volatile Operating System Data8.5 Examining and Analyzing Operating System Data4. Recommendations for Using Data from Operating Systems5. Using Data from Network Traffic6. TCP or IP Basics<ol style="list-style-type: none">6.1 Layers' Significance in Network Forensics6.2 Network Traffic Data Sources6.3 Firewalls and Routers6.4 Packet Sniffers and Protocol Analyzers7. Intrusion Detection Systems (IDS)8. Remote Access9. Security Event Management Software
Unit II Introduction to Live Forensics, Network Forensics
<ol style="list-style-type: none">1. Live Forensics<ol style="list-style-type: none">1.1 Types of evidence found in Computer Memory1.2 Live Forensic Process1.3 Benefits of implementing live forensics1.4 Traditional Forensics vs. Live Forensics1.5 Challenges faced by live forensics1.6 Steps in Volatile Data Collection Process.1.7 Legal Considerations of Live Analysis and Collecting Evidence from a Running Computer1.8 volatile memory analysis using Volatility and PTFinder1.9 Live forensics resources2. Network Forensics<ol style="list-style-type: none">2.1 Introduction2.2 Sources of Network based evidence2.3 Challenges relating to Network Evidence2.4 Network Forensic Investigative methodology (OSCAR)2.5 Evidence Acquisition2.6 Network traffic Acquisition and Analysis tools: libpcap and winpcap, wireshark, tcpdump
Unit III: Concealment Techniques
<ol style="list-style-type: none">1. Introduction to Cryptography2. Types of Cryptographic Algorithms<ol style="list-style-type: none">2.1 Secret Key Cryptography2.2 Public Key Cryptography2.3 Hash Function3. Electronic Signature4. Stenography5. Reversing the Stenographic Process6. Cloaking Techniques<ol style="list-style-type: none">6.1 Data Hide and Seek6.2 Renaming Files6.3 Manipulating File System6.4 Data Hiding on NTFS with Alternate data Stream
Unit IV: Biometrics

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| <ol style="list-style-type: none"> 1. Introduction to Biometrics, <ol style="list-style-type: none"> 1.1 What is Biometrics 1.2 Why use Biometrics 2. Model of Biometric system 3. Various types of Biometric methods, 4. User Acceptance, Evaluating Accuracy, 5. Advantages & disadvantages 6. General Biometric System (Identification and Verification), 7. General Architecture 8. Comparison of different Biometric Technologies 9. What makes Biometrics difficult |
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4P6:Practicals based on Advanced Digital and Cyber Forensics (Semester III& IV)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Assignment to demonstrate use of data types, simple operators (expressions)
2. Assignment to demonstrate decision making statements (if and if-else, nested structures, switch case)
3. Assignment to demonstrate use of simple and nested loops (for, while do-While) and break, continue statements.
4. Assignment to demonstrate writing C programs in modular way (use of user defined functions), recursion function.
5. Assignment to demonstrate use of arrays (1D and 2D) (Matrix Addition and Multiplication)
6. Study of DDL, DML commands and aggregate functions in SQL.
7. Assignment to create simple tables , with only the primary key constraint (as a table level constraint & as a field level constraint) (include all data types)
8. Assignment to insert / update / delete records using tables created in previous Assignments. (use simple forms of insert / update / delete statements)
9. Identification , Seizure ,Search of Digital media
10. Disk imaging using FTK imager, Encase, etc.
11. Demonstration of various Forensic tools like Winhex, sleuthkit and autopsy.
12. Memory Forensic (Capturing memory using dumpit, FTK imager) and study of Volatility Framework.
13. Live system evidence collection procedure using various tools (batch file for evidence collection, pstools, nmap, etc).
14. Data Recovery, Deleted File Recovery.
15. Demonstration of Concealment Techniques (Cryptography PGP)
16. Demonstration of Concealment Techniques (Stenography)
17. Demonstration of other Concealment Techniques(Data Hiding)
18. Case study of Biometric Techniques.

Suggested Readings

1. Let Us C By Yashavant Kanetkar
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, , PHI Learning
3. How to Solve it by Computer, R.G. Dromey, Pearson Education
4. Programming in ANSI C, E. BalaguruswamyTata McGraw Hill Publishing Co.Ltd.-New Delhi
5. Database Management Systems By Raghu Ramakrishnan, Johannes Gehrke McGraw-Hill Education,
6. Database System Concepts By Abraham Silberschatz, Henry F. Korth, S. Sudarshan McGraw-Hill
7. Incident Response and Computer Forensic by Kelvin Mandia, TMH Publication.
8. Digital Forensics: Digital Evidence in Criminal Investigations by Angus McKenzie Marshall
9. Cyber Forensic A Field Manual for Collecting, Examining and Preserving Evidence of Computer Crimes by Albert J Menendez. Auerbach Publications.
10. First Responder's Guide to Computer Forensics by Richard Nolanetal - Carnegi Mellon, 2005.
11. Cyber Forensic by Marecella Menendez.
12. Computer Forensic by Newman.
13. Cyber Crime Investigation Field Guide, by B Middleton.
14. Network Forensics Tracking Hackers Through Cyberspace By Sherri Davidoff, Jonathan Ham Prentice Hall

15. Collecting Evidence from a Running Computer- A Technical and Legal Primer for the Justice Community By Todd G. Shipley, CFE, CFCE And Henry R. Reeve, Esq.
16. Handbook of Digital Forensics and Investigation By Eoghan Casey
17. A Practical Guide to Computer Forensics Investigations By Darren R. Hayes
18. Computer Forensics: Computer Crime Scene Investigation, Volume 1 John R. Vacca, Charles River Media
19. Advances in Digital Forensics II edited by Martin S. Olivier, Sujeet Sheno

**Semester V
&
Semester VI**

B.Sc. Forensic Science Semester - V

5T1: Applied Forensic Science

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Document Examination-I

General and individual characteristics of handwriting. Identification of writer of anonymous and disguise writings. Examination of alterations- erasures, overwriting, additions and Obliterations. Decipherment of secret writings, indentations & charred documents. Paper Examination: Manufacturing of paper, Physical and Chemical examination of paper, watermark examination, Age of paper. Ink Examination: Types of inks, Physical and Chemical examination of Ink and Age of Ink. Examination of Indian Currency Notes of all denomination.

Unit II: Medical Jurisprudence and Forensic Thanatology-I

Medical Jurisprudence: Police Inquest, Magistrate Inquest, Coroner's Inquest, Oath and affirmation, and Perjury. Documentary Evidences: Medical certificate, Medical Report, Dying Declaration, and Dying Deposition.

Medico legal aspects of death: Types of Death – Somatic and Molecular, Signs of Death – Immediate, Early and Late signs of Death – Asphyxia, Coma, Syncope, followed with Cooling of body, Changes in Eye, Post mortem Lividity, and Rigor Mortis, followed with late signs- Putrefaction, autolysis, bacterial action, Factor effecting these changes. Determination of time since death.

Unit III: Quality Management System

Quality management requirement: Testing and calibration procedure, Total quality assurance - quality control, quality planning, resulting and report writing, quality check.

Audit: Internal and External Audit, Accreditation & Certification: Introduction and objectives, organizations and certifying bodies, NABL, ISO, IEC, BIS. Scientific Report Writing.

Unit IV: Other Acts-I

Introduction to some acts, relevant sections and their important amendments: The Indian Constitution (Article 20(3)), The Juvenile Justice (care and protection of children) Act 2000, The Narcotic Drugs and Psychotropic Substances Act 1985, Prevention of Illicit Traffic in Narcotic Drugs and Psychotropic Substance Act 1988, Mental Health Act 1987, Prevention of Food Adulteration Act 1954. Case studies related to Forensic Aspects of these Acts.

B.Sc. Forensic Science Semester - V
5T2: Applied Forensic Chemistry

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit	Content	Scope	Lect
Unit I Organic Chemistry	Polymers	Introduction, General idea of structures, types of polymerization processes, radical and ionic mechanism of polymerization, properties of polymers, Structure, preparation and applications of Polyethylene, Teflon, PVC, Polystyrene, etc.	7
	Rubbers, Fibres & Plastics	General idea of plasticizers, stabilizers, fillers, Epoxy Resins. Rubber: types of rubber, vulcanization of rubber, synthetic rubbers Fibres (synthetic fibres): Classification, properties, polyamides - Nylon, Polyesters - Dacron Fibre reinforced plastics: types, properties, applications.	5
Unit II Inorganic chemistry	Chemistry of elements of first transition series	Characteristic properties of the elements of first transition series with reference to their: Electronic configuration, Atomic and ionic radii, Ionization potential, Variable oxidation states, Magnetic properties, Colour, Complex formation tendency and catalytic activity.	6
	Chemistry of Lanthanides and Actinides	Position in periodic table, electronic configuration, Oxidation states, Atomic and ionic radii, Lanthanide contraction and its consequences, Complex forming tendency. Occurrence and separation of lanthanides (ion exchange and solvent extraction).	6
Unit III Physical Chemistry	Gaseous State	Introduction, Significance of ideal gas equation, real gases, compressibility factor, Van der Waals equation of state, isotherms of CO ₂ , Critical constants.	6
	Liquid State	Introduction, Properties of liquids, Ideal solutions, Comparison between gaseous and liquid state, Experimental determination of vapor pressure, and viscosity by Ostwald method, liquid crystals and their applications.	6
Unit IV Inorganic Chemistry	Theories of Chemical Bonding	Introduction, Postulates, Applications and Limitation of VBT, VSEPR, MOT, CFT, etc. MO diagrams of homonuclear and heteronuclear diatomic molecules, etc.	12

B.Sc. Forensic Science Semester - V

5T3: Applied Forensic Physics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Ballistics

Internal Ballistics: Energy Considerations, Initiation, Combustion of Propellants, Density of Loading, Atmospheric Temperature, Shape of the Cartridge Case. Heat Problems, Barrel Pressure and Its Determination, Recoil, Measurement of Recoil, Vibration and Jump, Barrel Fouling.

Exterior Ballistics: Trajectory Formation, Vacuum Trajectories, Range, Experimental Determination and Shape of Trajectory, Spin, Drift, Angle of Fire, Structure of the Projectile, Sectional Density, Ballistic Coefficient, Influence of Earth and Escape Velocity, Air Resistance, Retardation, Wind Deflection, Firing Guns in the Air, Ricochet.

Unit II: Tools & Tool Marks

Common Hand Tools: Levers (Screw Drivers, Crow Bars, Pry Bars, Nail Pullers, Pinch Bars, Moulding Bar, Wrecking Bar), Hand Saw (Rip Saw, Cross Cutting Saw, Bow Saw, Teeth Saw, Compass Saw, Dip Cut, Coping Saw, Wall Board Saw, Bow Saw, Hacksaw, Chisel Teeth Saw, Coarse Cut Carpenter Saw), Striking Tools (Hammers, Hatches and Axes), Grasping Tools (Wrenches, Vise Grips, Pliers), Cutting Tools (Metal Snips, Wire Cutters, Bolt and Cable Cutters), Crimping Tools, Knives, Scissors and Shears, Chisels and Punches, Drill Bits.

Tool Marks: Marks Made by Hand Tools (Impression / Compression Marks, Dent, Saw Marks, Drill Marks and Holes, Punctures, Point to Point Blade Cut Marks, Scratch and Scour Marks), Collection, Documentation and Forensic Examination of Tool Marks.

Unit III: Accidents

Road Terminologies: Cut, Final Grade, Surface, Existing Grade, Fill, Sub Grade, Base, Traffic Lane, Travelled Way, Shoulders, Roadbed, Roadway, Roadway Ditch, Ditch Slope, Back Slope, Fill Slope, Interceptor Ditch, Slope Ratio, Central Line, Crown, Super Elevation, Road Dividers. Road Signs, Symbols and Traffic Control Mechanisms.

Vehicular Accidents: Primary Causes of Road Accident, Types of Road Accident, Sources of Information, Eye Witnesses, Tyre and Other Marks, Pedestrian Impacts and Vehicle Speed, Vehicle Condition, Vehicle Speed and Damage, Types of Skid Marks, Curved Scuffmarks, Speed Estimation from Skid/Scuffmarks. Time and Distance, Reaction Time and Peripheral Vision of a Driver, Photography and Plans, Brake System and Steering Failure, Motor Vehicle Examination.

Rail Accidents: Investigation of Rail Crash: Criminal and Safety Investigation, Investigation Principles, Best Practices: Tests, Inspection of Driving Cab, Examination of Electrical/Electronic/Technological System and their Failure. Necessary Equipments Required for Forensic Examination.

Unit IV: Detectors

Interaction of Radiation with Matter and Its Consequences. Reflection, Absorption, Transmission, Scattering, Emission, Fluorescence, Phosphorescence.

Photographic Detectors, Thermal Detectors, Photoelectric Detectors, PMT and Semiconductor Detectors. Construction and Working Principle of Ionization Chamber, Proportional Counter, Geiger Muller Counter, Scintillation Counter, Solid State Detectors.

Optical Fibres: Importance of Optical Fiber, Propagation of Light Waves in Optical Fiber, Basic Structure, Stepped Index Monomode Fiber, Graded Index Fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Fiber Losses and their Units (Basic Concept), Electrical and Optical Band Width, Bandwidth Length Product, Dispersion In Optical Fiber.

B.Sc. Forensic Science Semester - V
5T4: Applied Forensic Biology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I:

Body fluids-composition, detection and forensic significance of following body fluids. Amniotic fluid, synovial fluid, gastrointestinal secretions, aqueous humour, menstrual blood, semen, saliva, sweat, tear, pus, vomit, bone marrow.

Unit II:

Sources of DNA evidence, extraction of DNA-basic principles, methods of DNA extraction, DNA amplification-PCR, Southern/Northern blotting, DNA electrophoresis, DNA quantification. DNA databases, Human Genome Project.

Unit III: Forensic Anthropology

Definition, scope, types and theories. Fossils and fossilization, dating techniques- relative and absolute, somatoscopic and somatometric observations, estimation of sex- role of pelvis, skull and long bones. Racial differences in human skeleton. Estimation of age and time since death.

Unit IV: Forensic Odontology

Introduction and history of odontology, dentition, types of dentition, dental formula, basic structure of human teeth, types of teeth and their morphology, determination of age from teeth using various methods, dental anomalies and their role in personal identification, role of forensic odontology in mass disaster victim identification, estimation of sex, Bite mark analysis.

B.Sc. Forensic Science Semester - V

5T5: Applied Forensic Psychology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

UNIT I: Psychology of Violence and Sexual Assault

- Violence : Definition, nature, types of criminal violence, causes of violence,
- Criminal Homicide
- Serial Killer: characteristics, Typologies of serial killer
- Hate or Bias Crimes
- Stalking: meaning, types of stalking
- Sexual Assault and Date Rape: Definition
 - (i) Demographics of the men who rape
 - (ii) Typologies of the men who rape: MTC:R3
- Pedophilia

UNIT II: Developmental, Environmental and Psycho-Social Causes of Criminal Behaviour

- Early sources of delinquency and crime: Family influence, peer influence, other environmental factors.
- Developmental factors
 - (i) ADHD
 - (ii) Conduct disorder
- Individual factors
 - (i) Cognitive skills
 - (ii) Language development
 - (iii) Executive functions
 - (iv) Self-regulation skills

UNIT III: Theories of Crime

- Social Perspective: Differential Association theory, Labelling theory, Critical theory, Control theory.
- Social learning Theory
- Eysenck's biosocial theory
- Psychoanalytic perspective
- Cognitive perspective
- Substance abuse and crime
- Antisocial Personality Disorder & Psychopathy
- Offending pattern of Criminal Psychopath

UNIT IV: Intervention with the Victims of Crime

- Counselling: definition, nature, and scope
- Difference between counselling and psychotherapy
- Counselling process: initial phase, middle phase, and termination phase
- Counselling skills: active listening, paraphrasing, empathy, communication skills, reflection
- Types of counselling
- Characteristics of counsellor
- Counselling to the victims of crime

B.Sc. Forensic Science Semester - V
5T6: Applied Digital and Cyber Forensics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Data and Evidence Recovery
<ol style="list-style-type: none">1. Cell Phone / Mobile Forensics2. Computer Ethics and Application Programs.3. Data and Evidence Recovery-Formatted Partition Recovery,4. Data Recovery Tools,5. Data Recovery Procedures and Ethics6. File Transfer Protocol (FTP)7. Preserve and safely handle original media,8. Document a "Chain of Custody"9. Complete time line analysis of computer files based on file creation, file modification and file access10. Recover Internet Usage Data,11. Recover Swap Files/Temporary Files/Cache Files12. Data Recovery Using Encase Forensic Edition, Forensic Tool Kit (FTK) etc.13. Use computer forensics software tools to cross validate findings in computer evidence related cases.
Unit II: Cyber Forensics Investigation
<ol style="list-style-type: none">1. Technical issues2. Security Technologies<ol style="list-style-type: none">2.1 Certification and key Distribution2.2 Cryptographic Applications2.3 Digital Signature Protocols for Transactions2.4 SSL-Secure Socket Layer2.5 SET-Secure Electronic Transaction.3. E-Mail Investigation<ol style="list-style-type: none">3.1 E-Mail Tracking3.2 IP Tracking3.3 E-Mail Recovery4. Search and Seizure of Computers5. Password guessing and Password Cracking
Unit III: Mobile Forensics
<ol style="list-style-type: none">1. Evolution and importance of cell phone forensics2. Types of evidences on mobile devices3. Handling Mobile Devices as Sources of Evidence4. Forensic Preservation of Mobile Devices5. Forensic Examination and Analysis of Mobile Devices6. Forensic Acquisition and Examination of SIM Cards7. Legal considerations associated with cell phone investigations.8. Investigative Reconstruction Using Mobile Devices9. Future Trends
Unit IV Security Issues
<ol style="list-style-type: none">1. Security Issues<ol style="list-style-type: none">1.1 Types of Attacks(Active and Passive)1.2 Stealing Passwords1.3 Social Engineering,1.4 Bugs and Backdoors1.5 Illegal accessing1.6 Authentication Failures1.7 Protocol Failures1.8 Information Leakage1.9 Viruses and Worms1.10 Denial-of-Service, etc.2. Firewalls<ol style="list-style-type: none">2.1 Packet Filters2.2 Application-Level Filtering2.3 Circuit-Level Gateways2.4 Dynamic Packet Filters

2.5 Distributed Firewalls;

2.6 Digging for Worms, Packet Filtering, Implementing policies (Default allow, Default Deny) on proxy, etc.,

3. Introduction to Cyber Security

3.1 Implementing Hardware Based Security

3.2 Software Based Firewalls

3.3 Security Standards, Threats, crimes, etc.

4. Why require a security?

4.1 Picking a Security Policy

4.2 Strategies for a Secure Network

4.3 The Ethics of Computer Security

4.4 Security Threats, and levels

4.5 Security Plan (RFC 2196)

B.Sc. Forensic Science Semester - VI

6T1: Applied Forensic Science

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Document Examination-II

Identification and comparison of typescripts: -Identification of typist, various types of printing processes, printing and machine defects, and alterations in typed text. Various types of typewriting devices: - examination of typewriters with proportional letter spacing, electronic typewriters, dot matrix, inkjet & laser printers, machines used for printing security documents, cheques, and currency notes, etc. Photocopy & photocopier examination: - photocopier identification, visual photocopy examination, photocopy forgery.

Unit II: Medical Jurisprudence and Forensic Thanatology- II

Medicolegal investigation of sexual offences, including examination of victims and suspects. Medicolegal aspects of death:- causes of death such as asphyxia, electrocution, thermal trauma, heat burns, starvation, natural death, sudden death, death by accident. Medico legal aspects of wounds:- medical and legal definition of wounds, types of mechanical and regional injuries, aging of wounds, difference between suicidal, homicidal and accidental wounds.

Unit III: Recent Advancement & Emerging trends in Forensic Science

Introduction to VSC, ESDA, GC-MS, HPLC, HPTLC, Micellar Liquid Chromatography, FTIR, Raman Spectroscopy, XRF, SEM-EDX, X-Ray – photoelectron Spectroscopy, Touch DNA, STRmix, Automated Fingerprint Identification, Forensic Radiology, Forensic Accounting, Forensic Journalism, Forensic Archaeology, Environmental Forensics, Nuclear Forensics, Radio carbon Dating, Forensic Meteorology, Hyphenated techniques.

Unit IV: Other Acts-II

Introduction to some acts, relevant sections and their important amendments: Wildlife Protection Act 1972, Information Technology Act 2000, Motor Vehicles Act 1988, Small Coins (offence) Act 1971, Standards of Weight and Measures Act 1976, The Antiquities and Art Treasures Act 1972, Arms Act 1950, The Drug and Cosmetics Act 1945. Case studies related to Forensic Aspects of these Acts.

6P1: Practicals based on Applied Forensic Science (Semester V & VI)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Calibration of various instruments (UV Spectrophotometer/Colorimeter/Weighing Balance/Pipette).
2. Scientific Report Writing (In case of Murder/Rape/Hit & Run/Arson).
3. Preliminary Examination of paper (Physical and Chemical methods).
4. Examination of altered documents.
5. Identification of Indented writing.
6. Identification of Secret writing.
7. Identification of typewritten documents.
8. Identification of printed documents.
9. Identification of normal/ disguise writings.
10. Detection of forgeries including traced and simulated Forgery.
11. Examination of ink by TLC method.
12. Examination of Security Features of Currency Notes.
13. Examination of security features of bank cheques.
14. Case Studies of Forensic relevance.
15. Visit to Forensic Science Laboratory.

B.Sc. Forensic Science Semester - VI
6T2: Applied Forensic Chemistry

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit	Content	Scope	Lect
Unit I Forensic Chemistry	Fire and Arson	Analysis of fire debris. Analysis of ignitable liquid residue. Post-flashover burning. Scientific investigation and evaluation of clue materials. Information from smoke staining.	6
	Explosives	Bomb scene management. Searching the scene of explosion. Mechanism of explosion. Post blast residue collection and analysis. Blast injuries. Detection of hidden explosives.	6
Unit II Forensic Chemistry	Forensic Toxicology	Introduction and concept of forensic toxicological examination and its significance. Collection and preservation of toxicological exhibits, signs and symptoms of poisoning, mode of action and its effect on vital functions, medico-legal and post mortem examination reports.	6
	Narcotic Drug and Psychotropic Substances	Introduction, Drug effects, drug Hazards, Tolerance and dependence of drugs, Problems of drug addiction. Identification of a drug addict, drug addicts and crimes, Classification of Narcotics and other drugs, Analytical techniques for identification of drugs. Introduction to NDPS act.	6
Unit III Spectroscopy	Nuclear Magnetic Resonance (NMR)	Introduction, PMR spectroscopy, Nuclear shielding and deshielding, Chemical shift, Spin-spin splitting and Coupling constant. Areas of signals. Interpretation of NMR spectra of simple organic molecules, Applications and Problem related to the structure elucidation by NMR technique.	12
Unit IV Spectroscopy	Mass Spectrometry	Introduction, theory, instrumentation, working and applications.	6
	ICP-OES and ICP-MS	Principle, theory, instrumentation, working and applications	6

6P2: Practicals based on Applied Forensic Chemistry (Semester V & VI)
Max. Marks: 40 (Practical) + 10 (Internal)

1. To determine the molecular weight of a high polymer by using solutions of different concentrations.
 2. To investigate the adsorption of oxalic acid /acetic acid by activated charcoal.
 3. Analysis of given polymer by IR spectroscopy.
 4. Gravimetric Analysis - 02
 5. Quantitative or qualitative study of Narcotic drugs. - 02
 6. Examination of fire arson cases by GC / TLC.
 7. Extraction and analysis of alcohol from urine/ blood by colour tests.
 8. Plant / animal poison analysis – 03
 9. Analysis of Volatile and non-volatile poison. – 03
 10. Examination of chemicals used in Trap cases by TLC / UV-visible spectroscopy. - 02
 11. Separation of drugs or poison from food / biological samples. – 02
 12. Estimation of Cu²⁺ by UV-visible spectroscopy.
 13. Interpretation of given NMR spectrum of organic compound. – 02
 14. Analysis of explosives.
 15. Quantitation of Ethanol
 16. Quantitation of Zinc Phosphide/Aluminium Phosphide (1)
 17. Report on one day Industrial / Laboratory educational visit.
- * **Note – Minimum 12 experiments should be conducted.**

Suggested Readings

1. Introduction to Polymers by R. J. Young and P. A. Lovell
2. Polymer Chemistry by B.K. Sharma
3. Concise Inorganic Chemistry by J.D. Lee - 5th edition.
4. Inorganic Chemistry, - D.F. Shiver & P.W. Atkins- C.H. Longford ELBS – 2nd edition
5. Introduction Spectroscopy by Pavia
6. Spectroscopic identification of organic molecules by Silverstein
7. Forensic Medicine by B. Umadethan
8. Text Book of Medical Jurisprudence Forensic Medicines and Toxicology by Parikh C.K. CBS Publications New Delhi (1999)
9. Text Book of Medical Jurisprudence and Toxicology by J. P. Modi, 25th edition
10. Instrumental Methods of Chemical Analysis- Chatwal and Anand
11. Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar
12. Casarett & Doll Toxicology, The basic Science of Poisons
13. Forensic Science in Criminal Investigation and Trial, 4th ed. By B.R. Sharma

B.Sc. Forensic Science Semester - VI

6T6: Applied Forensic Physics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Ballistics

Terminal Ballistics: Introduction, Stopping Power of Bullet, Injuries and the Quantity of Energy of Projectiles, Shockwave and Cavitation Effect, Wounding Mechanism, Elements of Wound Ballistics; Nature of Target, Velocity of Projectile, Constructional Features of Projectile. Range; Classification of Range (Maximum Horizontal/ Vertical, Effective, Dangerous, Safe and Legal Sense), Contact Range, Point blank Range, Near Range, Chips Range, Distant Range. Penetration of Shots in Different Regions of the Body.

Unit II: Microscopy and Spectrophotometry

Principle, Working, Advantages and Disadvantages of

Optical Microscopes: Stereomicroscope, Polarizing Microscope, Phase Contrast Microscope And Comparison Microscope.

Advanced Microscopes: Scanning Electron Microscopes (SEM), Transmission Electron Microscope (TEM), X-Ray Diffraction (XRD), X-Ray Fluorescence (XRF).

Spectrophotometer: Fourier Transform Spectrophotometer (FTIR), UV Spectrophotometer, Fluorescence Spectrophotometer.

Unit III: Instrumentation

Magnetic Measurements: Magnetic Susceptibility and its Measurement by Quincke's and Gouy's Method, Hall Effect and Related Measurements.

Electrical Measurements: Resistivity Measurement of Thin Samples by Four Probe Method, Bulk Samples by Van-Der Pauw Method, Resistivity Measurement of Electrical Wires and Cables.

Communication Systems: Modulation and Demodulation, Amplitude & Frequency Modulation, Optical Fiber Communication System.

Photography: Introduction, 35 Mm Film / Digital SLR Camera, Digital Photo Imaging, ISO Number, Exposure Index, Photo Imaging Evidence; Angle, Scale, Depth of Field, Light, Ambient Light, Colour Temperature, Flash/ Strobe. Photography of Footwear Impressions, Crime Scene Investigation Report Writing. Forensic Image Processing and Analysis.

Unit IV: Trace Evidence

Physical Properties of Materials: Temperature, Weight and Mass, Density, Refractive Index and their Forensic Importance.

Glass: Composition of Glass, Comparison of Glass Fragments, Measuring and Comparing Density and Refractive Index of Glass, Classification of Glass Samples, Glass Fractures, Collection and Preservation of Glass Evidence.

Soil: Significance of Soil Evidence, Variations in Soil, Collection and Preservation of Soil Evidence, Forensic Examination of Soil.

Fibre: Types, Identification and Comparison of Manufactured Fibres (Microscopic Examination, Dye Composition, Chemical Composition, Other Properties for Examination), Significance of Match, Collection and Preservation of Fibre Evidence. Forensic Examination of Cloth and Cloth Fibres.

Paint: Composition of Paint, Classification of Common Paints, Pigment Volume Concentration Number, Microscopic Examination of Paint, Analytical Tools used in Paint Comparison, Significance of Paint Evidence, Collection and Preservation of Paint Evidence. Forensic Examination of Paint.

Plastic: Classification of Plastics according to Thermal and Mechanical Property, Plastics in Common Use.

6P3: Practicals based on Applied Forensic Physics (Semester V & VI)

Max. Marks: 40 (Practical) + 10 (Internal)

1. Study of Characteristics of Optical Fibre and Determination of Numerical Aperture of Optical Fibre
2. Study of Amplitude and Frequency Modulation
3. Measurement of Resistivity using Four Probe / Van der Pauw Method
4. Study of Hall Effect and Determination of Hall Coefficient
5. Measurement of Magnetic susceptibility by Quincke's / Gouy's method
6. Study of the Effect of Magnetic Field on Aqueous Solution of Paramagnetic Salt
7. Piezoelectric Measurements
8. Working with Geiger Mueller Counter
9. Study of Photographic Technique using SLR/ Digital Camera
10. Development of 35 mm Photograph
11. Investigations of Fake Documents using UV Light
12. Examination of Tyre/ Other Marks
13. Measurement of Speed using Tyre Marks
14. Analysis of XRD Pattern
15. Trajectory Simulation (Sample Calculations)
16. Measurement of Recoil (Sample Calculations) and Determination of Remaining Velocity (Sample Calculations)
17. Twist versus Muzzle Velocity (Sample Calculations) and Muzzle Velocity (Sample Calculations)
18. Examination of Fibres under Biological Microscope and Strength Measurements
19. Comparison of Glass Fragments and Study of Fractures
20. Examination of Soil Sample

Suggested Readings

1. Optoelectronics Devices and Circuits; Amar K. Ganguly
2. Modern Spectroscopy; J. Michael Hollas
3. Electronics Communication Systems; Kennedy and Davis
4. Measurements, Instrumentation and Experiment Design in Physics and Engineering; Michael Sayer
5. Instrumental Analysis; Skoog, Holler and Crouch
6. Transducers and Instrumentation; D. V. S. Murty
7. The Practical Methodology of Forensic Photography; David Redsicker
8. Hand book of Firearms and Ballistics; Brain J. Heard
9. Firearm in Criminal Investigation and Trials; B. R. Sharma
10. Firearms and Forensic Ballistics; S. N. Gaur, B. C. Jauhari
11. Fire Arms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence; S. N. Gaur
12. Forensic Ballistics in Criminal Justice; Kaushalendra Kumar
13. Criminalistics: An Introduction to Forensic Science; Richard Saferstein
14. Basic of Automobile Engineering; C. P. Nakra
15. Automobile Engineering; K. M. Gupta
16. Automotive Mechanics; Joseph Heitner
17. Auto Design; R. B. Gupta
18. Forensic Medical Investigation of Motor Vehicle Incidence; Michel P. Burke
19. Forensic Engineering Fundamentals; Harold Franck
20. Building Materials; P. C. Varghese
21. Trace Evidence; Max M. Houck
22. Elements of Civil Engineering; Mimi Das Saikia
23. Encyclopedia of Forensic Science; Jay A Siegel, Pekka J Saukko, Geoffery Knupfer
24. Forensic Science: An Introduction to Scientific and Investigative Techniques; James, Nordby
25. Laboratory Procedural Manual; Physics Section, DFSL, Mumbai
26. Laboratory Procedural Manual; Forensic Ballistics, DFS, New Delhi
27. Advanced Practical Physics; S. P. Singh
28. Practical Physics; Worsnoff and Flint

B.Sc. Forensic Science Semester - VI

6T4: Applied Forensic Biology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I:

Population Genetics-Hardy-Weinberg equation, r-DNA technology-introduction, steps involved and forensic significance, History of DNA fingerprinting, Polymorphism in DNA system – DNA markers RFLP, RAPD, VNTRs, SNP, Autosomal – STR, Y-STR, Mitochondrial DNA, Reverse transcriptase PCR, Real-Time PCR. Forensic Significance of DNA Profiling: - Application in disputed paternity cases, child swapping, Missing person's identity – immigration, veterinary & wild life and Agriculture cases, legal perspectives – legal standards for admissibility of DNA profiling, procedural and ethical concerns, New and future technologies: DNA chips, SNPs.

Unit II: Forensic Botany and Microbiology

Botanical evidence in legal investigation, legal plant definition, alibis, timing, gravestie growth, stomach content of plant, storage, analysis and documentation of botanical evidence. Plant DNA analysis in forensics: introduction, sample collection, use of genetic data, genotyping methods.

Algal diversity, collection and processing of algal evidence in forensic investigation and its applications. Understanding Bioterrorism: Types of biological agents – Category A, B, C. Planning and response to bioterrorism – Preparedness Biosurveillance, Biodefence. Epidemiology of Bioterrorism, Punishments for Bioterrorism act Under Prevention of Terrorism Act, 2002. Study of spore.

Unit III:

Serological reagents: antigens, antibodies (polyclonal Vs monoclonal), antiglobulins, antigen-antibody binding reactions (primary, secondary), serological techniques: primary binding assays, ELISA, Immunoelectrophoresis, immonodiffusion, agglutination based assays (direct, passive), agglutination inhibition assays.

Unit IV:

Other biological evidences: identification of food stuffs and their stains, examination of plant foods (starch, herbs, spices, fruits and vegetables), examination of animal foods (meat and fish), histopathological examination of tissues, examination of stomach content-microscopic examination. Examination of faecal matter, urobilinogen test.

6P4:Practicals based on Applied Forensic Biology (Semester V & VI)

Max. Marks: 40 (Practical) + 10 (Internal)

1. To determine titre of antisera.
2. Extraction and isolation of DNA from blood.
3. Preparation of permanent slides by using maceration technique of various forensic material of Plant origin.
4. Determination of age from skull sutures.
5. Determination of age from Teeth.
6. Determination of sex from skull.
7. Determination of sex from Pelvis.
8. To examine Barr bodies from blood sample.
9. Study of pollens and spores of forensic significance.
10. Identification of birds from feathers.
11. To identify blood strains.
12. To identify semen stains.
13. To identify saliva stains.
14. To determines species of origin from blood.
15. Visit to autopsy center at mortuary, Forensic Science Laboratory, Pathology Laboratory, Veterinary Center, Biodiversity and wildlife Center.

Suggested Readings

1. Practical Crime Scene Analysis & Reconstruction – Roos M. Gardner & Tom Bevel
2. Death Scene Investigation – Scott A. Wagner
3. Forensic Science in criminal investigation and trials – B.R. Sharma
4. Forensic Science in Crime Investigation – Dr. Mrs. Rukmani Krishnamurthy
5. Forensic Science – An introduction to scientific and investigative techniques – Stuart H. James Jon J. Nordby
6. Forensic Medicine – P.V. Guharaj & M. R. Chandran
7. Bryant, V.M. Jr, Mildenhall, D.C. and Jones, J.G., Forensic Polynology in the United States of America Polynology. 1990, 14.PP.193-208
8. Faegri, K. Iverson, J. and Krzywinski, K. Textbook of Pollen Analysis 4th Edition. John Wiley & Sons, New York 1989.
9. Microbial forensics By Roger Breeze, Bruce Budowle, Steven E. Schutzer. Elsevier Academic Press
10. The Forensic Laboratory Handbook Procedures and Practice By Ashraf Mozayani, Carla Noziglia. 2nd edition. 2011. Human Press.
11. Forensic Science in Wildlife Investigations. Adrian Linacre Taylor and Francis, 2009
12. The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature By Donna M. Jackson, Wendy Shattil, Bob Rozinski UniversalAthenaeum (Denver, CO, U.S.A.)
13. Forensic Entomology: The Utility of Arthropods in Legal Investigations Jason H. Byrd, James L. Castner Taylor and Francis, 2009
14. Forensic entomology: an introduction By Dorothy E. Gennard Wiley.
15. Forensic palynology Dallas Mildenhall, Patricia Wiltshire, Vaughn Bryant Elsevier, 2006
16. Forensic palynology: an in-depth look at its indispensable value National University, San Diego, 2002

B.Sc. Forensic Science Semester - VI
6T5: Applied Forensic Psychology

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

UNIT I: Correctional Psychology

- Correctional facilities
- Psychological assessment in corrections
- Psychological treatment
 - (i) Behavioral model
 - (ii) Cognitive behavioral model
- Community based intervention (rehabilitation)
- Juvenile correction: an overview
- Psychological evaluation of juvenile offenders
- Approaches to juvenile Rehabilitation
 - (i) Group home model
 - (ii) Family prevention models: homebuilders, Multisystem therapy, functional family therapy
 - (iii) Boot Camps
- Violence prevention program

UNIT II: Investigative Psychology: Part One

- Criminal Profiling
 - (i) Definition, nature
 - (ii) FBI Profiling: four stage model
 - (iii) Procedures used in criminal profiling/Stages
 - (iv) Evaluation
 - (v) Case studies
- Polygraph (Lie detector): overview, objectives, theoretical basis, stages of polygraph examination, case studies
- Psychological autopsy

UNIT III: Investigative Psychology: Part Two

- Narcoanalysis: overview, theoretical basis, case studies
- Forensic Hypnosis
- false confession: an overview
- Psychology of false confession
- Police Interrogation and false confession
- Role of police interrogation in generating confessions

UNIT IV: Legal Psychology

- Relevant provision on Indian Penal Code 1860 (General Exception)
- Mental Health Act, 1987 (objectives, establishment or maintenance of psychiatric hospital and psychiatric nursing home)
- Relevant Provision of Juvenile Justice Act 1986 (objectives, juvenile court and its procedure).
- Ethical standards of a Forensic Psychologist.

6P5:Practicals based on Applied Forensic Psychology (Semester V & VI)
Max. Marks: 40 (Practical) + 10 (Internal)

1. Relevant Questions Technique using Lie detector Test
2. Irrelevant Questions Technique using Lie detector Test
3. Control Questions Technique using Lie detector Test
4. 16 P.F. Test
5. MMPI/Multiphasic Personality Questionnaire (MPQ)
6. Eysenck Personality Inventory
7. The Hare psychopathy Check List
8. Levenson Self-Report psychopathy Scale
9. Sentence Completion test (Adult)
10. Picture Frustration Test (Adult) (Indian adaptation)
11. Draw a Person Test (Indian Adaptation)
12. Medico Psychological Questionnaire-J. Bharatraj
13. Culture Fair Test of Intelligence
14. Non-verbal Test of Intelligence – Dr. Nafde
15. Differential Aptitude Test:
16. Abstract Reasoning
17. Numerical Special
18. Spatial
19. Verbal
20. Clerical
21. Mechanical
22. Orientation to Online assessment

*** Note – Minimum 8 tests should be conducted.**

Suggested Readings

1. Introduction to Forensic Psychology-Research and Application', Curt R. Bartol, Anne M. Bartol, Editon 2nd, 2008, Sage Publication.
2. 'Handbook of Forensic Psychology', Irving B. Weiner, Allen K. Hiss, Edition 3rd, 2006, Wiley Publication.
3. 'Forensic Psychology', Solomon M. Fulero & Lawrence S. Wrightsman, edition 3rd, 2009, Wadsworth, Cengage learning, United States of America.
4. 'Forensic and Criminal Psychology', Dennis Howitt, 2002, Pearson education Publication.
5. 'Introduction to Forensic Psychology-Research and Application', Curt R. Bartol, Anne M. Bartol, Editon 2nd, 2008, Sage Publication.
6. Abnormal Psychology, Irwin G. Sarason & Barbara R. Sarason, Edition 11th, PHI Learning Private Limited, New Delhi.
7. Barlow & Durand. V. M. (2005) Abnormal Psychology, 6th Ed. New.
8. Serial Crime, Theoretical & Practical issues in behavioural profiling, Petherick, Woodworth Publications.
9. Prof. Paranjape N. V., Criminology and Penology, Central Law Publication, Allahbad.
10. Kocsis, R. N. (2003). Criminal psychological profiling: Validities and abilities. *International Journal of Offender Therapy and Comparative Criminology*, 47 (2), 126-144.

B.Sc. Forensic Science Semester - VI
6T6: Applied Digital and Cyber Forensics

Max. Marks: 40 (Theory) + 10 (Internal)

12 Lectures/Unit

Unit I: Electronic World
<ol style="list-style-type: none">1. E-Governance<ol style="list-style-type: none">1.1 Introduction1.2 IT and business1.3 EDI2. E-Business,3. E-Banking<ol style="list-style-type: none">3.1 Real Time Gross Settlement (RTGS)3.2 National Electronic Funds Transfer (NEFT)3.3 Immediate Payment Service (IMPS)3.4 Mobile Banking4. E-commerce<ol style="list-style-type: none">4.1 Concerns for E-commerce Growth4.2 EDI to E-commerce4.3 UN/EDIFACT Concerns for E-commerce Growth4.4 Internet bandwidth4.5 Technical issues4.6 Security issues.4.7 India E-commerce Readiness4.8 Legal issues4.9 Credit Card Business4.10 Electronic Commerce providers.5. CyberCash6. Digicash7. VeriSign
Unit II: Introduction Forensics Auditing
<ol style="list-style-type: none">1. Forensics auditing – step-by-step,2. How-to process for securing, investigating, and auditing or assessing various IT environments.3. Introduction to Forensic Accounting<ol style="list-style-type: none">3.1 Introduction to Forensic Accounting and Fraud Examination3.2 Principles of Forensic Accounting and Fraud Examination3.3 Roles of the Forensic Accountant4. Frauds<ol style="list-style-type: none">4.1 Introduction to Fraud4.2 The Nature of Fraud4.3 Why People Commit Fraud5. Fighting Fraud<ol style="list-style-type: none">5.1 Fraud Prevention5.2 Fraud Detection5.3 Recognizing the Symptoms of Fraud6. Data- Driven Fraud Detection7. Fraud Investigation8. Investigating Theft Acts;9. Investigating Concealment10. Conversion Investigation Methods11. Private Sources of Information12. Inquiry Methods and Fraud Reports Honesty Testing13. The Fraud Reports14. Management Fraud
Unit III: Financial Frauds
<ol style="list-style-type: none">1. Financial Statement Fraud;2. Revenue-and Inventory-Related Financial Statement Frauds3. Liability, Asset, and Inadequate Disclosure Frauds4. Fraud Against Organizations, Consumer Fraud;5. Identity Theft, Investment Scams, Money Laundering; Bankruptcy, and Tax Fraud6. Fraud in E-Commerce7. Resolution of Fraud , Legal Follow-Up, Being an Expert Witness8. Financial Statement Fraud Standards9. Avoiding common mistakes in fraud risk assessment and examination10. Credit Card Frauds, Online Transaction Frauds, Cheque Frauds etc.

Unit IV: Information technology law

1. IT Act 2000- Introduction, Scope and Objective
2. Digital Signature
3. Electronic Governance,
4. Regulation of certifying authorities and Controller
5. Digital signature certificates
6. Penalties and adjudication
7. The cyber regulations appellate tribunal
8. Offences, penalties.
9. IT Act (Amendment) 2008.

6P6: Practicals based on Applied Digital and Cyber Forensics(Semester V & VI)**Max. Marks: 40 (Practical) + 10 (Internal)**

1. Study of Cyber Forensic Investigation Tools (Computer, Network, Memory, Mobile forensic, etc.)
2. Studying of packets and packet formats.
3. Packet Capture & Traffic Analysis with Wireshark
4. Mobile Forensic using various tools.
5. Study of Sim Card details and sim card cloning.
6. Creation & verification of Digital Signature
7. Detail Analysis of E-mail, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery
8. E-Commerce (E-shopping of any product to understand the transaction and security issues)
9. Net Banking - Transactions and security issues.
10. Windows Event Log Monitoring, Analysis and Reporting
11. Password strength assessment, Password Guessing and Password Cracking.
12. Image processing using tools like Microsoft office picture management, Photoshop, Corel Photo paint etc.

Suggested Readings

1. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving evidence of computer crimes By Albert J. Marcella, Jr. Doug Menendez Auerbach publication
2. Cyber Forensics: From Data to Digital Evidence By Albert J. Marcella, Jr., Frederic Guilloso
3. Handbook of Digital Forensics and Investigation By Eoghan Casey
4. A Practical Guide to Computer Forensics Investigations By Darren R. Hayes
5. Computer Forensics: Computer Crime Scene Investigation, Volume 1 John R. Vacca ,Charles River Media
6. Advances in Digital Forensics II edited by Martin S. Olivier, Sujeet Sheno
7. Computer Forensics: Investigating File and Operating Systems, Wireless networks and storage CHFI By EC- Council (book 2 of 4)
8. Handbook of Security, Cryptography & Digital Signature
9. Forensic Science – From the Crime Scene to the Crime Lab by Richard Saferstein
10. E-Commerce: The Cutting Edge of Business, Kamlesh K. Bajaj & Debjani Nag, Tata McGraw Hill
11. Cyber Law and E .Commerce, David Baumer, J C Poindexter, TMG Cyberlaw Simplified Vivek Sood, TMG
12. e- Commerce Strategy, Technologies and Applications, David Whiteley, McGraw Hill International
13. E- Security, Electronic Authentication and Information Systems Security Sundeep Oberoi, TMG 11.
14. Firewalls and Internet Security: Repelling the Wily Hack