

## B.Sc. Forensic Science Syllabus

**Eligibility: Intermediate Examination (10+2 pattern) with Mathematics, Physics and Chemistry and Bi.P.C/PUC with Science group. Diploma with Mathematics, Physics and Chemistry (any two of this)**

Andhra Pradesh State Council of Higher Education

Table-1: B.Sc Forensic Science SEMESTER – I

Paper No.	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours	Credits
1	First Language English	100	25	75	4	3
2	Foundation Course - 1 HVPE (Human Values & Professional Ethics)	50	0	50	2	2
3	Foundation course -2 Communication & Soft Skills -1	50	0	50	2	2
4	Introduction to Forensic Science and Criminology	100	25	75	4	3
5	Various Divisions of Forensic Science Laboratory	100	25	75	4	3
6	Introduction to Forensic Science Practical's	50	0	50	2	2
7	Fundamentals of Computers	100	25	75	4	3
8	Fundamentals of Computers Practical's	50	0	50	2	2
9	Inorganic Chemistry & Organic Chemistry- 1	100	25	75	4	3
10	Chemistry Practical's - 1	50	0	50	2	2
Total		750			30	25

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### **Paper-1: First Language English**

**Paper-2:** Foundation Course - 1 HVPE (Human Values & Professional Ethics)

**Paper-3:** Foundation course -2 Communication & Soft Skills -1

### **Paper-4: Introduction to Forensic Science and Criminology:**

**Unit-1:** Forensic science- Introduction - Basic terminology- Forensic Science Laboratories in India & Worldwide- History- Principles of Forensic science with Examples - Forensic Science Laboratories and other allied institutions (FSL, CFSL, GEQD, FPB CDFD, NIA, CDTS, CCMB, IICT, NINetc).

**Unit-2:** Criminology - Introduction, scope of criminology- History – Famous criminologists- Definition of crime, criminal behaviour- types of crimes, causes of crime, Juvenile delinquency, criminal profiling.

Penology- Introduction- Administration- Theories of Punishment, Types of Punishments, Prisons and Correctional Institutions, , Functions and Limitations.

**Unit-3:** Indian Courts- Introduction, Hierarchy of courts- Powers of courts, types of courts, Lok Ayukta & Lok Adalat, etc. Role and responsibilities of Public Prosecution – Defence Council -Admissibility of Expert Testimony –Expert Evidence fallacies- Definition & Value of Expert Testimony.

**Unit-4:** Criminal justice system in India- Introduction, Administration of civil and criminal justice system. Introduction to constitution of India- Indian Penal Code( IPC), Criminal Procedure Code (Cr.PC) and Indian Evidence Act (IEA).

**Unit-5:** Different agencies involved in Crime Detection-Introduction to Various Investigative agencies-History-Development-Functions of- Police, Central Bureau of Investigation (CBI),Criminal Investigation Department (CID), Intelligence Bureau(IB), Research Analysis Wing (RAW), CRPF, BSF, SPG, NIA etc.

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### **Paper-5: Various Divisions of Forensic Science Laboratory.**

#### **Unit-1: Physics Division**

- (A) Physics Section: Glass Fracture studies, Glass pieces and fragments, Paint flakes, chips and smears, Footprints, shoe prints, Tyre impressions, Tool marks
- (B) Ballistics Section: Firearms, Parts of Firearms, Cartridges, Cartridge cases, Bullets/ Pellets wads & Clothes and other materials affected by firing.
- (C) Forensic Engineering: Road/ Train/ Vehicular Accidents Materials, Building Materials such as bricks, Cement, Mortar, Steel, etc

#### **Unit-2: Chemistry Division**

- (A) Chemistry Section: Explosives, its remnants, Residues, components etc. Arson and Fire residues, Suspected Petrol, Diesel and other Motor oils, Unknown substances in the form of solids liquids or gases, Suspected cosmetics, Toiletry, cement, metals Jewellery, ornaments, Alloys etc, Acid burn cases.
- (B) Narcotics Section: Suspected powders, Liquids, Plant products, Toddy, Liquor and their adulteration
- (C) Toxicology Section: Viscera, Body fluids, Suspected poisonous substances in plant materials, food, syringes, needles, Tablets, powders etc Bones, Ash, Skin, Vomit, Exhumed remnants

#### **Unit-3: Biology Division**

- (A) Biology Section: Examination of Hair, Fibres, Diatoms, plants materials, Cigarettes butts, Insects, Flies, Maggots, Human tissues and animal origins etc
- (B) Serology Section: Blood, Semen, Saliva, Other body fluids,
- (C) DNA Fingerprinting Laboratory: Liquid blood, blood stains, & swabs, semen, Seminal stains, tissues, Bones, Hairs, Teeth, Saliva, Skeletal remains etc. Samples of Animal & Plants origins

#### **Unit-4: General Division**

- (A) Questioned Documents Section: Examination of Handwriting, Signatures, Erasures, obliterations, Alterations, Overwriting, secret writing, Type writing, printed matter, photocopies, Ink & Paper.
- (B) Polygraph Section: Persons viz, Suspects, Witnesses or complainants
- (C) Computer Forensic Section: Software, Hardware, Computer peripherals & products, Computer data, Text, Images, Audio & Video files on Storage Media.

**Unit-5: Allied Institutes- CCMB Centre for Cellular and Molecular Biology, CFPB- Central Finger print Bureau, IICT- Indian Institute of Chemical Technology, NIN- National institute of Nutrition and NIA- National Institute Agency etc**

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### Paper-6: Introduction to Forensic Science Practical's:

- Experiments on Locard's principle of Exchange- Glass, Paint, Fingerprints, Blood etc.,
- Examination of blood & blood stains.
- ABO Blood grouping
- Identification of urine
- Identification of saliva
- Identification of semen
- Physical examination of soil.

### Paper-7: Fundamentals of Computer:

**Unit-1:** Basic Computer Knowledge Computer organizations, types of computers, Components of computer, Input Devices Key board, mouse, touch pad and other pointing Devices, Desktop Icons and control panel objects, Operating system types, Creating Files and Folders, Exploring the folders, files, and programs, Editing a document files

**Unit-II:** Introduction to Computer Networks: Computer networks, Intranet, Surfing the Internet, ISPs and connection types, Search, Email, Virtual communities, Social Networks, Tools on the web

**Unit-III:** Components of Computer and Printers Introduction to the Computer Hardware, Power Supplies, Motherboards, Internal PC Components, External Ports and Cables, Input and Output Devices, Select Computer Components, Safe Lab Procedures, Procedures to Protect Equipment and Data, Proper Use of Tools, Software Tools, Antistatic Wrist Strap, Printers, Installing and Configuring Printers, Configuring Options and Default Settings, Optimizing Printer Performance, Sharing Printers, Print Servers, Maintaining and Troubleshooting Printers, Troubleshooting Printer Issues, Common Problems and Solution

**Unit-IV:** Computer Assembly: Assemble the Computer, Computer Disassembly, Install the Motherboard, Install Drives, Install Cables, Install the Adapter Cards, Install the Adapter Cards, BIOS Beep Codes and Setup, BIOS and UEFI Configuration, Upgrade and Configure a Computer, Storage Devices, Peripheral Devices

**Unit-V:** Preventive Maintenance and Troubleshooting Preventive Maintenance and the Troubleshooting Process, PC Preventive Maintenance, Benefits of Preventive Maintenance, Preventive Maintenance Tasks, Clean the Case and Internal Components, Inspect Internal Components, Identify the Problem Probable Cause Test the Theory to Determine, Plan of Action to Resolve the Problem and Implement the Solution

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### Paper-8: Fundamentals of Computers Practical's:

- Basic Computer Knowledge
- Introduction to Computer Networks
- Components of Computer and Printers
- Computer Assembly
- Preventive Maintenance and Troubleshooting

### Paper-9 Inorganic and Organic Chemistry-1

#### Inorganic Chemistry

##### UNIT –I

P-block elements –I

Group-13: Synthesis and structure of diborane and higher boranes ( $B_4H_{10}$  and  $B_5H_9$ ), boron-nitrogen compounds ( $B_3N_3H_6$  and BN) and carboranes

Group - 14: Preparation and applications of silanes, silicones and graphitic compounds.

Group - 15: Preparation and reactions of hydrazine, hydroxylamine and Phosphazenes.

##### UNIT-II

1. p-block elements -II

Group - 16: Classifications of oxides based on (i) Chemical behaviour and (ii) Oxygen content, Oxyacids of sulphur (structures only).

Group-17: Inter halogen compounds, pseudo halogens and comparison with halogens. 2.

Organometallic Chemistry

Definition - classification of Organometallic compounds - nomenclature, preparation, properties and applications of alkyls of Li and Mg.

#### Organic Chemistry

##### UNIT-III

Structural theory in Organic Chemistry

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical Reagents including neutral molecules like  $H_2O$ ,  $NH_3$  &  $AlCl_3$ ). Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity - inductive effect. Application of inductive effect (a) Basicity of amines (b)

Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric Effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper Conjugation and its application to stability of carbonium ions, Free radicals and alkenes, carbanions, carbenes and nitrenes.

Types of Organic reactions: Addition - electrophilic, nucleophilic and free radical. Substitution - electrophilic, nucleophilic and free radical. Elimination- Examples.

##### UNIT-IV

1. Acyclic Hydrocarbons

Alkenes - Preparation of alkenes. Properties: Addition of hydrogen - heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of  $H_2O$ , HOX,  $H_2SO_4$  with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Dienes - Types of dienes, reactions of conjugated

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dienes - 1,2 and 1,4 addition of HBr to 1,3 – butadiene and Diel's - Alder reaction. Alkynes - Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides).

Preparation of higher acetylenes, Metal ammonia reductions, Physical properties. Chemical reactivity - electrophilic addition of X<sub>2</sub>, HX, H<sub>2</sub>O (Tautomerism), Oxidation with KMnO<sub>4</sub>, OsO<sub>4</sub>, reduction and Polymerisation reaction of acetylene.

2. Alicyclic hydrocarbons (Cycloalkanes) Nomenclature, Preparation by Freund's method, Wislicenus method. Properties - reactivity of cyclopropane and cyclobutane by comparing with alkanes, Stability of cycloalkanes - Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane, cyclopentane, cyclohexane.

### UNIT-V

Benzene and its reactivity -Concept of resonance, resonance energy. Heat of hydrogenation, heat of combustion of Benzene, mention of C-C bond lengths and orbital picture of Benzene. Concept of aromaticity - aromaticity (definition), Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)

Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution – Definition of ortho, para and Meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO<sub>2</sub> and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens (Explanation by taking minimum of one example from each type)

### Paper-10: Chemistry Practical's - 1

Practical-I Simple Salt Analysis

- Qualitative Inorganic Analysis 50 Marks
- Analysis of simple salt containing one anion and cation from the following
- Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.
- Cations: Lead, Copper, Iron, Aluminum, Zinc, Manganese, Nickel, Calcium, Strontium, Barium, Potassium and Ammonium.

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Table-2: B.Sc. Forensic Science SEMESTER – II

Paper No.	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours	Credits
1	First Language English	100	25	75	4	3
2	Foundation course - 3 Environmental Science	50	0	50	2	2
3	Foundation course – 4 ICT-I Computer Fundamentals and Office Tools	50	0	50	2	2
4	Crime Scene Management	100	25	75	4	3
5	Physical Evidence	100	25	75	4	3
6	Crime Scene Management Practical's	50	0	50	2	2
7	Networking and Security	100	25	75	4	3
8	Networking and Security Practical's	50	0	50	2	2
9	Physical & General Chemistry- 2	100	25	75	4	3
10	Chemistry Practical's - 2	50	0	50	2	2
Total		750			30	25

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**Paper-1: First Language English**

**Paper-2:** Foundation course – 3 Environmental Science

**Paper-3:** Foundation course – 4 ICT-I Computer Fundamentals and Office Tools

**Paper-4: Crime Scene Management:**

**Unit-1:** Crime Scene Definition, Types of crime scenes: Primary, Secondary & Tertiary, Crime scene Protection – Different types of Crimes- Burglary, Homicide, Suicides, Sexual offences, Accidents etc.

**Unit-2:** Crime Scene Photography- Introduction to Crime scene photography – History - cardinal rules of CS photography – Basic principles of CS photography – Macro & Micro Photography- Forensic photogrammetry Variations of Photography- Mid range, Close-up , Aerial & over all Photography – EMR photographic techniques – SWGIT – Photo images as evidences – Documentation of Crime scene Photography – Forensic Videography.

**Unit-3:** Sketching of Crime Scene- Rough Sketch & Fine Sketch- Rectangular Coordinate Method, Polar method, Baseline Method, Triangulation Method etc. optical methods of mapping, 3D laser Scanning.

**Unit-4:** Processing of Crime Scene- Where to search, what to Search & How to search Crime scene safety: Introduction, Types of hazards-chemical, biological, and physical. Types of Safeties - Routes of exposure- General precautions- Exposures to Violent Crimes, Exposure to Traumatic Incidents, and Exposure to Explosion- Personal protective equipment's.

**Unit- 5:** Crime scene reconstruction- Definition – Nature& Importance - Types of Crime scene reconstruction - Role of pattern analysis in reconstruction. Sequence of events recording, Documentation required for Crime scene reconstruction.



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### **Paper-5: Physical Evidence:**

**Unit-1:** Physical Evidence- Definition- Importance of Physical Evidence -Types of Physical Evidence- Trace Evidence- Identification of Physical Evidence-Sources of Physical evidence-Type of Information to be elicited from Different types of Physical Evidence.

**Unit-2:** Physical Evidence- Protection & Search methods, Types of search methods- Spiral, Strip or Lane, Grid, Zone and Wheel or Pie methods. General precautions to be taken while collecting Physical Evidence- Collection– Evidence collection equipment's, techniques of collection. Chain of Custody.

**Unit -3:** Handling of Different Physical Evidences, Guidelines for different evidences- Biological evidence, Chemical Evidence, Explosive evidence, Ballistics evidence Digital evidence, Narcotic Evidence, Wild life evidence etc

**Unit-4:** Packing Materials of Physical Evidence- Lifting of Physical Evidence- Importance of packing materials. Sealing, Marking, & labelling- Letter of advice- Precaution to be taken while transporting Physical Evidence.

**Unit- 5:** Protection of Physical Evidence- Definition- Importance of Protection of Physical Evidence- General precautions - Types of Preservatives for different Physical Evidence- Blood, Vomit & Viscera etc

### **Paper-6: Crime Scene Management Practical's**

- Search methods for Identification of physical evidence.
- Handling, Lifting & Packing of physical evidence.
- Sealing, Labelling & Preservation of different physical evidence.
- Methods for sketching the crime scene- Rough & Fine Sketch
- Mapping techniques of crime scene- Baseline, Rectangular, Triangulation & Polar techniques.
- Crime scene Photography

## B.Sc. Forensic Science Syllabus

### Paper-7: Networking and Security:

**Unit-I:** Operating Systems and Installation: Windows Installation, Operating System Terms and Characteristics, Types of Operating Systems and Operating Systems Upgrade, Operating System Installation, Storage Device Setup Procedures, Custom Installation Options, Boot Sequence and Registry Files, Multiboot Procedures, Disk Management Utility, Windows Configuration and Management, Windows Desktop, Tools and Applications, Control Panel Utilities, Administrative Tools, System Configuration, Disk Defragmenter and Disk Error-Checking Tool, Command Line Tools, Client-Side Virtualization, Common Preventive Maintenance Techniques for Operating Systems

**Unit-II:** Applied Computer Networking: Computer Networks, Types of Networks, OSI Reference Models, Wired and Wireless Ethernet Standards, Physical Components of a Network, Hubs, Bridges, and Switches, Cables and Connectors, Basic Networking Concepts and Technologies, IP Addresses, IPv4 vs. IPv6, Static Addressing, Dynamic Addressing, Transport Layer Protocols, TCP, UDP, Port Numbers, Computer to Network Connection, Wireless and Wired Router Configurations, Network Sharing, Remote Connections, ISP Connection Technologies, Internet Technologies, Networked Host Services, Common Preventive Maintenance Techniques Used for Networks, Basic Troubleshooting Process for Networks

**Unit-III:** Laptops and Mobile Devices: Laptops and Mobile Devices, Laptop Components, Laptop Displays, Laptop Configuration, Wireless Configuration, Laptop Hardware and Component Installation and Configuration, Replacing Hardware Devices, Mobile Device Hardware, Common Preventive Maintenance for Laptops and Mobile Devices, Basic Troubleshooting Process for Laptops and Mobile Devices, Mobile, Linux, and OS X Operating Systems, Mobile Operating Systems, Methods for Securing Mobile Device, Mobile Device Synchronization, Configuring Email, Linux and OS X Operating Systems, Basic Troubleshooting Process for Mobile, Linux, and OS X O/S, Common Problems and Solutions for Mobile, Linux, and OS X O/S.

**Unit-IV:** Network Security: Introduction to Security, Security Threats, Security Procedures, Securing Web Access, Protecting Data, Protection Against Malicious Software, Security Techniques, Protecting Physical Equipment, Common Preventive Maintenance Techniques for Security, Basic Troubleshooting Process for Security

**Unit-V:** Troubleshooting Computer Networks: Apply Troubleshooting Process to Networks, Apply Troubleshooting Process to Security, Identify and Troubleshooting LAN problems, Cyberwarfare and Network Attacks, Mitigating Cyber Attacks, Troubleshoot Security Problems

### Paper-8: Networking and Security Practical's

- Operating Systems and Installation
- Applied Computer Networking
- Laptops and Mobile Devices
- Network Security
- Troubleshooting Computer Network

## B.Sc. Forensic Science Syllabus

### Paper- 9 (Physical & General Chemistry) - II

#### PHYSICAL

#### CHEMISTRY

**UNIT-I:** Solid-state - Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Defects in crystals. Stoichiometric and non-stoichiometric defects

#### UNIT-II:

1. Gaseous state- Compression factors, deviation of real gases from ideal behavior. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The Vander Waal's equation and the critical state. Law of corresponding states. Relationship between critical constants and Vander Waal's constants. Joule Thomson effect.

2. Liquid state- Structural differences between solids, liquids and gases. Liquid crystals, the mesomorphic state. Classification of liquid crystals into Smectic and Nematic. Differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices

#### UNIT-III

1. Solutions- Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Nonideal solutions. Vapour pressure - composition and vapour pressure- temperature curves. Azeotropes-HCl-H<sub>2</sub>O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water, trimethylamine-water, nicotine-water systems. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

#### GENERAL CHEMISTRY

#### UNIT-IV

1. Surface chemistry: Definition of colloids. Solids in liquids(sols), preparation, purification, properties - kinetic, optical, electrical. Stability of colloids, Hardy-Schulze law, protective colloid. Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses. Adsorption: Physical adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption

2. Chemical Bonding: Valence bond theory, hybridization, VB theory as applied to ClF<sub>3</sub>, Ni(CO)<sub>4</sub>, Molecular orbital theory - LCAO method, construction of M.O. diagrams for homonuclear and hetero-nuclear diatomic molecules (N<sub>2</sub>, O<sub>2</sub>, CO and NO).

#### UNIT-V

Stereochemistry of carbon compounds- Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria(Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L and R,S configuration methods and E,Z- configuration with examples.

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### **Paper-10: Chemistry Practical Practical's - 2**

#### **Qualitative inorganic analysis**

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, sulphate, chloride, bromide, acetate, nitrate, borate, phosphate.

Cations: Lead, copper, iron, aluminum, zinc, manganese, calcium, strontium, barium, potassium and ammonium.

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Table-3: B.Sc. Forensic Science SEMESTER – III

Paper No.	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours	Credits
1	First Language English	100	25	75	4	3
2	Foundation course - 5 Information and communication technology-2	50	0	50	2	2
3	Foundation course – 6 Communication and soft skills-2	50	0	50	2	2
4	Forensic documents Examination	100	25	75	4	3
5	Fingerprints, Impressions & Biometrics	100	25	75	4	3
6	Forensic documents & Fingerprints Practical's	50	0	50	2	2
7	Cyber Security	100	25	75	4	3
8	Cyber Security Practical's	50	0	50	2	2
9	Inorganic Chemistry & Organic Chemistry- 3	100	25	75	4	3
10	Chemistry Practical's - 3	50	0	50	2	2
Total		750			30	25

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### **Paper-1: First Language English**

**Paper-2:** Foundation course – 5 Information and communication technology-2

**Paper-3:** Foundation course – 6 Communication and soft skills-2

### **Paper-4: Forensic Documents Examination**

**Unit-1:** Introduction to questioned document- Terminology of documents- History of forensic document examination. Classification of documents-procurement of standard admitted/specimen writings-handling and marking of documents-preliminary examination of documents – Types of crimes related to documents – criminal investigation.

**Unit-2:** Handwriting analysis –Definition of Graphology- Basics of Handwriting Identification - Individuality of handwriting - General characteristics of handwriting- Analysis of handwriting- Tools for Forensic document examination- Simulation and Comparison of Handwriting- Collection of proper standards.

**Unit-3:** Disguised writing and anonymous letters-Identification of writer-Examination of signatures. Characteristics of forged and genuine signatures. Examination of alterations, erasures, over writings, additions and obliterations. Decipherment of secret writings indented and charred documents. Examination of seal impressions and mechanical impressions.

**Unit-4:** Forgeries and their detection. Definition of Forgery, Types of forgeries. Examination of built up documents. Determination of sequence of strokes, physical matching of documents. Examination of black and white, colour Xerox copies, carbon copies and fax messages- Identification of type writer writings-identification of type writer, identification of printed matter, various types of printing of security documents, printing of currency notes. Examination of counterfeit currency notes, passports, visa, stamp papers, postal stamps etc.

**Unit-5:** Determination of age of documents by examination of signatures, paper, ink writing/signatures etc. Examination of computer printouts- dot matrix, ink jet and laser printers, electronic type writers, credit cards, E-documents, digital signatures. Opinion writing, Reasons for opinion and court testimony. Instrumentation and Principles of Video Spectral Comparator, Stereoscopic microscopes, TLC, HPLC, Spectrofluorimetry and X-Ray fluorimetry.

## **B.Sc. Forensic Science Syllabus**

### **Paper-5: Finger prints, Impressions & Biometrics**

**Unit-1:** Introduction of Fingerprints- Dactylography— History and Importance of Fingerprints- Fundamentals of Fingerprints Patterns- Systematic method of classification – Types of Fingerprints- Visible, plastic, & Latent- Development of Latent Fingerprints Physical , Chemical methods & Modern methods- Recording & lifting of Fingerprints -Collection of Fingerprints at Scene of crime.

**Unit-2:** Poroscopy – Skin outer surface impressions – Types of skin impressions– Evidence collection on victim and suspects – Preservation and lifting techniques - Identification and comparison of Fingerprints - Palm prints – AFIS - Digital imaging of FP- Fingerprint collection of cadavers

**Unit-3:** Introduction of Foot prints– types of Foot prints – Surface & Sunken Footprint Recording & Casting of Foot prints– Comparison of Footprints- Examination of footprints- Footwear Impressions- Introduction, Recording of footwear impressions- Enhancement methods – Walking picture/ Gait pattern analysis- Gait pattern scan and its principles- Determination of personality by gait analysis.

**Unit-4:** Tire impressions-Introduction– Tire impression examination – Photography of tire impressions – Evidences Collection process. Skid marks- Calculation of vehicle speed at accident.

**Unit-5:** Biometrics – Introduction- History – Definition – Types of Biometrics – Features and functions of biometrics — Iris detection & its principles– Lip prints- Ear prints- Bite marks- Judicial acceptance

### **Paper-6: Forensic documents & Fingerprints Practical's**

1. Detection of types of Forgeries.
2. Examination of rubber stamps and seals.
3. Examination of Printed Material
4. Examination of Alterations, Additions, Erasures, Obliterations and overwritings
5. Deciphering of indented writing, secret writing and charred documents
6. Examination of inks by TLC.
7. Examination of inks & Paper by VSC
8. Examination of security features of documents like Currency notes, Passports, Stamp papers, Driving License by VSC.
9. Development of Finger prints by Powders and Iodine fuming.
10. Lifting & Collection of developed Finger prints
11. Collection of Plain & Rolled Finger prints
12. Footprint casting.

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### Paper-7: Cyber Security

**Unit- 1 :** Need of Cyber Security- Introduction to Cyber -The Cybersecurity World, Cybersecurity Domains Overview of the Cybersecurity Domains, Examples of Cybersecurity Domains, The Growth of the Cyber Domains, Cybersecurity Criminals versus Cybersecurity Specialists, Cybersecurity Criminals, Who Are the Cyber Criminals? Cyber Criminal Motives, Cybersecurity Specialists, Why Become a Cybersecurity Specialist? Thwarting Cyber Criminals Digital Forensic and Cyber Crime- Understanding Cyber Crime: Indian IT Act 2008 and amendments categories of cyber crimes ie., unauthorized access and hacking

**Unit- 2:** E-mail related crimes, Internet relay, chat relating crimes, sale of illegal articles, online gambling, phishing, Intellectual property crimes, web defacement, cyber stalking etc., Computer hardware/Software: Hardware- Storage related simple problems, OCR, OMR, BAR Code etc., Memory Hierarchies : Basics of Semiconductor Memories, Circuits, Address Decoding, Access Time, Examples of Integrated Circuit ROMs, PROMs, EPROMs, EEPROM, Components of CPU, Register, Accumulator, Software System- application Software and their Examples in real life. Operating System and their usage. Multitasking –Multiprogramming- Multiprocessing Operating System

**Unit- 3:** Foot printing & Social engineering, Information gathering methodologies, Competitive Intelligence, DNS Enumerations, Social Engineering attacks, Analysis of Deep web/ dark web and silk road analysis, Working with Windows and DOS Systems, Understanding File Systems, Exploring Microsoft File Structures, Examining NTFS Disks, Understanding Whole Disk Encryption, Understanding the Windows Registry, Understanding Microsoft Startup Tasks, Understanding MS-DOS Startup Tasks, Understanding Virtual Machines. Examining UNIX and Linux Disk Structures and Boot Processes, Understanding Other Disk Structures, Free space Management Bit-Vector Linked List Grouping Counting Efficiency Performance Recovery Physical Damage, Physical Damage Recovery Logical Damage, Logical Damage Recovery.

**Unit- 4:** Ethical Hacking terminology: Five stages of hacking, Vulnerability Research, Legal implication of hacking, Impact of hacking, System Hacking, Password cracking techniques, Key loggers, Escalating privileges, Hiding Files, Steganography, The Cybersecurity Cube, Three Dimensions of the Cybersecurity Cube, The Principles of Security, Cybersecurity Safeguards, CIA Triad, Confidentiality, The Principle of Confidentiality, Protecting Data Privacy, Controlling Access-Laws and Liability Integrity: Principle of Data Integrity, Need for Data Integrity Integrity Checks, Availability, The Principle of Availability, Ensuring Availability

**Unit- 5:** States of Data: Data at Rest, Types of Data Storage, Challenges of Protecting, Stored Data, Data In-Transit, Methods of Transmitting Data, Challenges of Protecting, Stored Data, Data In-Transit, Methods of Transmitting Data, Challenges of Protecting Data In-Transit, Data



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in Process, Forms of Data Processing and Computation, Challenges of Protecting Data In-Process, Cybersecurity Countermeasures

### **Paper-8: Cyber Security Practical's**

#### **LAB Concepts:**

1. Phishing
2. Fake Email
3. VM Ware Installations
4. System Hacking
5. Key - Loggers & Key Scramblers

**Paper 9 - INORGANIC & ORGANIC CHEMISTRY- III**

**INORGANIC CHEMISTRY**

**UNIT –I**

1. Chemistry of d-block elements: Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.
2. Theories of bonding in metals: Metallic properties and its limitations, Valence bond theory, Free electron theory, Explanation of thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators.

**UNIT – II**

1. Metal carbonyls : EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni.
2. Chemistry of f-block elements: Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides, separation of lanthanides by ion exchange method and solvent extraction method.

**ORGANIC CHEMISTRY**

**UNIT – III**

1. Halogen compounds: Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aryl alkyl, allyl, vinyl, benzyl halides. Nucleophilic aliphatic substitution reaction- classification into  $SN_1$  and  $SN_2$  – reaction mechanism with examples – Ethyl chloride, t-butyl chloride and optically active alkyl halide 2-bromobutane.
2. Hydroxy compounds: Nomenclature and classification of hydroxy compounds. Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols. Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from cumene. Physical properties- Hydrogen bonding (intermolecular and intramolecular). Effect of hydrogen bonding on boiling point and solubility in water. Identification of alcohols by oxidation with  $KMnO_4$ , Ceric ammonium nitrate, Luca's reagent and phenols by reaction with  $FeCl_3$ . Chemical properties: a) Dehydration of alcohols. b) Oxidation of alcohols by  $CrO_3$ ,  $KMnO_4$ . c) Special reaction of phenols: Bromination, Kolbe-Schmidt reaction, Reimer-Tiemann reaction, Fries rearrangement, azocoupling, Pinacol-Pinacolone rearrangement.

**UNIT-IV**

Carbonyl compounds

Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group. Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties: Reactivity of carbonyl group in aldehydes and ketones. Nucleophilic addition

## B.Sc. Forensic Science Syllabus

reaction with a)  $\text{NaHSO}_3$ , b)  $\text{HCN}$ , c)  $\text{RMgX}$ , d)  $\text{NH}_2\text{OH}$ , e)  $\text{PhNHNH}_2$ , f) 2,4-DNPH, g) Alcohols-formation of hemiacetal and acetal. Base catalysed reactions: a) Aldol, b) Cannizzaro's reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction. Oxidation of aldehydes Baeyer-Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, reduction with  $\text{LiAlH}_4$  and  $\text{NaBH}_4$ . Analysis of aldehydes and ketones with a) 2,4-DNPH test, b) Tollen's test, c) Fehling test, d) Schiff's test e) Haloform test (with equation)

### UNIT-V

1. Carboxylic acids and derivatives: Nomenclature, classification and structure of carboxylic acids. Methods of preparation by a) Hydrolysis of nitriles, amides b) Hydrolysis of esters by acids and bases with mechanism c) Carbonation of Grignard reagents. Special methods of preparation of aromatic acids by a) Oxidation of side chain. b) Hydrolysis by benzotrichlorides. c) Kolbe reaction. Physical properties: Hydrogen bonding, dimeric association, acidity strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids. Chemical properties: Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, ArndtEistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

2. Active methylene compounds: Acetoacetic ester: keto-enol tautomerism, preparation by Claisen condensation, Acid hydrolysis and ketonic hydrolysis. Preparation of a) monocarboxylic acids. b) Dicarboxylic acids. c) Reaction with urea Malonic ester: preparation from acetic acid. Synthetic applications: Preparation of a) monocarboxylic acids (propionic acid and n-butyric acid). b) Dicarboxylic acids (succinic acid and adipic acid) c)  $\alpha,\beta$ -unsaturated carboxylic acids (crotonic acid). d) Reaction with urea.

### Paper -10 Chemistry Practical III:

#### Titrimetric Analysis and Organic Functional Group Reaction

##### Titrimetric analysis

1. Determination of Fe (II) using  $\text{KMnO}_4$  with oxalic acid as primary standard.
2. Determination of Cu(II) using  $\text{Na}_2\text{S}_2\text{O}_3$  with  $\text{K}_2\text{Cr}_2\text{O}_7$  as primary standard.

##### Organic Functional Group Reactions

3. Reactions of the following functional groups present in organic compounds: (at least four) Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids and Amides

## B.Sc. Forensic Science Syllabus

Table-4: B.Sc. Forensic Science SEMESTER – IV

Paper No.	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours	Credits
1	Foundation course - 7 CSS-3	50	0	50	2	2
2	Foundation course – 8 Analytical Skills	50	0	50	2	2
3	Foundation course – 9 Entrepreneurship	50	0	50	2	2
4	Foundation course –10 Leadership Education	50	0	50	2	2
5	Forensic Biology	100	25	75	4	3
6	Forensic Ballistics	100	25	75	4	3
7	Forensic Biology & Ballistics Practical's	50	0	50	2	2
8	Cyber Forensics	100	25	75	4	3
9	Cyber Forensics Practical's	50	0	50	2	2
10	Spectroscopy & Physical Chemistry- 4	100	25	75	4	3
11	Chemistry Practical's - 4	50	0	50	2	2
Total		750			30	25

**Paper-1:** Foundation course – 7 CSS-2

**Paper-2:** Foundation course – 8 Analytical Skills

**Paper-3:** Foundation course – 9 Entrepreneurship

**Paper-4:** Foundation course –10 Leadership Education

## **B.Sc. Forensic Science Syllabus**

### **Paper-5: Forensic Biology**

**Unit-1:** Introduction to Forensic Biology- Developmental History of Modern Forensic Biology- Definition and introduction of F.Botany- Toxic Principles of Plants and their forensic significance- Poisonous mushrooms – Study and Identification of pollen grains- identification of seeds, leaves, flowers, starch grains, powders, stains of spices.

**Unit-2:** Forensic Microbiology- Microbial poisoning-Quality of various food products & examination procedure- growth of microorganisms- Bioterrorism- Diatoms test for drowning- Diatoms types & morphology- collection of diatom samples & examination. Hair analysis- Structure of hair – growth and chemistry of hair - Differences between human & animal hair.

**Unit-3:** Fibre examination- Introduction – Classification of fibres- Identification and comparison of fibres by physical, chemical, microscopic, spectroscopic – Forensic Significance.

**Unit-4:** Forensic Entomology- introduction to insects, arthropods- insects of forensic importance – indicators of time of death stages of insect development & comparative decomposition of human body- colonization- Evidence collection of insects- Terrestrial & Aquatic Insects.

**Unit-5:** Wildlife Forensics- Introduction- importance of wildlife- Wildlife protection act- endangered species- CITES- Census of wild life population- Smuggling and poaching – crime scene search- criminal investigation- identification of animals by teeth, claws, ivory, antlers, furs, skins, bitemarks, pugmarks- identification of blood, excreta, and other visceral samples.

## **B.Sc. Forensic Science Syllabus**

### **Paper-6: Forensic Ballistics**

**Unit-1:** Definition of Forensic Ballistics & Firearms. History of firearms- Parts of firearm, classification of firearms. Rifling and its significance- Firing mechanism. Improvised/Country made/imitative firearms and their constructional features. Ammunition- Introduction, classification of ammunition. Constructional features of different types of cartridges. 12 bore cartridge- Types of primers, priming compositions. Propellants and their compositions. Various types of bullets and their compositional aspects- Safety aspects of handling firearms and ammunitions.

**Unit-2:** Gunshot residues-introduction, nature-black powder and smokeless powder residues. Location, detection, collection-dry methods, wet methods and collection of organic residues. Evaluation-visual examination, infrared photography, soft x-ray radiography, dermal nitrate test, Walker's test, Harrison and Gilroy's test, Price's spot test and other Instrumental methods.

**Unit-3:** Introduction to Internal and external ballistics- Direction of fire, Time of fire, Range of fire- Close range firing effects - muzzle patterns, Scorching, Blackening, Tattooing, Powder residues, Metal particles, Wad distribution, Pellet patterns, Direction of wound &

**Unit-4:** Terminal Ballistics-Effect of projectile on hitting the target, Function of bullet shape, Striking velocity, Striking angle, Tumbling of bullets, Cavitations, Ricochet and its effects. Wound ballistics- Nature of wounds of entry and exit.

**Unit-5:** Principles for identification of fire arms. Different types of marks produced during firing process on cartridge-firing pin marks, breech, face marks, chamber marks, extractor and ejector marks. Bullet-number, direction of land and grooves, striation marks, land and grooves under comparison microscope. Indian Arms Act (IAA) - Report writing and court of testimony.

### **Paper-7: Forensic Biology & Ballistics Practical's**

1. Identification of Diatoms
2. Identification of Pollen grains
3. Morphological characteristics of plant material (datura, Cannabis, Nerium etc)
4. Morphological Examination of Human Hair & Animal hair
5. Morphological Examination of natural & synthetic Fibres
6. Examination of Bullets & Cartridge cases.

## **B.Sc. Forensic Science Syllabus**

### **Paper-8: Cyber Forensics**

**UNIT- 1 :** Cybersecurity Threats, Vulnerabilities, and Attacks \* Types of Malware \* Viruses, Worms, and Trojan Horses \* Ransomware \* Email and Browser Attacks \* Types of Cyber Attacks \* Sniffing \* Spoofing

**UNIT- 2 :** The Art of Protecting Secrets \* Cryptography \* Types of Encryption \* Types of Access Controls \* Access Control Strategies \* Identification \* Authentication Methods \* Types of Security Controls \* Data Masking

**UNIT- 3 :** Cyber Incident Response \* Threat classification \* Factors contributing to incident severity and prioritization \* Scope of impact \* Types of data

**UNIT- 4 :** Forensics kit \* Digital forensics workstation \* Forensic investigation suite \* Stakeholders \* Purpose of communication processes \* Role-based responsibilities \* Common network-related symptoms \* Containment techniques \* Incident summary report

**UNIT- 5 :** Security Architecture \* Regulatory compliance - Frameworks \* Policies \* Controls \* Procedures \* Verifications and quality control \* Security issues associated with context-based authentication \* Security issues associated with identities \* Security issues associated with identity repositories \* Security issues associated with federation and single sign-on \* Exploits \* Types of Data Storage \* Challenges of Protecting Stored Data \* Challenges of Protecting Data Cybersecurity Countermeasures

### **Paper-9: Cyber Forensics Practical's**

1. VM Ware Work Station
2. Email Tracing
3. Phishing
4. Website bypassing
5. Key loggers and Key Scanders

## B.Sc. Forensic Science Syllabus

### Paper 10 (SPECTROSCOPY & PHYSICAL CHEMISTRY) - 4

#### SPECTROSCOPY

**UNIT-I:** General features of absorption - Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of 1. Chromium in  $K_2Cr_2O_7$  2. Manganese in Manganous sulphate

Electronic spectroscopy: Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals ( $\sigma$ ,  $\pi$ ,  $n$ ). Selection rules for electronic spectra. Types of electronic transitions in molecules effect of conjugation. Concept of chromophore and auxochrome.

#### UNIT-II

Infra red spectroscopy: Different Regions in Infrared radiations. Modes of vibrations in diatomic and polyatomic molecules. Characteristic absorption bands of various functional groups. Interpretation of spectra-Alkanes, Aromatic, Alcohols carbonyls, and amines with one example to each.

Proton magnetic resonance spectroscopy ( $^1H$ -NMR): Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

#### PHYSICAL CHEMISTRY

##### UNIT-III

Dilute solutions: Colligative properties. Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Theory of dilute solutions. Determination of molecular weight of non-volatile solute from osmotic pressure. Abnormal Colligative properties- Van't Hoff factor.

##### UNIT-IV

Electrochemistry-I: Specific conductance, equivalent conductance. Variation of equivalent conductance with dilution. Migration of ions, Kohlrausch's law. Arrhenius theory of electrolyte dissociation and its limitations. Ostwald's dilution law. DebyeHuckel-Onsagar's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorfs method. Application of conductivity measurements- conductometric titrations.



## **B.Sc. Forensic Science Syllabus**

### **UNIT-V**

1. Electrochemistry-II: Single electrode potential, sign convention, Reversible and irreversible cells Nernst Equation- Reference electrode, Standard Hydrogen electrode, calomel electrode, Indicator electrode, metal – metal ion electrode, Inert electrode, Determination of EMF of cell, Applications of EMF measurements - Potentiometric titrations.

2. Phase rule: Concept of phase, components, degrees of freedom. Thermodynamic Derivation of Gibbs phase rule. Phase equilibrium of one component system - water system. Phase equilibrium of two- component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, simple eutectic diagram, desilverisation of lead., NaCl-Water system, Freezing mixtures.

### **Paper- 11 Physical Chemistry and IR Spectral Analysis Practical's - 4**

#### **Physical Chemistry**

1. Critical Solution Temperature- Phenol-Water system
2. Effect of NaCl on critical solution temperature (Phenol-Water system)
3. Determination of concentration of HCl conductometrically using standard NaOH solution.
4. Determination of concentration of acetic acid conductometrically using standard NaOH Solution.

#### **IR Spectral Analysis**

5. IR Spectral Analysis of the following functional groups with examples
- a) Hydroxyl groups
  - b) Carbonyl groups
  - c) Amino groups
  - d) Aromatic groups

## B.Sc. Forensic Science Syllabus

Table-5: B.Sc. Forensic Science SEMESTER – V

Paper No.	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours	Credits
1	Forensic Medicine & Anthropology	100	25	75	4	3
2	Forensic Medicine & Anthropology Practicals	50	0	50	2	2
3	Forensic Toxicology	100	25	75	4	3
4	Forensic Toxicology Practicals	50	0	50	2	2
5	DNA Fingerprinting	100	25	75	4	3
6	DNA Fingerprinting Practicals	50	0	50	2	2
7	Digital Forensics	100	25	75	4	3
8	Digital Forensics Practicals	50	0	50	2	2
9	Inorganic, Organic & Physical Chemistry- 5	100	25	75	4	3
10	Chemistry Practicals - 5	50	0	50	2	2
11	Inorganic, Organic & Physical Chemistry- 6	100	25	75	4	3
12	Chemistry Practicals - 6	50	0	50	2	2
Total		900			36	30

## **B.Sc. Forensic Science Syllabus**

### **Paper – 1 Forensic Medicine & Anthropology**

**Unit-1:** Introduction to Forensic Medicine – History of F.M – Definitions of Forensic Medicine, Pathology, Medical Jurisprudence. Medical evidences- documentations, investigation of scene of death - Medical Law and Ethics. Introduction, History & Development of Forensic Anthropology & Archaeology, Definitions of F.Anthropology, F.Archaeology, F.Odontology&F.Taphonomy. Role of Anthropologist at the Scene of Crime -Scene of Occurrence, Differences between Anthropologist & Archaeologist. Techniques &Equipment opted for search and recovery

**Unit-2:** Introduction to Human anatomy and Physiology- Axial Skeleton- Skull, Sutures of skull, Cranial bones, Facial bones, Sternum, thoracic bones, vertebral column, Appendicular Skeleton- Bones of Upper limbs, Lower limbs, Pelvic Girdle etc. Organization of human body- Circulatory System- Digestive system- Respiratory system- nervous system- Excretory System- Endocrine System- Urinogenital system- Reproductive System-

**Unit-3:** Medico-legal Autopsy- Death and its Causes- External examination of deceased body – Internal Examination- Determination of time since death and cause of death- Injuries - classification- Medico-legal aspects of injuries- Postmortem changes- collection of post-mortem samples and preservation. Determination of sex- from skull, mandible, pelvis, Femur, scapula etc., Determination of Age- Suture closures, growth of teeth & appearance of ossification centres- Determination of Stature- Height determination- Facial Reconstruction, Facial Superimposition, Exhumation process and its importance.

**Unit-4:** Sexual offences- rape- unnatural sexual offences- sexual perversions- Abortion- Infanticide- foeticides- impotence and sterility- virginity, Pregnancy and Delivery linked crimes- medico-legal crimes- thermal deaths- electrocution- starvation- anaesthetic & operative deaths- Mechanical Asphyxia- accidental- Drowning deaths- Poisoning deaths - Lightning.

**Unit-5:** Forensic Odontology- Basic principles, Applications in criminal investigations- Bite mark Analysis, Age estimation etc., Development of teeth- Dentition, Architecture of teeth, growth of teeth- Milk, Permanent. Dentition Library, Forensic Odontology limitations.

### **Paper-2: Forensic Medicine & Anthropology Practicals**

#### 1. Autopsy

- i) External Examination of Deceased body
- ii) Internal Examination of Deceased body
- iii) Post-mortem Changes

#### 2. Collection and Preservation of Visceral Samples.

#### 3. Identification and differentiation of Human Bones (Male & Female)

- i) Skull
- ii) Pelvis
- iii) Upper limbs
- iv) Lower limbs

## **B.Sc. Forensic Science Syllabus**

### **Paper-3: Forensic Toxicology**

**Unit-1:** Introduction to Forensic Toxicology - History & Development. Poisons Act 1919, Sections – IPC 193, 201, 202, 270, 271, 272, 273, 274, 275, 276, 277, 278, 284, 328. Cr.P.C. 39, 40, 175. National Poisons Information Centre (NPIC). Definitions – Toxins, Drug, Toxicodynamics, Toxicokinetics, Dose, Lethal Dose, LD<sub>50</sub>, Tolerance, Role of Forensic Toxicologist in Criminal Justice System.

**Unit-2:** Poisons – Definition, Forms of Poison – Physical, Chemical & Mechanical state. Classification – Corrosives/caustics – Strong acids & Alkalis, Irritants – Organic (Vegetable, Animal & Organic acids) Inorganic (Metallic & Non Metallic) & Mechanical Poisons. Neurotoxic Poisons – Cerebral & Spinal. Cardiovascular Poisons. Asphyxiants. Miscellaneous poisons – Pesticides, Pharmaceutical drugs, Petroleum poisons, Food poisons. Radioactive poisons.

**Unit-3:** Toxicokinetics. Routes of Administration of poisons - Inhalation, Ingestion, Injection, Topical etc. Mode of Action, Clinical features, Diagnosis, Elimination of poisons - Urinary excretion, Faecal Excretion, and other routes of elimination. Definition of Antidote– Types of antidotes. Pharmacokinetics of Antidotes.

**Unit-4:** Post mortem Toxicology – Types of samples. Collection of visceral samples, other body fluids - Blood, Saliva, Urine, and Stomach washes etc. their Preservation. Analytical Toxicology – Isolation and Purification, Screening tests, Methods of Identification, Quantitative estimation of individual poisons.

**Unit-5:** Toxicology of alcohol – Alcohol testing for intoxication. Alcohol in Circulatory system. i.e., Mode of Action. Analysis of alcohol samples. Introduction, Principle, Instrumentation, Working & Applications of Thin Layer Chromatography, Gas Chromatography, High Performance Liquid Chromatography and Mass Spectrometry.

### **Paper-4:**

#### **Forensic Toxicology Practicals**

1. Preliminary tests of heavy metals, Pesticides and Alcohol
2. Detection of Ethanol by Kozelka & Hine Method
3. Identification of pesticides by TLC
4. TLC of pesticide followed by GC & HPLC

## **B.Sc. Forensic Science Syllabus**

### **Paper-5: DNA Fingerprinting**

**Unit-1:** Introduction to Molecular biology – DNA – Structure of DNA – Nucleotides- General structure of nucleotides – Pyrimidines & Purines – RNA&DNA- Organization of DNA into Chromosome – Human Chromosomes – loci, Alleles, Genotypes and DNA markers – DNA markers nomenclatures – Types of DNA polymorphisms – Legal Standards for admissibility of DNA profiling.

**Unit-2:** Sources of DNA Evidences – Collection of Forensic DNA evidence- Preservation, Packaging and transportation of Samples -Extraction & Isolation of DNA samples – Different Extraction Methods – Quantification & Quality checking of DNA – PCR Technique.

**Unit-3:** Modern DNA profiling– The evolution of DNA technology- VNTR – STR - Minisatellites- STR multiplex – STR Polymorphism - SNP's, mtDNA, Y - chromosome analysis – Application of DNA profiling. Technology/ Instrumentation of DNA testing (capillary electrophoresis – separation and detection of PCR products (STR alleles)

**Unit-4:** Genetics of DNA testing - Statistical Probability- Parentage Testing and Kinship Analysis – Bayes theorem – Hardy Weinberg law – Frequency estimation calculations.

**Unit-5:** Advances in DNA testing - Next generation sequencing and single nucleotide polymorphisms. DNA Database & Databank - Human Genome Project - Bioinformatics - Proteomics –Gene Regulation. Admissibility of DNA evidence in court of law. The DNA legislation-India , USA, UK-The DNA Technology Regulation bill (act) – DNA Profiling relating to Article 21 & 20. IEA 112 & 114.

### **Paper-6: Forensic DNA Fingerprinting Practicals**

1. Collection & Preservation of DNA Samples
2. Isolation & Extraction of DNA from Blood
3. DPA method of DNA analysis
4. Orcinol Method RNA analysis
5. Lowry's Method of RNA analysis
6. Gel electrophoresis of DNA
7. Gel electrophoresis of Protein

## **B.Sc. Forensic Science Syllabus**

### **Paper-7: Digital Forensics**

**UNIT-1:** Computer Forensics and Investigations: Understanding Computer Forensics, Preparing for Computer Investigations, Taking A Systematic Approach, Procedure for Corporate High-Tech Investigations, Understanding Data Recovery Workstations and Software Office and Laboratory: Understanding Forensics Lab Certification Requirements Determining the Physical Requirements for a Computer, Forensics Lab Selecting a Basic Forensic Workstation

**UNIT-2:** Data Acquisition:, Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions, Using Acquisition Tools, Validating Data Acquisition, Performing RAID Data Acquisition, Using Remote Network Acquisition Tools, Using Other Forensics Acquisition Tools

**UNIT-3:** Processing Crime and Incident Scenes:, Identifying Digital Evidence, Collecting the Evidence in Private-Sector Incident Scenes, Processing law Enforcement Crime Scenes, preparing for a Search, Securing a Computer Incident or Crime Scene, Sizing Digital evidence at the Scene, Storing Digital evidence, Obtaining a Digital Hash, Current Computer Forensics Tools, Evaluating Computer Forensics Toll Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools

**UNIT-4:** Validating and Testing Forensics Software Computer Forensics Analysis and Validation, Determining What Data to Collect and Analyse, Validating Forensic Data, Addressing Data-Hiding Techniques, Performing Remote Acquisition, Recovering Graphics and Network Forensics, Recognizing a Graphics File, Understanding Data Compression, Locating and Recovering Graphics Files, Understanding Copyright Issues with Graphics, Network Forensic

#### **UNIT-5:**

Developing Standard Procedure for Network Forensics, Using Network Tools, Examining Hiney Project, E-mail Investigations Cell Phone and Mobile Device Forensics, Exploring the Role of E-mail in Investigations, Exploring the Role of Client and Server in E-mail, Investigating E-mail Crimes and Violations, Understanding E-mail Servers, Using Specialized E-mail Forensics Tools, Understanding Mobile Device Forensics, Understanding Acquisition Procedure for Cell Phones and Mobile Devices

### **Paper-8: Digital Forensics Practicals**

1. Disk Imaging (2types)
2. FTK Imager
3. Forensic Imaging of Virtual Machines
4. Live Acquisition
5. Live Incident Response
6. Network Minor

## B.Sc. Forensic Science Syllabus

### Paper - 9 (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)

#### INORGANIC CHEMISTRY

##### UNIT – I

Coordination Chemistry: IUPAC nomenclature - bonding theories - Review of Werner's theory and Sidgwick's concept of coordination - Valence bond theory - geometries of coordination numbers 4-tetrahedral and square planar and 6-octahedral and its limitations, crystal field theory - splitting of d-orbitals in octahedral, tetrahedral and square-planar complexes - low spin and high spin complexes - factors affecting crystal-field splitting energy, merits and demerits of crystal-field theory. Isomerism in coordination compounds - structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers.

##### UNIT-II

1. Spectral and magnetic properties of metal complexes: Types of magnetic behavior, spin-only formula, calculation of magnetic moments, experimental determination of magnetic susceptibility-Gouy method.
2. Stability of metal complexes: Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

#### ORGANIC CHEMISTRY

##### UNIT- III

Nitro hydrocarbons: Nomenclature and classification-nitro hydrocarbons, structure - Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity - halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Michael addition and reduction.

##### UNIT – IV

Nitrogen compounds: Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1°, 2°, 3° Amines and Quaternary ammonium compounds. Preparative methods – 1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties and basic character - Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline - comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous and non-aqueous medium), steric effects and substituent effects. Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation e) Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitution of Aromatic amines – Bromination and Nitration. Oxidation of aryl and Tertiary amines, Diazotization.

## **B.Sc. Forensic Science**

### **PHYSICAL CHEMISTRY UNIT- V:**

Thermodynamics- The first law of thermodynamics-statement, definition of internal energy and enthalpy. Heat capacities and their relationship. Joule-Thomson effect- coefficient.

Calculation of  $w$ , for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. State function. Temperature dependence of enthalpy of formation Kirchoff's equation. Second law of thermodynamics. Different Statements of the law. Carnot cycle and its efficiency. Carnot theorem. Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes.

### **Paper – 10 Organic Chemistry Laboratory**

#### **Course – V**

#### **Organic Qualitative Analysis:**

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic Primary Amines, Amides and Simple sugars.

### **Paper 11 (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY) - VI INORGANIC**



## B.Sc. Forensic Science

### CHEMISTRY

#### UNIT-I

1. Reactivity of metal complexes: Labile and inert complexes, ligand substitution reactions - SN 1 and SN 2, substitution reactions of square planar complexes - Trans effect and applications of trans effect.

2. Bioinorganic chemistry: Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and Cl. Metalloporphyrins – Structure and functions of hemoglobin, Myoglobin and Chlorophyll.

#### ORGANIC CHEMISTRY UNIT- II

Heterocyclic Compounds: Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1,4,- dicarbonyl compounds, Paul-Knorr synthesis. Properties : Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity - Comparison with pyrrole - one method of preparation and properties

- Reactivity towards Nucleophilic substitution reaction.

#### UNIT-III

Carbohydrates: Monosaccharides: (+) Glucose (aldo hexose) - Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation) - Proof for the ring size (methylation, hydrolysis and oxidation reactions) - Pyranose structure (Haworth formula and chair conformational formula). (-) Fructose (keto hexose) - Evidence of 2 - keto hexose structure (formation of pentaacetate, formation of cyanohydrin its hydrolysis and reduction by HI). Cyclic structure for fructose (Furanose structure and Haworth formula) - osazone formation from glucose and fructose – Definition of anomers with examples. Interconversion of Monosaccharides: Aldopentose to Aldohexose (Arabinose to D- Glucose, D-Mannose) (Kiliani - Fischer method). Epimers, Epimerisation - Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose (D-Glucose to D- Arabinose) by Ruff degradation. Aldohexose to Ketohexose [(+) Glucose to (-) Fructose] and Ketohexose to Aldohexose (Fructose to Glucose)

#### UNIT- IV

Amino acids and proteins: Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis. Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

#### PHYSICAL CHEMISTRY UNIT-V

1. Chemical kinetics: Rate of reaction - Definition of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for time half change. Methods to determine the order of reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

2. Photochemistry: Difference between thermal and photochemical processes. Laws of photochemistry Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence. Quantum yield-

## **B.Sc. Forensic Science**

Photochemical reaction mechanism- hydrogen- chlorine, hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Photosensitized reactions- energy transfer processes (simple example)

### **Practical Paper –12 Physical Chemistry Laboratory**

#### **Course – VI**

1. Determination of rate constant for acid catalyzed ester hydrolysis.
2. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
3. Determination of Surface tension of liquid
4. Determination of Viscosity of liquid. 5. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.

## B.Sc. Forensic Science

Table-6: B.Sc. Forensic Science SEMESTER – VI

Paper No.	Course / Subject Name		Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours	Credits
1	Narcotics Drugs & Psychotropic Substances		100	25	75	4	3
2	Narcotics Drugs & Psychotropic Substances Practicals		50	0	50	2	2
3	Mobile Forensics		100	25	75	4	3
4	Mobile Forensics Practicals		50	0	50	2	2
5	Chemistry	Analytical methods of chemistry	100	25	75	4	3
6	Chemistry Practicals		50	0	50	2	2
7	Forensic Science Cluster	A. Forensic Chemistry	100	25	75	4	3
		B. Forensic Chemistry Practicals	50	0	50	2	2
		C. Multimedia Forensics & Speaker Identification	100	25	75	4	3
		D. Multimedia Forensics & Speaker Identification Practicals	50	0	50	2	2
		E . PROJECT	100	-	-	-	5
Total			850			28	30

## **B.Sc. Forensic Science**

### **Paper-1: Narcotic Drugs & Psychotropic Substances**

**Unit-1:** Narcotics- Introduction, Legal Definitions, Classification- Sedatives, Stimulants, Hallucinogens, Solvents, Synthetic Narcotics, Designer Drugs and Miscellaneous.

**Unit-2:** Drugs and crimes- nonviolent crimes, violent crimes, drug problems in India-cannabis and poppy cultivation – illegal possession – Smuggling – Transportation – Drug Profiling – Clandestine laboratories – Drug abuse in sports – Preliminary tests for Narcotic Drugs and Psychotropic Substances (NDPS) – Sample collection.

**Unit-3:** Sedatives-opium and opium derivatives- Morphine- Administration, Physiological Effects, Addiction, Identification - Heroin- Abuse, Physiological Effects and Identification -Barbiturates- Nature, Administration and Identification.

**Unit-4:** Stimulants: Cocaine-Origin, Use, Abuse, Intake, Psychological Effects Of Cocaine, Physiological Effects, Addiction and Identification – Amphetamine, Benzodiazepines: Administration, Effects, Addiction, Identification - Hallucinogens: Cannabis, Quinazolones- Administration, Effects, Addiction and Identification- LSD (Lysergic Acid Diethylamide), Psylocybin, Mescaline and MDMA: Administration, Effects, Addiction and Identification.

**Unit-5:** NDPS Act 1985 - Drug law enforcements in India- Narcotic control bureau, Central Bureau of Narcotics, Narcotics Control and Intelligence Bureau– Prevention Drug trafficking -Penalties for NDPS related offenses – NDPS Amendments 2014 – United Nations Drugs Conventions.

### **Paper-2: Narcotic Drugs & Psychotropic Substances Practicals**

1. Detection of following of Narcotic Drugs & Psychotropic Substances by spot/colour test
  - a. Opiates
  - b. Barbiturates
  - c. Benzodiazepines
  - d. Amphetamines and Cannabis

## **B.Sc. Forensic Science**

### **Paper-3: Mobile Forensics**

**UNIT-1:** Introduction to Mobile Forensics – I - Mobile Phone Basics, Inside Mobile devices , Cell Phone Crime, SIM Card , SIM Security ,Mobile forensics ,Mobile forensic & its challenges, Mobile phone evidence extraction process ,The evidence intake phase , The identification phase, The preparation phase, The isolation phase, The processing phase, The verification phase, The document and reporting phase, The presentation phase.

**UNIT-2:** Introduction to Mobile Forensics – II - Potential evidence stored on mobile phones - Rules of evidence, Admissible, Authentic, Complete, Reliable, and Believable. Good forensic practices-Securing the evidence, preserving the evidence, documenting the evidence, documenting all changes. Windows Phone Forensics- Windows Phone OS, Windows Phone file system, Data acquisition. BlackBerry Forensics- BlackBerry OS, Data acquisition, BlackBerry analysis

**UNIT-3:** Android Forensics - I - The Android models- The Linux kernel layer, Libraries, Dalvik virtual machine, the application framework layer, the applications layer. Android security - Secure kernel, the permission models, Application sandbox, Secure interprocess communication, Application signing. Android file hierarchy - Android file system, Viewing file systems on an Android device, Extended File System – EXT

**UNIT-4:** Android Forensics – II- 4.1. Android Forensic Setup and Pre-Data Extraction Techniques, A forensic environment setup, Screen lock bypassing techniques, Gaining root access. Android Data Extraction Techniques- Imaging an Android Phone, Data extraction techniques. Android Data Recovery Techniques, Data recovery. Android App Analysis and Overview of Forensic Tools- Android app analysis, Reverse engineering Android apps, Forensic tools overview, Cellebrite – UFED, MOBILedit, and Autopsy

**UNIT-5:** Understanding the Internals of iOS Devices, iPhone models, iPhone hardware, iPad models, File system, The HFS Plus file system, Disk Layout, iPhone operating system, data Acquisition via a custom ram disk, Acquisition via jail breaking, data Acquisition from iOS backups, iTunes backup, iCloud backup.

### **Paper-4: Mobile Forensics Practicals**

## B.Sc. Forensic Science

### Paper-5: Chemistry Elective

#### Analytical Methods in Chemistry

##### UNIT-I

Quantitative analysis: a) Importance in various fields of science, steps involved in chemical analysis. Principles of volumetric analysis: Theories of acid-base, redox, complexometric, iodometric and precipitation titrations - choice of indicators for these titrations. b) Principles of gravimetric analysis: precipitation, coagulation, peptization, coprecipitation, post precipitation, digestion, filtration and washing of precipitate, drying and ignition.

##### UNIT-II

Treatment of analytical data: Types of errors, significant figures and its importance, accuracy - methods of expressing accuracy, error analysis and minimization of errors, precision - methods of expressing precision, standard deviation and confidence limit

##### UNIT-III

Separation techniques in chemical analysis: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism., Application - Determination of Iron (III) Ion exchange : Introduction, action of ion exchange resins, separation of inorganic mixtures, applications, Solvent extraction: Principle and process.

##### UNIT-IV

Chromatography: Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, R<sub>f</sub> values, factors effecting R<sub>f</sub> values. Paper Chromatography: Principles, R<sub>f</sub> values, experimental procedures, choice of paper and solvent systems, developments of chromatogram - ascending, descending and radial. Two dimensional chromatography - applications.

##### UNIT

**V**

Thin layer Chromatography (TLC): Advantages - Principles, factors effecting R<sub>f</sub> values - Experimental procedures - Adsorbents and solvents - Preparation of plates - Development of the chromatogram - Detection of the spots – Applications - Column Chromatography: Principles - experimental procedures - Stationary and mobile Phases - Separation technique – Applications. HPLC : Basic principles and applications.

### Paper-6: Analytical Methods in Chemistry Practicals

1. Identification of amino acids by paper chromatography.
2. Determination of Zn using EDTA
3. Determination of Mg using EDTA

**Paper- 7: Forensic Science Cluster**

**A - Forensic Chemistry**

**Unit-1:** Introduction to Forensic Chemistry – Types of cases – Preliminary Screening – Presumptive Tests (colour/spot tests) Examination procedure by Standard methods – Different types Test kits & contents – Introduction to Analytical Chemistry -Quantitative and Qualitative Forensic analysis of inorganic and organic material – Volumetric, Titrimetric, Gravimetric methods of analysis -Analysis of fertilizers , Insecticides & Metallurgical analysis – Industrial chemicals – Organic Solvents- Significance of Forensic Chemistry

**Unit-2:** Introduction to Explosives – Definition of explosives- Classification – Composition of explosive components– Explosive Devices – Improvised Explosive devices – Country made explosive and material used - Investigation of explosives - Identification of hidden explosives – Approach to SOC – Post blast Residues Collection – Systematic Analysis of Explosive – Profiling & evaluation of explosives – Disposal of IEDs – Explosives act & Explosive substances act

**Unit-3:** Chemistry of fire – Fire triangle- Definition Arson – Nature of Fire – Collection of Evidences – Evaluation of Evidences – Causes of Fire – Chemical analysis of Arson residues – Instrumental methods of analysis.

**Unit-4:** Beverages: Composition and analysis of alcoholic and non-alcoholic beverages – country made liquor – illicit liquor – classification of alcoholic beverages – Toxic kinetics of alcohol – Effects of alcohol – Collection of samples for identification of alcohols – Chemical & physical tests and evaluation – common adulterants and toxic substances in alcoholic beverages – Breath analysers – Blood alcohol content (BAC).

**Unit-5:** Examination of Petroleum products – Distillation and fractionation – Standard methods of analysis of petroleum products – Adulteration of petrol – Various fractions and their commercial use – Petroleum act – BIS – Drugs and Cosmetics act – Central excise act.

**B - Forensic Chemistry Practicals**

1. Analysis of Alcoholic Liquor as per BIS Specifications
2. Detection of Methanol, Chloral hydrated, Diazepam, Alprazolam in Alcoholic Liquors
3. Extraction and detection of organic and inorganic explosive / explosion residues by spot/ colour tests / TLC
4. Density/ Specific gravity Determination of Petroleum by Hydrometer
5. Filter paper test for detecting adulteration of petrol
6. Detection of adulteration of petrol by GC
7. Chemical Properties of Oils& Fats
8. Analysis of Precious Metals
9. Phenolphthalein test for Bribe Trap cases
10. Preliminary examination of Explosives (tests for nitrite, nitrate, thiocyanate, chlorate, Thiosulphate, Perchlorate, Sulphite, Phosphate etc)
11. Test for Cations & anions

**C - Multimedia Forensic & Speaker Identification**

**Module-I: Foundation to Multimedia Forensics**

- 1.1 Introduction to digital signals: audio, image and video
- 1.2 Digitization process: sampling and quantization
- 1.3 Image Enhancement Techniques: Spatial and frequency domain
- 1.4 Image Compression Techniques: Introduction and techniques
- 1.5 Image description and representation techniques
- 1.6 Pattern clustering and classification

**Module-II: Introduction to Multimedia Forensics**

- 2.1 Introduction and scope of Multimedia Forensics
- 2.2 Basics of Multimedia
- 2.3 Devices for capturing image and video
- 2.4 Devices for capturing audio
- 2.5 Standard and best practices in Multimedia Forensics
- 2.6 Admissibility of multimedia evidence to the court of law

**Module-III: Image and Video Forensics**

- 3.1 Image and Video Forensics: Introduction and scope
- 3.2 Standards for video transmission
- 3.3 Active and passive image/video forensics
- 3.4 Blind and non-blind image/video forensics
- 3.5 Methods of source camera identification
- 3.6 Methods for tampering of digital image/video
- 3.7 Forensic authentication of digital image/video
- 3.8 Enhancement of digital image/video

**Module-IV: Audio Forensics**

- 4.1 Audio Forensics: Introduction and scope
- 4.2 Methods of tampering for digital audio
- 4.3 Forensic authentication of digital audio
- 4.4 Microphone Forensics
- 4.5 Enhancement of digital audio

**Module-V: Speaker Identification**

- 5.1 Introduction and scope of speaker identification
- 5.2 Human vocal tract and production and description of speech sound
- 5.3 Forensic phonetics and phonetic transcription
- 5.4 Methods of speaker identification: auditory and spectrographic analysis
- 5.5 Automatic speaker identification system
- 5.6 Collection of voice samples: methods and challenges



**B.Sc. Forensic Science**

**D - Multimedia Forensic & Speaker**

**Identification Practicals E - PROJECT**