

# SCHOOL OF FORENSIC SCIENCE



**CENTURION UNIVERSITY OF TECHNOLOGY AND  
MANAGEMENT**

Ramachandrapur, Jatani, Bhubaneswar  
Khurda – 752050  
Odisha- India

Syllabus –2017-19  
M.Sc. Forensic Sciences

SEMESTER I

SI No.	Subject Code	Name of Subject	Credit Theory + Practice
01	MSFS1101	Introduction to Forensics, Psychology, Law and Statistics	4 + 0
02	MSFS1102	Instrumental Techniques	4 + 0
03	MSFS1103	Crime Scene Management and Forensic Physics	4 + 0
04	MSFS1104	Finger prints and Questioned Documents	4 + 0
05	FCHU1203	Business Communication	0+2 (Workshop)
06	MSFS1105	Instrumental Techniques Laboratory	0 + 2
07	MSFS1106	Crime Scene Management and Forensic Physics Laboratory	0 + 2
08	MSFS1107	Finger prints and Questioned Documents Laboratory	0 + 2
		<b>Total</b>	<b>24</b>

SEMESTER II

SI No	Subject Code	Name of subject	Credit Theory + Practice
01	MSFS1201	Quality Management, Narcotic Drugs, Explosives, and Forensic Chemistry	4 + 0
02	MSFS1202	Forensic Biology and Forensic Medicine	4 + 0
03	MSFS1203	Forensic Serology and DNA Profiling	4 + 0
04	MSFS1204	Forensic Toxicology and Pharmacology	4 + 0
05	MSFS1205	Forensic Ballistics and Computer Forensics	4 + 0
06	MSFS1206	Quality Management, Narcotic Drugs, Explosives, and Forensic Chemistry Laboratory	0 + 2
07	MSFS1207	Forensic Biology and Forensic Medicine Laboratory	0 + 2
08	MSFS1208	Forensic Serology and DNA Profiling Laboratory	0 + 2
09	MSFS1209	Forensic Toxicology and Pharmacology Laboratory	0 + 2
10	MSFS1210	Forensic Ballistics and Computer Forensics Laboratory	0 + 2
		Total	30

**SEMESTER III**  
**SPECIALIZATION IN FORENSIC CHEMISTRY AND TOXICOLOGY**

<b>Sr. no.</b>	<b>Subject Code</b>	<b>Name of Subject</b>	<b>Credit Theory + Practice</b>
1.	MSFS2101	Pharmacology and Pharmaceutical Drug Analysis	4 + 0
2.	MSFS2102	Concepts of Toxicology	4 + 0
3.	MSFS2103	Modern and Applied Analytical Forensic Chemistry	4 + 0
4.	MSFS2104	Pharmacology and Pharmaceutical Drug Analysis Laboratory	0 + 2
5.	MSFS2105	Concepts of Toxicology Laboratory	0 + 2
6.	MSFS2106	Modern and Applied Analytical Forensic Chemistry Laboratory	0 + 2
7.	MSFS2107	Assignment	0+6
8.	MSFS2108	Seminar	0+6

**SPECIALIZATION IN FORENSIC BIOLOGY**

<b>Sr. no.</b>	<b>Subject Code</b>	<b>Name of Subject</b>	<b>Credit Theory + Practice</b>
1.	MSFS2111	Molecular Biology and Genetics	4 +0
2.	MSFS2112	Biotechnology in Pharmaceutical Sciences	4 +0
3.	MSFS2113	Environmental Biotechnology	4 +0
4.	MSFS2114	Molecular Biology and Genetics Laboratory	0 + 2
5.	MSFS2115	Biotechnology in Pharmaceutical Sciences Laboratory	0 + 2
6.	MSFS2116	Environmental Biotechnology Laboratory	0 + 2
7.	MSFS2107	Assignment	0+6
8.	MSFS2108	Seminar	0+6
			30

**SPECIALIZATION IN FORENSIC PHYSICS**

<b>Sr. no.</b>	<b>Subject Code</b>	<b>Name of Subject</b>	<b>Credit Theory + Practice</b>
1.	MSFS2121	Advances in Physical Techniques	4+0

2.	MSFS2122	Concepts of Conventional and Modern Ballistics	4+0
3.	MSFS2123	Audio Recognition and Video Analysis	4+0
4.	MSFS2124	Advances in Physical Techniques Laboratory	0+2
5.	MSFS2125	Concepts of Conventional and Modern Ballistics Laboratory	0+2
6.	MSFS2126	Audio Recognition and Video Analysis Laboratory	0+2
7.	MSFS2107	Assignment	0+6
8.	MSFS2108	Seminar	0+6
			30

### SPECIALIZATION IN FINGERPRINTS AND QUESTIONED DOCUMENT

Sr. no.	Subject Code	Name of Subject	Credit Theory + Practice
1.	MSFS2131	Modern Trends in Fingerprint Sciences	4+0
2.	MSFS2132	Questioned Document and Forensic Accounting	4+0
3.	MSFS2133	Forensic Photography and Biometric Traits	4+0
4.	MSFS2134	Modern Trends in Fingerprint Sciences Laboratory	0+2
5.	MSFS2135	Questioned Document and Forensic Accounting Laboratory	0+2
6.	MSFS2136	Forensic Photography and Biometric Traits Laboratory	0+2
7.	MSFS2107	Assignment	0+6
8.	MSFS2108	Seminar	0+6
			30

### SEMESTER IV

Sr. no.	Subject Code	Name of Subject	Credits
1.	MSFS 2200	Project	12

Total credits for M. Sc Forensic science - 96

# *Semester-I*

# School of Forensic Sciences

## M. Sc. Forensic Sciences

### MSFS 1101 Introduction to Forensics, Psychology, Law and Statistics

#### UNIT-I

**Forensic Sciences** Definition and Scope of Forensic Sciences, History and development of Forensic Sciences, Need and Principle, Police and, Forensic Sciences laboratories / institutions in India, Organizational Structure of a Forensic Sciences Laboratory/Institution, Services provided by other institutions, Functions and responsibility of Forensic scientist

**Forensic Photography:** Definition of photography, Cameras and its working, attachments of camera, types of camera lenses, crime scene and laboratory photography, UV and IR photography, Photomicrography and macro photography. Digital photography, digital imaging, photogrammetry, basic concepts of videography/high speed videography.

#### UNIT-II

**Law:** Sections of Indian Evidence Act: 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 159, Sections of Criminal Procedure code:53,53A, 54, 291, 292, 293.311A

Sections of Indian Penal Code: Offences against person: 299, 300, 302, 304B, 306, 319, 320, 326, 339, 340, 351, 359, 362, 375, 377. Offences against property: section 378, 383, 390, 405, 415, 441, 463, 471, 499, 503, and 511.

x Indian constitution article 20,21

#### UNIT-III

**Crime:** Definition, types of crimes, causes of crime, Theories and prevention of crime, characteristics of criminal

**Criminal Justice System:** Structure of Police, Police and Forensic Scientist relationship with reference to Crime Investigation, Modus Operandi and its role in Crime Record, maintenance of crime records, Prosecution and Judicial Organizations. Courts in India, Jurisdiction of courts in criminal cases and FIR.

**Report writing and evidence evaluation:** Components of reports and report format in respect of crime scene and laboratory findings.

x **Court testimony:** Admissibility of expert testimony, pre court preparation and court appearance, examination in chief, cross examination and re- examination. Ethics in forensic Sciences.

#### UNIT-IV

x **Psychology and investigative techniques:** Polygraph (Lie-detection), Narco analysis,

Brain mapping, Forensic psychiatry – human behavior and relationship between human behavior and legal proceeding in both civil and criminal cases.

## **UNIT-V**

**Laboratory management System:** Laboratory information management system, Chain of custody of samples covered by LAN system, Security system, validation and safety equipments.

**Forensic statistics:** Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test

### **Reference books:**

Saferstein: Criminalistics : An Introduction To Forensic Sciences, Prentice Hall Inc. USA  
G. G. G. Aitken and D. A. Stoney; The use of statistics in Forensic Sciences, Ellis Harwood Limited, England  
James, S.H. And Nordby, J. J.; Forensic Sciences; An Introduction To Scientific And Investigative Techniques, CRC Press USA  
O' Hara & Osterberg: An Introduction to Criminalistics.  
Forest; Forensic Sciences: An Introduction.  
Lee, Honry; Advances in Forensic Sciences.  
Sharma JD: Vidhivigyan Avem Vish Vigya.  
Sharma JD: Apradh Ka Vaigyanik Anveshan.  
Sharma BR: Forensic Sciences in Criminal Investigation And Trials.  
Mordby, J Deed Reckoning – The Art Of Forensic Sciences Detection, CRC Press LLC, Boca Raton FL, CRC Press  
Ram Ahuja: Criminology, Rewal Publ. Jabalpur  
Indian Penal Code  
Indian Evidence Act.  
ISO/IEC 17025:2005, NABL 113,113A, 131, guidelines of NABL.



**School of Forensic Sciences**  
**M. Sc. Forensic Sciences**  
**MSFS 1102 Instrumental Techniques**

**UNIT- I**

**Spectroscopic Methods:**

- x Electromagnetic radiations  
General properties of electromagnetic radiations: Wave and Quantum mechanical properties  
Interaction of EMR with matter
- x Electronic spectra and molecular structure
- x Internal standards and standard addition calibration methods
- x Ultraviolet and visible spectroscopy: Instrumentation and Applications.

**UNIT- II**

**Molecular and Atomic Spectroscopy:**

Infrared Spectroscopy: Molecular vibration, Theory of IR absorption, IR Sources and Instrumentation, FT-IR Applications.

Raman Spectroscopy: Theory of Raman & FT-Raman spectroscopy, Instrumentation, Applications.

Instrumentation and Applications of Flame emission spectrometry, Atomic absorption spectrometry and Atomic Fluorescence Spectrometry

**UNIT- III**

**Emerging and Hyphenate Spectroscopy:**

- x Mass Spectroscopy: Theory, Instrumentation and Applications.  
Inductively coupled plasma-Mass Spectroscopy: Theory, Instrumentation and Applications.
- X-Ray Spectroscopy: Theory, Types, Instrumentation, Applications and Applications.
- Nuclear Magnetic Resonance Spectroscopy: Theory, Instrumentation and Applications.

**UNIT- IV**

**Separation and Detection Techniques**

Introduction to Chromatography: Partition, Adsorption, Ion exchange, Size Exclusion Chromatography, their principle and types of chromatography. Forensic applications of Chromatography.

Gas Chromatography: Principle, instrumentation and applications. Gas-liquid and gas-solid chromatography, GC – MS, GC – MS – MS (Tandem).

- x Gas Chromatography – Head Space: Principle, instrumentation and applications.  
High Performance Liquid Chromatography: Principle, instrumentation and applications, LC  
– MS, LC – MS – MS (Tandem)

## **UNIT- V**

### **General Principles of Biological / Biochemical Analysis**

- x pH and Buffers, Physiological solution

### **Centrifugation Techniques**

Basic principle of sedimentation, various types of centrifuges, Density Gradient Centrifugation, Preparative Centrifugation, analysis of sub-cellular fractions, Ultra centrifuge- Refrigerated Centrifuges.

### **Microscopy**

- x Basic principles of microscopy, Simple and Compound microscope
- x Study of different types of microscopes: Comparison microscope, Phase contrast microscope, Stereoscopic microscope, Polarizing microscope, Fluorescence microscopy, IR microscopy, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM)

## **MSFS 1205 Instrumental Techniques Laboratory**

Experiments on UV absorption of drug/dyes/Chemicals.

Experiments on IR spectroscopy of Paints / Drugs / Organic compounds.

Comparison of polythene films by IR spectrophotometry.

Identification of drugs / solvents by Gas Chromatography and Gas Chromatography – Mass Spectrometry (GC-MS).

Identification and Estimation of Volatile Substances by chemical and Gas Chromatography – Head Space technique (GC-HS).

### **Reference Books:**

D.A.Skoog, F.J.Holler and T.A.Neman, Harcourt Principles of Instrumental Analysis college publishers, Singapore

G.D.Christian and J.E.O'Reilly, Instrumental Analysis, Allyn and Bacon, Inc., Boston.

F.W.Fifield and D.Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London.

R.P.Bauman, Absorption Spectroscopy, John Wiley, New York.

M.Donhrow, Instrumental Methods in Analytical Chemistry; Their Principles and practice Vol.2, optical method, Pitaman, New York.

G.G.Guilbanlt, Practical Fluorescence: Theory, Methods and Practice, Marcel Dekker, New York.

S.Udenfriend, Fluorescence Assay in Biology and Medicine, Academic Press, New York.  
W.J.Price, Spectrochemical Analysis by Atomic Absorption, Hyden, London.  
R.S.Alger, Electron Paramagnetic Resonance: Techniques and Applications, InterSciences, New York.  
Analytical Chemistry by open Learning, John Wiley & Sons, New York.  
J.C.Giddings, Dynamics of Chromatography, Marcel Dekker, New York.  
R.C.Grob, Modern Techniques of Gas Chromatography, Marcel Dekker, New York.  
J.A.Dean, Chemical Separation Methods, Ban Nostrand Reinhold Co., New York.  
R.E.Smith, Ion Chromatography Applications, C.R.C. Press, Inc., Boca Raton.  
R.E.Smith, Supercritical Fluid Technology, C.R.C. Press, Inc., Boca Raton.  
G.Zweig and J.R.Whitaker, Paper Chromatography and Electrophoresis, Academic Press, New York.  
Safferstein: Forensic Sciences Handbook Vol. I, II, III.  
Lee Honry: An Introduction to Forensic Sciences  
Egon Stahl: Thin Layer Chromatography

# School of Forensic Sciences

## M. Sc. Forensic Sciences

### Paper – 3

#### MSFS 1103 Crime Scene Management and Forensic Physics

##### UNIT-I

###### **Crime scene management:**

Introduction to the crime scene, Types of crime scene, Evaluation and processing of crime scene, Securing the scene of crime, Documenting the crime scene( Note making, Sketching, Photography ,videography of crime scene), role of the first arriving officer at the crime scene

- x Digital Imaging of Crime Scene, 3-D scanning technique

Searching techniques of Crime scene, Processing of physical evidence-discovering, recognizing and examination of physical evidences

- x Collection, Safety measures for evidence collection

Preservation, Packaging, sealing, labeling and forwarding of physical evidences, Maintaining the chain of custody, Probative value of physical evidences, Reconstruction of scene of crime.

Introduction to physical evidences, Types of physical evidences, Classification and Role of physical evidences in Criminal Investigations & Trails

###### **Advances in crime scene management:**

- x Tele forensic Technology for crime scene investigation  
Information, Manpower, and logistics management of crime scene  
Mobile kits and equipments, their utility on crime scene  
Technology innovation in crime scene management  
Case studies & report writing of crime scene visits  
National and International scenario of crime scene management

##### UNIT-II

###### **Glass:**

Introduction to glass, Types of glass and their compositions, Forensic examination of glass fractures under different conditions, determination of direction of impact: hackle marks, backward fragmentation, Physical measurements of glass, color and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis, and interpretation of glass evidence, Case Studies.

**Paints:**

Introduction, Composition, Manufacture of Paint, types of paint, Forensic Examination of Paints and Coatings: Collection and Preservation of paint samples, macroscopic and microscopic techniques for the characterization of Paint Fragments, Physical , Chemical & Instrumental analysis of paint, , interpretation of Paint Evidence, Case Studies

**Soil:**

Soil and its composition, Classification of soil, Collection and preservation of soil as an evidence, analysis of soil samples: Physical, chemical and instrumental, interpretation of soil evidence, Case Studies

**UNIT-III****Tool mark Evidences**

Introduction to tool marks, Types of tool marks, Class characteristics and individual characteristics of tool marks, Collection and Preservation of tool marks, Forensic examination of tool marks, Case Studies

**Restoration of erased/obliterated marks:**

- x Principle of restoration of erased marks, Techniques involved for alteration of individual markings, Restoration of erased and obliterated marks on various surfaces, Photography and Forensic assessment of methods for restoration of obliterated marks, case studies

**Bite marks**

Objectives and forensic importance of bitemark examination, the typical bitemarks morphology, types of bitemarks, Evidence collection from victims and suspects, Photography, lifting, preservation of bite marks, casting of bitemarks, Identification and comparison of bite marks, Case Studies

**Tyre Impressions**

Introduction to tire impressions, Collection and Preservation of the tire impression evidence, Forensic Significance of skid marks, Forensic Examination for identification and comparison, Case Studies

**UNIT-IV****Footprints & Shoe impression examination**

Introduction to footprints & Shoe impression , locating impressions at the scene of crime, Evidence collection: Collection, Lifting/Casting and Preservation of foot/footwear impressions, importance of Gait pattern, Forensic Identification and Methods of comparison, Case Studies

**Lip print**

Introduction to Cheiloscopy and history of lip prints, Classification of lip prints, Collection, Development , Identification and Comparison of lip prints

## **Ear Prints**

Introduction to the history of ear prints, Morphology of the ear, Procedure of taking standards from the suspects, Identification and comparison of ear prints

## **UNIT-V**

### **Speaker identification:**

Speaker identification and tape authentication: voice production theory, Speech signal processing and pattern recognition, acoustic parameters of sound, analogue to digital conversion, Frequency and time domain representation of speech signal, fast Fourier transform, Authentication of audio-video signal, Interpretation of voice evidence and Case studies.

## **MSFS 1106 Crime Scene Management and Forensic Physics Laboratory**

### **Forensic Physics**

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

### **Crime Scene Management**

Forensic crime Scene Management  
Sketching and photography of scene of crime  
Collection and packing of physical clues at the scene of crime  
Reconstruction and evaluation of scene of crime.

### **Reference Books:**

C.E. O'Hara and J.W. Osterburg; An Introduction to Criminalistics: Indiana University Press, Blomington.

Dahiya M S, Crime scene management: a scientific approach; Shanti Sarvar Prakashan  
R. Saferstein; Forensic Sciences Handbook, Vols. I, II; (Ed); Prentice Hall, Eaglewood Cliffs, NJ;

F.W. Sears, M.W Zemansky, and H. D. Young; University Physics, Sixth Ed., Narosa;  
Dennis Shaw; Physics in the Prevention and Detection of Crime, Contem Phys. Vol 7;

Philip Rose; Forensic Speaker Identification; Taylor and Francis Forensic Sciences Series, London

Bengold & Nelson Moryson- Speech and Audio signal processing; John Wiley & Sons, USA, Nickolls, L.C; Scientific Investigation of Crime, Bulterwest, London

Raymond C Murray & John C.F Tedrew; Forensic Geology; Prentice Hall, New Jersey  
Working Procedure Manual: Physics BPR&D Publication

B. Caddy; Forensic Examination of glass and paints analysis and interpretation ISBN 0784  
05749

Philip Rose; Forensic Speaker Identification; Taylor & Francis Forensic Sciences series, London

Bengold& Nelson Morgan; Speech and Audio Signal Processing; John Wiley and Sons, USA

Jenkins and White; Fundamentals of Optics; Mc Graw Hill; Fourth Ed, (I) James, S.H. And  
Nordby, J. J.; Forensic Sciences; An Introduction to Scientific And Investigative Techniques, CRC  
Press USA

Ray D. Kent and Charles Read; Acoustic analysis of speech

Phil Rose & James R Robertson; Forensic speaker identification

# School of Forensic Sciences

## M. Sc. Forensic Sciences

### MSFS 1104 Finger prints and Questioned Documents

#### UNIT- I

History of Fingerprint Sciences, main function of FPB

Development of Fingerprint Sciences

Composition of sweat and secretion of sweat.

Pattern types & Ridge characteristics

Ridge tracing, Ridge counting

#### UNIT- II

x Various systems for FP classification.

x Henry classification system, numerical value, symbol, primary classification, secondary classification, sub-secondary classification and final classification, NCIC classification, AFIS classification.

#### UNIT- III

x Development, Identification & Presentation of FP

Known prints & Rolled impressions, Direct or Inked prints.

Development of Latent Prints & Lifting techniques

Physical & chemical Methods: Powder techniques & Various chemical techniques, Processing of Post developed prints.

Finger print comparison & Identification.

Introduction to AFIS

#### UNIT- IV

Nature and problems of document examination,

Care of documents, classification of documents,

Procurements of standards- admitted / specimen writings,

Handling and packing of documents,

Preliminary examination of documents,

Principles of hand writing & signature identification.

Forgeries & its types and their detections

Physical matching of Documents



## **UNIT- V**

Examination of alterations, erasers, overwriting, addition and obliterations.  
Decipherment of secret, indented and charred documents,  
Photography of questioned documents.  
Determination of sequence of strokes  
Examination of counterfeit currency notes, passport, credit card, visa, seal and other mechanical impressions  
Examination of typescripts, xerox and computer printouts  
Instrumental techniques used for document examinations

### **MSFS 1107 Finger prints and Questioned Documents Laboratory**

#### **Questioned Documents**

Identification of Handwriting-general characteristics, fundamental divergences and individual characteristics.  
Examination and Identification of Signature Forgeries  
To study the natural variations in handwriting written in different circumstances.  
Examination of additions, alterations, and obliterations in the documents.  
Examination of mechanical and chemical use of erasers on the documents  
Examination of indented handwriting.  
Examination of writing inks by TLC.  
Examination of sequence of intersecting strokes

#### **Fingerprints:**

To take plain and rolled finger prints and to identify the patterns.  
To perform ridge tracing and ridge counting.  
To identify ridge characteristics.  
To compare the fingerprints.  
To develop latent finger prints with powders, fuming and chemical methods.  
Preparation of Foot print cast  
AFIS

#### **Reference Books:**

David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press  
E. Roland Menzel; Fingerprint Detection, with Lasers, Second edition; Marcel, Dekker, Inc. USA.  
James F. Cowger; Friction Ridge skin CRC Press London.  
Mehta, M.K: Identification of Thumb Impression & Cross Examination of Finger Prints, N

.M. Tripathi (P) Ltd, Bombay

Moenssens: Finger Prints Techniques, Chitton Book Co. Philadelphia, New York.

Chatterjee S.K., Speculation in Finger print identification, Jantralekha, Printing Works, Kolkata.

Cowger, James F: Friction ridge skin: Comparison and Identification of Fingerprints; CRC Press, Boca Raton, New York.

Cook Nancy: Classifying finger prints -Innovative learning publication Mento Park

Cossidy, M. J. Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada.

J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciencess Vol. I, II and III, Acad. Press

Smith, B.C, Holland MM, Sweel, DL & Dizinno. A; DNA & Forensic Odontology -Manual of Forensic Odontology, Colorado Springs, USA

Hillison, S; Dental Anthropology, Cambridge Univ. Press, UK.

Kasprzak, J; Possibilities of Cheiloscopy in Forensic Sciences.

Medlin H 0: Ear print Identification, Solve Crime Military Police Journal.

Iannarelli A V. Ear Identification, Forensic .Identification series, Paramount.

Henry C. Lee & R. E. Ganesslen, Advances in Finger Print Technology, CRC Press, Boca Raton, London.

Rev. ED.; Ordway Hilton; Scientific Examination. I of Questioned Documents, Elsevier, New York;

Albert S. Osborn; Questioned Documents, Second Ed.; Universal Law Publishing, Delhi;

Albert S. Osborn; The Problem of Proof~ Second Ed.; Universal Law Publishing, Delhi;

Charles C. Thomas, Typewriting Identification I.S.Q.D.; Billy Prior Bates; Springfield, Illinois, USA

Charles C. Thomas, I.S.Q.D. Identification System for Questioned Documents; Billy Prior Bates Springfield, Illinois, USA

Wilson R. Harrison; Suspect Documents -Their Scientific Examination; Universal

Hard less, H.R: Disputed Documents, handwriting and thumbs -print identification: profusely illustrated, Low Book Co., Allahabad

Morris, Ron, N: Forensic handwriting identification, Acad Press, London

Kurtz Sheila: Graphotypes a new plant on handwriting, analysis, Crown Publishers Inc., USA

Lerinson Jay; Questioned Documents, Acad Press, London

# **School of Forensic Sciences**

## **M. Sc. Forensic Sciences**

### **FCHU 1203 Business Communication**

#### **UNIT-I: UNDERSTANDING COMMUNICATION IN BUSINESS (8 hrs.)**

The module is a guide to organization communication. It is directed towards enabling students to develop the skills necessary to manage the human resources of their organization.

- General Communication and Business Communication
- Communication in Organizational Settings: Patterns of Communication in the Business World – Upward, Downward, Horizontal Grapevine etc, Channels of Communication- Internal and External, Formal and Informal
- Introduction to Cross Cultural Communication
- Strategies to Overcome Communication Barriers

#### **UNIT -II: READING AND WRITING (10 hrs.)**

This unit works on the competency in reading and writing skills through such tasks/activities as reading books, articles, magazines, novels, developing outlines, key expressions, situations, slogan writing and theme building exercises, dialogue writing, interpreting pictures, technical writing.

- Importance of Developing Reading Skills
- Sub-Skills of Reading: Predicting Content, Skimming & Scanning, Topic sentence and supporting details, Inferential Reading, Guessing the Meaning of Unfamiliar Words, Note Making
- Importance of Writing Skills and Principles of Effective Writing
  - Writing Process: Pre-writing, Drafting and Re-Writing
    - Paragraph Writing
    - Summaries and Abstracts
  - Business Correspondence: Writing Business Letters, E-mail Messages, Memo, Notice, Circulars, Reports, Proposals
  - Career Communication: Writing Resume/ CV and Job Application Letter

#### **UNIT -III: LISTENING AND SPEAKING (9 HOURS)**

Listening is the mother of all speaking. This unit aims to achieve competence in speaking i.e., the ability to communicate orally in clear, coherent, and persuasive language appropriate to purpose, occasion, and audience. The module focuses on developing this competency which includes acquiring poise and developing control of the language through experience in making presentations to small groups, to large groups, and through the media.

- Listening Skills: Listening Process, Hearing and Listening, Types and Barriers, Effective Listening Strategies
  
- Common forms of Oral Communication in the Business World:
  - Meetings: Organize Meetings, Preparing an Agenda, Chairing a Meeting, Drafting Resolutions, Writing Minutes
  - Persuasive Speaking: Improving Fluency and Self-Expressions, Articulation, Good Pronunciation, Voice Quality

- Making an Oral Presentation: Planning, Preparing and Delivery
- Facing an Interview: Preparation, Types of Interview, Do's and Don'ts
- Group Discussions: Debate and GD, Types of GD, GD Etiquette

(Treatment: Developing listening and speaking skills through various activities, such as role play activities, practicing short dialogues, JAM, group discussions, debates, speeches, listening to news bulletins, viewing and reviewing documentaries and short films etc.)

# *Semester-II*

# School of Forensic Sciences

## M. Sc. Forensic Sciences

### MSFS 1201 Quality Management, Narcotic Drugs, Explosives and Forensic Chemistry

#### UNIT I

##### **Forensic chemistry**

Introduction to forensic chemistry, Types of cases/exhibits received for analysis, Overview of forensic chemical analysis

##### **Quality management:**

Introduction to Quality, Quality Assurance, Quality control, TQM

Definition of Accreditation, History and development of ISO

Importance of accreditation in Forensic Sciences laboratories, Process of accreditation, Quality system, Procedure for sample selection, collection, preservation, packaging, identification, storage and transport

Traceability and Validation of new methods, measurement of uncertainty, Equipment maintenance and calibration, Evaluation of materials and reagents, sample and data handling in the laboratory, sample disposal, Assessment, interpretation and reporting of results

Proficiency testing, external quality assessment programmes, internal audit/External audit, MRM

Training and conferences

#### UNIT- II

##### **Narcotic drugs & psychotropic substances**

Introduction to Controlled Substances, Classification of controlled substances, Precursor chemicals, Narcotic raids and clandestine drug laboratories evidences and forensic examination  
Mandatory provisions of NDPS Act, 1985

NDPS Drugs, Classification of Drugs

Commonly abused drugs, Drug dependence and Drug Tolerance

Designer Drugs, Analysis of Drug of abuse by various chemical and instrumental methods

#### UNIT- III

##### **Explosives**

Introduction, classification and chemistry of explosives

Various types of IEDs and their reconstruction

Mechanism of explosion and their effects

Systematic examination of explosive and explosion residues (organic and inorganic) by chemical and instrumental techniques and interpretation of results Explosives Act and Explosive Substance Act

#### **UNIT- IV**

##### **Fire**

Introduction to Fires, Types of Fires, and Causes of fire, Patterns of fire Thermodynamics of fire

Accelerants and incendiary devices, Forensic Analysis of Fire Debris by Instrumental methods

##### **Forensic Analysis of petroleum products**

Introduction to petroleum products and adulteration in petroleum products Analysis of Petrol, Kerosene and Diesel as per BIS Specifications

#### **UNIT- V**

##### **Forensic Analysis of beverages**

Introduction to Alcoholic and non-alcoholic beverages

Analysis of alcoholic beverages, country made liquor, illicit liquor and medicinal preparations containing alcohol as constituents.

Analysis of non-alcoholic beverages like tea, coffee

##### **Bribe Trap Cases:**

Examination of Chemicals (Phenolphthalein) used in Bribe trap cases.

**Inks :** Forensic Examination of inks by various techniques, Dating and aging of inks

**Polymers:** Forensic examination of plastics and Adhesives.

##### **Adulterated Food Analysis**

Analysis of samples taken under Food Adulteration

##### **Act Fibers and Forensic Chemical Analysis**

Introduction to fibers, Classification of fibers, Analysis by microscopy, melting point and solubility testing of fibers, Chromatography, Spectroscopy and elemental analysis of fibers.

#### **MSFS 1206 Quality Management, Narcotic Drugs, Explosives, and Forensic Chemistry Laboratory**

Identification of NDPS drugs by color test and TLC.

Identification of acidic and basic drug by UV/TLC

Detection of low explosives by chemical/color test and TLC

Examinations of petroleum products as per BIS specifications.

Identification of alcohol by chemical/color test.

Analysis of phenolphthalein in bribe trap cases

Identification of adulterants in some common food samples by chemical methods/color test (Turmeric, chilli, ghee, honey, pulses, sugar, salt etc.)

Analysis of ink by TLC

Analysis of polythene by FTIR

Analysis of NDPS drugs by instrumental methods.

## Reference Books:

- Maudham Bassett et al; Voget's Textbook of Quantitative Chemical Analysis, 6<sup>th</sup> Ed.  
Longman Essex
- I. I. Finar: Organic Chemistry vol. II Pearson Education (Singapore)
- R. T. Morrison, R.N. Boyd; Organic Chemistry, 6<sup>th</sup> Ed. Prentice Hall, New Delhi
- Brean S. Furniss Etal; A.I. Vogel Textbook Of Practical Organic Chemistry, Addison Wesley  
Longman, Edinburg
- A. Burger; Medicinal Chemistry, Vol. II, Wiley InterSciences, Ny
- D A Skoog, D.M. West, F.J. Holler; Analytical Chemistry – An Introduction, 7<sup>th</sup> Ed.  
Saunders College Pub, Philadelphia, USA
- Boudreau JE, Etal; Arson & Arson Investigation, Survey & Assessment National Schools Of  
Law Enforcement, U.S. Deptt Of Justice, U.S. Govt Printing Press
- Dettean J D; Kirk's Fire Investigation, 5<sup>th</sup> Ed. Prentice Hall, Eaglewood Cliffs, N. J.
- Yinon Jitrin; Modern Methods & Application In Analysis Of Explosives, John Wiley & Sons,  
England
- Working Procedure Manual – Chemistry, Explosives And Narcotics, BPR&D Pub.
- C.A. Watson; Official And Standardized Methods Of Analysis, Royal Society Of  
Chemistry, UK
- Feigl; Spot Test In Inorganic Analysis, Elsevier Pub. New Delhi
- Feigl; Spot Test In Organic Analysis, Elsevier Pub. New Delhi
- Silverman; Organic Chemistry Of Drug Design & Drug Action, Elsevier Pub. New Delhi
- Abraham Burger; Medicinal Chemistry & Drug Discovery, 6 Vol Set, 6<sup>th</sup> Ed John Wiley  
& Sons, NY.
- NDPS Act, 1985.



**School of Forensic Sciences**  
**M. Sc. Forensic Sciences**  
**MSFS 1202 Forensic Biology & Forensic Medicine**

**UNIT-I**

**Fundamentals of Forensic Biology**

- x Scope of Forensic Biology –Structure and Function of Cell – Plant cell and animal cell  
Basics of Human anatomy and physiology

**Forensic Botany**

Various types of woods.

Varieties of timber, seeds and leaves – their identification and matching.

Study and identification of pollen grains, starch grains.

Morphological and anatomical characteristics of plants yielding drugs of abuse like opium, Cannabis, Coca plant, Psilocybe mushrooms, Tobacco, etc

**Wild Life Forensics**

Importance of wild life species in ecosystem.

Endangered and rare species

Wild life Management, Different methods of killing and poaching of the wild life animals.

Scientific methods of investigation - identity wild life animals - examination of physical evidences like hair, nails, teeth, ivory, horn, footprints (pugmarks) etc. by conventional and modern methods.

Wild Life Protection Act.

**UNIT-II**

**Forensic Anthropology**

Introduction to forensic anthropology

Forensic Anthropometry, osteometry

Identification of individuals (living)

Identity of missing person by superimposition techniques

Facial reconstruction method.

Portrait parley.

**Disaster Victim Identification**

Examination and identification of dead bodies in mass disasters, mutilated bodies, fragmentary skeletal remains and bones. Determination of age, sex, race and species origin from bones and assessment of stature

### **Forensic odontology-**

Identification of individuals from teeth. Ages of eruption and other individual characteristics

### **Hair examination**

- x Morphological, anatomical & Microscopic examination of hair.
- x Characteristics of hair to determine the species origin, race, sex and site

## **UNIT-III**

### **Forensic medicine/Medico legal investigation**

- x Objectives of medico legal investigation,  
Death and its causes, types of death , Signs of death  
Post mortem changes- classification  
Determination of cause of death, manner of death  
Estimation of time since death  
Post mortem biochemistry of the body fluids-Modern techniques used for the estimation of time since deaths  
exhumation

### **Forensic Entomology**

Identification of specific insects and their developmental stages (life cycles), Medico legal importance

## **UNIT-IV**

### **Asphyxial deaths:**

- x Classification of asphyxia deaths
- x Hanging, Strangulation, evidence collection and analysis, establishing manner of deaths
- x Suffocation, Drowning and traumatic asphyxia , medico legal importance of diatoms, medico legal importance , manner of deaths

Crimes against women- Introduction to sexual offences

Natural and unnatural sexual offences, perversions

Domestic violence and abuses at work place against women

child abuses and abuses of old people

Abortion & Infanticide

Deaths from starvation

## **UNIT- V**

### **General and medico legal aspects of injuries/ traumatology**

Mechanical Injuries: Abrasions, Bruises, Lacerations, Incised wounds, Stab wounds, Firearm injuries, Defense injuries, fabricated injuries. vital clues for establishing the manner of deaths due to various injuries

Traffic accident injuries: vehicular injuries, railway injuries & aircraft injuries.  
Thermal injuries: Heat and cold -Burns and scalds,  
Deaths due to electrocution- lightning ,Electricity,  
Deaths due to explosions.- establishing the causes of deaths and vital clues/evidences to be collected  
Deaths due to Chemical trauma.

## **MSFS 1207 Forensic Biology and Forensic Medicine Laboratory**

Microscopic examination of hairs – identification of species origin.  
Microscopic examination of diatoms.  
Examination of skeletal remains- Long bones- Femur, Humerus,  
Identification of individuals by long bones and stature estimation  
Determination of sex and age from Skull with mandible  
Determination of sex from pelvis and sacrum.  
Identification of individuals by dental examination  
Anthropometry.- Identification of individuals (in living)  
Postmortem examination in various Asphyxial deaths.  
Postmortem examination of various homicidal/ accidental injuries

### **Reference Books:**

Modi JS: Medical Jurisprudence and Toxicology  
Taylor: Medical Jurisprudence  
Parikh CK: Text book of Medical Jurisprudence and Toxicology  
Keith Simpson & Bernard Knight: Forensic Medicine  
C.M.V. Cox Medical Jurisprudence and Toxicology  
K.S. N. Reddy: Text book of Forensic Medicine & Toxicology  
Aparna Nandi: Text book of Forensic Medicine  
Krishan Vij: Text book of Forensic medicine  
Bisbing, Englewood Cliffs, New Jersey, Prentice Hall  
Forensic Hair Investigation : Forensic Sciences Progress, Vol II – Seta S. Sato, H & B Miyake,  
Springer – Verlag, Berlin  
Laboratory Procedure Manual - Forensic Biology (2005), Directorate of Forensic Sciences,  
MHA, New Delhi  
The forensic Identification and Association of Human Hair in Forensic Sciences Handbook –  
Text book of Forensic medicine and toxicology –V.V.Pillay

# **School of Forensic Sciences**

## **M. Sc. Forensic Sciences**

### **MSFS 1203 Forensic Serology and DNA Profiling**

#### **Unit I**

##### **Cell Biology and Basic Biochemistry**

Structure and function of cell and cellular organelles: Endoplasmic Reticulum, Golgi complex, Mitochondria, Chloroplast and Lysosomes. Organization of Nucleus and nuclear transport.

- x Amino acids – structure and functional group properties.

Proteins and peptides – Composition of proteins – Primary, Secondary and Tertiary structure of protein.

Chemistry of Carbohydrates - Definition, biological importance and classification. Monosaccharides - Isomerism, anomerism. Sugar derivatives, Disaccharides,

Chemistry of Lipids - Definition, Biological importance and classification, Fats and fatty acids, Introduction to compound lipids, Hydrophobic and hydrophilic groups, Cholesterol, Bile salts, Micelle. Bimolecular leaflet, Lipoproteins.

#### **UNIT- II**

##### **Basic Serology**

Blood and its composition.

Hemoglobin and its variants.

Theories and biochemical tests for the identification of blood.

Blood Typing/Grouping – ‘ABO’ system and its significance in forensic investigation.

Other blood group antigens - ‘Rh sub types’, MN, I, P, Kell, Duffy, Kidd, Lewis, Lutheran and Bombay blood group

Forensic Examination of semen and other body fluids – vomit, feces, urine, saliva and vaginal secretions.

Overview of cells and organs of immune system and basic immunology.

#### **UNIT- III**

##### **Forensic Microbiology**

Introduction to microbiology, cellwall composition of Gram positive and Gram negative bacteria

Sterilization techniques - Physical agents: Dry heat, wet heat and cold sterilization, filtration, radiation; Chemical agents (Disinfectants, antibiotics, alcohols) and their mechanisms.

x Microbial growth and environmental factors affecting the growth.

Different methods for isolation of microorganisms from forensic samples like vomit, stool, stomach wash and residual food.

Introduction to biological warfare, general properties of various biological warfare agents and their toxic effects. Popular case studies of bioterrorism.

## **UNIT- IV**

### **Basics of forensic DNA analysis**

Chemical structure of DNA and RNA

Overview of DNA replication, transcription and translation

Procedure for collection and preservation of biological sample for DNA analysis.

Techniques of DNA isolation and its quantitation.

DNA separation techniques

## **UNIT- V**

### **Basic Methodologies in forensic DNA analysis**

History of DNA fingerprinting and DNA polymorphism.

Genes and DNA markers in forensic DNA analysis.

Introduction to Polymerase Chain Reaction and its applications.

Introduction to mitochondrial DNA and its forensic importance

## **MSFS 1208 Forensic Serology and DNA Profiling Laboratory**

Different staining procedures for cellular organelles.

Physical, biochemical and spectrophotometric examination of blood stains.

Examination of seminal stains by crystal tests, biochemical and microscopical analysis.

Examination of saliva and its stains.

Biochemical and microscopic examination of urine, vomit and sweat.

Determination of origin of species from biological fluids.

Blood group typing of biological fluid stains by absorption elution, absorption inhibition and mixed agglutination techniques.

Experiments on electrophoresis of red cell isoenzymes e.g. PGM, GLO-I, EsD, EAP.

Isolation of DNA from blood and its quantification.

Collection and extraction of DNA using FTA card

## **Reference Books:**

- The examination and Typing of Blood Stains in the crime laboratory – B J Culliford, U. S. Dept. of Justice, Washington D. C.
- Blood Group Serology – Boorman KE, Dodd BE and LOncoln PJ, Chuchill Livingstone Inc. New York.
- Laboratory Procedure Manual - Forensic Serology (2005), Directorate of Forensic Sciences, MHA, New Delhi.
- Laboratory Procedure Manual – DNA Profiling (2005), Directorate of Forensic Sciences, MHA, New Delhi.
- Molecular Biology of the Cell, 6th Edition (2014) – Bruce Alberts, et al., Garland Sciences, ISBN: 978-0815341055
- Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528
- Forensic Sciences: An Introduction to Scientific and Investigative Techniques – StuartH. James, Jon J. Nord by, CRC Press, ISBN:0849327474
- Genes XI (2012) – Benjamin Lewin, Jones & Bartlett Learning, ISBN: 978-1449659851
- Kuby Immunology<sup>6<sup>th</sup></sup> Edition– Kindt, Goldsby and Osborne, W.H. Freeman and Co. ISBN: 978-0716767640
- Lehninger Principles of Biochemistry <sup>6<sup>th</sup></sup> Edition (2012) – Nelson and Cox, W.H. Freeman, ISBN: 978-1429234146
- Microbiology <sup>5<sup>th</sup></sup> Edition – Pelczar et. al., McGraw-Hill Inc., ISBN: 978-0074623206
- Prescott's Microbiology 9th Edition (2013) - Joanne Willey, Linda Sherwood, Christopher J. Woolverton, McGraw-Hill Education, ISBN: 978-0073402406
- An Introduction to Forensic Genetics <sup>2<sup>nd</sup></sup> Edition (2010) - William Goodwin, Adrian Linacre and Sibte Hadi, Wiley-Blackwell, ISBN: 978-0470710197

**School of Forensic Sciences**  
**M. Sc. Forensic Sciences**  
**MSFS 1204 Forensic Toxicology and Pharmacology**

**UNIT- I**

- x Introduction and concepts of forensic toxicological examination and its significance.
- x Law relating to poisons.  
Introduction to Poisons, form of poisons, classification and methods of administration of poison
- x Mode of action of poison, Diagnosis and management of poisoning cases.
- x Factors affecting the effect of poison and medico-legal aspects in poisoning cases

**UNIT- II**

Collection and preservation of biological evidences (viscera and /or body fluids) and circumstantial evidences in fatal and survival cases. Submission of samples to the laboratory, postmortem examination, specific analysis plan / approach to toxicological examinations of poisoning samples. Classification of matrices.

Isolation and Extraction of poison/ drug by various classical and modern methods using instrumental techniques.

**UNIT- III**

Method of analysis of Inorganic poisons (metallic, non metallic and anions).

Method of analysis of Neutral poison.

Method of analysis of Basic drugs / poisons.

Method of analysis of Acidic drugs / poisons.

Method of analysis of volatile poisons.

**UNIT- IV**

- x Insects and animal poisons and their examination.  
Plant poisons: Classification and analysis by chemical and instrumental techniques.  
Mechanical poisons and their examination.  
Analytical aspect of toxicological evidence.  
Toxicological analysis of decomposed materials.  
Interpretation of toxicological findings and preparation of reports.

## UNIT- V

### Forensic pharmacology

Forensic pharmacological studies, absorption, distribution, pharmacokinetics and metabolism, pathways of drug metabolism, drug toxicity, excretion of drugs and poisons.

- x Detection of poison on the basis of their metabolic studies.

### **MSFS 1209 Forensic Toxicology and Pharmacology Laboratory**

Systematic extraction and detection of poisons and drugs from visceral samples by various suitable chemical and instrumental techniques.

Detection of metallic poisons from viscera samples and food samples.

Identification of vegetable poisons of Forensic interest.

### **Reference Books:**

Modi JS: Medical Jurisprudence and Toxicology

Taylor: Medical Jurisprudence

Parikh CK: Medical Jurisprudence and Toxicology

Keith Simpsen & Bernard Knight: Forensic Medicine

Poison, CJ, DJ Gee, B. Knight: Forensic Medicine

Reddy: Forensic Medicine

Laboratory Procedure Manual- Forensic Toxicology, DFS, MHA, New Delhi

Pharmacology and Therapeutics-Bhandarkar& Satoskar

Medical Pharmacology- Tripathy

Essentials of Toxicology- Ellenhorn



# School of Forensic Sciences

## M. Sc. Forensic Sciences

### MSFS 1205 Forensic Ballistics and Computer Forensics

#### UNIT- I

**Firearms** characteristics & classification of firearms, History and background of firearms, Functional assembly & Operating principle of firearms, Characteristics & Working mechanism of Standard: Rifled firearms, Small arms, Shot guns & Non-standard: Improvised, Country made, Imitative firearms, identification of origin.

**Ammunition** & its constructional parts, Classifications of Ammunition on basis of constructional features, Functional assembly of different types of ammunition & their types, Safety aspects for handling firearms and ammunition, cartridge-firing mechanism.

#### UNIT- II

Types of ballistics & their aspects, **Internal ballistics**: General elementary & other principle problems: Heat problems, Pressure, Recoil, Vibration & Jump, Barrel Fouling.

**External ballistics**: Trajectory formation & its computation, Vacuum Trajectories & its measurement, Influence of earth trajectory, Effect of air resistance on trajectories, Parameters involved in exterior ballistics.

#### UNIT- III

**Terminal/Wound ballistics**: Effect of projectile on target based on: nature of target, bullet shape, striking velocity, striking angle and nature of target, intermediate targets, range, etc

Basic concepts of wound ballistics & phenomenon involved: threshold velocity for penetration of skin / flash / bones, Nature of wound of entry & exit wound, Characterization & evaluation of injuries depending upon Range, Velocity, Projectile Types, Firearm types, etc.

#### UNIT- IV

**Identification of firearms**, ammunition and their components: Principles, Processing of Firearm Exhibits involved, Class characteristics & Individual characteristics (Identifiable marks) produced during firing process on cartridge cases & projectiles and their linkage with firearms.

**Analysis of GSR** –Composition of GSR, Location & Collection, Mechanism of formation, Chemical & Instrumental techniques involved in analysis, Shooter Identification technique.

**Determination of range of fire** & its related phenomena, Techniques involved in ballistic studies, Stereo and comparison microscopy, BDAS, IBIS.

## **UNIT- V**

### **Computer Forensics:**

Introduction to Computer and its components, Computer Storage Media, Windows and Unix File Storage, Introduction to Cyber crime and Cyber Law, Terms: Internet, hacking, virus, obscenity, pornography, program manipulation, Software piracy, attacks, phishing etc, case studies.

## **MSFS 1210 Forensic Ballistics and Computer Forensics Laboratory**

### **Forensic Ballistics:**

Characteristics of Firearms-Caliber, Choke, Trigger pull, and Proof marks.

Examination and comparison of fired bullet with reference to caliber, rifling characteristics, and identification of firearm

Examination and comparison of fired cartridge case with reference to caliber, firing pin, breech face, chamber indentations, extraction, and ejector marks by comparison microscope

Determination of shot numbers from size and weight of shots

Identification of propellants

Chemical tests for powder residue and barrel wash

Instrumental examination of GSR.

### **Cyber forensics:**

Imaging of hard disc, restoration of deleted files, password cracking, e-mails tracking.

## **Reference Books**

J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1,2,& 3; Springfield, Illinois;

Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, P A

Vincent Di Maio, Gunshot Wounds; Crc Press, Washington, Dc;

Brain J. Heard;, Hand Book Of Firearms And Ballistics; John Willey, England;

TA, Warlow; Firearms, The Law And Forensic Ballistics; Taylor And Francis, Landon;

Karl G. Sellier et al ; Wound Ballistics And The Scientific Background; Elsevier, London

M. Johari, Identification Of Firearms, Ammunition And Firearms Injuries; BPR&D, New Delhi;

L V. Hogg; The Cartridges Guide - A Small Arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, P A

Gary J. Ordog, Management Of Gunshot Wounds, Elsevier, New York

Working Procedures Manual: Ballistics, BPR&D Pub.

S.K.Sharma, cyber laws and crime.

Fry & Nystron, security monitoring, O. reilly  
Tipton Krause, Information security management, Aner Bach  
Schneider, hacking the code, Syngers.

# *Semester-III*

# Specialization

**Specialization**

**In**

**Forensic Chemistry**

**&**

**Toxicology**

# School of Forensic Sciences

## M. Sc. Forensic Sciences

### MSFS 2101 Pharmacology and Pharmaceutical Drug Analysis

#### UNIT- I

##### Basic Principles of Pharmacology

Introduction to Pharmacology  
Pharmacopoeias IP, USP, EP  
Drug & Drug Receptor mechanisms  
Pharmacodynamics  
Factor affecting the effects of Drug  
Post mortem redistribution

#### UNIT- II

##### Pharmacokinetics

- x L-ADME
  - Bioavailability and Bioaccumulation
  - Dose response relationship
  - Drug Interactions like Agonism, Antagonism, Addition, Synergism, Potentiation
  - Adverse drug reactions and pharmacogenetics
  - Drug concentration and pharmacological response
  - Drug dependence and drug abuse

#### UNIT- III

##### Pharmacology and Pharmaceutical Analysis

- x Aliphatic alcohols
  - General and local Anesthetics
  - CNS Stimulants
  - Sedative, Hypnotics and Pharmacotherapy of sleep disorders
  - Drugs effective in convulsive disorders

## UNIT- IV

### Pharmacology and Pharmaceutical Analysis

Antipsychotic Agents  
Antidepressant drugs  
Antiseizure Drugs  
Drugs of Abuse  
Tranquillizers  
Narcotic Drugs and Psychotropic Substance  
Schedule and Nonscheduled Drugs  
Designer Drugs  
Doping Drugs  
Hallucinogens

## UNIT- V

### Pharmacology and Pharmaceutical Analysis

Chemotherapeutic Drugs  
Antibacterial  
Antifungal agents  
Antiviral agents  
Antiprotozoal Drugs  
Disinfectants, Antiseptics and Sterilants

## MSFS 2104 Pharmacology and Pharmaceutical Drug Analysis Laboratory

Qualitative and quantitative analysis of Pharmaceuticals by various chemical and instrumental techniques.

### Reference Books:

- Klaassen, C. D.,: Casarett and Doull's Toxicology: The Basic Sciences of Poisons, 5<sup>th</sup> ed, McGraw-Hill, 1995.
- Moffat, A.C. : Osselton, D. M. Widdop, B. : Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and postmortem material, 3<sup>rd</sup> ed., Pharmaceutical Press 2004.
- Bogusz, M. J.,: Hand Book of Analytical Separations, Vol. 2: Forensic Sciences, 1st ed., Elsevier Sciences, 2000.
- Siegel, J.A., Saukko, P. J., Knupfer, G.,: Encyclopedia of Forensic Sciences (Vol3), Academic Press, 2000.
- Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4<sup>th</sup> ed., Harcourt/Churchill Livingstone, 2000.
- Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1<sup>st</sup> ed., Nirali Prakashan, 1990.



Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2<sup>nd</sup> ed., 1999.  
 Wiseman, H and Henry J.: Management Of Poisoning, A Handbook for Healthcare workers, 1<sup>st</sup> ed., A.I.T.B.S, 2002  
 Hardman, J. G. and Limbird, L. E.,: Goodman and Gilman's The Pharmacological basis of Therapeutics, 9<sup>th</sup> ed., McGraw-Hill, 1996  
 Laboratory procedure Manual, Forensic Toxicology: DFS, 2005  
 Sunshine, I ; Methods for Analytical Toxicology, CRC Press USA (1975)  
 Cravey, R.H; Baselt, R.C.: Introduction to Forensic Toxicology , Biochemical Publications, Davis, C.A. (1981)  
 Stolmen, A.; Progress in Chemical Toxicology: Academic Press, New York (1963)  
 Modi, Jaisingh, P.; Textbook of Medical Jurisprudence& Toxicology, M.M. Tripathi Publication (2001)  
 Eckert; An Introduction to Forensic Sciences, CRC Press  
 Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001  
 Curry, A. S: Poison Detection in Human Organ  
 James, S. H. and Nordby, J. J.: Forensic Sciences: An Introduction to Scientific and Investigative Techniques, 2003.  
 Saferstein, R: Criminalistics - An Introduction to Forensic Sciences, Prentice Hall, 1995.  
 Sarkar, S: Fuels and Combustion, Orient Longman, 1990  
 Verma, R. M: Analytical Chemistry – Theory and Practice, CBS Pub., 1994  
 Svehla, G. Ed.: Vogel's Qualitative Inorganic Analysis, Longman, 1998.  
 Bassett: Vogel's Text Book of Quantitative Inorganic Analysis, Longman, 1978  
 Vogel, A. I: Text Book of Practical Organic Chemistry including Qualitative Organic Analysis, ELBS, 1971.

# **School of Forensic Sciences**

## **M. Sc. Forensic Sciences**

### **MSFS 2102 Concept of Toxicology**

#### **UNIT-I**

##### **Introduction to Toxicology**

History, scope and applications

Types of Toxicology

Principle of Toxicology

Mechanism of Toxicology

Risk Assessment and Safety evaluation of chemicals

#### **UNIT-II**

##### **Disposition and Translocation of Toxicants**

x Exposure of Toxicants

x Translocation of Toxicants

Bioaccumulation of Xenobiotics

Biotransformation of Xenobiotics

Antidotal therapy

#### **UNIT-III**

##### **Toxic Agents**

Toxic effects of Pesticides

Toxic effects of Metals

Toxic effects of Solvent

Toxic effects of Plants

Toxic effects of Insects & Animal poisons

## UNIT-IV

### Analytical Toxicology

- x Introduction
  - Provision of analytical toxicology services
  - Samples and sampling techniques
  - Choice of analytical method
  - Method implementation, development and validation
  - Quality control and quality assurance
  - Applications of analytical toxicology

## UNIT-V

### Applications of Toxicology

- x Clinical Toxicology
- x Environmental Toxicology/ Ecotoxicology
  - Forensic Toxicology/ Postmortem Toxicology
  - Industrial/Occupational Toxicology
  - Food Toxicology
  - Behavioral toxicology
  - Preventive toxicology
  - Descriptive Toxicology
  - Mechanistic Toxicology
  - Regulatory Toxicology
  - Genetic Toxicology
  - Systemic Toxicology

### **MSFS 2105 Concept of Toxicology Laboratory**

Systematic extraction, isolation, purification and identification of volatile, acidic, basic and neutral drugs by various analytical techniques.

Extraction and detection of metallic poisons from biological and non biological matrices.

Identification of plant poisons by chemical and microscopic methods.

#### **Reference books:**

Curry: Analytical Methods in Human Toxicology, Part II, 1986.

Casarett & Doll Toxicology: The Basic Sciences of poisons.

Clark, E.G.C.: Isolation and identification of Drugs, 1966

Curry, A.S.: Poison Detection in Human Organs, 1976  
Curry, A.S.: Advances in Forensic Chemical Toxicology, 1972  
Holfmann, F.G.: Handbook of Drug and Alcohol Abuse.  
Turner: Drugs & Poisons.  
Samford : Poisons Their Isolation Identification  
Stoleman: Progress in Chemical Toxicology.  
Sunshine, I: Guidelines for Analytical Toxicology Programme, Vol-I, CRC press, 1950.  
Sunshine, I: Handbook of Analytical Toxicology, press, 1969.  
Mule, S. J. et al. : Immunoassays for Drugs subjects to ab, CRC Press, 1974  
Connors, K.: A text book of Pharmaceuticals analysis, Interscience, New York, 1975

## **School of Forensic Sciences**

### **M. Sc. Forensic Sciences**

#### **MSFS 2103\_Modern and Applied Analytical Forensic Chemistry**

##### **UNIT-I**

##### **Forensic nuclear chemistry**

Introduction to nuclear forensics, nuclear threats, Nuclear explosive devices, Radioactivity, Radioactive decay rates and Half lives, Methods of detection and measurement of radio actives (G.M and Scintillation Counter). Applications of Radioisotopes.

##### **Activation analysis:**

Neutron activation analysis, principle, technique, applications and steps involved in neutron activation analysis.

##### **Isotope dilution analysis:**

Principle, types of isotope dilution analysis, typical applications of isotope dilution analysis.

##### **UNIT-II**

##### **Forensic Drug Chemistry**

Introduction to Drugs, Controlled Substance Act, Forensic examination of drugs/Narcotics (Cannabis), Phenethylamines (Amphetamine, Methamphetamine), Hydroxyl derivative (Ephedrine) Ketone Derivative (Cathinone), Methoxy Derivative (Mescaline) Tertiary Amines (Cocaine and Opiates) Tryptamines (Psilocin and Psilocybin) Anabolic Steroids, Miscellaneous Controlled Substances (Barbiturates, Benzodiazepines, GHB, Ketamine and LSD)

Sample Preparation, Extraction Techniques- Chemical-color test, Microcrystal techniques and other instrumental techniques involved in analysis.

## **UNIT-III**

### **Petroleum Chemistry**

Paraffins, , Iso-olefins, Olefin Hydrocarbons, Naphthenes, Cycloparaffins or Aromatic Hydrocarbons, Sulphur Compounds, Nitrogen Compounds, Oxygen Compounds, Organo-Metallic Hydrocarbons; H/C Ratio of Hydrocarbons;

Physical Properties of Petroleum Products : Density, Viscosity, Surface Tension, Color, Fluorescence, Cloud Point, Pour Point, Aniline Point, smoke point, boiling point, Optical Properties, Flash Point, Refractive Index and Calorific Value, Determination of Cetane and Octane number, **Analytical Techniques:** Quantitative and Qualitative Steps in Analysis of Petroleum

### **Fire Chemistry**

Scientific Investigation of Fire, NEPA 921 and NEPA 1033, The chemistry and physics of combustion, Dynamics of Fire, Development of fire patterns, Separation and analytical techniques of ignitable liquid residues, Field tests, Interpretation of Data Obtained from Fire Debris, Quality Assurance in Fire debris Analysis, Report Writing and Court Testimony.

## **UNIT-IV**

### **Explosives Chemistry**

Introduction and assessment of explosives , Oxygen balance, Explosive Power Index, Heat and Temperature of Explosion, Pressure of explosion, Mechanism of Ignition and hot spot formation. Thermal decomposition , physical and chemical aspects of combustion, Deflagration and Detonation, Kinetics of Explosive Reactions, Analysis of low and high explosives by different instrumental techniques, Quality control, Proficiency Testing, Interpretation and Significance of Results

### **Chemical Warfare Agents**

Classification, physical and biochemical properties, toxic effects detection by Biosensors and various instrumental Techniques

## **UNIT-V**

### **Food Chemistry**

**Analysis of Lipids and fats:** Physical examination of lipids, Chemical examination of lipids (Acid value, Saponification value, Ester value, Acetyl value, Iodine value), Test for hydrogenated oils and fats, Detection and Determination of rancidity, Analysis of butter and butter fats, Analysis of adulterated and non-adulterated oils

**Analysis of dairy products: Milk and its products.**

## **MSFS 2106 Modern and Applied Analytical Forensic Chemistry**

Microcrystalline tests for drugs

Separation of alkaloids, glycosides, tryptamines by TLC

Separation of Psychotropic substance by TLC  
 Separation of Cannabis/Opium by TLC  
 Separation of lipids by TLC  
 Analysis of high explosives by color test and TLC.  
 Extraction of caffeine from tea leaves, characterization by IR.  
 Estimation of protein in food samples.  
 Analysis of calcium and magnesium in milk.  
 Analysis of fire residues by GC  
 Analysis of adulterated and non-adulterated oil by chemical/Color Test and TLC method  
 Analysis of dye in petrol and kerosene by UV spectrophotometry and TLC  
 Estimation of nitrite/nitrate in water samples  
 Separation of amino acids by thin layer chromatography  
 Analysis of NDPS drugs and explosives by instrumental techniques.

### **Reference Books:**

- Klaassen, C. D.,: Casarett and Doull's Toxicology: The Basic Sciences of Poisons, 5<sup>th</sup> ed, McGraw-Hill, 1995.
- Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and postmortem material, 3<sup>rd</sup> ed., Pharmaceutical Press 2004.
- Bogusz, M. J., Hand Book of Analytical Separations, Vol. 2: Forensic Sciences, 1st ed., Elsevier Sciences, 2000.
- Siegel, J.A., Saukko, P. J., Knupfer, G.,: Encyclopedia of Forensic Sciences (Vol3), Academic Press, 2000.
- Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4<sup>th</sup> ed., Harcourt/Churchill Livingstone, 2000.
- Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1<sup>st</sup> ed., Nirali Prakashan, 1990.
- Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2<sup>nd</sup> ed., 1999.
- Wiseman, H and Henry J.: Management Of Poisoning, A Handbook for Healthcare workers, 1<sup>st</sup> ed., A.I.T.B.S, 2002
- Hardman, J. G. and Limbird, L. E.,: Goodman and Gilman's The Pharmacological basis of Therapeutics, 9<sup>th</sup> edn., McGraw-Hill, 1996
- Laboratory procedure Manual, Forensic Toxicology: DFS, 2005
- Sunshine, I ; Methods for Analytical Toxicology, CRC Press USA (1975)
- Cravey, R.H; Baselt, R.C.: Introduction to Forensic Toxicology , Biochemical Publications, Davis, C.A. (1981)
- Stolmen, A.; Progress in Chemical Toxicology: Academic Press, New York (1963)
- Modi, Jaisingh, P.; Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Publication (2001)
- Eckert; An Introduction to Forensic Sciences, CRC Press
- Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001
- Curry, A. S: Poison Detection in Human Organ
- James, S. H. and Nordby, J. J.: Forensic Sciences: An Introduction to Scientific and

Investigative Techniques, 2003.

Saferstein, R: Criminalistics - An Introduction to Forensic Sciences, Prentice Hall, 1995.

Sarkar, S: Fuels and Combustion, Orient Longman, 1990

Verma, R. M: Analytical Chemistry – Theory and Practice, CBS Pub., 1994

Svehla, G. Ed.: Vogel's Qualitative Inorganic Analysis, Longman, 1998.

Bassett: Vogel's Text Book of Quantitative Inorganic Analysis, Longman, 1978

Vogel, A. I: Text Book of Practical Organic Chemistry including Qualitative Organic Analysis, ELBS, 1971.

Skoog, D. A., West, D. M. and Holler, F. J: Analytical Chemistry: An Introduction, Saunders College, 1994.

Siegel, J. A, Saukko, P. J. and Knupfer, G. C: Encyclopedia of Forensic Sciences, Academic Press, 2000.

Townsend, A. (Ed): Encyclopedia of Analytical Sciences, Academic Press, 2005.

Beveridge, A: Forensic Investigation of Explosives, Taylor & Francis, 2000.

Yallop, H. J: Explosion Investigation, Forensic Sciences Society & Scottish Academic Press, 1980.

Narayanan, T. V: Modern Techniques of Bomb Detection and Disposal, R. A. Security System, 1995.

Yinon, J. and Zitrin, S: The Analysis of Explosives, Oxford: Pergamon, 1981

An Introduction to Physics and chemistry of Petroleum

Kinghorn: Introduction to Petrochemicals Sukumar Maiti

D.W.Waples : Geochemistry in Petroleum Exploration

A.L.Waddams : Petroleum Geochemistry and Geology Chemicals from Petroleum

Day& Underwood :Analytical Chemistry

H. J. Arnikar Essentials of Nuclear Chemistry, 4th Edition Wiley Eastern (1987).

H. J. M. Bowen. Buttler and Tanner Chemical Applications of Radioisotopes, (1969).

G Friedlander, T. W. Kennedy, E. S. Macias and J. M. Miller, Introduction of Nuclear and Radiochemistry, 3rd Edition, John Wiley (1981).

P.D.Vowels and D.W: Experiments in Environmental chemistry.

**Specialization**  
**In**  
**Forensic Biology**



# School of Forensic Sciences

## M. Sc. Forensic Sciences

### MSFS 2111 Molecular Biology and Genetics

#### UNIT – I

##### Immunology

- x Antigen – Epitope, essential factors for antigenicity, haptens and adjuvant.  
Immunoglobulin – structure, classes of immunoglobulin, antigen – antibody reactions and their techniques in serological analysis.  
Application of various polymorphic enzymes and proteins in criminal investigation.  
Antigen Processing and presentation  
Production of Monoclonal and polyclonal antibodies, hybridoma technology  
Autoimmunity and hypersensitivity  
HLA typing and its forensic importance.  
Vaccines  
Lectins and their forensic significance

#### UNIT - II

##### DNA, RNA and Protein Metabolism

- Organization of genome in prokaryotes and eukaryotes  
Fluorescence in situ hybridization (FISH) for genome analysis and Chromosome micro dissection  
Key historical experiments of DNA metabolism  
Enzymes and accessory proteins involved in DNA replication, Mechanism of DNA replication in prokaryotes and eukaryotes.  
Gene transcription and post transcriptional modification in prokaryotes and eukaryotes.  
Translation in prokaryotes and eukaryotes, post translational modification, Synthesis of secretory and membrane proteins, import into nucleus, mitochondria, chloroplast and peroxisomes. Receptor mediated endocytosis.  
Operon concept-Lac and Trp operon.

#### UNIT - III

##### Population Genetics and Bioinformatics

- Concept of population structure  
Indian population structure  
Hardy-Weinberg equilibrium  
Causes of evolution- admixture, selection, mutation, drift  
Linkage disequilibrium  
Phylogenetic tools  
Paternity/ maternity indices, sibship indices

Population Genetics in Forensic DNA typing  
Factors affecting accuracy of Forensic DNA typing  
Principles of sequence alignment and its tools  
Forensically important databases – BOLD, Hapmap, STRBase, DNA databases

#### **UNIT - IV**

##### **Advanced Methodologies in Forensic DNA Analysis**

Fundamentals of RFLP and PCR based DNA typing.  
STR genotyping  
Result of STR marker analysis and its interpretation.  
Single Nucleotide Polymorphism (SNP) and its applications in forensic investigation  
LCN typing  
Mitochondrial DNA analysis in Forensic investigation.  
Y-STR analysis and its significance in establishing paternal relationships.  
Non-human DNA analysis

#### **UNIT - V**

##### **Recent Developments and future Directions in DNA profiling**

Methods of DNA sequencing  
Prediction of physical characteristics, such as eye, hair, and skin color based solely on DNA  
Molecular autopsy  
Genetic genealogy in the genomic era  
Evolving technologies in forensic dna analysis  
Forensic tissue identification with nucleic acids: Classical, RNA based and DNA methylation based approaches

#### **MSFS 2114 Molecular Biology and Genetics Laboratory**

Different mathematical calculations for data analysis using Microsoft Excel.  
Extraction of proteins from various biological samples.  
Protein estimation by different techniques  
SDS-PAGE for protein analysis  
DNA extraction from various forensic samples  
Polymerase chain reaction  
STR Genotyping and interpretation  
Sequence comparison using BLAST  
Construction of Phylogenetic tree from nucleotide and protein sequences.  
Analysis of protein structure using RASMOL

#### **Reference Books:**

Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley & Sons Ltd., New York, 1988.

2. Molecular Biology of the Gene, 7<sup>th</sup> Edition (2013), James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick, Benjamin Cummings ISBN: 978-0321905376
3. Molecular Cell Biology 7th Edition (2012) - Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Matthew P. Scott, W. H. Freeman, ISBN: 978-1429234139
- Genes VIII – Benjamin Lewin, Oxford University Press, ISBN: 0-19-879276-X
- Molecular Biology and Biotechnology. A comprehensive desk reference, R.A. Meyers (Ed.) VCH Publishers, Inc, New York, 1999.
- Gene Cloning and DNA Analysis: An Introduction 7th Edition (2016) - T. A. Brown, Wiley-Blackwell, ISBN: 978-1119072560
- Lehninger Principles of Biochemistry 6th Edition – Nelson and Cox, Macmillan Publishers, ISBN: 978-1464109621
- Kuby Immunology 6th Edition– Kindt, Goldsby and Osborne, W.H. Freeman & Co. ISBN: 978-0716767640
- Introduction to Bioinformatics, 3<sup>rd</sup> Edition – Arthur Lesk, Oxford University Press, ISBN: 978-0199208043
- An Introduction to Genetic Analysis, 6<sup>th</sup> Edition – Anthony J. F. Griffiths et. al., W.H. Freeman and Co. ISBN: 978-716726043
- Bioinformatics – A practical guide to the analysis of genes and proteins, 3<sup>rd</sup> Edition – Andreas D. Baxevas and B.F. Francis Oullette, Wiley-Liss, ISBN: 978-0471478782
- Bioinformatics for Beginners: Genes, Genomes, Molecular Evolution, Databases and Analytical Tools, 1st Edition (2014) - Supratim Choudhury, Academic Press, ISBN: 978-0124104716

**School of Forensic Sciences**  
**M. Sc. Forensic Sciences**  
**MSFS 2112 Biotechnology in Pharmaceutical Sciences**

**UNIT-I**

**Introduction to Recombinant DNA technology**

- x DNA modifying enzymes  
Cloning strategies: Genomic libraries, cDNA libraries, single gene cloning.  
RAPD, RFLP and AFLP  
Vectors: Types of vectors and choice of vectors- Plasmids, cosmids, lamda phage vectors, shuttle vectors, BACs and YACs  
Transformation and Transfection  
Expression systems in Eukaryotic cells, Yeast, Bacteria, Insect cell lines, Gene screening  
Biosafety guidelines and containment strategies

**UNIT-II**

**Bioprocess and Bio-chemical engineering**

- Bioreactor design: Body construction, aeration and agitation, operation and applications
- Microbial Growth: measurement, batch and continuous culture and its kinetics
- Downstream processing: recovery and purification of products
- Strains improvement
- Fermentation economics

**UNIT-III**

**Animal and Plant biotechnology**

- Cell lines: Definition, development, maintenance and management, established cell lines and their characteristic features.
- x Transgenic animals- Creating transgenic animals, Example of transgenic animals-Dolly, Insects, Primates, mice
- x Somaclonal and gameto clonal variation: applications and limitations.  
Transgenic Plants: Herbicide resistant, insect Resistant, drought/stress resistant, delayed ripening, Ti Plasmid and T-DNA transfer.
- x Gene therapy: potential approach to gene therapy  
Southern blotting, Northern blotting, Western blotting, Iso-electric focusing  
Overview of Stem cells and its applications

## UNIT-IV

### **Biotherapeutics and industrial microbiology**

Introduction to industry important recombinant proteins, recombinant protein stability,  
Improved recombinant protein secretion,

Introduction to industrially important primary and secondary metabolites from plants and microbes

Microbial production: Antibiotics, acetic acid, lactic acid, wine, beer, SCP

## UNIT-V

### **Regulatory affairs and IPR**

Basic principles of quality control (QC) and quality assurance (QA)

Guidelines for QA and QC: raw materials, products and validation

Introduction to pharmacopoeia

Intellectual Property Rights

Importance of protecting scientific discoveries

IPR policy of Government of India

Patent: Qualification (novel, commercial and non-obvious), jurisdiction of patent laws, Indian and international patent laws, filing procedures.

### **MSFS 2115 Biotechnology in Pharmaceutical Sciences Laboratory**

Validation of various instruments and glasswares

Isolation of bacteria by different methods.

Genomic and Plasmid DNA Isolation from bacteria

Restriction digestion of DNA

RAPD/AFLP for GMO detection

Agarose gel electrophoresis

Western Blotting

Preparation of the competent cells for transformation

Selection of the transformed cells

Growth curve of *E. Coli* and determination of growth rate and generation time.

Microbial production of citric acid.

### **Reference Books:**

Pharmaceutical Biotechnology : Concepts & Applications – Gary Walsh (Wiley)

Modern Industrial Microbiology and Biotechnology – Nduka Okafor (Sciences Publisher)

Biotechnology and Biopharmaceuticals – Rodney J.Y.H.O and Milo Gibaldi (Wiley)

Biotechnology in Healthcare – Gavin Brooks (PLP)

Gene Therapy: Protocols - Joseph M. Le Doux (Humana Press)

Biotechnology – Applying the genetic revolution – David P. Clark and Nanette J. Pazdarnik,  
Academic Press, ISBN: 978-0121755522

Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4<sup>th</sup> Edition –  
Bernard G. Glick, Jack J. Pasternak and Cheryl L. Patten, ASM Press, ISBN: 978-  
1555814984

Plant, Gene and Crop Biotechnology, 2<sup>nd</sup> Edition – Maarten J. Chrispeels and David E.  
Sadava, Jones and Bartlett Publishers, ISBN: 978-0763715861

Biotechnology – U. Satyanarayana, Books and Allied (P) Ltd., ISBN:

Plant Tissue Culture by MK Razdan & SS Bhojwani (1996) Elsevier

Freshney, Culture of Animal Cells, 5th Edition, Wiley-Liss, 2005

Ed. John R.W. Masters, Animal Cell Culture - Practical Approach, 3rd Edition, Oxford  
University Press, 2000.

**School of Forensic Sciences**  
**M. Sc. Forensic Sciences**  
**MSFS 2113 Environmental Biotechnology**

**UNIT-I**

**Introduction to environmental biology**

- x Basic components of environment  
Concept of ecosystem, abiotic and biotic components.  
Environmental pollution: Air, water, and soil pollution.
- x Environmental monitoring: environmental impacts and their assessments using bioindicators,  
Biomarkers, biosensors and toxicity testing  
Air, water and soil sampling  
Analyses of samples by physical, chemical and biological methods

**UNIT-II**

**Waste treatment strategies**

- x Classification and characterization of waste
- x Principles and mechanisms of waste treatment
- x Nitrification and denitrification – microbial fundamentals and application  
Aerobic processes: Activated sludge, oxidation ditches, trickling filters, towers, rotating discs, rotating drums, oxidation ponds.  
Anaerobic processes: Anaerobic digestion, anaerobic filters, up flow anaerobic sludge blanket reactor.
- x Economics and special aspects of waste treatment  
Examples of treatment schemes for waste waters of dairy, tannery, sugar and antibiotic industry
- x Biotechnology in reduction of CO<sub>2</sub> emission

**UNIT-III**

**Environmental Forensic**

- x Introduction and applications of environmental forensic  
Principles and methods of chemical fingerprinting (crude oil and refined products)  
Forensic techniques used in environmental litigation  
Environmental forensic microscopy  
Case studies in environmental forensic

## UNIT-IV

### Biodegradation and bioremediation

- x Principle and mechanism of biodegradation,  
Biodegradation of xenobiotic compounds (Lignin, Hydrocarbons, Detergents, Dyes and pesticides)
- x Phytoremediation: Use of plants for removal of organic and metallic pollutants
- x Microbial interaction with metallic elements, metal toxicity, molecular mechanism of metal resistance and metal extraction  
Biosurfactants: Microbial production and application  
Biodeterioration – Principles, prevention and control

## UNIT-V

### Environmental protection and conservation

Status and Scope of biotechnology in environmental protection.  
Non-conventional energy sources.  
Various environmental standards: air, water and noise quality.  
Environment protection Act: environmental laws, policies, ethics.  
Environmental protection agencies

### **MSFS 2116 Environmental Biotechnology laboratory**

Microbial analysis of air.  
Microbial examination of food : Milk, Chutney and packed food materials  
Estimation of BOD.  
Physical characterization of waste  
Chemical characterization of waste : chlorides, sulphate, iron, acidity, alkalinity, phosphate, copper, TS, TDS, TSS  
Biodegradation of hydrocarbon  
Biotransformation of metals  
Bacterial decolorization of dye

### **Reference Books:**

Microbial Biotechnology: A. N. Glazer and H. Nikaido  
Molecular Biotechnology: Gleck and Pasternack.  
Biotechnology: A Text Book of Industrial Microbiology, T. D. Brock.  
Prescott & Dunn's Industrial Microbiology – G. Reed, CBS Publishers & Distributors, ISBN: 978-8123910017  
Environmental Biotechnology - Alan Scragg, Pearson Education Limited  
Biotechnology, a comprehensive treatise - Rehm H J and Reed G, VCH Verlag  
Introduction to environmental biotechnology by A K Chatterjee, PHI, India



Environmental Forensics: Contaminant Specific Guide- Robert D. Morrison,  
Academic Press, ISBN: 978-0125077514

Introduction to Environmental Forensics, 2<sup>nd</sup> Edition - Robert D. Morrison, Academic  
Press, ISBN: 978-0123695222

Environmental Sciences – A Global Concern, 7<sup>th</sup> Edition – W. P. Cunningham et al.,  
McGrow Hill Higher Education, ISBN: 978-0070294264

Environmental Engineer's Handbook, 2<sup>nd</sup> Edition – David H. F. Liu et al., Lewis  
Publication, ISBN: 978-0849399718

**Specialization**  
**In**  
**Forensic Physics**

# School of Forensic Sciences

## M. Sc. Forensic Sciences

### MSFS 2121 ADVANCES IN PHYSICAL TECHNIQUES

#### UNIT-I

**Thermal Analysis:** Principle theory and applications of Thermo gravimetric analysis, differential thermal analysis and differential scanning calorimetry.

Density gradient analysis, Specific Gravity analysis, Abbe's and Digital Refractometer, Micro-chemical analysis, TLC.

Introduction to principles and application for analysis of physical evidences: IR spectroscopy, Raman spectroscopy, FT-IR spectroscopy, Atomic Absorption Spectroscopy.

#### UNIT-II

**Lasers:** Characteristics of laser light, Spontaneous emission, Stimulated emission, Stimulated absorption, Einstein coefficients, Population inversion and light amplification, Essential components of the laser, Ruby and He-Ne laser (principles only). Holography: Formation of a hologram, Reconstruction of the hologram, Requirements, Application In forensic investigation **X-rays:** Production; continuous and characteristic X-rays and their spectra; Mosley's law; diffraction of X-rays by crystals; Bragg's law; Compton Effect.

#### UNIT-III

**Natural Radioactivity & Radioactive Decays:** Type of radioactive decays, theory of radioactive disintegration, radioactive constants, Mean life of a radio element, Activity of radioactive sources, Radioisotopes – their production & uses and forensic applications

**Nuclear Reactions:** Types of nuclear reactions, conserved quantities of nuclear reaction, energies of nuclear reaction—Q-value & its experimental determination. Exoergic & endoergic reactions, Weapons of mass destruction, forensic significance

**Nuclear Magnetic Resonance Spectroscopy (NMR):** Theory of NMR, Environmental effect on NMR, NMR spectrophotometers, Proton NMR, C-13 NMR, and other nuclei, their Applications.

#### UNIT-IV

Introduction to Microscopy, Types of Microscopes, Principles and Working of microscopes, Forensic Applications

**Forensic Nanotechnology**, introduction to Nano particles, Nano tubes, Utilization of nanotechnology in analysis of physical evidences, selectivity particles with compatibility and feasibility.

Case studies related to physical evidences and short circuit analysis.

## **UNIT-V**

### **Forensic Engineering**

Introduction to forensic engineering, ISI/Code of Building Construction, Structural failures, static loads, dynamic loads, causes of structural collapse, Types of cement and their composition, determination of adulterants by physical, chemical and instrumental methods, examination of brick, analysis of Bitumen & road materials, analysis of cement mortar and cement concrete & stones, forensic examination of electrical appliances installations.

### **MSFS 2124 Advances in Physical Techniques Laboratory**

Examinations of physical evidence by EDXRF technique

Examinations of RI of physical evidence by Abbe's and Digital Refractometer.

Examination and analysis of various physical evidences by Comparison and Stereomicroscope

Examination of physical evidences by AFM.

Examinations of physical evidence by SEM technique

Synthesis, characterization and Utilization of nanomaterials for various forensic applications (silver, cadmium )

Examination of various physical evidences by Nanotechnology

Examination of various physical evidence by ICP technique.

Examination of Structural materials.

### **Reference Books:**

B. Caddy; Forensic Examination of Glass and Paints Analysis and Interpretation ISBN 0784 05749 (2001)

David A. Crown; The Forensic Examination of Paints and Pigments, Taylor & Francis, NY (2001)

J.Walls; Forensic Sciences-An Introduction to Scientific Crime Detection 2nd Ed., Universal, 1st Indian Reprint (2002).

Richard Saferstein; Criminalistics-An Introduction to Forensic Sciences 5th Ed., Prentice Hall (1995).

Jay A.Siegel, Pekka J Saukko and Geoffrey C. Koouper; Encyclopedia of Forensic Sciences, Academic Press (2000).

E.R.Mengel; Forensic Physics in 2002 year book, McGraw hill Encyclopedia of Sciences & Technology.

R.W. Moncrieff; Man-Made Fibres 6th Ed.,Newnes Butterworths (1975)

J.E.Booth; Principles of Textile Testing-An Introduction to Physical Methods of testing textile Fibres, Yarns and Fabrics. 3rd Ed., CBS Pub. & Distributors (1996).

Katharine Paddock Hess; Textile Fibres and their use, 6<sup>th</sup> Ed.,Oxford & IBH Pub.,Co. (1974)

A.B. Wildman; The Microscopy of Animal Textile Fibers. Wool Industries Research Association (1954).

Elliot B. Grover and D.S. Hamby; Handbook of Textile testing and Quality Control, Wiley Eastern Pvt. Ltd. (1969)

Dorothy Catling and John Grayson; Identification of vegetable Fibers, Chapman and Hall (1982)

John H.Skinkle; Textile Testing- Physical, Chemical and Microscopial, 2nd Ed.,Revised and Enlarged, D.B. Tarapore vala Sons and Co. (1972).

J. Gordon Cook; Handbook of Textile Fibers, Vol-I, Natural Fibres,5th Ed., Merrow (1993)

B.P. Saville; Physical Testing of Textiles, The Textile School CRC Press and wood head Pub., (2000)

AATCC Technical Manual of American Association of Textile Chemists and Colorists, Vol-75 (2000), American Association of Textile Chemists and Colorists, USA

W.E. Morton and J.W. S. Hearle; Physical Properties of Textile Fibers, 3rd Ed., The textile School, 1993 (Re printed 1997)

Roger Brown; Handbook of Polymer Testing- Physical Methods, Marcel Dekker, Inc. (1999)

# School of Forensic Sciences

## M. Sc. Forensic Sciences

### MSFS 2122 Concepts of Conventional & Modern Ballistics

#### UNIT-I

Ballistics & its forensic aspects, Arms Act **Conventional Concepts of firearms:** their classification and characteristics, various components of small arms, smooth bore and rifled firearms.

**Operational features of firearms:** Barrel, body, Firing pin, Breech face, trigger, cork, and firing mechanism, measurement of strength of barrel & trigger pull.

**Rifled Firearms:** Caliber, Rifling, purpose of rifling, types of rifling and methods to produce rifling to produce rifling,

x **Smooth bore firearms:** Bore, Choking & types of choking, Methods of choking purpose of choking, method of choking, purpose of choking.

x **Illegal firearms:** AK-47, SKS and M16/AR15 Assault Rifles

x Techniques of dismantling / assembling of firearm, improvised / country-made / imitative firearm and their constructional features.

**Conventional Concepts of Ammunition:** Types of ammunition- classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, velocity and pressure characteristics under different conditions, various types of bullet and compositional aspects, latest trends in their manufacturing and design projectile, identification of origin, improvised ammunition and safety aspects for handling firearm and ammunition.

#### UNIT-II

**Core concepts of Internal Ballistics:** Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting, equation of motion of projectile, Density of loading, Pressure, Heat problems, Vibration & jump, Measurement of strength of firearm, projectile velocity determination, theory of recoil, methods for measurement of recoil.

**Core concepts of External Ballistics:** principal of external ballistics: vacuum trajectory, Trajectory Formation & its computation, effect of air resistance on trajectory, Angle of Fall, Influence of Earth on Trajectory, base drag, yaw, shape of projectile and stability, ballistics

coefficient and limiting velocity, Ballistics tables, measurements of trajectory parameters, Escape velocity & Ricochet.

### UNIT-III

**Core concepts of Terminal Ballistics:** Effect of projectile on hitting the target: function of Bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate targets, Influence of range Cavitations-Temporary and permanent cavities, Ricochet and its effects, stopping power

**Wound Ballistics:** Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, penetrative in gel block and other targets, nature of wounds of entry, exit, initial with various ranges and velocities with various types of projectiles, explosive wounds, evaluation of injuries caused due to shot-gun, rifle, handguns and country made firearms, methods of measurements of wound ballistics parameters, post-mortem and anti-mortem firearm injuries. Determination of range of fire- burning, scorching, blackening, tattooing and metal fouling shots dispersion and GSR distribution, time offering different method employed, and their limitations, Bullet recovery, time of firing.

**Gunshot Residues/ Powder Residues:** Composition of GSR depending upon propellants & primer mixtures, GSR Distribution, Mechanism of formation of GSR, Location, source and collection of GSR, Analysis of GSR: spot test, chemical test, identification of shooter and instrumental techniques involved of GSR Analysis, Practical problems related with GSR detections.

### UNIT-IV

**Test firing,** Procedure for test fire, Purpose for test firing, Recovery methodology, Specifications of Firing gallery, working of automatic firing rest, Safety & Preventive measures., Characterization of bullet proof jacket,

- x Introduction to various standard for ballistic and material testing.

**Principles and practice of identification of origin:** ammunition and their components, different types of marks produced during firing process on cartridge- firing pin marks, breech face marks, chamber marks, extractor and ejector marks band on bullet- number/ direction of lands and grooves, striation marks on lands and grooves, identification of various parts of firearms, techniques for obtaining test material from various types of weapons and their linkage with fired ammunition, class and individual characteristics.

### UNIT-V

**Instrumental techniques used for ballistic evidence analysis:** Borescope, Comparison Microscope, Stereo microscope, traveling microscope, Scanning Electron microscope, EDXRF.

Introduction to automated system of trajectory computation (**Ballistic Data Acquisition system**): Operating system & its concepts, Universal Receiver, ICM, Target Frame.

Automated management of ballistics data (**Integrated Ballistics Identification system**): History of establishment, Brass Trax, Bullet Trax & Match Point, Limitation & Advantages, Application- comparison of bullets and cartridges- data base creation and significance in forensic ballistic investigations

Management and reconstruction of cases involving firearm; Report writing and court findings.

## **MSFS 2125 Concepts of Conventional & Modern Ballistics Laboratory**

Instrumental Examination & Analysis of GSR

Barrel Wash Examination

Instrumental techniques used for identification of origin

Measurement of Rifling by traveling microscope

Test Firing System

Ballistic data Acquisition system

Integrated ballistics identification system.

Testing ballistic material in line with different standards.

### **Reference Books**

J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1,2,& 3; Springfield, Illinois;

Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, P A

Vincent Di Maio, Gunshot Wounds; Crc Press, Washington, Dc;

Brain J. Heard;, Hand Book Of Firearms And Ballistics; John Willey, England;

TA, Warlow; Firearms, The Law And Forensic Ballistics; Taylor And Francis, Landon;

Karl G. Sellier et al ; Wound Ballistics And The Scientific Background; Elsevier, London

M. Johari, Identification Of Firearms, Ammunition And Firearms Injuries; BPR&D, New Delhi;

L V. Hogg; The Cartridges Guide - A Small Arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, P A

Gary J. Ordog, Management Of Gunshot Wounds, Elsevier, New York

Working Procedures Manual: Ballistics, BPR&D Pub.

S.K.Sharma, cyber laws and crime.

Fry & Nystron, security monitoring, O. reilly

Tipton Krause, Information security management, Aner Bach  
Schneider, hacking the code, Syngrrers.



# **School of Forensic Sciences**

## **M. Sc. Forensic Sciences**

### **MSFS 2123 Audio Recognition & Video Analysis**

#### **UNIT-I**

Introduction to voice identification/speaker recognition and its forensic importance, History of voice analysis, Voice production theory, uniqueness in person's voice, interspeaker and intraspeaker variations, text-dependent and text-independent speaker recognition, Discriminating tests, closed test, Open test, Scope of voice analysis, collection of standards for comparison

#### **UNIT-II**

Handling of audio recording evidences & its physical examination, marking of speakers, Procedure for preparation of working copies.

Speech signal processing, Components of speaker recognition- feature extraction, pattern matching and comparison, normalization techniques, speaker profiling, enhancement of speech signal/audio recordings, establishing the authenticity and integrity of audio recordings

#### **UNIT-III**

Approaches to speaker recognition- Segregation of Speech samples, auditory analysis/listener's approach, spectrographic approach or voiceprint analysis, automatic speaker recognition technique, phonetic Transcription, linguistic & phonetic analysis, acoustic parameters for examining speech samples, Temporal measurement, Fourier analysis, frequency & time domain representation of speech signal, analogue to digital conversion.

#### **UNIT-IV**

CSL & Linear predictive coding technique, Gold wave analysis, Multi speech analysis, SIS software, Voice Net, CEDAR, Video Focus, Discrete Fourier transformation, Fast Fourier transformation, Examination using SPID.

Vocal behaviors-alcohol speech relationships- importance in forensic investigations, Report writing, Limitations, Precautions, Related Case Studies and its admissibility in court proceedings.

#### **UNIT-V**

Forensic Video analysis, establishing the authenticity of video recordings, Processing of video media, Capturing, Enhancement techniques, Specific frame analysis, Resolution, Image analysis,

Biometric Analysis for Identification of Individual, Scope & its forensic application in the field of security, Related Case Studies and its admissibility in court proceedings.

## **MSFS 2126 Audio Recognition & Video Analysis**

Recording, editing, processing, and conversion of audio files using Goldwave v 5.63 software.

Speech acquisition and analysis of speech samples using CSL-4500 and Multispeech software.

Detection of tampering in audio files, audio restoration and speech enhancement using CEDAR Cambridge<sup>TM</sup>.

Working procedure of SIS.

Working procedure of Voice net software.

Video analysis and detection of tampered video files using Videofocus.

### **Reference books:**

Forensic Speaker Identification by Phil Rose & James R Robertson

Forensic Voice Identification by Harry Hollien

The Acoustic Analysis of Speech by Ray D Kent & Charles Read

Speech Language & Hearing Disorders by Franklin H Silverman

Voice Recognition by Richard L Klevans & Robert D Rodman

**Specialization**  
**In**  
**Fingerprints &**  
**Questioned Document**

# **School of Forensic Sciences**

## **M. Sc. Forensic Sciences**

### **MSFS 2131 Modern Trends in Fingerprint Sciences**

#### **UNIT-I**

Introduction and re capsulation to fingerprint Sciences  
Functions of Fingerprints bureau  
Fundamental principles of fingerprint Sciences  
Anatomy of skin, Biological significance of skin  
Composition of sweat, secretary glands eccrine glands apocrine glands Sebaceous glands chemical composition  
Age of donor- various age groups  
Composition of latent print residues

#### **UNIT-II**

Chemical developmental methods:

Iodine fuming, cyanoacrylate esters acceleration procedures  
Post treatment procedures  
Fluorescent and other chemical alternatives  
Ninhydrin analogues  
Silver nitrate reagent  
Special surfaces and situations : bloody prints, tape and sticky surfaces and skin  
Postmortem fingerprinting techniques

#### **UNIT-III**

Latent print enhancement by Laser and other alternate light sources:

Using photo luminescent nano particles  
Basics of time gated fingerprint detection  
Basics of phase resolved imaging  
Fingerprint treatments :lanthanide based procedures  
Photo luminescent fluorescence and phosphorescence  
Use of Nano particles :cadmium , Zinc, Silver salts

Silver physical development of latent prints:

Silver physical development process of latent prints

Formation of silver physical developer particles and preparation

Water and acid pretreatment

Multi metal deposition process

Colloidal gold solution , modified physical developer enhancement techniques

Digital imaging methods, optic methods, X ray , SEM methods

Chemical methods: bleaching , intensification

#### **UNIT-IV**

Introduction to Molecular fingerprinting- importance of the molecules detected from the fingerprint residues- factors influencing them- identification characteristics with the molecular concentration

Importance of ridgeology and poroscopy- for individual identification-

Application of the pores dimensions and ridge dimensions in the identification- scope of establishing the identification – characteristics and traits. Application of edgeoscopy- personal identification using fingerprints

#### **UNIT-V**

Automated fingerprint Identification and imaging systems:

Introduction , emerging application

System architecture, sensing, finger print representation

Minutiae feature extraction , orientation, estimation, segmentation

Segmentation, ridge detection

Ridge detection, finger print matching enhancement

Challenges , system issues system evaluation

Other biometric methods of identification iris scan, retinal scan.

Cheiloscopy, palato prints, ear prints etc. in forensic and other Sciences.

Importance of poroscopy , ridgeology/ edgeoscopy

An introduction to UID aadhaar and its significance

Scope of research on DNA from fingerprint residues

#### **MSFS 2134 Modern Trends in Fingerprint Sciences Laboratory**

Analysis of fingerprints with microscopic techniques for the ridge dimensions with the complete identification profiling

Comparison of males' and females' fingerprints with the specific reference to the ridge dimensions

Development of latent finger prints using Ninhydrin.  
Development of latent finger prints using iodine fuming  
Development of latent finger prints using Nanoparticles  
Understanding AFIS method of fingerprints analysis  
Palatoprints  
Cheiloscopy  
Importance of molecular fingerprints with special reference to fingerprint residues using instrumental methods

### **Reference Books:**

- David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press (1999)  
E. Roland Menzel; Fingerprint Detection with Lasers, 2nd Ed., Marcel Dekker, Inc. USA (1999)  
James F. Cowger; Friction Ridge skin, CRC Press London, (1993)  
Mehta, M.K; Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay (1980)  
Moenssens; Finger Prints Techniques, Chitton Book Co. Philadelphia, NY (1975)  
Chatterjee S.K.; Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata (1981)  
Cowger, James F; Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY (1993)  
Cook Nancy; Classifying Finger Prints, Innovative learning pub. Mento Park (1995)  
Cossidy M.J; Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada (1980)  
J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press (2000)  
Smith B.C, Holland MM, Sweel DL & Dizinno. A; DNA & Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA (1995)  
Hillison, S; Dental Anthropology, Cambridge Univ. Press, UK (1996)  
Kasprzak J; Possibilities of Cheiloscopy in Forensic Sciences (1980)  
Iannarelli, A V; Ear Identification, Forensic Identification series, Paramount (1989).  
Henry C. Lee & R. E. Ganesslen; Advances in Finger Print Technology, CRC Press, London (1991).  
Saxena, B.L.; Law and techniques relating to identification of handwriting, disputed documents, finger prints, foots and detection of forgeries, Central Law Agency, Allahabad (1990)  
Hardless, H.R; Disputed documents examination and fingerprints Identification (with Illustrations, Sketches, Diagrams, Photos etc), Law Book Co. Allahabad (1995)  
Menzel, E Roland; Fingerprint detection with lasers, Marcel Dekker, NY (1999)  
Jain L C; Intelligent Biometric Techniques in Fingerprint and face recognition, CRC Press Ohio (1999)  
Bridges B C; Criminal Inverstigation, Practical fingerprinting, Thumb Impressions, Hand writing expert testimony opinion Evidence, University Book Agency, Allahabd (2000)  
Maltoni, Davide; Handbook of fingerprint recognition, Springer Verlag, NY (2003)  
Ratha Nalini; Automatic Fingerprint recognition system, Springer Pub., NY (2004)

# **School of Forensic Sciences**

## **M. Sc. Forensic Sciences**

### **MSFS 2132 Questioned Documents & Forensic Accounting**

#### **UNIT-I**

Basics of handwriting identification & individuality of handwriting, natural variations, process of comparison, types of documents-genuine and forged documents, holographic documents, Care and Handling of Document Exhibits, Forgeries & its types, detection of forgeries in handwriting, signatures and related case studies, basic tools needed for forensic documents examination and their significance.

#### **UNIT-II**

Disguised writing and anonymous letters- Identification of writer  
Examination of alterations- erased writing, overwritings, additions, substitutions and obliterations  
Examination, preservation and decipherment of secret writing, Indented writings and charred writings, Examination of seal and other mechanical impressions  
Built up documents, determination of sequence of strokes, physical matching of documents

#### **UNIT-III**

Examination of Photostat (Xerox) copies, carbon copies, fax message, typewritings, printed matter: letterpress printing, intaglio printing, offset printing, screen printing & its related concepts, types of printing of security documents, examination of counterfeit currency notes, passports, visa, credit cards, debit cards, pan card, license, stamp papers, legal deeds, postal stamps, etc, Related Case Studies.

#### **UNIT-IV**

Determination of age of document and writings  
Types of computer printers and their working: dot-matrix, daisywheel, line printers, ink-jet, thermal jet and laser printers, Examination of Computer printouts  
Forensic linguistics and stylistics, its importance in writer identification Examination of e-documents and digital signatures

Opinion- Reporting to the court juxtaposed charts - evidence in the court- cross examination,  
Related Case Studies

## **UNIT-V**

Introduction to Forensic accounting, Money laundering, Fraud deterrence, Types of money laundering, understanding business information & financial reporting system accounting & auditing standards & procedures, evidence gathering & investigative techniques, litigation processes, Examination of financial documents.

### **MSFS 2135 Questioned Documents & Forensic Accounting Laboratory**

Examination of ink by TLC  
Examination of ink by GCMS  
Examination of ink by LCMS  
Examination of ageing of paper  
Examination of currency notes  
Examination of Passport  
Examination of Stamp  
Examination of Rubber Stamp Impressions  
Related case studies

### **Suggested Readings**

Ordway Hilton; Scientific Examination of Questioned Documents, Rev ED, Elsevier, NY (1982)  
Albert S. Osborn; Questioned Documents, 2nd Ed., Universal Law Pub., Delhi (1998)  
Albert S Osborn; The Problem of Proof, 2nd Ed., Universal Law Pub. Delhi (1998)  
Charles C. Thomas; I.S.Q.D. Identification System for Questioned Documents, Billy Prior Bates Springfield, Illinois, USA (1971)  
Wilson R. Harrison; Suspect Documents Their Scientific Examination, Universal Law Pub. Delhi Indian Reprint (2001)  
Hard less H.R; Disputed Documents, Handwriting and Thumbs – Print Identification, profusely illustrated, Law Book, Allahabad (1988)  
Morris Ron N; Forensic Handwriting Identification, Acad Press, London (2001)  
Kurtz Sheila; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA (1983)  
Lerinson Jay; Questioned Documents, Acad Press, London (2001)  
Mcmenamain, Gerald R; Forensic Linguistics- Advances in Forensic Stylistics, CRC Press, Washington, D.C. (2002)  
Ellen David; Questioned Documents- Scientific Examination, Taylor & Francis, Washington (1997)  
Roy A Huber, A.M. Headrick; Handwriting Identification- Facts and Fundamental, CRC Press (1999)



# **School of Forensic Sciences**

## **M. Sc. Forensic Sciences**

### **MSFS 2133 Forensic Photography & Biometric Traits**

#### **UNIT-I**

Introduction to Photography, photographic instruments: light sources, types of camera and lenses, optical filters, fundamentals of light and vision, Basic principles and techniques of Black & White and color photography, Spectral sensitivity of photographic materials, Concepts of colored photography, Camera exposure determination.

#### **UNIT-II**

Linkage of cameras and film negatives, Modern developments in photography: digital photography, Image sensors, photo shop-development- digital images processing and manipulation- forensic application,

#### **UNIT-III**

Crime scene photography, photomicrography, macro photography, photography of fingerprints and documents, IR and UV photography, photogrammetry, crime scene videography / high speed videography, and laboratory photography, Court representation and admissibility in judicial system.

#### **UNIT-IV**

Introduction to Biometrics, Types of Biometrics, Biometric applications, Technique of biometric recognition: Facial recognition, Hand geometry, Fingerprints, Iris scan & Retinal Scan, Thermogram.

#### **UNIT-V**

Gait Pattern, Keystroke Analysis, Signature Analysis, Voice pattern Analysis, Heartbeat Analysis, Recent Advances in Biometrics for Security Prospects.

## **MSFS 2136 Forensic Photography & Biometric Traits laboratory**

Photography of objects-close up, normal, telephoto and processing.

Document and Finger print photography.

Crime scene photography-long shot, medium and close up shots

Developing of black and white Photographic prints

Photomicrography and Macro photography

Photography with different filters for developing contrasts.

Study on types of Biometric Analysis

# *Semester- IV*

MSFS 2200 Lab Work/ Dissertation

