

**Dr. Babasaheb Ambedkar Marathwada University,  
Aurangabad**



*Syllabus for*

**M.Sc. Forensic Science  
Sem-I & II**

**(Only for Department of Forensic Science, Dr. BAM University, Aurangabad)**

Effective from the academic year **2022-23**

## **Structure and Curriculum for M.Sc. Forensic Science Programme (Choice-Based Credit and Grading System)**

The M. Sc. Forensic Science programme is divided into four semesters having 108 credits. There are 16 theory courses of 62 credits, 08 laboratory courses of 32 credits, a research project of 12 credits (distributed in III and IV semesters), and one course on the constitution of India, which is of 02 credits. Tutorials, assignments, and seminar presentations are an integral component of all theory courses

### **Eligibility:**

Any candidate possessing a B.Sc. degree in any stream from a recognized college/university. Students of B.Sc. Forensic Science will be given the preference. The eligibility can be modified as per the regulations issued by the university from time to time.

### **Admission / Promotion Process:**

In response to the advertisement for registration, interested students will have to register themselves. Admission will be done on the basis of the Common Entrance Test (CET) (50% weightage) and the performance of students at their qualifying graduate level examination (50% weightage of Marks obtained at B. Sc level) or direct on marks obtained in the qualifying examination. Once the student is admitted he/she will be promoted to the 2nd year (3rd semester) as per university rules and regulations. The admission of the concerned student will be automatically cancelled if he/she fails to complete the M. Sc. degree within a period of maximum four years / eight semesters.

### **Choice-Based Credit System (CBCS):**

The choice-based credit system has been adopted by this department. This provides flexibility to make the system more responsive to the changing needs of our students, professionals, and, society. It gives greater freedom to students to determine their own pace of study. The credit-based system also facilitates the transfer of credits.

### **Credit-to-contact hour Mapping:**

One contact hour per week is assigned 1 credit for theory and 0.5 credits for laboratory courses/research projects. Thus a 4- credit theory course corresponds to 4 contact hours per week and the same analogy will be applicable for laboratory courses/research projects.

### Course Structure:

MSFS- M.Sc. Forensic Science, P-Paper, L-Lab, E- Elective, D- Dissertation

<b>Semester I</b>				
<b>Course</b>	<b>Course Title</b>	<b>Teaching time/week</b>	<b>Marks</b>	<b>Credits</b>
MSFS-1T1	Introduction to Forensic Science	4 hours	100	4
MSFS-1T2	Instrumental method of analysis	4 hours	100	4
MSFS-1T3	Crime Scene Investigation and Evidences	4 hours	100	4
MSFS-1T4	Forensic Ballistics and Explosives	4 hours	100	4
COM-100	Constitution of India	2 hours	50	2
MSFS-1L1	Lab course 1 (Based on MSFS-1T1 and 1T2)	8 hours	100	4
MSFS-1L2	Lab course 2 (Based on MSFS-1T3 and 1T4)	8 hours	100	4
<b>Total Credits for Semester I : 26 ( Theory : 18 ; Laboratory : 08 )</b>				
<b>Semester II</b>				
MSFS-2T1	Document and Fingerprint Forensics	4 hours	100	4
MSFS-2T2	Digital Forensics and Biometrics	4 hours	100	4
MSFS-2T3	Forensic Toxicology and Medicine	4 hours	100	4
MSFS-2T4	Forensic Biology, Serology and DNA Fingerprinting	4 hours	100	4
MSFS-2T5	Research Methodology	2 hours	50	2
MSFS-2L1	Lab course 3 (Based on MSFS-2T1 and 2T2)	8 hours	100	4
MSFS-2L2	Lab course 4 (Based on MSFS-2T3 and 2T4)	8 hours	100	4
<b>Total Credits for Semester II : 26 (Theory : 18 ; Laboratory : 08)</b>				

# **SEMESTER-I**

## **MSFS-1T1: Introduction to Forensic Science**

### **UNIT-I**

#### **Introduction to Forensic Science**

- Definition and scope of forensic science
- Laws and principles of Forensic Science
- History and development of Forensic Science (global and Indian perspective)
- Branches of forensic science
- Directorate of Forensic Science Services and Forensic Science Laboratories in India
- Organizational set-up of forensic science laboratory
- Function and responsibility of forensic scientists

### **UNIT-II**

#### **Law**

- Sections of Indian Evidence Act: 32, 45, 46, 47, 57, 58, 60, 65, 65A, 65B, 73, 135, 136, 137, 159,
- Sections of Criminal Procedure Code: 53, 53A, 54, 291, 292, 293, 311A
- Sections of Indian Penal Code: 299, 300, 302, 303, 304, 304B, 306, 319, 320, 326, 339, 340, 351, 359, 362, 375, 377, 378, 383, 390, 405, 415, 441, 463, 471, 499, 503 and 511

### **UNIT-II**

#### **Crime and Criminology**

- Crime: definition, elements, and types of crime
- Criminology: Introduction and various perspectives of criminal behavior
- Criminal justice system: definition and component, structure and functions of law enforcement agencies (police), structure and functions of courts, structure, and functions of corrections
- Introduction to Organizations: NCRB, BPR&D, CBI, CID, NIA, IB, R&AW, Interpol
- Court testimony: Admissibility of expert testimony, pre-court preparation and court appearance, examination-in-chief, cross-examination, and re-examination

### **UNIT- IV**

#### **Investigative techniques and Statistics**

- Polygraph, narco-analysis, brain mapping
- Statistics: Data and its types, basic concept of frequency distribution, measure of central tendency: mean, median, mode, measure of dispersion: range, mean deviation, standard deviation, and variance, probability: classical definition of probability, addition theorem,

multiplication theorem, conditional probability, test of hypothesis: t-test, chi-square test, F-test and ANOVA

**Reference Books:**

1. Richard Saferstien, Forensic Science: From the Crime Scene to the Crime Lab, 4th edition, Pearson, USA.
2. B. R. Sharma, Forensic Science: Criminal Investigation and Trial, Universal Publication, New Delhi
3. Suzane Bell, Forensic Science: An Introduction to Scientific and Investigative Techniques, Fifth Edition, CRC Press.
4. Mahendra P Singh, V N Shukla's Constitution of India, Fourteenth Edition, Eastern Book Company, New Delhi.
5. Evidence Act, 1872, Bare Act with Case Laws, Forty-eighth Edition, Eastern Book Company, New Delhi.
6. Code of Criminal Procedure, 1973 Bare Act, Thirty-fifth edition, Eastern Book Company, New Delhi.
7. Penal Code, 1860, Bare Act, State amendments and case laws, Forty-fourth edition, Eastern Book Company, New Delhi.
8. Ram Ahuja, Criminology, Rawat Publishers, New Delhi
9. Hans Raj Bhardwaj, The Criminal Justice System in India, Konark Publishers Pvt. Ltd., New Delhi
10. David M. Diez, Christopher D. Barr, Mine Çetinkaya-Rundel, OpenIntro Statistics, OpenIntro, 2016.
11. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.

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## **MSFS-1T2: Instrumental Methods of Analysis**

### **UNIT- I**

#### **Spectroscopy-I**

- Electromagnetic radiation (EMR)
- Wave and quantum properties of EMR
- Atomic and Molecular spectra
- UV-Visible Spectroscopy: Principle, instrumentation, and forensic applications
- IR-Spectroscopy: Principle, instrumentation, and forensic applications

### **UNIT- II**

#### **Spectroscopy-II**

- Raman Spectroscopy: Principle, instrumentation, and forensic applications
- Mass Spectroscopy: Principle, instrumentation, and forensic applications
- Atomic Absorption Spectroscopy: Principle, instrumentation and forensic applications
- Atomic Emission Spectroscopy: Principle, instrumentation and forensic applications
- X-Ray; principle, instrumentation, and applications of XRF and XRD

### **UNIT-III**

#### **Separation Techniques**

- Introduction to chromatography and principle of separation: adsorption, partition, ion exchange, size-exclusion
- TLC: principle, method, and forensic applications
- HPTLC: principle, instrumentation, and forensic applications
- HPLC: principle, instrumentation, and forensic applications
- GC: principle, instrumentation, and forensic applications
- Hyphenated Techniques: LC-MS, GC-MS

### **UNIT-IV**

#### **Bioanalytical Techniques**

- pH and buffers, physiological solutions
- Centrifugation techniques: the basic principle of sedimentation, various types of centrifuges, density gradient centrifugation, preparative centrifugation, analysis of sub-cellular fractions, ultra-centrifuge-refrigerated centrifuges
- Electrophoresis: principle, types, instrumentation, and applications
- Immunoassay techniques
- Microscopy: Basic concepts of microscopy, simple and compound microscope, comparison, polarizing microscope, phase contrast microscope, fluorescence microscope, Stereo-microscope, scanning electron microscope, and transmission electron microscope

## Reference Books

1. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Principles of Instrumental Analysis, Cengage Learning
2. Hobart H. Willard, Lynne Lionel Merritt, John Aurie Dean, Frank A. Settle, Instrumental Methods of Analysis, CBS Publishers.
3. Suzanne Bell and Keith Morris, An Introduction to Microscopy, CRC Press
4. Abhilasha Shourie, Bioanalytical Techniques, The Energy and Resources Institute

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## **MSFS-1T3: Crime Scene Investigation and Evidences**

### **UNIT-I**

#### **Introduction**

- Introduction to crime scene and its classification
- Crime scene management and its component
- Processing of crime scene: initial survey, assistance to victims, securing the scene, documentation of crime scene, role of first responding officer
- Searching methods of evidences at scene of crime
- Methods for collection and packaging of evidence
- Forwarding the evidence to forensic science laboratories
- Maintaining chain of Custody
- Physical evidence and its types

### **UNIT-II**

#### **Glass, paint, and soil as evidence**

- Glass: introduction to glass, types and their composition, forensic examination of glass fractures under different conditions. Determination of the direction of impact, physical measurement of glass: color, fluorescence, physical matching, density, refractive index, elemental profiling.
- Paints: Introduction, composition, type of paints, forensic examination of paints and coatings: collection and preservation, microscopic techniques for examination, chemical methods for analysis and interpretation, instrumental methods for analysis.
- Soil: soil and its composition, classification of soil, collection and preservation of soil analysis of soil samples: physical, chemical and instrumental
- Restoration of erased numbers: principle of restoration, techniques of alteration of numbers, methods of restoration on various surfaces

### **UNIT- III**

#### **Impression evidence**

- Footprint/Shoeprint: introduction, collection and lifting methods, methods of comparison, gait pattern and its importance in person identification
- Toolmark: introduction, types, class, and individual characteristics, collection and preservation, forensic examination
- Tyre marks: introduction, types, class and individual characteristics, skid marks, tyre as evidence, collection and packaging, forensic examination

- Lip print: introduction to cheiloscopy, history and development, classification, collection, packaging and forensic examination
- Bite marks: introduction and types, collection from the surface and from the suspect, forensic examination.

#### **UNIT– IV**

##### **Bloodstain Pattern and Crime Scene Reconstruction**

- Bloodstain Pattern: Historical perspective, physical and biological properties of human blood, classification: spatter and non-spatter, droplet directionality and angle of impact, determination of Point of convergence and point of origin, altered bloodstain patterns
- Crime Scene reconstruction (CSR): nature and importance of CSR, basic principles and stages. Case study for CSR.

##### **Reference Books**

1. Henry C Lee, Crime Scene Handbook, Academic Press
2. Ross M. Gardner and Tom Bevel, Practical Crime Scene Analysis and Reconstruction
3. Max M. Houck and Jay A. Siegel, Fundamental of Forensic Science
4. Jaqueline T fish, Larry S. Miller, Crime Scene Investigation
5. Barry A J Fisher, David R. Fisher, Technique of crime scene investigation
6. Richard Saferstein, Introduction to criminalistics
7. Tom Bevel, Ross Gardner, Bloodstain pattern analysis with introduction to crime scene reconstruction. Third edition.
8. Richard Saferstein, Criminalistics: An Introduction to Forensic Science (10th Edition)
9. Richard Saferstein, Handbook of Forensic Science, Volume-I, II and III

## **MSFS-1T4: Forensic Ballistics and Explosives**

### **Unit- 1**

#### **Introduction to Ballistics**

- Introduction to ballistics and its importance in crime investigation
- Types of ballistics
- Firearms: Brief history, types of weapons, and their mechanism
- Ammunition: Brief history, Types of ammunition, nomenclature, percussion caps and their types, various priming composition, propellants, types of cartridge cases, their heads, various types of bullets, and their compositional aspects.
- Safety aspects about the handling of firearms and ammunition.

### **Unit- II**

#### **Firearm evidence and its analysis**

- Physical evidence available in crime involving firearms, principles, and practice of identification of firearms, class and individual characteristics, various marks on fired cartridge cases and bullets, test firings, techniques of obtaining test materials, comparison microscope and
- Matching of marks on evidence and test exhibits, automated bullet-cartridge identification system – IBIS and NIBIN.
- Estimation of range of firing: burning, blackening, tattooing, the spread of pellets, Walker's test.
- Chemical tests of copper and lead around gunshot holes.
- Gun-Shot Residue Analysis: Mechanism of formation of gunshot residue, various methods of the lifting of gunshot residue, Dermal nitrate test, why was it abandoned, detection of GSR by AAS.

### **Unit-III**

#### **Explosives**

- Explosives: Explosive, types of explosives and their chemical structure
- Initiation techniques: combustion, detonation and deflagration, thermal decomposition Explosion and its effects, type of hazards, the effect of the blast wave on structures and humans.
- IEDs and firing mechanisms of IEDs.
- Collection of samples, Methods for extraction of explosives from post blast material/debris
- Qualitative analysis of explosives and explosion residue by preliminary analysis and Instrumental techniques.
- ASTM guidelines for analysis of explosives/post blast debris

### **Unit-IV**

#### **Fire and Arson**

- Fire and arson: introduction, pathology of arson
- Chemistry and Physics of combustion

- Fire dynamics: introduction, ignition: spontaneous and chemical ignition, flames and flame abilities, development of fire pattern
- Investigation of fire and arson: Planning of investigation, survey, determination of origin and cause of fire, reconstruction
- Analysis of ignitable liquid residue (ILR): standard method for extraction of ILR, analysis of ILR, criteria for identification: (a) gasoline (b) distillates and other classifiable products

### **Reference Books**

1. Hatcher, Jury and Weller, Firearm Investigation, Identification and Evidence, Stackpole Books
2. Brain J Heard, Handbook of Firearms and Ballistics, John Willey
3. John L Lentini, Scientific Protocols for Fire Investigation, CRC Press
4. Alexander Beveridge, Forensic Investigation of Explosion, CRC Press
5. Max M. Houck and Jay A. Siegel, Fundamental of Forensic Science

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**MSFS-1L1: Laboratory Course-1 (Based on MSFS-1T1 and MFS-1T2)**  
**(At least six experiments have to be performed)**

**List of experiments:**

1. To study laws and principles of forensic science
2. Examination of hair/fibre through a microscope
3. Examination of soil through a microscope
4. Estimation of pH of a given solvent/solution
5. Examination of chemicals/drugs using TLC
6. Examination of chemicals/drugs using UV-visible spectrophotometer
7. Examination of chemicals/drugs using FT-IR spectrophotometer
8. Examination of chemicals/drugs using Gas Chromatography
9. Examination of chemicals/drugs using HPLC
10. Examination of chemicals/drugs using HPTLC
11. Examination of chemicals/drugs using AAS
12. Examination of chemicals/drugs using XRF

**SCHEME OF MARKING**

- I. A major question based on chromatography/spectroscopy – 30 marks
- II. two minor questions on microscopy/Laws and principles/TLC etc.-20 marks each
- III. Journal- 10 marks
- IV. Viva-voce-20 marks

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**MSFS-1L2: Laboratory Course-2 (Based on MSFS-1T3 and MFS-1T4)**  
**(At least six experiments have to be performed)**

**List of experiments:**

1. To perform crime scene photography
2. To perform crime scene sketching
3. To collect various evidences from the scene of the crime
4. To reconstruct the given crime scenes
5. To examine given glass pieces for its (dis)similarity (color/opacity/refractive indices/density etc.)
6. To examine given soil samples for (dis) similarity (color, ignition, density gradient, weight loss etc.)
7. To restore erased numbers from different vehicles/articles/firearms
8. Physical and chemical examination of given paint samples
9. Study footprints/tyre marks on various surfaces
10. Study tool marks on various surfaces
11. Classify various blood spatter patterns
12. Determination of angle of impact from blood droplets
13. Determination of point of origin and area of convergence from the given blood spatters
14. Study firing mechanism of various firearms
15. Study bullets/palettes of the given firearms
16. Study firing range from the given ammunitions/firearms
17. Analysis of gunshot residue
18. Examination of various explosives
19. Examination of ignitable liquid residue

**SCHEME OF MARKING**

- I. A major question based on crime scene/blood spatter/erased numbers - 30 marks
- II. Two minor questions on any of the method for measuring (dis)similarity/comparison-20 marks each
- III. Journal- 10 marks
- IV. Viva-voce-20 marks

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# **SEMESTER-II**

## **MSFS-2T1: Document and Fingerprint Forensics**

### **UNIT-I**

#### **Fingerprint Forensics-I**

- History and development of fingerprints
- Scientific basis for persistence and uniqueness of fingerprints
- Fingerprint patterns and related terms: Delta, type lines, core, ridge counting, ridge tracing
- Classifications: Henry, Henry-FBI, single digit classification, NCIC classification
- Recording of fingerprints: Rolled and plain impression
- Recording of fingerprints of mutilated/damaged fingers and of dead

### **UNIT-II**

#### **Fingerprint Forensics-II**

- Types of fingerprints at the crime scene: patent, plastic, and latent prints
- Various factors influencing the development of fingerprint
- Sweat glands, the composition of sweat, and its role in fingerprint development
- Development of latent prints: Physical and chemical methods
- Enhancement of partially visible fingerprints including bloody prints
- Lifting of fingerprints
- Fingerprint comparison and identification
- Introduction to Automated Fingerprint Identification System

### **UNIT-III**

#### **Document Forensics-I**

- Document forensics: Introduction and scope
- Nature and types of documents
- Handling, preservation, and care of documents
- Preliminary examination of documents
- Handwriting/signature Identification: Principles and characteristics
- Methods for collection of standards of handwriting/signature
- Computer based handwriting examination
- Forgeries, its types and their detection

### **UNIT- IV**

#### **Document Forensics-II**



- Alteration in documents and their examination: addition, erasure, obliteration, overwriting
- Decipherment of secret writing, indented writing, and charred documents
- Determination of the sequence of strokes
- Examination of counterfeit currency, passport, visa, credit, and debit cards
- Examination of rubber stamps, seals, and other mechanical impressions
- Examination of printers and printed/photocopied documents
- Instrumentations/equipment used in document examination
- International Standards for Document Examination: NIST, SWGDOC

**Reference Books:**

1. Hawthorne, Mark R., Fingerprints: analysis and understanding, CRC Press, 2009.
2. Henry C. Lee and R.E. Gaensslen, Advances in fingerprint technology, Second Edition, CRC Press, 2001.
3. Marzena Mulawka, Postmortem Fingerprinting, and Unidentified Human Remains, Elsevier, 2014.
4. Christophe Champod, Chris Lennard, Pierre Margot, And Milutin Stoilovic, Fingerprints, and Other Ridge Skin Impressions, CRC Press, 2004.
5. Eric H. Holder, Jr., Laurie O. Robinson, and John H. Laub, The Fingerprint Sourcebook, US Department of Justice, 2009.
6. Jan Seaman Kelly and Brian S. Lindblom, Scientific examination of questioned documents, Taylor and Francis, 2006
7. Roy A. Huber and A.M. Headrick, Handwriting Identification: facts and fundamentals, CRC Press, 1999.
8. A. S. Osborn, Questioned Documents, 6<sup>th</sup> Edition, Law and Justice Publishing Company, 2020
9. Wilson R. Harrison, Suspect Documents Their Scientific Examination, 5th Edition, Universal Law Publishing, 2011.
10. Ellen, David, The scientific examination of documents: methods and techniques, 3rd Edition, CRC Press, 2005
11. Jane A. Lewis, Forensic Document Examination, Elsevier, 2014

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## **MSFS-2T2: Digital Forensics and Biometrics**

### **UNIT-I**

#### **Foundation to Digital Forensics**

- Basics of computer operation, hardware, and software
- Number systems: binary and hexadecimal
- Types of memory and storage of data
- File systems
- File extensions and file signatures
- Basics of computer networks

### **UNIT-II**

#### **Basics of Digital Forensics**

- Introduction to Digital evidence and Digital Forensics
- Computer crimes and their types
- History and terminology of computer crime investigation
- Handling the scene of crime in computer-related crimes: steps, evidence collection, and reconstruction
- A brief introduction to IT Act and admissibility of electronic/digital evidences

### **UNIT-III**

#### **Tools and techniques in Digital Forensics**

- Memory Forensics: tools and techniques
- Forensic Examination of Window Systems
- Forensic Examination of Linux and Macintosh System
- Forensic Examination of Computer Networks
- Mobile Forensics: tools and techniques

### **UNIT- IV**

#### **Biometrics**

- Introduction to biometric and biometric system
- A general overview of components and working of a biometric system
- Physiological biometrics and system: fingerprint, face, iris, palm print
- Behavioral biometrics and system: voice, signature, gait
- Soft biometrics
- Multi-biometric system and security issues

**Reference Books:**

1. Eoghan Casey, Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet, Second Edition, Academic Press, 2004
2. Eoghan Casey, Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet, Third Edition, Academic Press, 2011
3. John Sammons, The Basics of Digital Forensics, Syngress, Elsevier, 2012.
4. Marjie T. Britz, Computer Forensics and Cyber Crime, Pearson, 2013
5. Stephen Pearson and Richard Watson, Digital Triage Forensics: Processing the Digital Crime Scene, Syngress, Elsevier, 2010.
6. Brian Carrier, File Systems Forensic Analysis, Addison-Wesley Professional, 2005
7. Gerard Johansen, Digital Forensics and Incident Response: A practical guide to deploying digital forensic techniques in response to cyber security incidents, Packt, 2017.
8. Anil K. Jain, Arun A. Ross and Karthik Nandakumar, Introduction to Biometrics, Springer, 2011.
9. Ruud M. Bolle, Jonathan H. Connell, Sharath Pankanti, Nalini K. Ratha and Andrew W. Senior, Guide to Biometrics, Springer, 2004.

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## **MSFS-2T3: Forensic Toxicology and Medicine**

### **UNIT-I**

#### **Introduction to Forensic Toxicology and Drugs of Abuse**

- Introduction and concepts of forensic toxicological examination
- Definition and classification of poison, methods of administration of poison
- Mode of action of the poison, diagnosis, and management of poisoning cases
- Classification of drug of abuse: depressant, stimulant, and hallucinogen; Depressants: opium and opioids, barbiturates, and benzodiazepines; Stimulants: cocaine, nicotine, and amphetamines; Hallucinogens: cannabis and its derivatives, phencyclidine and LSD.
- Alcohol and alcoholic beverages
- Collection and preservation of biological and non-biological samples in a toxicological analysis
- Extraction and isolation of poison/drug using classical and modern method
- Pharmacokinetics: Absorption, distribution, metabolism and excretion of drug/poison

### **UNIT-II**

#### **Methods of Analysis of Poison/Drug**

- Analysis of Inorganic poisons (metallic, non-metallic and anions)
- Analysis of neutral poisons
- Analysis of basic drugs/poison
- Analysis of acidic drug/poison
- Analysis of volatile poisons

### **UNIT-III**

#### **Forensic Medicine-I**

- Objective of medicolegal examination
- Legal aspects in view of forensic medicine: Inquest, exhumation, dying declaration, dying deposition, medical certificate, medical report, postmortem reports.
- Death: definition, types, signs, cause, mode, manner and stages
- Postmortem changes in the body: early and late changes
- Asphyxia: Mechanical asphyxia, strangulation, suffocation, and drowning

### **UNIT- IV**

#### **Forensic Medicine-II**

- Medical Autopsy: introduction and objective, rules, internal and external examination of

body

- Injury: Introduction, classification and medico legal aspects of injuries
- Mechanical injury: Abrasions, Bruises, Lacerations, Incised wounds, stab wounds, defense wound and self-inflicted wounds
- Regional injuries- Head injury, injuries to brain, abdomen and other body parts
- Accident injuries: vehicular injuries, railway injuries and aircraft injuries
- Injury due to fall from a height
- Thermal injuries: Burn and scalds, Lightning, Electricity and Explosions.

**Reference Books:**

1. Textbook of Forensic Medicine and Toxicology, Nageshkumar G Rao, Jaypee Publishers, 1999.
2. Textbook of Forensic Medicine and Toxicology, Anil Aggarwal, Avichal Publishing Company, 2014.
3. Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology: C.K. Parikh, CBS Publishers & Distributors Pvt. Ltd., India, 1999
4. Forensic Medicine: Guharaj, P. V., Chandran M. R, 2nd Ed., Universities Press (India) Pvt. Ltd., Hyderabad, 2006 .
5. Modi's Medical Jurisprudence and Toxicology-23 rd Ed. Publisher-Lexis Nexis Butter worths Wadhwa.
6. John R. Dean, Extraction techniques in analytical sciences, John Wiley and Sons.
7. Clark, E.G.C.; Isolation and Identification of Drugs, Vol. I and Vol. II, Academic Press, (1986)
8. Michael J. Deverlanko etal: Hand Book of Toxicology, CRC Press, USA (1995)
9. Text book of Micro chemistry of poisons including their physiological, pahalogical and legal relation. -Theodore George

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## **MSFS-2T4: Forensic Biology, Serology and DNA Fingerprinting**

### **UNIT-I**

#### **Forensic Biology**

- Introduction and scope of Forensic Biology
- Study and identification of pollen grains
- Diatoms in drowning cases
- Wildlife forensics: Scientific examination of physical evidence like hair, nails, teeth, ivory, pugmarks, etc.
- Forensic Anthropology: Bones and their characteristics in humans, identification (age, sex, stature, and race) of a person based on bone
- Forensic Odontology: Eruption of teeth in humans, identification of a person based on teeth
- Examination of Hair and Fibre: morphology, nature and Forensic examination
- Introduction to microbes in Forensics

### **UNIT-II**

#### **Forensic Serology**

- Introduction to Forensic Serology
- Blood and its composition
- Screening and confirmatory test for identification of blood
- Blood typing/Grouping: ABO systems, Rh, MN, I, P, Kell, Duffy, Kidd, Lewis, Lutheran, Bombay blood group
- ABO typing of dried blood stains
- Forensic Examination of other body fluids: semen, saliva, urine, fecal matter, vomit and vaginal secretion.
- Overview of cells and organs of immune system and basic immunology

### **UNIT-III**

#### **Basic Biochemistry**

- Amino Acids: structure and functional group properties
- Proteins: composition: primary, secondary and tertiary structure
- Carbohydrates: definition, classification and biological importance, Monosaccharides: isomerism, anomers, sugar derivatives, Disaccharides, Polysaccharides, structure of starch, glycogen and glycosaminoglycans
- Lipids: definition, classification and biological importance, fats and fatty acids, introduction to compound lipids, cholesterol, bile salts, micelle, biomolecular leaflet, lipoproteins

## **UNIT– IV**

### **DNA Fingerprinting**

- Chemical Structure of DNA and RNA
- Overview of DNA replication, transcription, and translation
- Collection and preservation of biological samples for DNA analysis
- Techniques of DNA isolation and quantification
- DNA Separation techniques
- History of DNA fingerprinting and DNA Polymorphism
- Genes and DNA markers in Forensic DNA analysis
- Introduction to Polymerase Chain Reaction (PCR)
- Introduction to mitochondrial DNA and its forensic applications

### **Reference Books:**

1. Richard Ali, Forensic Biology, Second Edition, CRC Press, 2015
2. Alan Gunn, Essential Forensic Biology, Third Edition, Wiley, 2019
3. James R. Robertson, Forensic Examination of Hair, Taylor and Francis, 1999
4. B. J. Culliford, The Examination and Typing of Blood Satins in Crime Laboratory, Dept. of Justice, US, 1986
5. John M Butler, Forensic DNA Typing, Second Edition, Academic Press, 2005
6. Nelson and Cox, Leininger Principles of Biochemistry, Sixth Edition, W. H. Freeman and Co., 2012

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## **MSFS-2T5: Research Methodology**

### **UNIT-I**

#### **Fundamentals of Research**

- Introduction to research methodology
- Definition and basic concepts of research
- Objectives of research and motivation behind research
- Types of research
- Research process: defining research problem, review the literature, formulation of hypothesis, research design, collection and analysis of data, interpretation and writing a report.
- Criteria for good research, measuring research impact and quality: JCR report, impact factor and citation index
- Ethics and scientific conduct, Ethics in human and animal studies.

### **UNIT-II**

#### **Writing and presenting research**

- Research writing: types and their components
- Components of research paper: the IMRAD system, title, authors and addresses, abstract, acknowledgements, references, tables and illustration
- Preparation for publication, submission of manuscript, publication processes
- Presentation of research: oral and poster presentations, presentation in conferences and symposia
- Presentation and submission of research proposals to the funding agencies.
- A brief idea about government research agencies including DBT, DFSS, DST, ICMR, CSIR, UGC, BPR&D, and DRDO.
- Plagiarism: definition, forms, consequences, unintentional plagiarism, copyright infringement, UGC regulations

#### **Reference Books:**

1. Research Methodology Tools and Techniques: H.C Purohit
2. Research Methodology: An Introduction: Wayne Dean Goddard, Stuart Melville
3. Research Methodology in the Medical and Biological Sciences: PetterLaake (Author) Haakon Breien Benestad (Author) Bjorn Reino Olsen (Editor)
4. Research Methodology For Biological Science : Gurumani N Gurumani
5. Research Methodology- G.R. Basotia and K.K. Sharma.
6. Research Methodology- C.H. Chaudhary, RBSA Publication
7. Research Methodology: An Introduction - Wayne Goddard & Stuart Melville
8. Research Methodology - Ranjit Kumar
9. Research Methodology: Methods & Techniques - Kothari, C.R.

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**MSFS-2L1: Laboratory Course-3 (Based on MSFS-2T1 and MFS-2T2)**  
**(At least six experiments have to be performed)**

**List of experiments:**

1. Recording of fingerprint
2. Identification of Fingerprint patterns
3. Determination of Ridge counting/tracing in a given fingerprint
4. Comparison of fingerprints using various methods
5. Classification of given fingerprints using Henry-FBI classification
6. Classification of fingerprints using a single digit classification
7. Development of latent prints using powder method
8. Development of latent prints using physical methods
9. Development of fingerprint using chemical methods
10. Development of submerged fingerprints
11. Study extent of natural variations in the handwriting samples
12. Compare two sets of handwriting samples for their origin
13. Compare two sets of signature samples for their origin
14. Detection and decipherment of invisible writing/charred documents
15. Detection and decipherment of alterations in documents/printed documents
16. Retrieval of deleted data from the various memory devices
17. Calculating hash value of a given file/folder/disc
18. Retrieval of deleted data from mobile devices
19. Examination of source of email
20. Examination of various logs of a window system
21. Examination of various logs of a Linux system
22. Examination of various logs of a Macintosh system
23. Examination of a network to check its vulnerability
24. Examination of a crime scene in case of a digital crime
25. Compare face/iris/fingerprint for their origin

**SCHEME OF MARKING**

- I. A major question based on Fingerprint/Document Forensics– 30 marks
- II. two minor questions on fingerprint/Questioned Documents/Digital Forensics-20 marks each
- III. Journal- 10 marks
- IV. Viva-voce-20 marks

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**MSFS-2L2: Laboratory Course-4 (Based on MSFS-2T3 and MFS-2T4)**  
**(At least six experiments have to be performed)**

**List of experiments:**

1. Extraction, isolation and analysis of metallic poison from biological sample/food material
2. Extraction, isolation and analysis of non-metallic poison from biological sample/food material
3. Extraction, isolation and analysis of anions from biological sample/food material
4. Extraction, isolation and analysis of acidic drug/poison from biological sample/ food material
5. Extraction, isolation and analysis of basic drug/poison from biological sample/ food material
6. Extraction, isolation and analysis of alcohol from biological sample/suspected bottle
7. Detection of blood using preliminary/confirmatory tests
8. Determination of species of origin
9. ABO profiling of dried blood stains
10. Examination of semen/saliva and other body fluids
11. Examination of hairs/fibres for their origin
12. Examination of diatoms in the given water samples
13. Examination of pollens
14. Isolation and quantification of DNA from blood and other biological materials
15. Performing PCR on the given DNA samples
16. Performing DNA identification from the given biological samples
17. Detection of various biochemicals (fats/carbohydrate/protein)

**SCHEME OF MARKING**

- I. A major question based on Toxicology/Biology/DNA Fingerprinting– 30 marks
- II. two minor questions on Toxicology/Biology/DNA Fingerprinting -20 marks each
- III. Journal- 10 marks
- IV. Viva-voce-20 marks

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