

**Program Name:** Master of Forensic Science  
**Program Code:** FORS 401



**SCHEME & SYLLABUS**  
**(Choice Based Credit System)**  
**for**  
**M.Sc. Forensic Science**  
**1st TO 4th SEMESTER**

**(w.e.f. Session 2021 onwards)**

**Program Code: FORS401**



**DEPARTMENT OF FORENSIC SCIENCE**  
**SCHOOL OF PARAMEDICAL SCIENCE**

**RIMT UNIVERSITY, MANDIGOBINDGARH, PUNJAB**



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## SECTION 1

# Vision & Mission of the University

### VISION

The department of forensic science stands out as an Institute that envisions a bright future by imparting Quality Professional Education of very high Standards with special emphasis of Research and Development (R & D) and continuous updating the curricula in consonance with local and Global needs. We see higher aspirations and better results with professional Excellence combined with Perfection and absolutely relentless collective efforts

### MISSION

- To impart teaching and learning through cutting-edge technologies supported by the world class infrastructure
- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values.



## SECTION 2

# Vision and Mission of the Department

### VISION

- The department of forensic science stands out as an Institute that envisions a bright future by imparting Quality Professional Education of very high Standards with special emphasis of Research and Development (R & D) and continuous updating the curricula in consonance with local and Global needs. We see higher aspirations and better results with professional Excellence combined with Perfection and absolutely relentless collective efforts.

### MISSION

- To prepare learners for world class Professionals empowered with competitive knowledge, skill ethical values and confidence to lead in the fields of forensic science.
- To provide students a stimulating and intellectual environment conducive to personality development and confident decision making.
- To sharpen India's young talent and helping them discover the true meaning of global education for true success.



## SECTION 3

# About the Program

Forensic science is the application of all sciences to law. The field of forensic science is undoubtedly expanding as global crime and fraud rates continue to rise. In order to define and uphold these regulations, forensic science utilises scientific knowledge and technology. This curriculum focuses on forensic science, where students learn about crimes, crime scenes, and the related methods and equipment needed to solve crimes, in addition to all laboratory methods and methods for gathering evidence. They research how to investigate different types of crime scenes and how to use lab analysis to find the primary offender. Forensic Experts are generally required in various government sectors, private organizations, and research centers. Some of the sectors where they can find employments are follows:

Police Department

Crime Branches

Quality Control Bureau

Narcotics department

Banks

Hospitals

Universities

Private Detective Agencies

Defense/Army

Various Law Firms

Eligibility for M.Sc: BSc Forensic Science/BSc. Medical/BSc. Nursing/BSc in any medical stream.

M.Sc. Forensic Science is a Two-year Postgraduate program that includes four semesters with training in forensic labs and research work.



## SECTION 4

# Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

### PROGRAMME EDUCATION OBJECTIVES (PEOs)

The PEOs are general statements that outline the career and professional achievements that the programme is preparing its alumni to attain in the few years after the receipt of their degree. The PEOs for the programme in forensic science are as follows:

PEO1	<b>PEO-1: Graduates of RIMT forensic programme will be well-prepared for successful jobs in the field of forensic science, as well as in research and innovation at businesses, in the public sector, and/or in related subfields.</b>
PEO2	<b>PEO-2: RIMT forensic graduates will be proficient in using cutting-edge and established software and technology for the discovery, analysis, and assessment of forensic evidence.</b>
PEO3	<b>Graduates from RIMT forensic programme will be effective in managing interdisciplinary teams with professional capabilities to expand their knowledge, skills, and dexterity in conducting scientific research and providing objective, dependable scientific conclusions in court.</b>
PEO4	<b>By educating the public about the various tactics used by criminals to commit crimes, RIMT forensic graduates will serve society in a way that goes beyond their expertise as forensic experts.</b>



## **PROGRAMME OUTCOMES (POs)**

<b>PO 1</b>	<b>Problem Solving Attitude: Be proficient in integrating knowledge and applying their understanding in identifying problems and producing powerful solutions.</b>
<b>PO 2</b>	<b>Professional Competence: Attain professional competence, intellectual maturity and personal growth along with a commitment for ethical development of the industry.</b>
<b>PO 3</b>	<b>Critical Analysis &amp; Decision Making: ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.</b>
<b>PO 4</b>	<b>Environment and Sustainability: To develop understanding of environment impact of businesses and be able to apply forensic knowledge to develop sustainable crime solving methods.</b>
<b>PO 5</b>	<b>Ethics &amp; Values: To learn and apply Forensic ethics principles and be committed to professional ethics and responsibilities and norms of the crime scene management.</b>
<b>PO 6</b>	<b>Individual &amp; Team Work: To develop team skills and be able to lead various cross functional team with members from different background. An ability to function effectively on teams to accomplish a common goal.</b>
<b>PO 7</b>	<b>Life Long Learning: Aptitude to acquire newer knowledge and skills, assimilate and adapt them to be ready to confront uncharted environment scientifically and confidently.</b>
<b>PO 8</b>	<b>Global Orientation and Cross-Cultural Appreciation: Ability to face any issues related to forensic science especially related to DNA, Fingerprints and Handwriting examination from a global perspective with confidence, positivity and exhibit an understanding of Cross Cultural perspective of science and technology.</b>



### **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

<b>PSO 1</b>	<b>Students will understand the basic concepts, fundamental principles, scientific theories related to forensic science and their respective applications in day-to-day life.</b>
<b>PSO 2</b>	<b>Students will be able to design &amp; demonstrate the use of tools and techniques required to provide solutions based on the available data. They will develop scientific outlook not only with respect to the science subjects but also in all aspects related to life.</b>
<b>PSO 3</b>	<b>Students will become familiar with the various disciplines of forensic science like forensic toxicology, forensic ballistics, fingerprint examination, questioned documents, etc. They will also learn to apply appropriate tests and techniques for the qualitative as well as quantitative analysis of various evidences in laboratories as well as industries.</b>





## SECTION 5

# Curriculum / Scheme with Examination Grading Scheme

### SEMESTER WISE SUMMARY OF THE PROGRAMME: M.SC FORENSIC SCIENCE

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	32	500	26
2.	II	32	500	26
3	III	27	500	21
4	IV	32	500	26
	<b>Total</b>	<b>123</b>	<b>2000</b>	<b>99</b>



## **EXAMINATION GRADING SCHEME**

<b>Marks Percentage Range</b>	<b>Grade</b>	<b>Grade Point</b>	<b>Qualitative Meaning</b>
80-100	O	10	Outstanding
70-79	A+	9	Excellent
60-69	A	8	Very Good
55-59	B	7	Good
50-54	B	6	Above Average
45-49	C	5	Average
40-44	P	4	Pass
0-39	F	0	Fail
ABSENT	AB	0	Absent

**Percentage Calculation: CGPA \*10**

**Syllabi Applicable For Admissions in 2021 Onwards**



**First Semester:**

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
<b>MFS-1101</b>	<b>Elements of Questioned Document Examination</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-1102</b>	<b>General Forensic Science including Elements of Law and Fingerprints</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-1103</b>	<b>Instrumental Analysis I</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-1104</b>	<b>Computer Forensics including Elements of Biometrics</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-1105</b>	<b>Examination of Questioned Document &amp; Fingerprint Laboratory</b>	0	0	12	6	---	40	---	60	100	6
<b>Total</b>		<b>20</b>	<b>0</b>	<b>12</b>	<b>26</b>	<b>64</b>	<b>40</b>	<b>96</b>	<b>300</b>	<b>500</b>	<b>18</b>

L-- Lecture

T-- Tutorial

P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam



**Second Semester:**

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
<b>MFS-1201</b>	<b>Criminalistics</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-1202</b>	<b>Forensic Ballistics and Photography</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-1203</b>	<b>Instrumental Analysis II</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-1204</b>	<b>Quality Management and Research Methodology</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-1205</b>	<b>Forensic Ballistics and Criminalistics Laboratory</b>	0	0	12	6	---	40	---	60	100	6
<b>Total</b>		<b>20</b>	<b>0</b>	<b>12</b>	<b>26</b>	<b>64</b>	<b>40</b>	<b>96</b>	<b>300</b>	<b>500</b>	<b>18</b>

L-- Lecture

T-- Tutorial

P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam



### Third Semester:

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
<b>MFS-2301</b>	<b>Forensic Biology &amp; Serology</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-2302</b>	<b>Forensic Chemistry &amp; Toxicology</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-2303</b>	<b>Forensic Anthropology</b>	5	0	0	5	16	---	24	60	100	3
<b>MFS-2304</b>	<b>Forensic Chemistry &amp; Toxicology Laboratory</b>	0	0	6	3	---	40	---	60	100	6
<b>MFS-2305</b>	<b>Forensic Biology &amp; Serology and Forensic Anthropology Laboratory</b>	0	0	6	3	---	40	---	60	100	6
<b>Total</b>		<b>15</b>	<b>0</b>	<b>12</b>	<b>21</b>	<b>48</b>	<b>80</b>	<b>72</b>	<b>300</b>	<b>500</b>	<b>21</b>

L-- Lecture

T-- Tutorial

P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam



### Fourth Semester:

#### Option - A: Specialization in Forensic Biology and Serology

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)						Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	EV	Total	
MFBS-2401	Advanced Forensic Biology	5	0	0	5	16	---	24	60	---	100	3
MFBS-2402	Advanced Forensic Serology including DNA Forensics	5	0	0	5	16	---	24	60	---	100	3
MFBS-2403	Practical Based on Forensic Biology and Serology	0	0	12	6	---	50	---	100	---	150	6
MFBS-2404	Special Report/Dissertation	10	0	0	10	50	---	---	---	100	150	---
<b>Total</b>		<b>20</b>	<b>0</b>	<b>12</b>	<b>26</b>	<b>82</b>	<b>50</b>	<b>48</b>	<b>220</b>	<b>100</b>	<b>500</b>	<b>12</b>

#### Option - B: Specialization in Forensic Chemistry and Toxicology

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)						Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	EV	Total	
MFCT-2401	Advanced Forensic Chemistry	5	0	0	5	16	---	24	60	---	100	3
MFCT-2402	Advanced Forensic Toxicology	5	0	0	5	16	---	24	60	---	100	3
MFCT-2403	Practical Based on Forensic Chemistry and Toxicology	0	0	12	6	---	50	---	100	---	150	6
MFCT-2404	Special Report/Dissertation	10	0	0	10	50	---	---	---	100	150	---
<b>Total</b>		<b>20</b>	<b>0</b>	<b>12</b>	<b>26</b>	<b>82</b>	<b>50</b>	<b>48</b>	<b>220</b>	<b>100</b>	<b>500</b>	<b>12</b>



**Option - C: Specialization in Questioned Documents and Finger Print Examination (QDFP)**

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)						Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	EV	Total	
<b>MFQF-2401</b>	<b>Advanced Questioned Document Examination</b>	5	0	0	5	16	---	24	60	---	100	3
<b>MFQF-2402</b>	<b>Advanced Finger Prints Examination</b>	5	0	0	5	16	---	24	60	---	100	3
<b>MFQF-2403</b>	<b>Practical Based on Questioned Documents and Finger Prints Examination</b>	0	0	12	6	---	50	---	100	---	150	6
<b>MFQF-2404</b>	<b>Special Report/Dissertation</b>	10	0	0	10	50	---	---	---	100	150	---
<b>Total</b>		<b>20</b>	<b>0</b>	<b>12</b>	<b>26</b>	<b>82</b>	<b>50</b>	<b>48</b>	<b>220</b>	<b>100</b>	<b>500</b>	<b>12</b>

L-- Lecture

T-- Tutorial

P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid. Term Exam

ETE End Term Exam

EV External Viva



## **PROGRAM OUTCOMES**

- 1. PO1 Problem Solving Attitude:** Be proficient in integrating knowledge and applying their understanding in identifying problems and producing powerful solutions.
- 2. PO2 Professional Competence:** Attain professional competence, intellectual maturity and personal growth along with a commitment for ethical development of the industry.
- 3. PO3 Critical Analysis & Decision Making:** ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
- 4. PO4 Environment and Sustainability:** To develop understanding of environment impact of businesses and be able to apply forensic knowledge to develop sustainable crime solving methods.
- 5. PO5 Ethics & Values:** To learn and apply Forensic ethics principles and be committed to professional ethics and responsibilities and norms of the crime scene management.
- 6. PO6 Individual & Team Work:** To develop team skills and be able to lead various cross functional team with members from different background. An ability to function effectively on teams to accomplish a common goal.
- 7. PO07 Life Long Learning:** Aptitude to acquire newer knowledge and skills, assimilate and adapt them to be ready to confront uncharted environment scientifically and confidently.
- 8. PO08 Global Orientation and Cross-Cultural Appreciation:** Ability to face any issues related to forensic science especially related to DNA, Fingerprints and Handwriting examination from a global perspective with confidence, positivity and exhibit an understanding of Cross Cultural perspective of science and technology.

## **PROGRAM SPECIFIC OUTCOMES**

**PSO1** Students will understand the basic concepts, fundamental principles, scientific theories related to forensic science and their respective applications in day-to-day life.

**PSO2** Students will be able to design & demonstrate the use of tools and techniques required to provide solutions based on the available data. They will develop scientific outlook not only with respect to the science subjects but also in all aspects related to life.

**PSO3** Students will become familiar with the various disciplines of forensic science like forensic toxicology, forensic ballistics, fingerprint examination, questioned documents, etc. They will also learn to apply appropriate tests and techniques for the qualitative as well as quantitative analysis of various evidences in laboratories as well as industries.





**MAPPING OF PROGRAMME SPECIFIC OUTCOME (PSOs) WITH PROGRAMME OUTCOME (POs)**

Program Specific Outcome (PSO)	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
PSO 1	3	3	2	1	3	3	1	2
PSO 2	2	3	3	1	3	2	2	2
PSO 3	2	3	3	2	3	2	1	2

**Contribution:** “1” Slight (Low) Correlation

“2” Moderate (Medium) Correlation]

“3” Substantial Correlation

“-“Indicates there is no correlation



**SUBJECT TITLE: Elements of Questioned Document Examination**

**SUBJECT CODE: MFS-1101**

**SEMESTER: I**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

### **Section A**

**Documents in general:** Importance, Classification and Preliminary Examination.

**Handwriting Characteristics:** General Characteristics, Individual Characteristics, Development of Individuality in Handwriting.

**Principles of handwriting identification.**

**Natural Variations in handwriting:** Definition and nature, Determination of range of variations (consistency) and its importance.

**Fundamental divergences in handwriting:** Its interpretation in relation to identification of handwriting, consideration of various writing instruments used in writing.

**Standards for comparison** of handwriting.

### **Section B**

**Comparison of type written matter:** Working of typewriter, Printing and Machine Defects, alterations in typed text.

**Forgery:** Definitions, types and characteristics.

**Indented and Invisible Writings:** Introduction and Methods of examination.

**Alterations in the document:** Erasures, Additions, Overwriting and Obliterations: their examination.

**Projectina/video- spectral comparator (VSC):** its working principles and applications.

**Electrostatic Detection Apparatus (ESDA):** Its working principles and applications.

**Built-up Documents:** nature and their examination. Determination of sequence of strokes.

**Examination of Currency notes.**



**Books Recommended:**

1. Huber A. R. and Headrike A.M. (1999), **Handwriting identification: facts and fundamental**, CRC LLC.
2. Ellen D. (2<sup>nd</sup> Edition) (1997), **The scientific examination of Documents, Methods and techniques**, Taylor & Francis Ltd.
3. Morris R.N. (2000), **Forensic Handwriting Identification (fundamental concepts and Principals)**, Academic press.
4. Harrison W.R. (1966), **Suspect Documents & their Scientific Examination**, Sweet & Maxwell Ltd. London.
5. Hilton O. (1982), **The Scientific Examination of Questioned Document**,Elsaevier North Holland Inc. New York.
6. Conway J.V.P. (1959), **Evidential Documents**, Charles C. Thomas, Illinois.
7. Mehta M. K. (1970), **Theidentification of Handwriting & Cross Examination of Experts**, N.M. Tripathi, Allahabad.
8. Sulner H.F. (1966), **Disputed Document**, Oceana Publications Inc. New York.
9. Saxena B.L. (1963), **Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery**, Central Law Agency, Allahabad (Ed. A.K. Singla).
10. Osborn A.S. (1929), **Questioned Documents**, Boyd Printing Co. Chicago.
11. Levinson J: (2000), **Questioned Documents**, Academic Press, Tokyo.
12. Kelly J.S and Lindblom B.S. (2006), **Scientific Examination of Questioned Documents**, Taylor & Francis, New York.



**SUBJECT TITLE:** General Forensic Science including Elements of Law and Fingerprints

**SUBJECT CODE:** MFS-1102

**SEMESTER:** I

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

**Basic concepts of Forensic Science-I:** Definition of Forensic Science by different authors, History of Forensic Science, Seven principles of Forensic Science, Nature, need, scope and functions of Forensic Science, Tools and techniques in forensic science, Ethics in Forensic Science, Subjective and objective observation, Qualitative and quantitative analysis, Preliminary and confirmatory tests, Positive control, negative control and blank samples.

**Basic concepts of Forensic Science-II:** Actus reus, Mens rea and its types, Modus operandi and its role in crime records, Corpus delicti, Prima facie, Admissibility of scientific evidence in the courtroom, Frye and Daubert standards.

**Forensic Science Laboratories in India:** Forensic science laboratories (FSLs) in India and its types- Central, State, Regional and Mobile FSLs, Branches of FSLs, Setup of FSLs, Hierarchy of experts in Forensic Science Laboratories, Services provided by FSLs, Functioning of FSLs, roles and responsibilities of forensic scientist, the Laboratory Information Management System (LIMS).

**Report writing and Court testimony:** FIR, Report writing and evidence evaluation, Components of report, Report format in respect of crime scene and laboratory findings, Court trial and testimony, Pre-court preparation, Court appearance.

#### **Section B**

**Criminal Profiling :** Introduction, Importance, Profile of the victim and culprit, Understanding Modus Operandi and its role in Criminal Investigation, investigative strategy, crime scene characteristics, criminal behavior on the internet, limitations.

#### **Police Administration**

History and development of police administration; Police duties, responsibilities and powers. Organization and structure of police station.



### **Criminal Law**

Criminal Procedure Code: sections- 291,292,293.

Indian Evidence Act: Section 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141.

Offences against the person-Sections:- 299, 300, 302, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362, 375, 376, 377.

Offences against property- Sections:-378, 383, 390, 391, 420, 463, 497, 499, 503 and 511.

Expert testimony.

### **Books Recommended:**

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. Sharma B.R. (2003) Forensic Science in Criminal Investigation and Trials, Universal Law Publishing Company.
3. Indian Evidence Act
4. Criminal Procedure code.
5. Saferstien R. (8<sup>th</sup> Edition) (1976), Forensic Science Handbook, Prentice Hall Inc. USA.
6. Indian Penal Code.
7. Bridges (1942), Practical Finger Printing, Funk and Washalls Co. New York.
8. Constitution of India
9. Nickolas P. and Sherman H. (2006), Illustrated Guide to Crime Scene Investigation, CRC press.



**SUBJECT TITLE: Instrumental Analysis I**

**SUBJECT CODE: MFS-1103**

**SEMESTER: I**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

### **Section A**

#### **Microscopy**

Optical Microscopy: Telescopes, Microscopes and the Eye. Numerical Aperture, Depth of Focus Contrast Mechanisms in optical microscopy: Bright field, Dark Field, DIC, Phase Contrast. Staining Role of Illumination: Koehler Illumination Light Microscopy- Introduction, Image formation, Magnification and Resolution, Latest developments and trends. Fluorescence, resolution & the diffraction limit. 3D imaging techniques in microscopy: confocals, multi-photon and mesoscopic techniques. Types of microscopes- Compound, Comparison, Fluorescence, Polarized, Stereo, Their basic principles, working and Forensic Applications.

**Electron Microscopy-** Introduction, Historical review, Scanning electron microscopy (SEM) SEM Basics of electron optics, resolution in SEM. Contrast Mechanisms. Detectors. STEM. Sample preparation for the SEM Forensic applications. Transmission electron microscopy (TEM), Theory and basic principles

### **Section B**

#### **Chromatography**

Fundamentals of chromatography, band broadening of chromatography, analytical impact of band broadening

**Thin layer chromatography (TLC):** Theory and instrumentation, HPTLC-method, qualitative and quantitative analysis, Forensic Application.

**Gas chromatography:** Theoretical principles, instrumentations and technique, columns, stationary phases, detectors, GC-MS, Forensic applications,

Liquid chromatography, HPLC, Theory and Instrumentation, Technique, column, detectors, Forensic applications.



### **Electrophoresis**

Theory and General Principles, Various factors affecting electrophoresis, Low and High Voltage electrophoresis, Horizontal and Vertical Electrophoresis.

Various electrophoresis techniques – Immuno-electrophoresis, Sodium dodecyl sulphate (SDS) polyacrylamide gel electrophoresis, Iso-electric focusing (IEF), Capillary electrophoresis-Theory and basic principles, Instrumentation, Forensic applications.

### **Books Recommended:**

1. Wheeler B. and Wilson J.L. (2008), **Practical Forensic Microscopy: A Laboratory Manual**, John Wiley & Sons Ltd.
2. Leach R.G. (2<sup>nd</sup> Edition) (2007), **Applied Thin-Layer Chromatography Best Practice and Avoidance of Mistakes**, Verlag GmbH & Co. KGaA, Weinheim
3. Murphy B. D. (2001), **Fundamentals of light microscopy and electronic imaging**, Wiley-Liss. Inc.
4. Skoog D.A. and West D.M. (1980), **Principles of Instrumental Analysis**, Saunders College.
5. Lee H.C. and Gaensslen R.E. (Vol.2)(1989), **Advances in Forensic Science: Instrumental Analysis**, Year Book Medical Publishers, Inc.
6. Petersen J.R. and Mohammad A.A. (2001), **Clinical and Forensic Application of Capillary Electrophoresis**, Humana press.
7. Lurie J.B.(1983), **High Performance Liquid chromatography in Forensic Chemistry**, Taylor & Francis.
8. Gilbert (1<sup>st</sup> Edition) (1997), **GC-MS guide to ignitable liquids**, CRC press.
9. Grahm D. (1973), **The use of X-ray Techniques in Forensic Investigation**, Churchill Livingstone.
10. Settle F.A. (1997), **Handbook of Instrumental Techniques for Analytical Chemistry**, Prentice Hall.
11. David Harvey; **Modern analytical chemistry; 1st Edition**; McGraw Hill
12. Dean John (2009); **Extraction techniques in Analytical Sciences; 1st Edition**; John Wiley & Sons Ltd.; London
13. Jeffrey G H, Bassett J, Mendham J, Denney R C (1989); **Vogel's Textbook of Quantitative analysis; 5th Edition**; Longman scientific and technical publication; New York
14. Skoog Douglas, West Donald M, Holler F James, Crouch Stanley (2004); **Fundamentals of analytical chemistry; 8th Edition**; Thompson Brooks; Australia
15. Smith Roger R (2008); **Handbook of analytical separations; 2nd Edition**; Elsevier Publication; Amsterdam
16. Willard Hobart H, Merritt Lynne L, Dean John A, Settle Frank A (2010); **Instrumental methods of analysis; 7th Edition**; CBS publishers & distributors pvt. Ltd.; New Delhi



**SUBJECT TITLE:** Computer Forensics including Elements of Biometrics

**SUBJECT CODE:** MFS-1104

**SEMESTER:** I

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment:** 40

**End Term Exam:** 60

**Duration of Exam:** 3 Hrs

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions(2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

### **Section A**

#### **Computer Crimes**

##### **Cyber Crime and Computer crime:**

Introduction to Digital Forensics, Definition and types of Computer crimes, Indian IT Act 2008 and amendments, Electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography and emerging digital crimes.

##### **Categories of cyber crimes**

Unauthorized access and hacking, virus, worms & Trojan attacks, E-mail related crimes, Internet relay, chat relating crimes, sale of illegal articles, online gambling, phishing, Intellectual property crimes, web defacement, DOS attack, cyber stalking etc.

##### **Introduction to Network Security**

Networking Devices (Layer1, 2, 3) - Different types of network layer attacks–Firewall (ACL, Packet Filtering, DMZ, Alerts and Audit Trails) – IDS, IPS and its types (Signature based, Anomaly based, Policy based, Honeypot based).VIRTUAL PRIVATE NETWORKS -VPN and its types –Tunneling Protocols – Tunnel and Transport Mode – Authentication Header-Encapsulation Security Payload (ESP)- IPSEC Protocol Suite – IKE PHASE 1, II – Generic Routing Encapsulation(GRE). WAN Topologies- Standard IP based Switching – CEF based Multi-Layer switching-MPLS Characteristics- Frame Mode MPLS Operation – MPLS VPN.





## **Section-B**

### **Non Linear Data Structures and Hash Tables**

Introduction- Definition and Basic terminologies of trees and binary trees. Hash Tables: Introduction- Hash Tables- Hash Functions and its applications. HASH FUNCTIONS AND DIGITAL SIGNATURES-Authentication functions-Message authentication codes-Hash functions-Hash Algorithms (MD5, Secure Hash Algorithm)-Digital signatures (Authentication protocols, Digital signature Standard

### **Mobile Phone Forensics**

Mobile phone data acquisition through logical, physical and file system techniques, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems- Android forensics: Procedures for handling an android device, imaging android USB mass storage devices. Decrypting of encrypted files, analysis of .db files. Recovering of files, Mobile application security. Voice, SMS and Identification data interception in GSM.

### **Books Recommended:**

1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, Computer Crimes and Computer
2. Forensics, Select Publishers, New Delhi (2003).
3. C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey (1997).
4. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
5. E. Casey, Digital Evidence and Computer Crime, Academic Press, London (2000).
6. **Bolle R.M., Connell J.H., Pankanti S., Ratha N.K. and Senior A.W. (2004), Guide to Biometrics**, Springer publications.
7. John D.W. and Nicholas M.O. (2002), **Biometrics: Identity Assurance in the Information age**, McGraw Hill.
8. **Sridhar S.** (2011), **Digital Image Processing**, Oxford University Press.
9. Maria P. and Costas P. (2010), **Image Processing: The Fundamentals**, Wiley.
10. Veerakumar T., Jayaraman S. and Esakkirajan S. (2009), **Digital Image Processing**, McGraw Hill.



**SUBJECT TITLE:** Examination of Questioned Document & Fingerprint Laboratory

**SUBJECT CODE:** MFS-1105

**SEMESTER:** I

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	5	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 6Hrs**

1. How to procure fingerprints & method of taking fingerprints manually (rolled & plain).
2. To carry out ten digit classification of fingerprints.
3. To identify different fingerprint patterns.
4. To carry out ridge tracing and ridge counting.
5. To investigate physical methods of fingerprint detection.
6. To investigate chemical methods of fingerprint detection.
7. To identify handwriting characters.
8. To examine currency notes.
9. To decipher the indented and invisible writings.
10. To study natural variations in handwriting.
11. To compare handwriting samples.



**SUBJECT TITLE:** Criminalistics

**SUBJECT CODE:** MFS-1201

**SEMESTER:** II

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

### **Section A**

**Crime Scene Investigation:** Types of crime scene, Understanding and purposes of crime scene examination, first responding officers, Protection of the crime Scene, documentation of Crime scene, methods of search for physical clue materials, Reconstruction of Crime scene.

**Physical Evidences:** Definition, their classification, collection, packing and transportation, chain of custody.

**Tool marks:** Importance, location, nature, collection and evaluation.

**Soil:** Formation and types of soil, Composition and color of soil, Forensic examination of soil, Interpretation of soil evidence.

**Track marks:** Importance, nature, location, collection and evaluation.

**Glass:** Types of glass and their composition, Forensic examination of glass, Glass fracture analysis, Interpretation of glass evidence.

**Paints:** Types of paint and their composition, Forensic examination of paints, Interpretation of paint evidence.

### **Section B**

**Road Accidents:** Examination of scene, Victim and the vehicle, Collection of the evidence, Examination of skid marks.

**Voice Identification:** Introduction, Significance, Theory of generation of voice, Characteristics, Voice Spectrography.

**Forensic Psychology:** Truth & Deception, Psychology of lying, Various methods of lie detection.

**Principles of Polygraph, Legal aspects.**

**Narco analysis:** History, Importance as an investigative tool, methods as use of drugs, Limitations and legal aspects.

**Hypnosis:** introduction, importance, legal aspects.

**Brain fingerprinting:** Concepts, History, Significance, method, future perspective of the technique, limitations.



**Books Recommended:**

1. Hess A.K. and Weiner I.B. (2<sup>nd</sup> Edition) (1999), Handbook of Forensic Psychology, Wiley, John & Sons, Incorporated.
2. Barak G. (1998), Integrative Criminology, Ashgate Pub Ltd.
3. Adler F. (5<sup>th</sup> Edition) (2004), Criminology, McGraw-Hill.
4. Reid S.T. (12<sup>th</sup> Edition) (2008), Crime and Criminology, Oxford University Press, USA.
5. Johnson E.H. (4<sup>th</sup> Edition) (1978), Crime, Correction and Society, Dorsey Press.
6. Gilbert N. (3<sup>rd</sup> Edition) (1993), Criminal Investigation, Macmillan Publishing company.
7. Nicharrs J. (1999), Investigative Forensic Hyponsis. CRC Press LLC.
8. Bodziak W.M (1989), Footwear Impression Evidence, Elsevier Science Publishing Co. New York.
9. Sharma B.R. (1974), Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad.
10. Lundquest and Curry (1963), Forensic Science, Thomas, Illinois, USA.
11. Saferstein R. (8<sup>th</sup> Edition) (2011): Forensic Science Handbook, Prentice Hall Inc. USA.
12. Saferstein R. (1976), Criminalistics, Prentice Hall Inc. USA.
13. Kirk (1953), Criminal Investigation, Interscience Publisher Inc. New York.
14. Nickolas P. and Sherman H. (2006), Illustrated guide to Crime Scene Investigation, CRC press.



**SUBJECT TITLE:** Forensic Ballistics and Photography

**SUBJECT CODE:** MFS-1202

**SEMESTER:** II

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

**The Arms Act: 1959 (India)**

**Firearms:** Early history of firearms, the earliest firearms, the fifteenth century Match lock, Wheel lock, sixteenth & seventeenth century small arms, The age of the Flint lock, the percussion lock firearms, Briefs of Pinfire, Rimfire and Centrefire systems of firearms.

**Different parameters of classification of firearms, their characteristics and firing mechanism:** Smooth bored firearms (shotguns), bore and caliber, shotgun barrels, chokes - their degrees and types, Rifled firearms (Pistol, Revolver, Rifles, Machine Guns), rifling, class characteristics of rifled bore, purpose of rifling, methods to produce rifling, Trigger and firing mechanism, trigger pull, accidental discharge of firearms, Country-made/Improvised/Imitative firearms- their nomenclature and constructional features, Different automatic mechanisms used in small arms- blow back, recoil operated and gas operated mechanisms, Techniques of dismantling/assembling the firearms, Proof Marks of Weapons

**Ammunition:** Types, Nomenclature, Percussion caps and their types, Cartridge Components (Cartridge case and its types, Primer and its composition, Propellant and its composition, Velocity and pressure characteristics under different conditions, Bullets, its types and compositional aspects along with latest trends in their manufacturing and designs, Pellets and Wads), Safety aspects of handling fire arms and ammunitions.

**Internal Ballistics:** Definition, Ignition of the propellant, manner of burning, Piobert's law, Shape and Size of the propellant, pressure space curve, shot start pressure. All burnt point, Velocity, Space curve, Le Due's formula, Muzzle velocity and factors affecting it, theory of recoil, Various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting, Barrel length and velocity, effect of quantity of gun powder,



effect of bullet weight, twist versus muzzle velocity. Strength of barrel and other parts, Recoil, jump and vibration.

### **Section-B**

**External Ballistics:** Definition, Principal problems of exterior ballistics- vacuum trajectory, drop in the flight of the projectiles force of gravity, air resistance-base drag, Yaw, Shape of bullet (Spherical ball, Cylinder-conical, flat nose, round nose etc.), stability, effective range, extreme range, Trajectory computation, Ballistics coefficient and limiting velocity, Ballistics tables, Measurements of trajectory parameters, Introduction to automated system of trajectory computation and automated management of ballistics data, Velocity and pressure characteristics under different conditions

**Terminal Ballistics:** Definition, behavior of various type of bullets on hitting the target, function of bullet shape, striking velocity, striking angle and nature of target, Effect of instability of bullet, Effect of intermediate targets, Influence of range, Cavitation – 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 antimortem firearm injuries.

**Principles and practice of identification of firearms:** Different types of marks produced during firing process on cartridge and on bullet- 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, Techniques for obtaining test material from various types of weapons and their linkage with fired ammunition, Class and individual characteristics, Determination of range of fire- burning, scorching, blackening, tattooing and metal fouling shots dispersion and GSR distribution, Time of firing- Different methods employed and their limitations, Stereo and comparison microscopy - Automatic bullet and cartridge comparison system, Analysis of Gunshot Residues (GSR), Mechanism of formation of GSR, Source and collection, Spot tests, Chemical tests, Identification of shooter, Instrumental methods of GSR analysis (AAS, SEM, NAA etc.) Management and reconstruction of crime scene, Suicide, murder and accidental and self-defense cases, Briefs of NIBIN, IBS, DRUGFIRE.

### **Books Recommended:**

1. Hatcher J. and Weller (1987), **Firearm Investigation Identification and Evidence**, The University Book Agency, Allahabad.
2. Gunther and Gunther (1935), **The Identification of Firearms**, Willies, New York.



3. Jauhri M. (1980), **Monograph on Forensic Ballistics**, Govt. of India Publication, New Delhi.
4. Burrad (1951), **The Identification of Firearms and Forensic Ballistics**, JENKINS.
5. Sharma B.R. (1990), **Firearms in Criminal Investigation and Trails**, Universal law publishing company.
6. Dimaio (1987), **Gunshot Wounds**, Elsevier, New York.
7. Kumar (1987), **Forensic Ballistics in Criminal Justice**, Eastern Book Company.
8. Warlow T.A. (1996), **Firearms, the law and Forensic Ballistics**, Taylor and Francis.
9. Heard B.J. (2011), **Handbook of Firearm and Ballistics: Examining and Interpreting**, Willies, New York.
10. Neblette C.B. (1970), **Fundamental of Photography**, Van Nostrand Reinhold Company, NY.
11. Russ J.C. (2001), **Forensic uses of Digital Imaging**, CRC press, NY.
12. Redsicker D.R. (2001), **The Practical Methodology of Forensic Photography**, Elsevier Science Publishing Co. Inc., NY.
13. Robinson (2<sup>nd</sup> Edition) (2010), **Crime Scene Photography**, Elsevier Inc. MA, USA.
14. Blitzer H.L. and Jacobia J. (2002), **Forensic Digital Imaging and Photography**, Academic Press.
15. Weiss S.L. (2008), **Forensic Photography; The importance of Accuracy**, Prentice Hall.



**SUBJECT TITLE: Instrumental Analysis II**

**SUBJECT CODE: MFS-1203**

**SEMESTER: II**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

##### **UV/VIS-Spectroscopy**

Introduction, Review of UV-Visible spectroscopy-Fundamental laws of spectrophotometry, deviation from Beer's Law, Instrumentation and techniques, qualitative and quantitative methods in UV-Visible spectroscopy, RAMAN Spectroscopy, Forensic applications.

##### **IR-Spectroscopy**

Introduction, Review of IR spectroscopy, Dispersive and Non-dispersive IR spectrophotometers, Fourier transform IR spectrophotometers, Instrumentation and Techniques, Interpretation of IR spectra, Microspectrophotometry, Forensic applications.

##### **Neutron Activation Analysis-**

Introduction, Basic theory and principles, Instrumentation-Variou neutron sources, qualitative and quantitative analysis, Forensic Applications.

#### **Section-B**

##### **Atomic Spectroscopy**

Atomic Absorption Spectroscopy- Introduction, Review, Basic principles, Instrumentation and Techniques, FAAS, Interference in AAS-Background correction methods, Forensic applications. Introduction, Review of Atomic Emission spectroscopy, Principles and Instrumentation, Interferences and background correction, techniques, Graphite electrodes spark emission, ICP-AES, Forensic applications.

##### **Mass Spectrometry**

Introduction, Review of Mass spectrometry, Basic Principles and Theory, Instrumentations and technique, Ionization methods, Fragmentations in Mass spectrometry, selected ion monitoring- Atomic mass spectrometry, Fast atom Bombardment mass spectrometry, stable Isotope ratio mass spectrometry, Tandem mass spectrometry, Forensic applications.

##### **X-ray Techniques-**





Introduction, Properties of X-Rays, Overview of various X-Ray techniques, X-ray Diffraction (XRD), X-ray Fluorescence (XRF), Basic theory and principles, Instrumentation, Forensic applications.

**Books Recommended:**

1. Yinon J. (1994), Forensic Application of Mass Spectrometry, CRC press.
2. Willard H. H. (1988), Instrumental Methods of Analysis, Wadsworth Publishing Company.
3. Moonesens A.A. and Inbau F.E. (1978), Scientific Evidence in Criminal Cases, Foundation Press.
4. Lundquist F. and Curry A.S. (1964), Methods of Forensic Science, Interscience Publishers.
5. Curry A.S. (1986), Analytical Methods in Human Toxicology, VerlagChemie.
6. Lee H.C. and Gaensslen R.E. (1989), Advances in Forensic Science: Instrumental Analysis, Year Book Medical Publishers.
7. Settle F.A. (1997), Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.
8. Ewing G.W. (1975), Instrumental Methods of Chemical Analysis, McGraw-HillKogakusha Ltd. Tokyo.
9. David Harvey; Modern analytical chemistry; 1st Edition; McGraw Hill ;
10. Dean John (2009); Extraction techniques in Analytical Sciences; 1st Edition; John Wiley & Sons Ltd.; London.
11. Herbert Christopher, Johnstone Robert (2003), Mass spectroscopy basics; 1st Edition; CRC press; USA.
12. Jeffrey G H, Bassett J, Mendham J, Denney R C (1989); Vogel's Textbook of Quantitative analysis; 5th Edition; Longman scientific and technical publication; New York.
13. Pavia Donald, Lampman Gary M, Kriz George S, Vyvyan James; Introduction to Spectroscopy; 4th Edition; Brooks/Cole Cengage learning.
14. Skoog Douglas, West Donald M, Holler F James, Crouch Stanley (2004); Fundamentals of analytical chemistry; 8th Edition; Thompson Brooks; Australia.
15. Willard Hobart H, Merritt Lynne L, Dean John A, Settle Frank A (2010); Instrumental methods of analysis; 7th Edition; CBS publishers & distributors pvt. Ltd.; New Delhi.



**SUBJECT TITLE: Quality Management and Research Methodology**

**SUBJECT CODE: MFS-1204**

**SEMESTER: II**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

**Quality Management System:** -Quality, Total Quality, Quality assurance, Quality control, Quality Planning, Quality Audit: Internal and External Audit, Accreditation, NABL, ISO,IEC, BIS

General requirements for the competence of testing and calibration laboratories-

**Management Requirements:-** organizational, document control, subcontracting of tests and calibrations control of Non conforming testing / calibration work, corrective and preventive actions, Management Review.

**Technical Requirements:-** Test and calibration methods and their validation, measurements, standards and reference material, traceability, sampling.

#### **Section-B**

**Selection of research Problem:** Research proposal, literature search, hypothesis, report writing. Sampling Population and sample, sampling procedures (random and non random), sampling statistics, sampling and physical state, homogenization of samples, sample size and hazards in sampling.

**Mean and standard deviation:** Distribution of random errors, reliability of results, tests of significance, confidence interval, Paired t-test, Correlation and linear regression, the number of replicate determination, analysis of variance, the value of statistics in forensic science.

#### **Books Recommended:**

1. C.G.G. Aitken and D.A Stoney (1991), The use of statistics in Forensic Science, Ellis Horwood Limited, England.
2. VisweswaraRao. K. (2<sup>nd</sup> Edition) (2007), Biostatistics: A Manual of Statistical Methods for Use in Health, Nutrition & Anthropology, JBP.



3. Sokal, R.R & Rolf, F.J. (2<sup>nd</sup> Edition) (1981), Biometry, Principles & Practices of Statistics in Biological Research, W.H.Freeman& Co Ltd.
4. Rao, C. R. (1970), Advanced Statistical Methods in Biometric Research, Hafner Press.
5. Safenstein R. (8<sup>th</sup> Edition) (1976),Forensic Science Handbook, Prentice Hall Inc. USA.
6. William L. Duncan, (1995), Total Quality, Key Terms and Concepts, AMACOM.
7. Murray S. Cooper, (1972), Quality control in the Pharmaceutical Industry, Academic Press.
8. John T. Rabbitt, Peter A Bergh, (1994), The ISO 9000 Book, Quality Resources.
9. Willard Merritt, Dean & Settle, (1986), Instrumental Methods of Analysis, CBS Publishers & Distributors.
10. Howard S. Gitlow, (2001) Quality Management systems: A Practical Guide, CRC Press ISBN 1-574-44261-9
11. Jami St. Clair, (2003), Crime Laboratory Management, Academic Press. ISBN 12661051-3
12. ASCLD Guidelines for Forensic Science Laboratory Practices.
13. Thomas A Ratliff. (3<sup>rd</sup> Edition) (2003), The laboratory Quality Assurance system: A manual of Quality Procedures and forms, John Wiley & Sons ISBN. 0-471 26918-2
14. Gary B Clark. (1995), Systematic Quality Management (Practical Laboratory Management Series), Amer Society of Clinical.
15. John K. Taylor. (1987), Quality assessment of chemical Measurements, CRC Press 087371-097-5.
16. E. Prichard, (1995), Quality in the analytical chemistry laboratory, JohnWiley ISBN 0471 955418.



**SUBJECT TITLE: Forensic Ballistics and Criminalistics Lab.**

**SUBJECT CODE: MFS-1205**

**SEMESTER: II**

**CONTACT HOURS/WEEK:**

<b>Lecture (L)</b>	<b>Tutorial (T)</b>	<b>Practical (P)</b>	<b>Credit (C)</b>
<b>0</b>	<b>0</b>	<b>12</b>	<b>6</b>

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 6Hrs**

1. Identification of firearms.
2. Identification of cartridges and bullets.
3. Identification of wads and pellets.
4. Matching of bullets and cartridge cases.
5. Comparison of Soil samples.
6. Comparison of glass pieces.
7. Comparison of Miscellaneous material like Cloth, Bangles, threads etc.
8. To prepare a cast of Shoe prints and their comparison.



**SUBJECT TITLE: Forensic Biology & Serology**

**SUBJECT CODE: MFS-2301**

**SEMESTER: III**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

**Biological evidence:** Importance, nature, location, collection and evaluation.

**Hair and Fibers:** Importance, nature, location, collection, evaluation and tests for their identification.

Importance and identification of Botanical evidence as Pollen grains, wood, leaves and seeds.

**Blood:** Composition and functions, collection and species identification.

**Human Blood groups:** General Principles, theory of their inheritance, Blood group determination from fresh blood, titer, raulax formation and Bombay blood group.

Definition of antigen and antibody, various Antigen-antibodyagglutination and precipitation reactions.

Blood grouping from stains of blood, semen, saliva and other body fluids by Absorption-inhibition, Absorption-elution and mixed agglutination techniques, determination of secretor/non-secretor status.

#### **Section-B**

**Semen:** Forensic significance, location, collection, evaluation and tests for identification

Forensic significance of other body fluids as saliva, sweat, milk and urine, their collection and identification

**Polymorphic enzymes:** Forensic significance, identification from fresh blood and stains.

**Paternity disputes:** Causes, Various serological (ABO, Rh, MN, HLA) and biochemical (PGM, AK, GLO-1, EsD, Acid Phosphatase and DNA) methods, calculation of paternity index and probability for paternity and maternity.

#### **Books Recommended:**

1. Robertson, J. (1996): Forensic Examination of Hair. Taylor and Francis, USA.
2. Modi, J.K. (1988): Medical Jurisprudence and Toxicology, N.M. Tripathi Pvt. Ltd.
3. Fraser, Roberts J.A (1965): An introduction to Medical Genetics.
4. Chatterjee, C. C- (1975): Human Physiology.



5. Boorman, K. E: Blood Group Serology, Churchill, and Lincoln, P. J. (1988)
6. Race, R. R. and Sangar, R. (1975): Blood Groups in Man. Blackwell Scientific, Oxford.
7. Saferstein, R. (1982): Science Handbook, Vol. I, II and III, Prentice Hall, New Jersey.
8. Barris, H. and Hopkinson, D. A. (1976): Handbook of Enzyme, Electrophoresis, Elsevier, North, Holland, New York.
9. Gilblet, E. (1969): Marker's in Human Blood, Davis, Pennsylvania.
10. Culliford, B. E. (1971), The examination and Typing of Blood Stains, US Deptt. of Justice, Washington.
11. Chowdhuri, S. (1971): Forensic Biology, B P R & D, and Govt. of India.
12. Dunsford, I. and Bowley, C. (1967): Blood Grouping Techniques, Oliver & Boyd, London.
13. Eckert, W. G. & James, S.H. (1989): Interpretation of Blood Stain, Evidence, Elsevaier, New York.



**SUBJECT TITLE: Forensic Chemistry & Toxicology**

**SUBJECT CODE: MFS-2302**

**SEMESTER: III**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

**Forensic Chemistry:** Introduction, Types of cases which require chemical analysis, Limitations of forensic samples, conventional methods of chemical analysis, presumptive tests (colour/spot tests), Microcrystal tests, Elemental analysis (organic and inorganic).

**Examination of contact Traces:** Introduction to cosmetics and detective dyes, collection, sampling and analysis.

**Arson:** Introduction, chemistry of fire, scientific investigation and evaluation of clue materials, collection and preservation, analysis of flammable residues.

**Drugs of abuse:** Introduction, drug addiction and its problems, classification of drugs of abuse, Depressants, stimulants, Hallucinogens, Identification, Field tests and laboratory tests.

**Drug abuse in sports:** Introduction, common prohibited substances, analytical approach.

#### **Section-B**

**Forensic Toxicology:** Introduction, Role of the toxicologist, significance of toxicological findings, poisons, definition, classification on the basis of their origin, physiological action and chemical nature, poisons and poisoning in India, Introduction to metabolism of various drugs a poisons.

**Management of Toxicological cases in the hospital:** Signs and symptoms of common poisons, antidotes.

**Collection and preservation of viscera for various types of poisons:** Choice of preservatives, containers and storage.

#### **Books Recommended:**

1. Ret Newman, Micheal Gilbert, Kevin Lothridge; GC-MS Guide to Ignitable Liquids, CRC Press, LLC, 1999.
2. Modi's: Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabd, 1988.
3. S.N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.



4. Saferstein, R: Forensic Science Hand Book, Vol I, II and III, Pretince Hall, NI, 1982.
5. Saferstein, R: Criminalistics, 2002.
6. O Hara & Osterburg : Introduction to Criminalistics, 1949.
7. Sharma, B.R.: Forensic Science in Criminal Investigation & Trials, 2003.
8. Maehly and Stromberg: Chemical Criminalistics, 1980.
9. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
10. Casarett& Doll Toxicology: The Basic Science of poisons.
11. Curry, A.S.: Poison Detection in Human Organs, 1976.
12. Holfmann, F.G.: Handbook of Drug and Alchoho Abuse.
13. Arena Poisoning: Chemistry, Symptoms and Treatment.
14. Froede, R.C.: The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
15. Connors, K.: A text book of Pharmaceuticals analysis, Interscience, New York, 1975.
16. Gleason, M.N. et. al.: Clinical Toxicology of Commercial products,
17. Williams and Williams, Baltimore USA, 1969.





**SUBJECT TITLE:** Forensic Anthropology

**SUBJECT CODE:** MFS-2303

**SEMESTER:** III

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

**Forensic Anthropology:** Definition scope and Problems, Human skeleton, comparative skeletal anatomy of human and non-human. Classification of bones

**Identification of bones and determination of site:** Age determination from skeletal remains: General considerations, suture closure in skull and ossification in other bones. Sex determination from skeletal remains: skull, Pelvis, and other bones. Estimation of stature from skeletal remains with special reference to long bones.

**Personal Identification techniques as somatoscopy, somatometry, osteometry and craniometry their importance.**

Exhumation, recovery of fleshed and burnt remains, packaging and storage of human skeletal remains. **Portrait Parle/Bertillon system, Forensic Composite imagery:** photofit / identi kit system for facial reconstruction. Cranio facial super imposition techniques as photographic super imposition, Video-superimposition, Roentgenographic superimposition. Importance of tissue depth to reconstruct various facial features.

**Personal identification of living persons-** Identification through somatometric and somatoscopic observation, nails, occupation marks, scars, tattoo marks and deformities; handwriting and mannerisms. Genetic traits of forensic significance: Colour blindness, ear lobe, brachydactyly, polydactyly, widow's peak, eye colour, hair colour, face form, frontal eminences, nasal profile, nasal tip, lips, chin form. Genetic and congenital anomalies: causes, types, identification and their forensic significance.



### **Section-B**

**Forensic odontology:** Development and scope, role in mass disaster and anthropology, structural variation in teeth ( human and non-human), types of teeth and their functions, determination of age from teeth: eruption sequence, Gustafson's method, dental anomalies, their significance in personal identification.

**Bites marks:** Forensic significance, collection and preservation of bite marks, photography of bite marks, and evaluation of bite marks. Legal aspects of bite marks.

Examination of Lip Prints.

**Forensic Medicine:** Medico legal aspect of Death causes of Death as asphyxial death, starvation, electrocution, Accidents.

Determination of time since death by various methods including, histopathological methods.

Determination of age of living person, Medico-legal investigation of sexual offences, including examination of victim and suspect.

**Injuries:** Types and classification of injuries, anti-mortem and post-mortem injuries, aging of injuries, artificial injuries.

### **Books Recommended:**

1. KrishanVij (2001), Text book of Forensic Medicine, B.I. Churchill Livingstone Pvt. Ltd.
2. David R. Senn and Paul G. Stimson (2nd Edition) (1999), Forensic Dentistry, CRC Press, LLC.
3. John. G Clement and David. L. Ranso (1998), Craniofacial Identification in forensic Medicine, Oxiford University, Press.
4. William D. Haglernd, Marculla H. Sorg (1997), Forensic Taphonomy, CRC Press, LLC.
5. Beals, R.L. and Hozier, H. (1985), An Introduction to Anthropology, Macmillan, New Delhi.
6. Krogman, W.M. And Iscan, M. (1987), Human Skeleton in Forensic Medicine, Charles & Thomas, U.S.A.
7. Gray's Anatomy (1987): Churchill Livingston, Edinburgh.
8. Glaister (Ed)-Rentoul and Smith (1973), Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.
9. Modi, J.K. (1988), Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
10. Najjar, and Macwilliams (1979), Forensic Anthropology.
11. Mukherjee, J.B. (1981), Forensic Medicine & Forensic Toxicology, Academic Publisher.
12. Cummins, H. and Midlo, C. (1961), Finger Prints, Palms and Soles, Dover Publications, U.S.A.



13. Comas, J.A. (1960), Manual of Physical Anthropology, Charles C. Thomas U.S.A.
14. Whitaker, D.K. and MacDonald, D.U. (1989), Forensic Dentistry, Wolfe Medical Publications Ltd.
15. Singh, I.P. and Bhasin M. K. (1968), Anthropometry, Kamla-Raj Publications, Delhi.
16. Steward T.D. (1978), Essentials of Forensic Anthropology, Charles C. Thomas Publisher, Limited, 1979.



**SUBJECT TITLE:** Forensic Chemistry & Toxicology Laboratory

**SUBJECT CODE:** MFS-2304

**SEMESTER:** III

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 6Hrs**

1. M.P, B.P and flash point Determination.
2. Color/spot tests for common drugs of abuse.
3. TLC separation of drugs of abuse.
4. TLC separation of pesticides/insecticides.
5. TLC separation of anabolic steroids.
6. Analysis of phenolphthalein in trap cases.
7. UV spectrometric analysis of common drug of abuse.
8. GC-MS analysis of alcohol.



**SUBJECT TITLE: Forensic Biology & Serology and Forensic Anthropology Laboratory**

**SUBJECT CODE: MFS-2305**

**SEMESTER: III**

**CONTACT HOURS/WEEK:**

<b>Lecture (L)</b>	<b>Tutorial (T)</b>	<b>Practical (P)</b>	<b>Credit (C)</b>
<b>0</b>	<b>0</b>	<b>6</b>	<b>3</b>

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 6Hrs**

1. Determination of age from skull sutures and Teeth.
2. Determination of sex from skull and Pelvis.
3. To perform osteometric measurements on Long bones.
4. To perform craniometric measurements on skull.
5. To perform somatometric measurement on living (Height vertex, Head length, Head breadth, Foot length, Foot breadth, Nasal height, Nasal breadth, External biorbital breadth, Internal bi-orbital breadth, Bigonial breadth, Bizygomatic breadth), observations on Nose, Eye, Ear and Facial contour.
6. To prepare slides of scale patterns and examinations of cortex and medulla of human hair.
7. To examine Barr bodies from hair root.
8. Identification of blood, semen, saliva stains.
9. To identify various type of fibers.
10. To determine species of origin from blood.
11. To determine blood group from fresh blood and blood stains.



## **Option - A: Specialization in Forensic Biology and Serology**

**SUBJECT TITLE:** Advanced Forensic Biology

**SUBJECT CODE:** MFBS-2401

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

### **Section-A**

**Fibre Examination:** Introduction, Classification, Fibre transfer and persistence. Fibre Recovery: At the scene, in the laboratory, contamination and its prevention.

**Fibre Identification and comparison:** Microscopical Examination, Determination of optical properties, Refractive Index, Birefringence, Instrumental analysis, dye analysis by TLC, factors affecting the strength of fibre evidence.

**Hair examination:** Hair structure, growth phases of hair, species Identification, variation in different major population groups, somatic origin.

**Individualization:** Blood grouping, iso-enzyme typing and DNA typing

**Wildlife Forensics:** Introduction, importance, Wildlife (Protection) Act-1972, protected and endangered species of Animals and Plants. Identification of wild life materials such as skin, fur, bones, nails, horn, teeth, plants, plant parts and products by conventional and modern methods, Identification of Pug marks of various animals, DNA techniques in wildlife investigations.

### **Section-B**

**Forensic Entomology:** Introduction, general entomology and arthropod biology, insects of forensic importance, collection of entomological evidence during death investigations, the role of aquatic insects in forensic investigations, Insect succession on carrion and its relationship to determine time since death, factors influencing insect succession on carrion, its application to



Forensic Entomology. Entomology as an evidentiary tool in child and senior abuse cases and animal abuse cases

**Entomotoxicology:** Insects as toxicological indicators, impact of drugs and toxins on insect development, molecular methods for forensic entomology.

**Botanical evidences:** Introduction, types, location, collection evaluation and forensic significance.

**Wood:** Type of wood and their identification and comparison.

**Leaves:** Identification of various types of leaves and their anatomy, methods of comparison.

**Pollens:** Structure, function, methods of identification and comparison.

**Forensic Diatomology:** Diatoms: Nature, location, structure, Various types of Planktons and diatom extraction from various body tissues including bone marrow, preparation of slides, methods of identification and comparison, forensic significance.

**Forensic Microbiology:** Types and identification of microbial organisms of forensic significance.

### **Books Recommended:**

- 1) Richard Saferstein (Vol. I,II&III) (1982), Forensic Science Hand book, Prentice Hall, Publications.
- 2) Robertson, J. (1999), Forensic and microscopic examination of human hair, Taylor & Francis
- 3) Jens Amendt, (2010), Current Concepts in Forensic Entomology, John Wiley & Sons Ltd.
- 4) David B. Rivers and Gregory A. Dahlem (2014), The Science of Forensic Entomology, John Wiley & Sons, Ltd.
- 5) Dorothy E. Gennard, (2007), Forensic Entomology: An Introduction, John Wiley & Sons Ltd.
- 6) Alan Gunn, (2nd Edition) (2009), Essential Forensic Biology, John Wiley & Sons Ltd.
- 7) Heather Miller Coyle, (2nd Edition) (2012), Forensic Botany, CRC Press INC.
- 8) David Hall, Jason Byrd (2012), Forensic Botany: A Practical Guide, John Wiley & Sons Ltd.
- 9) Julie Roberts, Nicholas Marquez-Grant, (2012), Forensic Ecology: From Crime Scene to Court, John Wiley & Sons Ltd.



- 10) Jason H. Byrd, James L. Castner (2nd Edition) (2012), Forensic Entomology: The Utility of Arthropods in Legal Investigation, CRC Press INC.
- 11) Bruce Budowle, Roger G. Breeze, Steven E. Schutzer (2011), Microbial Forensics, Academic Press
- 12) Jane E. Huffman, John R. Wallace (2012), Wildlife Forensics: Methods and Applications, John Wiley & Sons Ltd.





**SUBJECT TITLE: Advanced Forensic Serology and Genetics**

**SUBJECT CODE: MFBS-2402**

**SEMESTER: IV**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

**Immunology:** Immune system, immune response, innate and acquired immunity and antigens, haptenes and adjuvants.

**Immunoglobulin:** Types, physio-chemical properties and function, raising of antisera.

**Lectins:** Forensic significance, buffers and serological reagents, methods of sterilization employed for serological work.

**Antigen-Antibody Reactions:** Precipitation, agglutination, complement, neutralization, immunofluorescence.

**HLA system:** Its applications in paternity testing, pitfalls of HLA system. Role of sero-genetic markers in individualization and paternity disputes. Antibody profiling in Forensic testing

#### **Forensic examination of Body fluids:**

1. Blood: Identification (Preliminary and confirmatory tests), species of origin (Immunodiffusion and Immunoelectrophoresis), Individualization: Blood grouping, enzyme typing.
2. Semen: Composition, functions and morphology of spermatozoa, Identification (Preliminary and confirmatory tests including Azoospermic semen stains), Individualization (Blood Grouping, seminal fluid isozymes typing).



3. Composition, functions and forensic significance of saliva, sweat, milk, urine, faecal matter, vaginal secretions and tests for their identification including the presence of blood group specific ABH substances.

### **Section-B**

#### **Forensic genetics**

**Introduction-**Elements of human genetics: Introduction, heritability, human genetic variations, human chromosomes (Normal chromosome set, chromosomal aberration, recent advances), Mendelian inheritances: Dominant inheritance, recessive inheritance, sex-linked inheritances, polymorphic traits. Mendelian Population, gene pool, Hardy-Weinberg equilibrium, deviation from H-W equilibrium, statistical assessment of deviation from H-W equilibrium, consanguinity, inbreeding, inbreeding coefficient, genotypes, phenotypes, mutation, multiple alleles, genetic variants, biochemical genetics, gene structure, its frequency determination, gene mapping and gene Expression.

**DNA typing systems-** RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR, Mitochondrial DNA, DNA Barcoding for species identification, Gene identification and prediction- Introduction Basics of gene prediction, pattern recognition, gene prediction tools, Tools for microarray analysis and application, FASTA and BLAST Algorithm. Major data basis in bioinformatics

**Legal perspectives-** Legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad, new and future technologies: DNA chips, SNPs and limitations of DNA profiling.

#### **Books Recommended:**

- 1) Race, R.R, and Sanger, R., (1975), **Blood Groups in Man**, Blackwell Scientific, Oxford.
- 2) Richard Saferstein (Vol. I,II&III) (1982), **Forensic Science Hand book**, Prentice Hall, Publications.
- 3) Richard Saferstein (Vol. I,II&III) (1982), **Forensic Science Hand book**, Prentice Hall New Jersey.



- 4) Barris, H. and Hopkinson, D.A., (1976), **Handbook of Enzyme, Electrophoresis**, Elsevier Publications
- 5) Culliford, B.E., (1971), **The Examination and Typing of Blood Stains**, US Deptt. of Justice, Washington
- 6) Chowdhari, S., (1971), **Forensic Biology**, BPR & D, Govt, of India.
- 7) Dunsford, I and Bowley, C., (1967), **Blood Grouping Techniques** , Oliver and Boyd, London
- 8) Henry C. Lee and R.E. Gaensslen; (1990), **DNA and other Polymorphism in Forensic Science**, Year book Medical Publishers, Inc.
- 9) Rudin, N. and Inman, K.(2<sup>nd</sup> Edition) (2002),**An Introduction to Forensic DNA Analysis**, CRC Press.
- 10) John M. Butler, (2<sup>nd</sup> Edition) (2005), **Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers**, Elsevier (USA).
- 11) John Buckleton, Christopher M. Triggs, Simon J. Walsh, (2005), **Forensic DNA Evidence Interpretation**, CRC Press.
- 12) Lawrence Kobilinsky, L., Liotti, T.F and Sweat, J.O., (2005), **DNA: Forensic and Legal Applications**, John Wiley and Sons, Inc.
- 13) William Goodwin, Adrian Linacre, SibteHadi, (2007), **An Introduction to Forensic Genetics**,John Wiley & Sons Ltd.
- 14) Angel Carracedo, (2004), **Forensic DNA Typing Protocols**, Humana Press.
- 15) John M. Butler, (2010), **Fundamentals of Forensic DNA Typing**, Elsevier (USA).
- 16) John M. Butler, (2012), **Advanced Topics in Forensic DNA Typing: Methodology**, Elsevier (USA).



**SUBJECT TITLE:** Practical Based on Forensic Biology and Serology

**SUBJECT CODE:** MFBS-2403

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	12	6

**Internal Assessment: 50**

**End Term Exam: 100**

**Duration of Exam: 6Hrs**

1. To determine titre of antisera.
2. To prepare anti-H from seeds of *Ulex europaeus*.
3. To perform precipitin test for species of origin determination.
4. To perform Immunodiffusion test for species of origin.
5. To determine blood group from stains of blood and various body fluids with Absorption-inhibition, mixed agglutination and absorption-elution techniques.
6. To prepare gel plates for electrophoresis.
7. To perform electrophoresis for separation of Haptoglobins.
8. To perform electrophoresis for separation of various polymorphic enzymes.
9. Examination of diatoms.
10. Examination of hair of different animals as cat, dog, cow, horse and goat.
11. Extraction and isolation of DNA from blood and other body fluids.



**SUBJECT TITLE:** Special Report/Dissertation

**SUBJECT CODE:** MFBS-2404

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
10	0	0	10

**Internal Assessment: 50**

**External Viva: 100**

Every student will have to submit a special report based on the option and the actual work carried out on the problem in the laboratory. The report will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and external examiners.



## Option - B: Specialization in Forensic Chemistry and Toxicology

**SUBJECT TITLE:** Advanced Forensic Chemistry

**SUBJECT CODE:** MFCT-2401

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

### Section-A

**Analysis of petroleum products and residues:** Distillation and fractionation, Various fractions and their commercial uses, Standards/methods of commercial analysis of petroleum products as per ASTM and BIS, Analysis of traces of petroleum products in forensic exhibits, Comparison of petroleum products, Adulteration of petroleum products, Characterization of petroleum products in oil spills, Application of conventional and Modern Techniques in the analysis of petroleum products.

**Analysis of Beverages:** Alcoholic and non-alcoholic beverages and their composition, Analysis of alcoholic beverages as per BIS and PFA Act, Detection and determination of ethanol, furfural, organic acids, aldehydes, chloral hydrate, methanol and ethylene glycol in liquors by color tests, TLC, GC, and GC-MS methods, Distinction between licit and illicit liquors.

### Section-B

**Analysis of Narcotic Drugs and Psychotropic Substances:** Job of forensic drug chemist, analysis of NDPS evidence by various procedures prescribed by U.N. Manual, DFS manual, spot tests, microcrystal tests, extraction methods, TLC, UV-Vis spectrophotometry, IR spectrophotometry, GC-HPLC, MS, GC-MS, NMR and XRD as exemplified by cocaine, cannabis, barbiturates, benzodiazepines, amphetamines, opiates and hallucinogens (LSD, psilocybine and mescaline), evidence handling techniques, clandestine laboratory investigation and designer drugs.



**Explosives:** Classification, composition and characteristics of explosives, pyrotechnics, IEDs, explosion process and affects, types of hazards, effect of blast wave on structures, human etc, specific approach to scene of explosion, post blast residue collection, reconstruction of sequence of events, evaluation and assessment of scene of explosion, systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques and interpretation of results.

**Books Recommended:**

- 1) Lundquis F. and Curry, A. S.(Vol.III) (1962), **Methods of Forensic Science**, Publisher Interscience.
- 2) Saferstein R. (Edition 8<sup>th</sup>) (1978), **Forensic Science Handbook: Criminalistics**, Prentice Hall Inc. USA.
- 3) O' Hara C.E and Osterburg J.W. (1949), **Introduction to Criminalistics**, The MacMillan Co.
- 4) Sharma B.R. (2003), **Forensic Science in Criminal Investigation & Trials**, Universal Law Publishing Company.
- 5) Walb&Bronds, **Drunks, Drugs & Driving**.
- 6) Crown (1968), **The Forensic Examination of Paint and Pigments**, Charles C Thomas Pub. Ltd.
- 7) White, **Dynamics of Accident Investigation in criminal cases**.
- 8) Moonesens A.A; Mosses and Inbaw (1973), **Scientific Evidence in Criminal Cases**
- 9) Winger G., Woods J.H., Hoffman F.G. (4<sup>th</sup> Edition) (2004), **A Handbook on Drug and Alcoholic Abuse**, Oxford University Press.
- 10) Maehly A. and Stromberg L. (1981), **Chemical Criminalistics**, Springer Berlin.
- 11) CunliffeF. and Piazza P.B. (1980), **Criminalistics and Scientific Investigation**, Prentice Hall.
- 12) Clarke E.G.C. and Moffat A.C. (Edition 2 revised) (1986), **Clark's Isolation and Identification of Drugs**, Publisher Pharmaceutical Press.
- 13) Kobilinsky Lawrence, (2012), **Forensic Chemistry Handbook; 1st Edition**; John wiley & sons publishing house; Canada
- 14) Suzanne Bell; **Forensic chemistry; 2nd Edition**; Pearson Higher Education.
- 15) Houck Max M; (2015) **Forensic Chemistry; 1st Edition**; Elsevier science publication; Amsterdam.



**SUBJECT TITLE:** Advanced Forensic Toxicology

**SUBJECT CODE:** MFCT-2402

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

**Systematic Extraction, Isolation, Identification, Estimation of following poisons from viscera, blood and urine.**

- (i) Common narcotics (as poisons): opium and its derivatives.
- (ii) Barbiturates, Benzodiazepines derivatives, Amphetamines.  
Insecticides/ Pesticides: Organochloro, organophosphorus and carbamates.
- (iii) Common inorganic poisons: salts of Arsenic, Mercury, Lead and Cyanides.

**Vegetable poisons: Nature, type, mode of action, extraction, isolation, Identification of the following:**

- (i) Poisonous seeds: Abrusprecatorius, Atropa belladonna, Argemonemexicana, Cerberathevetia, Croton tiglium, Daturafastuosa, Ricinuscommunis.
- (ii) Poisonous fruits: Semicarpusanacardium, Urgineascilla.
- (iii) Poisonous roots: Digitalis, Aconitum napellus, Plumbago rosea.
- (iv) Poisonous Mushrooms.

**Animal Poisons:** Snake venom, composition, site of action, mode of action, effect on the body as a whole, and tests for identifications.

Carbon monoxide poisoning: significance, signs and symptoms, methods of diagnosis, tests for identification.

#### **Section-B**

**Metabolism and excretion of poisons:-** Introduction, Pathways of drug-metabolism-Non synthetic pathway or phase- I reactions like oxidation, hydroxylation, N-and -O de-alkylation





and sulphoxide formation, Synthetic pathways or phase II reactions like conjugation, acetylation, methylation of drugs/poisons as exemplified by alcohols, aldehydes, ketones, aliphatic amines, carbamates, phenols, cyanides, barbiturates, amphetamines and opiates.

Interpretation of toxicological data, limitations of methods, Limits of detections: residue levels, toxic levels, and therapeutic levels, fatal levels of commonly encountered poisons in blood, urine and tissues.

Immunoassays: Basic principles, separation of bound and unbound drug, different techniques: radio-immunoassays, optical-immunoassays, enzyme-immunoassays, fluoro-immunoassays, luminescence-immunoassays, their basic principles and applications in forensic work.

### **Books Recommended:**

- 1) Curry A.S. (Part II) (1986), **Analytical Methods in Human Toxicology**, Publisher Wiley Verlag Chemie.
- 2) Klaassen C. (Edition 8<sup>th</sup>) (2013), **Casarett & Doll Toxicology: The Basic Science of poisons**, McGraw-Hill Medical.
- 3) Clarke E.G.C. and Moffat A.C. (Edition 2 revised) (1986), **Clark's Isolation and Identification of Drugs**, Publisher Pharmaceutical Press.
- 4) Curry A.S. (Second Edition) (1969), **Poison Detection in Human Organs**, Springfield Thomas.
- 5) Curry A.S. (1972), **Advances in Forensic and Clinical Toxicology**, CRC Press.
- 6) Hofmann, F.G. (1975), **A Handbook of Drug and Alcohol Abuse**, New York: Oxford University Press.
- 7) Turner W.W. (First Edition) (1965), **Drugs & Poisons**, Publisher Aqueduct Books.
- 8) Bamford F. (3<sup>rd</sup> Edition) (1955), **Poisons: Their Isolation and Identification**, McGraw-Hill.
- 9) Dubois K.P. and Gelling E.M.K. (1959), **Textbook of Toxicology**, Oxford University Press.
- 10) Stoleman A. (Vol.I, II and III) (1965), **Progress in Chemical Toxicology**, Academic Press.
- 11) Sunshine (Vol. I) (1950), **Guidelines for Analytical Toxicology Programme**, CRC Press.
- 12) Sunshine (Vol.I) (1969), **Handbook of Analytical Toxicology**, CRC Press.
- 13) Sunshine (1975), **Methods for Analytical Toxicology**, CRC Press, USA.
- 14) Curry A.S. (Second Edition) (1969), **Poison Detection in Human Organs**, Springfield Thomas.



**SUBJECT TITLE:** Practical Based on Forensic Chemistry and Toxicology

**SUBJECT CODE:** MFCT-2403

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	12	6

**Internal Assessment: 50**

**End Term Exam: 100**

**Duration of Exam: 6Hrs**

1. Analysis of alcoholic liquor as per BIS specifications.
2. Determination of methanol and ethanol in alcoholic liquors.
3. Analysis of gasoline as per BIS specifications.
4. Analysis of explosion residues (Qualitative).
5. Systematic identification of Narcotic Drugs and Psychotropic substances (opiates, cannabis and barbiturates, benzodiazepines and amphetamines) by spot colour tests.
6. Thin layer chromatographic analysis of above NDPS.
7. U.V/Vis spectrophotometric analysis of barbiturates, benzodiazepine and amphetamines.
8. Systematic extraction and identification of acidic and basic drugs from viscera (simulated sample).
9. Detection of metallic poisons (arsenic and mercury) in viscera and food stuff (simulated samples).
10. Analysis of viscera (simulated sample) for organo-chloro /organo-phosphorus pesticides by TLC.
11. Identification of vegetable poisons through microscopy.
12. GC-MS examination of arson products and alcohol.
13. FTIR examination of common drugs of abuse.



**SUBJECT TITLE:** Special Report/Dissertation

**SUBJECT CODE:** MFCT-2404

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
10	0	0	10

**Internal Assessment: 50**

**External Viva: 100**

Every student will have to submit a special report based on the option and the actual work carried out on the problem in the laboratory. The report will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and external examiners.



## Option - C: Specialization in Questioned Documents and Finger Print Examination

**SUBJECT TITLE: Advanced Questioned Document Examination**

**SUBJECT CODE: MFQF-2401**

**SEMESTER: IV**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

### Section-A

- 1) Handwriting: Writing Systems, Style or National characteristics in handwriting,
- 2) Effect of various writing instruments, age and illness on handwriting characteristics.
- 3) Forgery: Introduction, Classes of forgery, their examination and comparison.
- 4) Examination of numeral and initials
- 5) Disguise in handwriting, anonymous letters, Handedness and ambidexterity.
- 6) Composition of ink, paper and their examination.

### Section-B

- 7) Comparison of Printed matter: conventional Printing methods - letter press, offset, Intaglio and Lithography.
- 8) Computer printing devices as dot matrix printer, inkjet printer and laser printer: their working, Examination of their printouts.
- 9) Photostat Machine, Fax Machines: their working, Examination of their printouts.
- 10) Plastic currency: Examination of credit cards and similar material, Holographic marks and their examination.



**Books Recommended:**

- 1) Huber, A. R. and Headrike, A.M. (1999), **Handwriting identification: facts and fundamental**, CRC LLC.
- 2) Ellen, D (Edition 2<sup>nd</sup>) (1997), **The scientific examination of Documents, Methods and techniques**, Taylor & Francis Ltd.
- 3) Morris (Edition 1<sup>st</sup>) (2000), **Forensic Handwriting Identification (fundamental concepts and Principals)**, Academic Press Inc.
- 4) Harrison, W.R (1966), **Suspect Documents & their Scientific Examination**, Sweet & Maxwell Ltd., London.
- 5) Hilton, O (1982), **The Scientific Examination of Questioned Document**, Elsevier North Holland Inc., New York.
- 6) Sulner, H.F. (1966), **Disputed Document**, Oceana Publications Inc., New York.
- 7) Saxena B.L. (1968), **Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery**, Central Law Agency, Allahabad (Ed. A.K. Singla).
- 8) Quirke, A.J. (1930), **Forged, Anonymous & Suspet Documents**, Reorge Rontledge & Sons Ltd., London.
- 9) Osborn, A. S. (1929), **Questioned Documents**, Boyd Printing Co., Chicago.
- 10) Levinson, J (2000), **Questioned Documents**, Academic Press, Tokyo.
- 11) Kelly, J.S and Lindblom, B.S (2006), **Scientific Examination of Questioned Documents**, Taylor & Francis, New York.
- 12) Brunelle, R.L. and Reed, R.W. (1984), **Forensic Examination of Ink and Paper**, Charles C Thomas Publisher, U.S.A.
- 13) Baker, J.N. (1955), **Law of Disputed and Forged Documents**, The Michie Company, Virginia.



**SUBJECT TITLE: Advanced Finger Prints Examination**

**SUBJECT CODE: MFQF-2402**

**SEMESTER: IV**

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction of Question Paper setter:** The question paper consists of three sections A, B and C. Section-A is compulsory consisting of 6 short answer type questions (2 marks) from the whole syllabus. Total marks to this section are 12. There will be no choice in this section. Section-B consists of 8 questions. Each question carries 4 marks. Section-C consists of 4 questions. Students will attempt any three questions. Each carries 8 marks.

#### **Section-A**

History and development of finger prints as a science for personal, identification, structure of ridged skin, morphological plan of volar pads and configurational areas. Development of volar pads, ridges, factor affecting alignment of ridges, transition of configuration, types, and variations in finger prints: Causes and genetics, population variations.

Basics of taking inked prints, taking inked prints of living and dead: Plain and rolled prints, other devices and material for recording prints. Classification of finger Prints, pattern types, pattern area, Henry system of classification (Primary to tertiary and key classification) extension of Henry system searching of finger prints, classification system, single finger print, Finger Prints Bureau.

#### **Section-B**

Chance Finger Prints: Latent prints, plastic prints, causes, composition of sweat. Development of latent finger prints: Conventional methods as fluorescent powder, magnetic powder. Fuming methods: Iodine and cyanoacrylate methods. Chemical methods: Ninhydrin and its analogue silver nitrate, enhancement of latent prints, application of laser technologies, metal deposition method. Biological methods of development of latent prints on skin.

Systematic approach to latent print processing, preserving and lifting of finger prints. Photography of Finger Prints, comparison of finger prints: basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics.

Automatic Finger Print Identification system (AFIS) and its variants, digital Image processing of finger prints and their enhancement. Presentation of expert evidence on finger prints in court.



**Books Recommended:**

- 1) David R. Ashbaugh (1999), **Quantitative and Qualitative Friction Ridge Analysis**, CRC Press.
- 2) E. Roland Menzel (Second Edition) (1999), **Fingerprint Detection with Loseres**, Marcel Dekker, Inc.
- 3) Cowger and James F. (1993), **Friction Ridge skin: Comparison and Identification of Fingerprints**, Elsevier New York, CRC Press London.
- 4) Cummins and Midlo (1943), **Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics**, The Blakiston office London.
- 5) Cherril, F.R. (1954), **The Finger Prints. System at Scotland Yard**, Her Majesty's office, London.
- 6) Wentworth and Wilder (1957), **Personal Identification**, Richard. G. Badger. Boston.
- 7) Mehta, M. K. (1980), **Identification of Thumb Impression & Cross Examination of Finger Prints**, N. M. Tripathi (P) Ltd. Bombay.
- 8) Moenssens (1975), **Finger Prints Techniques**, Chitton Book Co., Philadelphia, New York.
- 9) Allison H.C.(1<sup>st</sup> Edition) (1973) **Personal Identification**, Holbrook Press.
- 10) Chatterjee S.K. and Hague R.V. (1988), **Fingerprints or Dactyloscopy and Ridgeoscopy**.
- 11) E. Ronald Menzel (1997), **A manual of Fingerprint Identification: Finger Print Detection with Lasers**.
- 12) H.C. Lee, R.E. Gaensslen and S.R. Ramotowski (3<sup>rd</sup> Edition) (2013), **Advances in Fingerprint Technology**, CRC Press, Boca Raton.
- 13) C. Champod, C. Lennard, P. Margot, M. Stoilovic (2004), **Fingerprints and Other Ridge Skin Impression (International Forensic Science and Investigation Series)**, CRC Press, Boca Raton.
- 14) B.C. Bridges, Vollmer A. and M. Monir (2002), **Criminal Investigation Practical Finger Printing, Thumb Impressions, Hand Writing, Expert Testimony, Opinion Evidence**, Allahabad University Book Agency.
- 15) Daluz H.M (2015), **Fingerprint Analysis Laboratory Workbook**, CRC Press.



**SUBJECT TITLE:** Practical Based on Questioned Documents and Finger Prints Examination

**SUBJECT CODE:** MFQF-2403

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	12	6

**Internal Assessment: 50**

**End Term Exam: 100**

**Duration of Exam: 6Hrs**

1. To study the forged signatures (free-hand forgery and traced forgery)
2. To study the initials
3. To perform TLC of writing inks, toners and inkjet inks and writing papers.
4. To study sequence of intersecting strokes.
5. To study the Photocopied documents (Physical examination).
6. To study the Laser printed documents (Physical examination).
7. To study the Inkjet printed documents (Physical examination).
8. To perform Cyno-acrylate method to develop latent finger prints.
9. To classify the fingerprints from Primary classification to key classification.
10. To perform SPR method to develop latent prints.





**SUBJECT TITLE:** Special Report/Dissertation

**SUBJECT CODE:** MFQF-2404

**SEMESTER:** IV

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
10	0	0	10

**Internal Assessment: 50**

**External Viva: 100**

Every student will have to submit a special report based on the option and the actual work carried out on the problem in the laboratory. The report will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and external examiners.

S.No.	Semester	Credit
1	I	26
2	II	26
3	III	21
4	IV	26

Total Credit= 99