

**DEPARTMENT OF GENETICS**  
**SCHEME OF EXAMINATION (M.Sc. FORENSIC SCIENCE)**  
**w.e.f. ACADEMIC SESSION 2011-12**

<b>SEMESTER-I</b>									
<b>Paper No.</b>	<b>Nomenclature of Paper</b>	<b>Nature of Paper</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>		
							<b>IA</b>	<b>Th</b>	<b>Total</b>
FS:101	General Forensic Science	PC	4	1	-	5	20	80	100
FS:102	Fingerprints and Impressions	PC	4	-	-	4	20	80	100
FS:103	Questioned Document Examination	PC	4	-	-	4	20	80	100
FS:104	Instrumental Analysis I	PC	4	1	-	5	20	80	100
FS:105	Biostatistics and Computers	OE	4	-	-	4	20	80	100
FS:106	Lab Course-I	PC	0	-	-	8	-	-	100
			<b>Total</b>			<b>30</b>			<b>600</b>

**L-Lecture; T-Tutorial; P-Practical; IA-Internal Assessment; Th-Theory; PC-Program Core; OE-Open Elective**

**NOTE: Semester –I**

**Open Elective (OE) - Biostatistics and Computers**

There will be one common and compulsory paper for the students listed as Open Elective (OE).

<b>SEMESTER-II</b>									
<b>Paper No.</b>	<b>Nomenclature of Paper</b>	<b>Nature of Paper</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>		
							<b>IA</b>	<b>T</b>	<b>Total</b>
FS:201	Criminalistics	PC	4	-	-	4	20	80	100
FS:202	Forensic Ballistics	PC	4	-	-	4	20	80	100
FS:203	Computer Forensics	PC	4	1	-	5	20	80	100
FS:204	Instrumental Analysis II	PC	4	1	-	5	20	80	100
FS:205-A	Police and Forensic Science	PE-I	4	-	-	4	20	80	100
FS:205-B	<b>Or</b> Criminology and Law								
FS:206-A	Bioinformatics	PE -II	4	-	-	4	20	80	100
FS:206-B	<b>Or</b> Forensic Psychology								
FS:207	Lab Course-II	PC	0	-	-	10	-	-	100
			<b>Total</b>			<b>36</b>			<b>700</b>

**NOTE: Semester-II**

**Program Elective-I & II**

**PE-I : FS: 205-A or FS: 205-B (Student would choose any one out of the these two papers)**

**PE-II : FS: 206-A or FS: 206-B (Student would choose any one out of the these two papers)**

<b>SEMESTER-III</b>									
<b>Paper No.</b>	<b>Nomenclature of Paper</b>	<b>Nature of Paper</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>		
							<b>IA</b>	<b>T</b>	<b>Total</b>
FS:301	Basics of Forensic Chemistry and Toxicology	PC	4	0	-	4	20	80	100
FS:302	Basics of Forensic Biology and Serology	PC	4	0	-	4	20	80	100
FS:303	Forensic Physical Anthropology and Odontology	PC	4	0	-	4	20	80	100
FS:304	Quality Management and Research Methodology	PC	4	2	-	6	20	80	100
FS:305A	Forensic Medicine, Botany and Microbial	PE-III	4	0	-	4	20	80	100
FS:305B	Forensic Physics and Photography								
FS:306	Lab Course-III	PC	0	0	-	10	-	-	100
FS:307	General Seminar	-	0	0	0	4			100
			<b>Total</b>			<b>36</b>			<b>700</b>

**Note: Semester-III**

**Program Elective-III**

**PE-III : FS: 305-A or FS: 305-B (Student would choose any one out of these two papers)**

**General Seminar:**

Student would deliver a seminar on any general topic of Forensic Science. Evaluation of the seminar would be done by the concerned faculty members.

<b>SEMESTER-IV</b>									
<b>Option –A: Forensic Biology &amp; Serology</b>									
<b>Paper No.</b>	<b>Nomenclature of Paper</b>	<b>Nature of Paper</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>		
							<b>IA</b>	<b>T</b>	<b>Total</b>
FS:401A	Advanced Forensic Biology	PC	4	-	-	4	20	80	100
FS:402A	Advanced Forensic Serology including DNA Forensics	PC	4	-	-	4	20	80	100
FS:403A	Lab Course –IV	PC	-	-	-	4	-	-	100
FS:404A	Dissertation	-	-	-	-	20	-	-	200
FS:405A	Self Study	-	-	-	-	-	-	-	-
<b>Total</b>						<b>32</b>			<b>500</b>

<b>SEMESTER-IV</b>									
<b>Option –B: Forensic Chemistry &amp; Toxicology</b>									
<b>Paper No.</b>	<b>Nomenclature of Paper</b>	<b>Nature of Paper</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>		
							<b>IA</b>	<b>T</b>	<b>Total</b>
FS:401B	Advanced Forensic Chemistry	PC	4	-	-	4	20	80	100
FS:402B	Advanced Forensic Toxicology	PC	4	-	-	4	20	80	100
FS:403B	Lab Course –V	PC	-	-	-	4	-	-	100
FS:404B	Dissertation	-	-	-	-	20	-	-	200
FS:405B	Self Study	-	-	-	0	-	-	-	-
<b>Total</b>						<b>32</b>			<b>500</b>

**GRAND TOTAL OF THE CREDITS = 134**  
**GRAND TOTAL OF THE MARKS = 2500**

**NOTE: Semester-IV**

**Dissertation:**

Each student would submit a special report of the dissertation work carried out on the selected problem either in the departmental laboratory or any other laboratory or both. The report would be evaluated in terms of quality of written work, experimental work and performance in the viva-voce as well. Both internal and external examiners would evaluate dissertation work.

**Self Study paper:**

Student would also take a discipline centric elective paper to acquire knowledge as a supplement to the project work. Student would study this paper on his/her own with an advisory support by the concerned teacher.

<b>SEMESTER-IV</b>									
<b>Option –C<sup>#</sup>: Questioned Document &amp; Fingerprint Examination</b>									
<b>Paper No.</b>	<b>Nomenclature of Paper</b>	<b>Nature of Paper</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>		
							<b>IA</b>	<b>T</b>	<b>Total</b>
FS :401C	Advanced Questioned Documents Examination	PC	4	-	-	4	20	80	100
FS :402C	Advanced Finger Prints Examination	PC	4	-	-	4	20	80	100
FS :403C	Lab Course –VI	PC	-	-	-	4	-	-	100
FS :404C	Dissertation	-	-	-	-	20	-	-	200
FS :405C	Self Study	-	-	-	-	-	-	-	-
						<b>Total</b>	<b>32</b>		<b>500</b>

<b>SEMESTER-IV</b>									
<b>Option D<sup>#</sup>: Computer &amp; Cyber Forensics</b>									
<b>Paper No.</b>	<b>Nomenclature of Paper</b>	<b>Nature of Paper</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Marks</b>		
							<b>IA</b>	<b>T</b>	<b>Total</b>
FS :401D	Advanced Computer Forensics	PC	4	-	-	4	20	80	100
FS :402D	Advanced Cyber Forensics	PC	4	-	-	4	20	80	100
FS :403D	Lab Course –VII	PC	-	-	4	4	-	-	100
FS :404D	Dissertation	-	-	-	-	20	-	-	200
FS :405D	Self Study	-	-	-	-	-	-	-	-
						<b>Total</b>	<b>32</b>		<b>500</b>

**NOTES: Semester -IV**

**# Option C & D:**

Options C and D are conditional. Student can opt these options only on the availability of faculty and facility to be provided by the university.

**SCHEME OF EXAMINATION & SYLLABUS**

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

**OF**

**MASTER OF FORENSIC SCIENCE**

**(SEMESTER I TO IV)**

**(w.e.f. Academic Session 2011-2012)**

**MAHARSHI DAYANAND UNIVERSITY**

**ROHTAK, HARYANA-124001**

## SEMESTER-I

Paper Code	Paper	Credits
FS: 101	Program Core	5
Semester: I	<b>GENERAL FORENSIC SCIENCE</b>	Time: 3 hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
<b>Section - A</b>	<b>History and Development of Forensic Science:</b> Meaning of Forensic Science, early History and development of Forensic Science, Need and significance of Forensic Science, Laws and Principles of Forensic Science, Branches of Forensic Science.
<b>Section - B</b>	<b>Organizational Setup:</b> Working of DFSS, CFSL, GEQD, FSL, RFSL, MFSL, FPB, NIFS, CDTS, NCRB, and International Perspective of Forensic Science (Interpol and FBI etc.)
<b>Section - C</b>	<b>Investigative Techniques &amp; Problems of Proof:</b> Medico-Legal Cases, Tools and Techniques of Forensic Science, Concise of Forensic analysis of Physical, Biological, Chemical and Psychological evidences, Scientific aspects, Investigative and Legal problems, Comparison and contrast the history of scientific forensic techniques used in collecting and submitting evidence for admissibility in court (e.g. Locard's Exchange Principle, Frye standard, Daubert ruling).
<b>Section - D</b>	<b>Education of Forensic Science:</b> Role of Media, Human Rights & Criminal Justice System, B.Sc., PG Diploma, M.Sc. and Ph.D. Courses in Forensic Science (with Criminology), Scope of Forensic Science, Qualifications of Forensic Scientists, Duties of Forensic Scientist and Ethics in Forensic Science <b>Report Writing and Expert Testimony:</b> Admissibility of expert evidence in court, Lab procedure, Case acceptance, case opening, and case examination, Report writing, Evidence in the Court.

### Suggested Readings:

1. Nanda, B.B. and Tewari, R.K. (2001) : Forensic Science in India : A vision for the twenty first century Select Publisher, New Delhi.

2. James, S.H and Nordby, J.J.. (2003) Forensic Science: An introduction to scientific and investigative techniques CRC Press,
- 3 Barnett (2001): Ethics in Forensic Science.
3. O'Hara & Osterburg : Introduction to Criminalistics, 1949, The MacMillan Co., 1964.
4. Osterburg : Crime Laboratory.
5. Saferstien : Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
6. Saferstein : Criminalistics, 1976, Prentice Hall Inc., USA.
7. Nickolas : Scientific Criminal Investigation
8. Deforest, Gansellen & Lee : Introduction to Criminalistics.
9. Sharma, B.R. : Forensic Science in Criminal Investigaion and Trials, Central Law Agency, Allahabad, 1974.
10. Kirk : Criminal Investigation, 1953, Interscience Publisher Inc. New York.



<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 102	Program Core	4
Semester: I	<b>FINGERPRINTS AND IMPRESSIONS</b>	Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
<b>Section - A</b>	<b>Identification and Classification:</b> Introduction and History, Basics of fingerprinting, Anatomical aspects and formation of ridges, Elements of fingerprints, Classification based on fingerprint pattern types and Henry System, Ten Digit and Single Digit Classification
<b>Section - B</b>	<b>Fingerprint Developing Methods:</b> Patent, Latent & Plastic Fingerprints, Chemistry of latent fingerprint residue, factor contributing to latent fingerprints, Methods of Development of latent fingerprints using conventional methods–Powdering (Black and grey, fluorescent and magnetic), Fuming method, Vacuum Metal Deposition (VMD) Method, Chemical method, Reagent chemistry and formulations, Sequential Treatment and Enhancement, Taking of finger prints from living and dead persons, preserving and lifting of fingerprints, Photography of fingerprints, digital transmission,
<b>Section - C</b>	<b>Comparison Protocols:</b> Class and individual characteristics (Galton’s details), different ridge characteristics, Standards of proof, Automatic Fingerprint Identification System (AFIS), Poroscopy and Edgeoscopy.
<b>Section - D</b>	Tyre marks/prints and skid marks examination and Taking of control samples. Nature, location, collection and evaluation of Lip Prints, Bite Marks and Ear Prints.

**Suggested Readings**

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press (1999)
2. E. Roland Menzel; Fingerprint Detection with Lasers, 2nd Ed., Marcel Dekker, Inc. USA (1999)
3. James F. Cowger; Friction Ridge skin, CRC Press London, (1993)
4. Mehta, M.K; Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay (1980)
5. Moenssens; Finger Prints Techniques, Chitton Book Co. Philadelphia, NY (1975)
6. Chatterjee S.K.; Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata (1981)
7. Cowger, James F; Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY (1993)
8. Cook Nancy; Classifying Finger Prints, Innovative learning pub. Mento Park (1995)
9. Cossidy M.J; Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada (1980)
10. J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press (2000)

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 103	Program Core	4
Semester: I	<b>QUESTIONED DOCUMENT EXAMINATION</b>	Time: 3 hours

### **INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### **INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Document in General:</b> Importance, Classification and Preliminary Examination. <b>Handwriting Characteristics:</b> General Characteristics, Individual Characteristics, Development of Individuality in Handwriting <b>Comparison of Handwriting:</b> Natural Variations, Fundamental Divergences. Standards for Comparison, Forgery-definitions, types and characteristics.
<b>Section - B</b>	Indented and Invisible Writings, Alterations in the document: erasures, additions, overwriting and obliterations. Determination of Age of Document: Absolute/relative age, sequence of intersecting strokes.
<b>Section - C</b>	<b>Comparison of type written matter:</b> Working of typewriter, Printing and Machine Defects, alterations in typed text, various type of typewriting devices- check writing machines, electronic typewriter and proportional spacing typewriter. <b>Comparison of Printed matter:</b> Various Printing Processes. Identifying features of fake and genuine Indian currency notes.
<b>Section - D</b>	<b>Instrumentation and Photography of Documents:</b> - Basic Principals & Techniques Visible and Florescence (UV and IR), Photomicrography & Microphotography <b>Introduction and Applications:</b> Stereo-zoom Microscopy, Video Spectral Comparator (VSC) and Electrostatic Detection Apparatus (ESDA)

### **Suggested readings**

1. Huber, A. R. and Headride, A.M. (1999) : Handwriting identification : facts and fundamental CRC LLC
2. Ellen, D (1997) : The scientific examination of Documents, Methods and techniuges. 2nd ed., Taylor & Francis Ltd.
3. Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
4. Madinger J. and zalopany, A.R. (1999) : Money Laundering CRC Press.
5. Manning, C.A (1999): Financial Investigations and Forensic Accounting CRC Press.
6. Harrison, W.R. : Suspect Documents & their Scintific Examination, 1966, Sweet & Maxwell Ltd., London.
7. Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsaevier North Holland Inc., New York.
8. Brewster, F, : Contested Documetns and Foregeries, The Eastern Law House, Calcutta. 1932.

9. Ames : Ames on Foregery, 1900, Ames Rellingson Co., New York.
10. Conway, J.V.P. : Evidential Documents, 1959, Charles C. Thomas, Illinois.
11. Mehta, M. K. : The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi, Allahabad. 1970.
12. Sulner, H.F. : Disputed Document, 1966 Oceana Publications Inc., Ner York.
13. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
14. Quirke, A.J. : Forged, Anonymous & Suspet Documents, 1930, Reorge Rontledge & Sons Ltd., London.
15. Osborn, A. S. : Questioned Documents 1929, Boyd Printing Co., Chicago.
16. Cummins & Midlo : Finger Prints, Palms and Soles, 1943, The Blakiston office London.
17. Cherril, F.R. : The Finger Prints. System at Scotland Yard, 1954; Her Majesty's office, London.
18. Wentworth & Wilder : Personal Identification, 1948. R. G. Badger. Boston.
19. Mehta, M. K. : Identification of Thumb Impression & Cross Examination of Finger Prints, 1980 N. M. Tripathi (P) Ltd. Bombay.
20. Moenssens : Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.
21. Allison : Personal Identification.
22. Bridges : Practical Finger Printing, 1942, Funk and Washalls Co. New York.
23. Holt : Genetics of Dermal Ridges.
24. Saferstein, R.: Criminalistics, Prentice Hall, New York, 1990.

Paper Code	Paper	Credits
FS: 104	Program Core	5
Semester: I	<b>INSTRUMENTAL ANALYSIS –I</b>	Time: 3 hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
<b>Section - A</b>	<b>UV/VIS-Spectroscopy:</b> 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, Forensic applications.
<b>Section - B</b>	<b>IR-Spectroscopy:</b> Introduction, Review of IR spectroscopy, Dispersive and Non-dispersive IR spectrophotometers, Fourier transform IR spectrophotometers, Instrumentation and Techniques, Interpretation of IR spectra, Forensic applications.
<b>Section - C</b>	<b>Atomic Absorption Spectroscopy-</b> Introduction, Review, Basic principles, Instrumentation and Techniques, FAAS, Interference in AAS-Background correction methods, Forensic applications. <b>Atomic Emission Spectroscopy:</b> Introduction and basic Principles, Instrumentation and Techniques, Graphite electrodes spark emission and ICP-AES, Forensic application
<b>Section - D</b>	<b>Mass Spectrometry:</b> 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.

### Suggested readings :

1. Yinon: Forensic Application of Mass Spectrometry 1994.
2. Borrow : Molecular Spectroscopy, 1980.
3. Wouldard, H. H., et al : Instrumental Methods of Analysis, 1974.
4. Moonesens A.A. et al : Scientific Evidence in Criminal Cases, 1973.
5. Lundquist & Curry : Methods of Forensic Science, 1963.
6. Curry : Analytical Methods in Human Toxicology, 1986.
7. Lee & Gaensslen : Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
8. Settle, F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 105	Open Elective	4
Semester: I	<b>BIostatISTICS &amp; COMPUTERS</b>	Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	Introduction of computer: Characteristics, classification of computer; block diagram of computer and overview of working, Number system: Non-positional vs. positional number, binary, octal, decimal, hexa-decimal conversion of number system.
<b>Section - B</b>	Hardware and software: Input, output, and secondary storage devices, central processing unit; types of software; meaning, functions and types of operating system; computer languages, Understanding computer networks: Types; topologies for LANS, transmission media; analog and digital signals; network security.
<b>Section - C</b>	Working with software packages: An introduction to PC-software packages; word processor-working with text, tables, checking spelling and grammar, printing a document; spreadsheet software-working with worksheet, formulas and functions, inserting charts; PowerPoint presentation-working with different views and designing presentation; window XP-working with files and folders, windows explorer.
<b>Section - D</b>	Methods of data collection, sampling and sampling methods, measurement of central tendency, mean, median, mode, standard deviation, standard error, variance. Correlation & regression analysis, analysis of variance (ANOVA), tests of significance, t-test, z-test.

**Suggested readings:**

1. Elements of Biostatistics in Health Science- W. Daniell.
2. Statistical Methods for Research: S. Singh et al (1988) Central Publishing Ludhiana.
3. Fundamental of Statistics – D. N. Enhance.
4. Statistical Methods: S.P. Gupta. S. Chand Publication
5. Fundamentals of Biostatistics- Khan and Khanna, Ukaz Publication
6. Biostatistical analysis- Zerold and Jar.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 106		8
Semester: I	<b>LAB COURSE –I</b>	Time: 6 hours

1. Identification of Handwriting General Characteristics.
2. Study of natural variations and fundamental divergences in handwriting.
3. Comparison of handwriting.
4. Detection of Simulated forgery.
5. Detection of traced forgery.
6. Study of Disguise in handwriting.
7. Comparison of Typewritten scripts
8. Identifying features of fake and genuine Indian currency notes.
9. To obtain Plain and rolled inked finger prints.
10. To identify the finger Print Patterns.
11. To perform Ridge tracing and Ridge counting.
12. To identify the Ridge characteristics (Minutia).
13. To compare the finger Prints.
14. To develop latent finger Prints with powdering methods.
15. To develop latent finger Prints with fuming methods.
16. To develop latent finger Prints with chemical methods.

**Note- Practical segment will also include followings:**

- Students would make a visit to Forensic Science Laboratory and they would submit assignments on the organizational setup and working of different divisions of FSL/CFSL.
- Demonstration of some forensically important instruments like UV-vis/FTIR and AAS etc.

## SEMESTER – II

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 201	Program Core	4
Semester: II	<b>CRIMINALISTICS</b>	Time: 3 hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
<b>Section - A</b>	<b>Crime Scene Investigation-</b> Protection of crime scene, Documentation (including photography and sketching), nature, location, collection and preservation of evidences, physical evidence: their types, significance, classification and stages in physical evidence analysis. <b>Road Accidents-</b> Examination of scene, Victim and the vehicle, Collection of the evidence, Filaments examination, Examination of skid marks, Head light bulb filaments.
<b>Section - B</b>	<b>Analysis of Physical Evidences:</b> <b>Glass-</b> Types of glass and their composition, Forensic examination of glass, Glass fracture analysis, Interpretation of glass evidence. <b>Soil-</b> Formation and types of soil, Composition and color of soil, Forensic examination of soil, Interpretation of soil evidence.
<b>Section - C</b>	<b>Paints-</b> Types of paint and their composition, Forensic examination of paints, Interpretation of paint evidence. <b>Resuscitation of Obliterated Numbers in Metal Surfaces-</b> Theoretical and practical aspects of resuscitation.
<b>Section - D</b>	<b>Tool Marks-</b> Types of tool marks, Class characteristics and individual characteristics, Lifting of tool marks, Examination <b>Foot prints</b> – Importance, Gait pattern, Casting of footprints in different medium, electrostatic lifting of latent footprints, Taking of control samples and comparison of tool marks.

### Suggested readings:

1. Kleiner, Munay (2002) : Handbook of Polygraph testing. Academic Press.
2. Kirk (2000) Vehicular Accident investigation and reconstruction.
3. H. James, Wouldiam G. Eckert; (1999) Interpretation of Blood stain evidence at crime scene stuart Second edition, CRC Press, 1999.
4. N. Gilbert; Criminal Investigation; Third edition, Macmillan Publishing company, 1993.
5. Bernard Robertson and G.A. Vignaur; (1995) Interpreting evidence John Wiley and Sons Ltd. 1995.
6. Sharma, B.R. : Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.
7. Lundquest & Curry : Forensic Science, Vol I to IV, 1963, Charls C. Thomas, Illinois, USA.

8. Saferstein : Forensic Science Handbook, Vol I, II & III, Prentice Hall Inc. USA.
9. Saferstein : Criminalistics, 1976, Prentice Hall Inc. USA.
10. Davis, E. : Tool Marks, Firearms and Straigraphy.
11. Kirk : Criminal Investigation, 1953, Interscience Publisher Inc. New York.
12. Nickolas : Scientific Criminal Investigation.
13. Sharma B. R. : Footprints, Tracks and Trials. 1980. Central Law Agency. Allahabad.
14. Deforest, Gaenssellen & Lee : Introduction to Criminalistics.



<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 202	Program Core	4
Semester: II	<b>FORENSIC BALLISTICS</b>	Time: 3 hours

### **INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### **INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<p><b>Firearms History:</b> Definition of Firearm, A Brief History of Firearms (Match lock, Wheel lock, Snaphaunce, Flint lock firearms), Percussion, Pinfire, Rimfire and centre systems of firearms.</p> <p><b>Classification:</b> Weapon Types and their Operation, Breech Loader and Muzzle loader, Smooth bore (Shotgun) and rifled firearms (Revolver, Pistol and Rifles) and Proof Marks of weapons, Country Made/ Improvised Firearms</p> <p><b>Ammunition</b> A Brief History of Ammunition, Ammunition Components of Shotgun and Rifle cartridges, Propellants, Priming Compounds and Primers, Projectiles (Bullets/Pellets/Slugs) Headstamp Markings on Ammunition.</p>
<b>Section - B</b>	<p><b>Internal Ballistics</b> Definition, Ignition of the propellant, Shapes of Propellants, Manner of the propellant burning, Piobert's law, Pressure space curve, Shot Start Pressure, All Burnt Point, Velocity, Le Du's formula, Muzzle velocity and Factors affecting muzzle velocity, Theory of Recoil.</p> <p><b>External Ballistics</b> Definition- Trajectory, Bullet Drop in the flight, Use of sight to compensate for bullet drop, Ballistic Coefficient and Air resistance-base drag, Sectional Density, Brief introduction to Terminal velocity, Maximum effective range, Drift, Yaw, Precession, Nutation, Terminal velocity</p>
<b>Section - C</b>	<p><b>Terminal Ballistics</b> : Definition, General wound ballistic concepts, Bullet performance and wounding capability, Behavior of various type of bullets on hitting the target, Brief introduction to Cavitations (Temporary and Permanent), Stopping power, Ricochet.</p> <p><b>Firearm injuries:</b> Ballistic aspect of firearm injuries, Identification of firearm injuries, Bullet Entry/Exit Hole Identification, Evaluation of Accident, Suicide, murder and self defense firearm injuries.</p> <p><b>Range of Firing Estimations;</b> Visual and Chemical, instrumental methods with special reference to the applications of Neutron activation, Atomic absorptions, Scanning Electron microscopy.</p>

<b>Section - D</b>	<p><b>Gun Shot Residues (GSR):</b> Mechanism of formation of GSR, modern methods of analysis of GSR from the shooting hand &amp; target with special reference to clothing.</p> <p><b>Forensic Firearms Examination</b> Introduction to Striation and Impressed marks, Matching of crime &amp; test bullets and cartridge in regular and country made firearms, Automated method (NIBIN and IBIS). of cartridge case and bullet comparison</p>
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**Suggested Readings:**

1. Redsicker (2000) : The Practical Methodology of Forensic Photography.
2. Hatcher Jury & Weller, 1987 : Firearm Investigation Identification and Evidence, The University Book Agency, Allahabad.
3. Gunther & Gunther, 1935 : The Identification of Firearms, Woldies, New York.
4. Jauhri, M. 1980 : Monograph on Forensic Ballistics, Govt. of India Publication, New Delhi.
5. Burrad, 1951 : The Identification of Firearms and Forensic Ballistics.
6. Sharma, B.R. : Firearms in Criminal Investigation and Trails, 1990.
7. Dimado : Gunshot Wounds, 1987.
8. Kumar : Forensic Ballistics in Criminal Justice, 1987.
9. Yallop : Explosion Investigation, 1980.
10. Lenz : Explosives and Bomb Diposal Guide, 1976.
11. Sucasca : Test Mehods for Explosives, 1995.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 103	Program Core	5
Semester: II	<b>COMPUTER FORENSICS</b>	Time: 3 hours

### **INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### **INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Basic about Computer and Internet:</b> Introduction, Computer generations, Computer Software and Hardware <b>Operating systems including:</b> DOS, Windows, NT/2000/XP, Linux, Internet: Basics setup and internetworking, Forensic utility of computer and internet.
<b>Section - B</b>	<b>Computer and Cyber Crimes:</b> Data manipulation, Printing of Counterfeit currency and other documents, Stand alone computer crimes, Unauthorized access and interception: Hacking, Computer Viruses, Trojan and worms, Programme manipulations Computer Security, Software piracy, Forensic Tools for data retrieval
<b>Section - C</b>	<b>Image Processing:</b> - Computer Scanners, Imaging Software (Photoshop, Paint, Corral etc.) Introduction and Process, Image Enhancement and restoration, The investigation of erased tapes and analysis of signals (Analog video image Processing), Compression, encryption methods.
<b>Section - D</b>	<b>Biometrics:</b> Basics concepts, Theory and role in personal identification. Methods for digital video recording, Digitalization techniques. Investigation of integrity of images and videos.

### **Suggested readings:**

1. Tewari, R.K., Sastry, P.K. and Ravikumar, K.V. (2003) : Computer Crime & Computer Forensics select Publisher, New Delhi.
2. Wold, G.H. : Computer Crime, Techniques of Prevention Goyal, R.M. and Pawar, M.S. : Computer crimes.
3. Stern D.L. Preventing Computer frands.
4. Nancy L. Pruitt, Larry S. Underwood, Wouldiam Surver, Bioinquiry Learning System 1.0.
5. Kenneth W. Adloph Human Genome Methods
6. C. Stan Tsai : An Introduction to Computational Biochemistry.
7. Wayne W. Daniel Biostatistics : A Foundation For Analysis in The Health Science.
8. David W. Mount Bioinformatics : Sequence and Genome Analysis
9. Christoph W. Sensen Essentials Of Genomics and Bioinformatics.
10. S.C. Rastogi, Namita Mendiratta Bioinformatics Concepts, Skills and Applications.
11. Warren J. Ewens, Gregory R. Grant Statistical Methods in Bioinformatics : An Introudction
12. Ben Hui Liu Statistical Genomics : Linkage, mapping and QTL Analysis.
13. Irfan Ali Khan, Atiya Khanum Fundamentals of Bioinformatics.
14. Mahajan T.S. and Singh, Didar (2003) : Computer Networking and HTML; Gurunanak Publication, Patiala.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 104	Program Core	5
Semester: II	<b>INSTRUMENTAL ANALYSIS- II</b>	Time: 3 hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Chromatography:</b> Introduction, Review of basic principles and types of chromatography, <b>TLC and HPTLC:</b> Principle, Theory and instrumentation, visualization, Qualitative and Quantitative concepts and Forensic applications. <b>Gas Chromatography,</b> Principles, theory, instrumentations and technique, columns, stationary phases, detectors, Pyrolysis GC, GC-MS and Forensic applications. <b>HPLC,</b> Review of theory, Instrumentation, Technique, column, detectors, with special reference to LC-MS, Forensic applications.
<b>Section - B</b>	<b>Electrophoresis:</b> 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.
<b>Section - C</b>	<b>Neutron Activation Analysis-</b> Introduction, Review, Basic theory and principles, Instrumentation-Variou s neutron sources, Detection and measurement of Gamma-rays for qualitative and quantitative analysis, Forensic Applications. <b>X-ray Techniques-</b> 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.
<b>Section - D</b>	<b>Microscopy:</b> Light Microscopy-Introduction, Geometrical optics, Image formation, Magnification and Resolution, Lens aberrations, Distortion of image and curvature of field, Types of microscopes- Compound, Comparison, Fluorescence, Polarized, Stereo, Their basic principles, working and Forensic Applications. <b>Electron Microscopy-</b> Introduction, Historical review, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Theory and basic principles, Instrumentation, Forensic applications.

### **Suggested readings:**

- Peterson: Clinical and Forensic Application of Capillary Electrophoresis, 2001.
- Lurie and Witturer : High Performance Liquid chromatography in Forensic Chemistry, 1983.
- Gilbert: GC-MS guide to ignitable liquids, 1997.
- Brown, P.R: Advance in chromatography
- Howard: Forensic Analysis by Gas Chromatography.
- Grahm D.: The use of X-ray Techniques in Forensic Investigation, 1973.
- Settle, F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997.
- Crowle: Immuno Diffusion.

## Program Elective for Semester –II

### Program Elective-I

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 205-A	Program Elective	4
Semester: II	<b>POLICE AND FORENSIC SCIENCE</b>	Time: 3 hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Evolution of Police Administration</b> , Indian Police Service, Nature, Rank of Police Officers–Badges, Role & Functions of Police
<b>Section - B</b>	<b>Central level Police organizations</b> , Commissionerate System of Policing, Bureau of Police Research and Development (BPR&D), Central Bureau of Investigation (CBI), National Crime Records Bureau (NCRB), National Institute of forensic Science (NICFS), Sardar Vallabhbhai Patel National Police Academy (NPA),
<b>Section - C</b>	<b>State level Police Organization</b> : Criminal Investigation Department (CID), Modus Operandi Bureau (MOB), District level police, setup of a Police Station
<b>Section - D</b>	<b>Practical Police work</b> – Role of Police at the Crime scene, scientific help at the scene, handling of various types of crime scenes by police, Relationship between police and forensic expert, forensic teaching of police personals, forensic case documentation by Police, Technological Advance and Police

### Suggested Readings:-

1. Ghosh S.K. and Rustomji K.F. Encyclopedia of police in India.
2. Raghavan R.K. Indian police.
3. Shamim Allem. Women in Indian Police.
4. Rajinder prasher. Police Administration.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 205-B	Program Elective	4
Semester: II	<b>CRIMINOLOGY &amp; LAW</b>	Time: 3 hours

### **INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### **INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Crime:</b> Concept and Definition of Crime, Causes of Crime, Social Change and Crime, Control and Prevention of Crime in context with Organization, Industrialization, Family set up, Criminal Behavior and Psychology.
<b>Section - B</b>	<b>Criminal Procedure Code</b> -291,292,293. Constitution of Courts-Hierarchy of Courts and their Powers, Evidence in Enquiries and Trials, Expert Witness (291-93) Lok Adalats, Lok Ayukts and Juvenile Courts.
<b>Section - C</b>	<b>Constitution of India</b> -Preamble, Fundamental Rights Article 20, 21, 22. Indian Evidence Act - Section 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141. Indian Penal Code sections pertaining offence against property offences against person. <b>Offences against the person-Sections:-</b> 299, 300, 302, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362, 375 and 377. <b>Offences against property-</b> Sections:-378, 383, 390, 391, 405, 415, 420, 441, 463, 489A, 497, 499, 503 and 511.
<b>Section - D</b>	<b>I.T.:- Information Technology.</b> Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act, I.T. Act 2000- Introduction of offences and Penalties.

### **Suggested readings:**

1. Arrigo (2002) : Introduction to forensic Psychology.
2. Cooke, G. (1980) : The role of Forensic Psychologist. Charles C. Thomas.
3. Howitt D : 2002 Forensic and Criminal Psychology. Prentice Hall Publications
4. Constitution of India
5. Indian Evidence Act
6. Criminal Procedure code.
7. Indian Penal Code.
8. Bare Acts with short notes on the following : Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Food Adulteration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act.

9. Hess, A.K. and Weiner, I.B. (1999) Handbook of Forensic Psychology 2nd Ed. John wiley & sons.
10. Barak, Gregg : Integrative Criminology.
11. Adler, Freda : Criminology
12. Reid S.T. : Crime and Criminology.
13. Johnson : Crime, Correction and Society.
14. Rideman : The Manipulation of Human Behaviour.
15. Lionel Haward: Forensic Psychology, 1981, Batsford Academic and Education Ltd., London.

## Program Elective-II

Paper Code	Paper	Credits
FS: 206-A	Program Elective	4
Semester: II	<b>BIOINFORMATICS</b>	Time: 3 hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
<b>Section - A</b>	<b>Introduction to computers and bioinformatics:</b> Types of operating systems, concept of networking and remote login, basic fundamentals of working with unix. Biological databases: Overview, modes of database search, mode of data storage (Flat file format, db-tables), flat-file formats of Gene Bank, EMBL, DDBJ, PDB
<b>Section - B</b>	<b>Sequence alignment:</b> Concept of local and global sequence alignment, Pair wise sequence alignment, scoring an alignment, substitutional matrices, multiple sequence alignment. <b>Phylogenetic analysis:</b> Basic concept of phylogenetic analysis, rooted/unrooted trees, approaches for phylogenetic tree construction (UPGMA, Neighbor joining, Maximum parsimony, Maximum likelihood).
<b>Section - C</b>	<b>Generation and analysis of high through-put sequence data:</b> Assembly pipeline for clustering of HTGS data, format of '.ace' file, quality assessment of genomic assemblies, International norms for sequence data quality, Clustering of EST sequences, concept of Unigene. Annotation procedures for high through-put sequence data: Identification of various genomic elements (Protein coding genes, repeat elements, Strategies for annotation of whole genome, functional annotation of EST cluster, gene ontology (GO) consortium.
<b>Section - D</b>	<b>Structure predictions for Nucleic acids and proteins:</b> Approaches for prediction of RNA secondary and tertiary predictions, energy minimization and base covariance models, Basic approaches for protein structure predictions, comparative modeling, fold recognition/'threading' and <i>ab-initio</i> prediction.

### Suggested readings:

1. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins Baxevanis, A. D. and Ouellette Wiley and Sons.
2. Bioinformatics Sequence and Genome Analysis Mount, D.W CSHL Press



<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 206-B	Program Elective	4
Semester: II	<b>FORENSIC PSYCHOLOGY</b>	Time: 3 hours

### **INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### **INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	Forensic Psychology and the Law, Ethical Issues in Forensic Psychology, Civil and criminal case assessment Assessing mental competency, Mental disorders and Forensic Psychology, Eye witness testimony, Criminal profiling- need and types, Forensic Scientific evidence, Crime and Psychopathology, Genetics and Crime, Serial murders, Modus Operandi
<b>Section - B</b>	Psychological Assessment, Personal History, Mental Status Examination, Psychological Assessment Tools Detection of deception, Various methods for detection of deception, Interview, Non-verbal detection, statement assessment, Hypnosis, Psychological assessment, voice stress analyzer, Polygraph, thermal imaging, Brain Electrical Oscillation Signature Profiling, functional magnetic resonance study, Current research in detection of deception/truth finding mechanisms
<b>Section - C</b>	Historical aspects of Polygraph, Principles of polygraph psycho physiological aspects, operational aspects, Question formulation techniques, Interviewing technique procedure, The Art-Polygraph, Legal and Ethical aspects Human rights of individual.
<b>Section - D</b>	Forensic Psychological Techniques: Polygraphy, Narco-Analysis and Brain Electrical Oscillation Signature (BEOS) Profiling: Historical aspects, Principle and Theory, General Procedure -Legal and Ethical aspects, Human rights of individual

### **Suggested readings:**

1. Forensic Science in Criminal Investigation & Trials - B.R.Sharma
2. The Hand Book of Forensic Psychology – Weiner Hass
3. Hand Book of Forensic Psychology – O’ Donohue Levensky
4. Brain Experience – C.R.Mukundan
5. Criminal Profiling – B.Turvey
6. Hand Book of Polygraph Testing – M.Kloinen
7. Detecting Lies & Deceit – A.Vrij

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 207	Program Core	10
Semester: II	<b>LAB COURSE-II</b>	Time: 6 hours

1. Identification of firearms, cartridges, bullets, gunpowder, etc.
2. Determination of range of fire
3. Matching bullets and cartridge cases by comparison microscope.
4. Preparation of report of the examination.
5. Determination of density, by density gradient tube techniques.
6. Comparison of paints, Soils and glass.
7. Miscellaneous (Cloth, Bangles, threads etc.)
8. Evaluation of Crime scene and photographs.
9. Lifting or prints and impressions by caste and replicas.
10. Sole prints/Foot print comparison and their lifting from the scene of crime.

**Note: Practical segment will also include following:**

- Student would make a visit to computer science lab for the demonstration of computer accessories and working etc.
- Demonstration of some forensically important instruments like Stereo zoom Microscope, SEM, GC-MS, HPLC and SDS-PAGE etc.

### SEMESTER – III

**Paper Code**

**Paper**

**Credits**

FS: 301

Program Core

4

Semester: III

**BASICS OF FORENSIC  
CHEMISTRY AND TOXICOLOGY**

Time: 3 hours

#### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

#### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
Section - A	<b>Forensic Chemistry:</b> 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), A general approach to the analysis of unknown substances <b>Examination of Contact Traces:</b> Introduction to cosmetics and detective dyes, forensic significance, methods of collection and analysis.
Section - B	<b>Drugs of abuse:</b> Introduction, Drug addiction, Classification of drugs of abuse, introduction to Depressants, Stimulants, Hallucinogens, Drugs in sexual assault, Screening tests (color/spot) and Microcrystalline testing for these drugs. <b>Drug abuse in sports:</b> Introduction, commonly prohibited substances, Dope test, analytical approach. <b>Arson:</b> Introduction, chemistry of fire, scientific investigation and evaluation of clue materials, Collection/Preservation of Arson Evidence, Analysis of Flammable Residues
Section - C	<b>Poisons:</b> Classification of poisons based on their origin, Physiological action and Chemical nature, Natural toxins, Types and Trends of Poisoning (animals and human) in India <b>Forensic Toxicology:</b> Introduction, Principles, Applications, Nature of cases, Role of the Forensic Toxicologist, Information required by the toxicologist, Samples, Interpretations of results and report Writing.
Section - D	<b>Medicolegal aspects of Hospital toxicology and Postmortem toxicology:</b> Signs and symptoms of common poisons and their antidotes, Emergency Hospital toxicology, Analysis of Exhumed and decomposed bodies. <b>Collection and preservation of viscera for various types of poisons:</b> Choice of preservatives, containers and storage conditions. <b>Alternative specimens:</b> Hair analysis, Drugs in oral fluid, Detection of drugs in sweat etc.

#### Suggested readings:

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. Wouldiams and Wouldiams, Baltimore USA, 1969.

**Paper Code**

FS: 302

**Paper**

Program Core

**Credits**

4

Semester: III

**BASICS OF FORENSIC  
BIOLOGY AND SEROLOGY**

Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Biological Evidence:</b> Morphology and types of <b>Hair and Fibers</b> their importance, nature, location, collection, evaluation and tests for their identification.
<b>Section - B</b>	<b>Blood:</b> 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-antibody 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.
<b>Section - C</b>	<b>Semen:</b> Forensic significance, location, collection, evaluation and tests for identification. Forensic significance of other body fluids as Saliva, Sweat, Milk and fecal maters, their collection and identification.
<b>Section - D</b>	<b>Polymorphic enzymes:</b> Forensic significance, identification from fresh blood and stains. Paternity disputes: Causes, Various serological and biochemical methods, calculation of paternity index and probability for paternity and maternity.

**Suggested readings:**

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, 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.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 303	Program Core	4
<b>Semester: III FORENSIC PHYSICAL ANTHROPOLOGY AND ODONTOLOGY</b>		<b>Time: 3 hours</b>

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<p><b>Forensic Anthropology:</b> Definition, Nature and formation of bones, Complete study of Human skeleton, Identification of bones and determination of site.</p> <p><b>Scope of Forensic Anthropology</b> within the medical-legal context of personal identification of human remains as in cases of homicides or mass disasters, Brief introduction to Forensic Archeology and Anthropometry</p> <p><b>Personal Identification techniques:</b></p> <p><b>Craniometry measurements,</b></p> <p><b>Somatoscopy:</b> somatoscopic observations of Skin color, Hair on head, Forehead, Supra orbital ridges, Eye, Eye brows, Nose, Lips, Face, Cheek bone and Chin form etc.</p> <p><b>Somatometry:</b> Measurements of Head, Face, Nose, Cheek, Ear, Hand and Foot etc.,</p> <p><b>Indices:</b> Cephalic Index (ii) Nasal Index (iii) Total facial index</p>
<b>Section - B</b>	<p><b>Determination of Age from skeletal remains:</b> With general considerations to Skeletal growth, suture closure in skull and ossification in other bones.</p> <p><b>Determination of Sex from skeletal remains:</b> With general consideration to the structure of skull, Pelvis, and parturition scar.</p> <p><b>Estimation of stature from skeletal remains</b> with general consideration to long bones ratio, Least square regression equation and Skeletal height etc.</p>
<b>Section - C</b>	<p><b>Forensic Facial Reconstruction:</b> (2-D and 3D Methods)</p> <p><b>Portrait Parle/Bertillon system:</b> introduction and importance of Photofit/Identi kit system for facial reconstruction.</p> <p><b>Cranio facial super imposition techniques:</b> Photographic super imposition, Video-superimposition, Roentgenographic superimposition. Use of somatoscopic and craniometric methods in reconstruction.</p> <p>Importance of tissue depth to reconstruct various facial features/Genetic and congenital anomalies: causes, types, identification and their forensic significance.</p>
<b>Section - D</b>	<p><b>Forensic Dentistry</b> Development and scope, role in mass disaster and anthropology, structural variation in teeth ( human and non-human), types of teeth and their functions</p> <p><b>Determination of age from teeth:</b> Eruption sequence, Gustafson's method, dental anomalies, their significance in personal identification.</p> <p><b>Bites marks:</b> Forensic significance, collection and preservation of bite marks, photography of bite marks, and evaluation of bite marks, Legal aspects of bite marks.</p>

**Suggested readings:**

1. Text book of Forensic Medicine by Krishan Vij; B.I. Churchill Livingstone Pvt. Ltd. 2001.
2. Forensic Dentistry by Paul G. Stimson, Curtis A. Mertz; CRC Press, LLC, 1999.
3. Craniofacial Identification in forensic Medicine, edited by John. G Clement and David. L. Ranso; Oxiford University, Press; 1998.
4. Forensic Taphonomy, edited by Wouldiam D. Haglernd, Marculla H. Sorg; CRC Press, LLC, 1997.
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 & Smith (1973) : Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.
9. Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
10. Najjar, and Macwouldiams (1978) : Forensic Anthropology.
11. Mukherjee, J.B.: Forensic Medicine & Forensic Toxicology.
12. Fraser, Roberts, J.A. (1965): An Introduction to Medical Genetics.
13. Comas, J.A. (1960): Manual of Physical Anthropology, Charles C. Thomas U.S.A.
14. Robert A. Jensen: Mass falality and Casulity incidents: A field guide
15. Taylor (2000) : Forensic Art and Illustrations CRC Press.
16. Singh, I.P. and Bhasin M. K. (1968): Anthropometry, Kamla-Raj Publications, Delhi.
17. Beals, R.L. and Hoizer, H. (1985): An introduction to Anthropology, Macmillan, New Delhi.
18. Hooton, E.A. (1946): Up from the Ape, Macmillan, New York.
19. Krogman, W.M. And Iscan, M. (1987): Human Skeleton in Forensic Medicine Charles & Thomas, U.S.A.
20. Gray's Anatomy (1987): Churchill Livingston, Edinburgh.
21. Glaister Anatomy (Ed)—Rentoul & Smith (1973): Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.
22. Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
23. Najjar, and Macwouldiams (1978): Forensic Anthropology.
24. Comas, J.A. (1960): Manual of Physical Anthropology, Charles C. Thomas. U.S.A.
25. Whitaker, D.K. and MacDonald, D.U. (1989): Forensic Dentistry, Wolfe Medical Publication Ltd.

**Paper Code**

**Paper**

**Credits**

FS: 304

Program Core

6

Semester: III

**QUALITY MANAGEMENT AND  
RESEARCH METHODOLOGY**

Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Quality Management System:-</b> Quality, Total Quality, Quality assurance, Quality control, Quality Planning, Quality Audit: Internal and External Audit, Accreditation, NABL, ISO,IEC, BIS
<b>Section - B</b>	General requirements for the competence of testing and calibration laboratories. <b>Management Requirements:-</b> organizational, document control, subcontracting of tests and calibrations control of Non conforming testing / calibration work, corrective and preventive actions, Management Review. <b>Technical Requirements:</b> - Test and calibration methods and their validation, measurements, standards and reference material, traceability, sampling.
<b>Section - C</b>	<b>Selection of Research Problem:</b> 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.
<b>Section - D</b>	Assessor guide -Assessor's role, Assessor assignment procedure, Procedure of assessment of new applicant laboratories, Pre-assessment visit, On-site assessment, Guide of assessors to formulate recommendations for NABL, Procedure for conducting closing meeting



### **Suggested Readings:**

1. C.G.G. Aitken and D.A Stoney; The use of statistics in Forensic Science, Ellis Horwood Limited, England 1991.
2. Visweswara Rao. K: Biostatistics, A Manual of Statistical Methods for Use in Health, Nutrition & Anthropology.
3. Sokal, R.R & Rolf, F.J: Biometry, Principles & Practices of Statistics in Biological Research
4. Wouldiam L. Duncan: Total Quality, Key Terms and Concepts.
5. Quality Management systems: A Practical Guide
6. Howard S. Gitlow 2001 CRC Press ISBN 1-574-44261-9
7. Crime Laboratory Management: Jami St. Clair 2003. Academic Press. ISBN 12661051-3
8. ASCLD Guidelines for Forensic Science Laboratory Practics.
9. The laboratory Quality Assurance system: A manual of Quality Procedures and forms. Thomas A Ratliff. 2003 3rd ed. John Wiley & Sons ISBN. 0-471 26918-2
10. Systematic Quality Management Gary B Clark. 1995 Practical Laboratory Management Series.
11. Quality assessment of chemical Measurements John K. Taylor. CRC Press 1987. 087371-097-5.
12. Quality in the analytical chemistry laboratory E. Prichard. 1995 JohnWiley ISBN 0471 955418
13. NABL-113, Issue No.01 Issue Dt : 8.6.1998
14. IS/ISO/IEC 17025 : 2005 General Requirements for the competence of testing and calibration laboratories
15. NABL -161, Guide for Internal audit and Management Review for Laboratories
16. NABL-210, Assessor Guide Issue No.3, 1.5.2002
17. NABL-141, Guidelines for Estimation and Expression of Uncertainty in Measurement
18. Juran's Quality Control Handbook, Fourth Edition, J.M. Juran, Frank M. Gryna, McGraw-Hill International Editions, Industrial Engineering Series (1988)
19. Total Quality Control Essentials - Key Elements Methodologies and Managing for Success, Sarv Singh Soni, Gryna, McGraw-Hill International Editions, Industrial Engineering Series (1993)
20. Quality Control & Application, Bertrand L. Hansen, Prabhakar M. Ghare, Prentice-Hall of India Pvt. Ltd., New Delhi-110001 (1993)

### Program Elective for Semester-III

#### Program Elective-III

Paper Code	Paper	Credits
FS: 305-A	Program Elective	4
Semester: III	<b>FORENSIC MEDICINE, BOTANY &amp; MICROBIAL</b>	Time: 3 hours

#### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

#### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
<b>Section - A</b>	<b>Forensic Medicine:</b> Definition of Forensic Medicine and Medical Jurisprudence, Dying declaration, Death: Definition, types; somatic, cellular and brain-death, Sudden natural and unnatural deaths. <b>Identification:</b> Definition, Identification of unknown person, dead bodies and remains of a person by age, sex, stature, dental examination, scars, moles, tattoos, dactylography, DNA typing and personal belonging including photographs. <b>Asphyxial deaths:</b> Definition, causes, types, post-mortem appearances and Medico-legal significance of hanging, strangulation, suffocation and drowning.
<b>Section - B</b>	<b>Determination of Time Since Death:</b> Immediate changes, cooling of body, lividity, rigor mortis, cadaveric spasm, cold stiffening and heat stiffening. Putrefaction, mummification, adipocere and maceration. Postmortem artifacts. Various methods including Livor, Rigor and Algor mortis <b>Types and classification of injuries:</b> Wounds, Bruises Abrasions, Lacerations, Incised wounds, Stab wounds, Bone damage, Burns and scalds, ante-mortem and post-mortem injuries, aging of injuries, artificial injuries. <b>Sexual Offences:</b> Medico-legal investigation of Sexual offences, including examination of victim and suspect.
<b>Section - C</b>	<b>Botanical evidences:</b> Introduction, types, location, collection evaluation and forensic significance of Fungi and Plants in Forensic Science, Wood and Pollen grains, Methods of identification and comparison.
<b>Section - D</b>	<b>Microbial Forensics:</b> Types and identification of Bacteria and Viruses in Forensic Science, Microbial profiles as identification tools, use of microorganisms in bioterrorism, Anthrax, transmission of HIV as a criminal act, role of microbes in food poisoning

#### Suggested Readings:

1. Text book of Forensic Medicine by Krishan Vij; B.I. Churchill Livingstone Pvt. Ltd. 2001.

2. Forensic Taphonomy, edited by Woudiam D. Haglernd, Marculla H. Sorg; CRC Press, LLC, 1997.
3. Glaister (Ed)-Rentoul & Smith (1973) : Forensic Medicine & Toxicology, Churchill Livingstone, Edinburgh.
4. Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
5. Mukherjee, J.B.: Forensic Medicine & Forensic Toxicology.
6. Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
7. Forensic Botany (2005) by Heather Miller Coyle, CRC Press
8. Microbial Forensics by Bruce Budowle, Steven E. Schutzer and Roger G. Breeze (2011)

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 305-B	Program Elective	4
Semester: III	<b>FORENSIC PHYSICS AND PHOTOGRAPHY</b>	Time: 3 hours

### **INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### **INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Introduction to Forensic Physics:</b> Nature, collection, preservation & forwarding of physical evidence for scientific examinations. <b>Fiber Examination:</b> Introduction, Classification, Fiber transfer and persistence. Fiber Recovery: At the scene, Contamination and its prevention. Fiber Identification and comparison: Microscopical examination, Determination of optical properties, Refractive Index, Birefringence, Instrumental analysis, Factors affecting the strength of fiber evidence.
<b>Section - B</b>	<b>Building Materials-</b> Types of cement and their composition, Determination of adulterants, Analysis of Bitumen and road material, Analysis of cement mortar and cement concrete and stones. Forensic examination of electrical appliances/installations. <b>Miscellaneous Clue Materials-</b> Examination of strings/ropes, threads and fabrics, Wires/cables, Seals, Counterfeit coins, <b>Gem Stones:</b> Analysis of crystalline substances.
<b>Section - C</b>	<b>Voice Identification:</b> Introduction, Significance, Theory of generation of voice, Characteristics, Voice Spectrography, Recent Development of Computerized Speech Laboratory, Legal Aspects.
<b>Section - D</b>	<b>Photography:</b> Basic principles and techniques, Working of Camera, F-Number, Depth of field, ISO, Developing and Printing, Modern Developments in Photography: Digital photography and advanced Crime scene and Laboratory photography.

### **Suggested Readings:**

1. Forensic Examination of Fibres, Second Edition - Kindle Edition - Kindle eBook (Apr. 16, 2007) by Ichael Grieve
2. Kleiner, Munay (2002) : Handbook of Polygraph testing. Academic Press.
3. Noon (2000) : Forensic Engineering Investigation.
4. Carper (200) : Forensic Engineering.
5. Hess, A.K. and Weiner, I.B. (1999) Handbook of Forensic Psychology 2nd Ed. John wiley & sons.
6. Bruce A. Arrigo (2000) Introduction to Forensic Psychology Academic Press, London
7. David L. Shapiro; (1991) Forensic Psychological Assessment An Investigative Approach; Allyn and Bacon Publisher, 1991.
8. Sharma, B.R. : Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.
9. Nickolas : Scientific Criminal Investigation.
10. Forensic Speaker Identification (2007) by Philip Rose
11. Forensic Digital Imaging and Photography – (2001) by Herbert L. Blitzer and Jack Jacobia
12. Advanced Crime Scene Photography (2010) by Christopher D Duncan

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 306		10
Semester: III	<b>LAB COURSE-III</b>	Time: 6 hours

#### **Practicals based on Forensic Chemistry and Toxicology**

1. TLC separation of pesticides/insecticides
2. Analysis of phenolphthalein in trap cases
3. Colour/spot tests for common drugs of abuse
4. TLC separation of drugs of abuse
5. M.P. and B.P Determination of various substances of forensic interest

#### **Practicals based on Forensic Biology and Serology**

6. To prepare slides of scale patterns of human hair.
7. To examine human hair for cortex and medulla.
8. To examine Barr bodies from hair root.
9. To determine species of origin from blood.
10. To determine blood group from fresh blood and blood stains.
11. To identify blood stains.
12. To identify semen stains.
13. To identify saliva stains.
14. Microscopic identification of Pollen grains

#### **Practicals based on Forensic Anthropology and Medicine**

15. Determination of age from skull sutures.
16. Determination of sex from skull.
17. Determination of sex from Pelvis.
18. To perform somatoscopic measurement of different subjects.
19. To perform Somatometric measurement of different subjects

**Note:** Students would be attached to the Department of Forensic Medicine for the practical demonstration of Post-mortem examination and injuries.

They may also be attached to forensic laboratory for the practical demonstration of voice examination/physical analysis. They would submit assignments on these topics which would also be a part of evaluation of theirs practical.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 307		4
Semester: III	<b>GENERAL SEMINAR</b>	

**SEMESTER – IV**  
**Option -A: Forensic Biology and Serology (FBS)**

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 401A	Program Core	4
Semester: IV	<b>ADVANCED FORENSIC BIOLOGY</b>	Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
<b>Section - A</b>	<b>Hair examination:</b> Hair structure, growth and replacement of hair. Identification: Species of origin, variation in different major population groups, somatic origin. <b>Methods of Individualization:</b> Blood grouping, enzyme typing and DNA typing.
<b>Section - B</b>	<b>Wild Life Forensics:</b> Introduction, importance, protected and endangered species of Animals and Plants. Identification of wild life materials such as skin, fur, bones, nails, horn, teeth, flowers and plants, by conventional and modern methods, Identification of Pug marks of various animals.
<b>Section - C</b>	<b>Forensic Entomology:</b> 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, its application to Forensic Entomology.
<b>Section - D</b>	<b>Diatoms:</b> Habitat, Structure and life cycle of diatoms, Diatom Monitoring and D-Mapping of water bodies, Extraction from water samples, Slide preparation and identifying features. <b>Diatom Test:</b> Ante-mortem and Post-mortem drowning, Diatom as a forensic evidence, Forensic significance of Diatom Test, Fate of Diatom inside the body, Extraction methods of diatoms from body, Criterion of Concordance, Validity of Diatom test and its Limitations

**Suggested Readings**

1. Richard saferstein; Forensic Science Hand book, Vol (I); Prentice Hall, Publications.
2. Jason H. Byrd and James L. Castner; Forensic entomology, CRC Press LLC, 2001.
3. Forensic Science Hand book by Richard saferstein Vol (II); Prentice Hall, Publications.
4. Robertson (1996) : Forensic examination of Hair. Francis & Taylor, USA.
5. Robertson (1999) : Forensic examination of Hair. Francis & Taylor, USA.
6. Safersstein, R. (1982) Science Handbook; Vol. III, Prentice Hall, New Jersey.
7. Curry, A. S. (1965) Methods of Forensic Science, Vol. IV, Interscience, New Youk.
8. Chowdhuri, S. (1971) : Forensic Biology, B P R & D Govt. of India.
9. Forensic Diatomology by M.S. Pollanen
10. Encyclopedia of Forensic Science, Wiley, 2010



<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 402A	Program Core	4
Semester: IV	<b>ADVANCED FORENSIC SEROLOGY INCLUDING DNA FORENSICS</b>	Time: 3 hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### INSTRUCTUIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<p><b>Immunology:</b> Immune system, immune response, innate and acquired immunity and antigens, haptenes and adjuvants.</p> <p><b>Immunoglobulin:</b> Types, physio-chemical properties and function, raising of antisera.</p> <p><b>Lectins:</b> Forensic significance, buffers and serological reagents, methods of sterilization employed for serological work.</p> <p><b>Antigen-Antibody Reactions:</b> Precipitation, agglutination, complement, neutralization, immunofluorescence.</p> <p><b>HLA system:</b> Its applications in paternity testing, pitfalls of HLA system.</p>
<b>Section - B</b>	<p><b>Forensic examination of Body fluids:</b></p> <p><b>Blood:</b> Identification (Preliminary and confirmatory tests), species of origin (Immunodiffusion and Immuno-electrophoresis), Individualization: Blood grouping, enzyme typing.</p> <p><b>Semen:</b> Composition, functions and morphology of spermatozoa. Identification (Preliminary and confirmatory tests including Azoospermic semen stains), Individualization (Blood Grouping, seminal fluid isozymes typing).</p> <p><b>Other body fluids:</b> Composition, functions and forensic significance of saliva, sweat, milk, urine, fecal matter, vaginal secretions and tests for their identification including the presence of blood group specific ABH substances. .</p>
<b>Section - C</b>	<p><b>DNA Profiling:</b> Introduction, History of DNA Typing, human genetics- heredity, alleles, mutations and population genetics, molecular biology of DNA, variations, polymorphism, DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR. Mitochondrial DNA, evaluation of results, frequency estimate calculations, interpretations, allele frequency determination, match probability- database, quality control, certification and accreditation. Ancient DNA typing.</p>
<b>Section - D</b>	<p><b>Forensic Significance of DNA profiling:</b> Applications in disputed paternity cases, child swapping, missing person's identity- civil immigration, veterinary, wildlife and agriculture cases, 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.</p>

### **Suggested readings:**

1. Medical immunology by Danniell P. Stites, Abba I. Jerr, Tristram G. Parstow, Ninth edition; Prentice Hall International Inc. 1997.
2. Stern, C. (1964) : Principles of Human Genetics, Freeman, California.
3. Chatterjee, C. C-(1975) Human Physiology.
4. Beerman, K.E.: Blood Group Serology, Churchill, and Lincoln, P.J. (1988)
5. Race, R.R, and Sanger, R. (1975) : Blood Groups in Man. Blackwell Scientific, Oxford.
6. Saferstein, R. (1982): Science Handbook, Vol. I, II, & III, Prentice Hall New Jersey.
7. Curry, A. S. (1965): Methods of Forensic Science, Vol IV, Interscience, New York.
8. Barris, H. and Hopkinson, D.A. (1976) : Handbook of Enzyme, Electrophoresis Elsevier, North, Holland, New York.
9. Gilblet, E. (1969) : Markers in Human Blood, Davis, Pennsylvania
10. Culliford, B.E. (1971) The Examination and Typing of Blood Stains, US Deptt. of Justice, Washington
11. Kirby : DNA Fingerprinting Technology.
12. Furley, M.A. & Harrington, J.J. (1991) Forensic DNA Technology
13. Chowdhari, S. (1971) : Forensic Biology, B P R & D, Govt, of India.
14. Dunsford, I and Bowley, C. (1967) : Blood Grouping Techniques, Oliver & Boyd, London
15. Bokert, W. G. & James, S. H. (1989) Interpretation of Blood Stain, Evidence, Elsevaier, New York.
16. Erikson : Blood Group Serology.
17. DNA structure and functions by Richard R. Sinden; Academic Press, Inc. 1994.
18. DNA Structure and functions by Richard R. Sinden; Academic Press, Inc. 1994.
19. DNA Profiling and DNA fingerprinting; Edited by Jorg T. Epplen and Thomas Lubjuhn; Birkhauser Verlag, Switzerland, 1999.
20. Forensic DNA Profiling Protocols edited by Patrick J. Lincoln and Jim Thomson; Humana Press, Inc. 1998.
21. DNA and other Polymorphism in Forensic Science by Henry C. Lee and R.E. Gaensslen; Year book Medical Publishers, Inc. 1990.
22. DNA Technology in Forensic Science by committe on DNA Technology in Forensic Science, Board on Biology, Commission on Life Sciences, National Research council; National Academy Press, Washington, D.C. 1992
- 23.25. Keith In man and Norah Rudin; An Introduction to Forensic DNA Analysis, CRC Press; Ny. 1997.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 403A		4
Semester: IV	<b>LAB COURSE –IV</b>	Time: 6 hours

1. To determine titre of antisera.
2. To prepare anti-H from seeds of Eulex.
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
6. Absorption-inhibition, mixed agglutination and absorption-elution techniques.
7. To prepare gel plates for electrophoresis.
8. To perform electrophoresis for separation of Haptoglobins.
9. To perform electrophoresis for separation of various polymorphic enzymes.
10. Comparative analysis of Diatoms.
11. Examination of hair of different animals as cat, dog, cow, horse and goat.
12. Extraction and isolation of DNA from blood and other body fluids.

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**Special Note:** For optional papers students would be attached to a Forensic Science laboratory for about a fortnight. For the evaluation of practical paper, the comprehensive attachment report is also to be submitted by each student.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 404A	<b>DISSERTATION</b>	20

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 405A	Self Study	-

**Option -B: Forensic Chemistry & Toxicology (FCT)**

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 401B	Program Core	4
Semester: IV	<b>ADVANCED FORENSIC CHEMISTRY</b>	Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Forensic Analysis of Petroleum:</b> Introduction and production processes (Distillation and fractionation) of different petroleum products like Gasoline and Kerosene and Diesel etc. Adulteration of petroleum products <b>Analytical Standards:</b> Standards/methods of commercial analysis of petroleum products as per ASTM and BIS, Forensic Analysis with special reference to Chemical fingerprinting of petroleum products.
<b>Section - B</b>	<b>Analysis of Narcotic Drugs and Psychotropic Substances:</b> Job of forensic Drug Chemist, Analysis of NDPS evidence by various procedures prescribed by U.N. Manual and Forensic lab manual.  Presumptive tests, Colour tests, Microcrystal tests, UV-Vis spectrophotometry, Thin layer chromatography (TLC), Gas chromatography (GC-FID/MS), High performance liquid chromatography (HPLC), IR spectroscopy for Cocaine, Cannabis, Barbiturates, Benzodiazepines, Amphetamines, Opiates and Hallucinogens (LSD, psilocybine and mescaline),  Clandestine laboratory investigation and Designer drugs.
<b>Section - C</b>	<b>Introduction to Explosives:</b> Explosives, Types of Explosives, Composition and characteristics of explosives, Pyrotechnics, IEDs.  <b>Explosive effects:</b> Explosion process and affects, Types of hazards, Effect of blast wave on structures, human etc,  <b>Collection and analysis of Explosive residues:</b> Specific approach to scene of explosion, Reconstruction of sequence of events, Evaluation and assessment of scene of explosion, Post blast residue collection, Systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques and interpretation of results.
<b>Section - D</b>	<b>Liquors:</b> Nature (Fermented and Distilled), Methods (Pot Still and Patent Still) and production of IMFL and CML including Beer, wines and Whisky etc. Congener content of alcoholic beverages, Licit and Illicit liquors, Alcoholic Strength (Over-proof spirit and Proof spirit),

	<b>Analysis of Liquors/Alcohol-</b> Laboratory methods of determination alcoholic strength, Analysis of distilled and fermented liquors with special reference to Color tests, TLC, and GC-MS method
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**Suggested Readings:**

1. Abraham Burger; Medicinal Chemistry & Drug Discovery, 6 Vol Set, 6th Ed., John Wiley & Sons, NY (2004.)
2. Bare Acts with short notes on the following : Narcotic Drugs & Psychotropic Substances Act,
3. DFS -Working Procedure Manual- Chemistry, Explosives and Narcotics,
4. E. Stahl. Thin Layer Chromatography: A Laboratory Handbook (1969)
5. Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi (2005)
6. Giriraj Shah Encyclopedia of Narcotic Drugs & Psychotropic Substances, ( 3,Volume Set)
7. Hara & Osterburg : Introduction to Criminalistics, 1949.
8. Hoffman : A Handbook on Drug Alcoholic Abuse.
9. Jehuda Yinon; Forensic and Environmental Detection of Explosives
10. Lundquist & Curry : Methods of Forensic Science, 1963.
11. M D Cole; The Analysis Of Drugs Of Abuse: An Instruction Manual: An Instruction Manual
12. Matthew Johl; Investigating Chemistry: A Forensic Science Perspective (2006)
13. Moffat, A.C. (Editor) : Clark's Isolation and Identification of Drugs, 1996.
14. P D Sethi Identification of Drugs in Pharmaceutical formulation by thin Layer
15. Ret Newman, Micheal Gilbert, Kevin Lothridge; GC-MS Guide to Ignitable Liquids, CRC Press, LLC, 1999.
16. Saferstein : Criminalistics, 1976.
17. Saferstien : Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
18. Suzanne Bell, Forensic Chemistry 2006
19. Turner Paul; Recent Advances in Pharmacology & Toxicology, Churchill Livingstone, Elenburgh (1989)
20. Yinon Jitrin; Modern Methods & Application in Analysis of Explosives, John Wiley & Sons ,England (1993)

Paper Code	Paper	Credits
FS: 402B	Program Core	4
Semester: IV <b>ADVANCED FORENSIC TOXICOLOGY</b>		Time: 3 hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

### INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION	TOPICS
<b>Section - A</b>	<p><b>Forensic Pharmacology</b>-Absorption, distribution, metabolism and excretion (ADME) of drugs, Enzyme induction and inhibition, First-pass metabolism and bioavailability, Volume of distribution, Elimination of drugs, Half-life, Drug concentration and pharmacological response, Postmortem redistribution, Interpretation, Estimating the dose, Therapeutic, toxic and fatal concentrations, dose response relationships, combined effect of drugs (synergism and antagonism)</p> <p><b>Drug Metabolism (Biotransformation):</b> Importance of Drug Metabolism, Principle Sites of Drug Metabolism, Phase-1 vs. Phase-2 Metabolism, Metabolic pathways of Morphine analogues, Benzodiazepines and Barbiturates, Hallucinogens, Amphetamines and Cocaine etc.</p>
<b>Section - B</b>	<p><b>Methods of Extraction:</b> Narcotics, Stimulants, Sedatives, Hallucinogens, Volatile, Metallic, Pesticides/Insecticides and Vegetable poisons from viscera and blood.</p> <p><b>Immunoassays in Drug Analysis:</b> Basic principles of immunoassay, Heterogeneous immunoassays (Enzyme immunoassays, Radioimmunoassay and Chemiluminescence immunoassays) and Homogeneous immunoassays (Fluorescence polarisation immunoassay)</p>
<b>Section - C</b>	<p><b>Alcohol Intoxication:</b> Properties of Alcohol, absorption, elimination, effects, fatal dose, Chemical tests for alcohol in blood and urine including Breath Screening devices, Quantitative estimation of ethyl alcohol in blood by chemical methods (Kozelk-hine) and instrumental methods (GC), Legal context to drinking and driving.</p> <p><b>Gaseous Poisoning:</b> CO and Phosphine gases, significance, signs and symptoms, methods of diagnosis, tests for identification.</p> <p><b>Pesticide Poisoning:</b> Organochloro/ Organophosphate and Carbamate poisoning, significance, signs and symptoms, methods of diagnosis, tests for identification.</p>

<b>Section - D</b>	<p><b>Animal Poisons:</b> Composition of Snake venoms, Sites and mode of action, Effect on the body as a whole, and tests for identifications.</p> <p><b>Plant Poisons:</b> Nature, type, mode of action, Identification of the following:</p> <p><b>Neurotic-</b> Papaver somniferum</p> <p><b>Spinal-</b> Strychnos nux vomica,</p> <p><b>Cerebral-</b> i) Cannabis sativa ii) Erythroxyton coca iii) Atropa belladonna Linn., iv) Datura fastuosa Linn.</p> <p><b>Cardiac-</b> i) Nicotiana tabacum Linn., ii) Aconitum napellus Linn., iii) Digitalis purpurea Linn.</p> <p><b>Irritant -</b> i) Abrus precatorius ii) Calotropis iii) Cytisus laburnum v) Croton tiglium vi) Argemone mexicana</p> <p><b>Miscellaneous-</b> i) Cyanogenetic glycosides ii) Ergot iii) Oleander (Glycoside) iv) Poisonous Mushrooms</p>
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**Suggested books:**

1. A C Moffat Clarke's Analysis of Drugs and Poisons, (Formerly Isolation & Identification of Drugs) 3rd Ed. 2 Vol. Set.
2. Arena : Poisoning Chemistry, Symptoms, Treatment.
3. Balraj S. Parmar et al; Pesticide Formulation, CBS Publishers, New Delhi (2004)
4. Casarett & Doll Toxicology : The Basic Science of poisons.
5. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004)
6. Clark, E.G.C. : Isolation and identification of Drugs, VI and Vol. II, 1966, 1975-1986.
7. Curry A.S; Analytical Methods in Human Toxicology, Part II, CRC Press Ohio (1986)
8. Curry, A.S. : Advances in Forensic Chemical Toxicology, 1972.
9. Curry, A.S. : Poison Detection in Human Organs, 1976.
10. David E. Newton (Sep 5, 2008); Forensic Chemistry (The New Chemistry)
11. Joseph Sherma, Bernard Fried; Practical Thin-Layer Chromatography: A Multidisciplinary Approach
12. Michael Dahl Poison Evidence (Forensic Crime Solvers)
13. Michael J. Deverlanko et al: Hand Book of Toxicology CRC Press, USA (1995)
14. Modi Medical Jurisprudence
15. Morgan B.J.T; Statistics in Toxicology, Clarendon Press, Oxford (1996)
16. Mule, S.J et. al. : Immunoassays for Drugs subjects to ab, CRC Press, 19 Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology. CBS Pub. New Delhi (1999)
17. Prakash M. et al; Methods in Toxicology Anmol Publication, New Delhi (1998)
18. Reiss C et al; Advance in Molecular Toxicology, Utrecht, Netherlands (1998)
19. Saferstien : Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
20. Shayne C.Gad et al; Acute Toxicology Testing Academic Press California USA (1998)
21. Stahl. E. Thin Layer Chromatography: A Laboratory Handbook
22. Stoleman : Progress in Chemical Toxicology.
23. Sue Jickells Clarke's Analytical Forensic Toxicology
24. Sunshine : Methods for Analytical Toxicology, Press USA, 1975.



<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 403B		4
Semester: IV	<b>LAB COURSE –V</b>	Time: 3 hours

1. Detection of metallic poisons (arsenic and mercury) in viscera and food stuff (simulated samples).
2. Analysis of viscera (simulated sample) for detection of pesticides/insecticides (OC/OP/Carbamate etc.) by TLC.
3. Colour/spot tests for Drugs of abuse.
4. Thin layer chromatographic of Drugs of abuse.
5. U.V/Vis spectrophotometric analysis of Drugs of abuse.
6. Chemical Analysis of Methyl and Ethyl alcoholic.
7. Determination of Methanol and Ethanol in alcoholic liquors.
8. Analysis of Explosive residues.
9. Microscopic Identification of some vegetable poisons.

**Practicals to be performed in Forensic Science Laboratory:**

10. Study of the extraction methods of Drugs and poisons from viscera samples
11. Estimation of alcohol in Blood
12. GC-MS/FTIR analysis of some Drugs of abuse
13. GC-MS analysis of arson/explosive residues
14. Physical, chemical and Instrumental examination of some petroleum products.

**Special Note:** For optional papers students would be attached to a Forensic Science laboratory for about a fortnight. For the evaluation of practical paper, the comprehensive attachment report is also to be submitted by each student.

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<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 404B	DISSERTATION	20

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 405B	Self Study	-

**Option - C: Questioned Document and Finger Print Examination (QDF)**

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 401C	Program Core	4
Semester: IV	<b>ADVANCED QUESTIONED DOCUMENT EXAMINATION</b>	Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<b>Handwriting:</b> teaching of handwriting, writing systems; Principal of handwriting identification, copy book form Deviations from copy book form Development of individuality in handwriting classification of characteristics: Class and individual characteristics, National characteristics in handwriting, accidental characteristics in handwriting. Various types of characteristics contributed due to (a) Element of style as Arrangement, connection, design, size and relative size, slant, spacing (b) elements of execution as Abbreviations, Alignment, Commencement and termination, diacritic and punctuation, embellishment, legibility, pen control leading to pen scope, pen pressure, pen lift, pen pause, writing movements, line quality.
<b>Section - B</b>	<b>Comparison of handwriting:</b> Natural Variations in handwriting range of variations (consistency), fundamental divergences in handwriting. Interpretation of these two in relation of identification of handwriting, individual characteristics, significant individual characteristics, relative weightage of characteristics of handwriting, consideration of various writing instruments used in writing. <b>Forgeries of Signature:</b> Classes of forgery and their examination, Disguise in handwriting, anonymous letters, Handed ness and ambidexterity, examination of numeral and initials
<b>Section - C</b>	<b>Alterations in the document:</b> Advanced methods of examination of alterations as Projectina, video- spectral comparator (VSC) and ESDA, their working principles and uses. Computer Printing devices as dot matrix printer, inkjet printer and laser printer, their working, identification and limitations, Composition of ink, paper and their examination.
<b>Section - D</b>	Types and working of Photostat Machine, Fax Machines, identification of Photocopies and Photocopier, fax machines. Desktop printing including image processing devices, their role in counterfeit currency and certificate etc. Plastic currency: Examination of credit cards and similar material, Holographic marks and their examination. Preparation of detailed report with reasons and illustrative charts, use of standard terminology.

### **Suggested Readings**

1. Huber, A. R. and Headride, A.M. (1999) : Handwriting identification : facts and fundamental CRC LLC
2. Ellen, D (1997) : The scientific examination of Documents, Methods and techniques. 2nd ed., Taylor & Francis Ltd.
3. Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
4. Manning, C.A (1999) : Financial Investigations and Forensic Accounting CRC Press.
5. Harrison, W.R. : Suspect Documents & their Scientific Examination, 1966, Sweet & Maxwell Ltd., London.
6. Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsevier North Holland Inc., New York.
7. Brewster, F. : Contested Documents and Foregeries, The Eastern Law House, Calcutta. 1932.
8. Ames : Ames on Foregery, 1900, Ames Rellingson Co., New York.
9. Conway, J.V.P. : Evidential Documents, 1959, Charles C. Thomas, Illinois.
10. Mehta, M. K. : The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi, Allahabad. 1970.
11. Sulner, H.F. : Disputed Document, 1966 Oceana Publications Inc., New York.
12. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabad (Ed. A.K. Singla).
13. Quirke, A.J. : Forged, Anonymous & Suspet Documents, 1930, George Rontledge & Sons Ltd., London.
14. Osborn, A. S. : Questioned Documents 1929, Boyd Printing Co., Chicago.
15. Levinson, J: Questioned Documents, 2000, Academic Press, Tokyo.
16. Kelly, J.S and Lindblom, B.S: Scientific Examination of Questioned Documents, 2006, Taylor & Francis, New York.
17. Brunelle, R.L. and Reed, R.W: Forensic Examination of Ink and Paper, 1984, Charles C Thomas Publisher, U.S.A.
18. Baker, J.N: Law of Disputed and Forged Documents, 1955, The Michie Company, Virginia.

**Paper Code**

FS: 402C

Semester: IV

**Paper**

Program Core

**ADVANCED FINGER PRINTS  
EXAMINATION****Credits**

4

Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	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.
<b>Section - B</b>	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.
<b>Section - C</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.
<b>Section - D</b>	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.

**Suggested Readings:**

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press, 1999.
2. E. Roland Menzel; Fingerprint Detection with Loseres; Second edition; Marcel Dekker, Inc. 1999.
3. James F. Cowger; Friction Ridge Skin CRC Press London, 1993.
4. Cummins & Midlo : Finger Prints, Palms and Soles, 1943, The Blakiston office London.
5. Cherril, F.R. : The Finger Prints. System at Scotland Yard, 1954; Her Majesty's office, London.
6. Wentworth & Wilder : Personal Identification, 1948. R. G. Badger. Boston.
7. Mehta, M. K. : Identification of Thumb Impression & Cross Examination of Finger Prints, 1980  
N. M. Tripathi (P) Ltd. Bombay.
8. Moenssens : Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.
9. Allison : Personal Identification.
10. Chatterjee S.K. and Hagne R.V. (1988) : Finger Print or Dactyloscopy and Ridgeoscopy.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 403C	Program Core	4
Semester: IV	<b>LAB COURSE –VI</b>	Time: 3 hours

1. To study the handwriting written on unusual surfaces on wall.
2. To study the initials.
3. To perform TLC of writing inks and writing papers.
4. To study alterations in the document.
5. To study the indented and invisible writings.
6. To photograph the watermarks in the document.
7. To examine currency notes.
8. To study the type scripts and printed matter from various computer print devices.
9. To study sequence of intersecting strokes.
10. To perform cyano-acrylate method to develop latent finger prints.
11. To classify the fingerprints from Primary classification to key classification.
12. To perform SPR method to develop latent prints.
13. To compare the fingerprints.

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**Special Note:** For optional papers students would be attached to a Forensic Science laboratory for about a fortnight. For the evaluation of practical paper, the comprehensive attachment report is also to be submitted by each student.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 404C	<b>DISSERTATION</b>	20

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 405C	Self Study	



**Option D: Advanced Computer and Cyber Forensics**

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 401D	Program Core	4
Semester: IV <b>ADVANCED COMPUTER FORENSICS</b>		Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	<p><b>Basics of Computer:</b> Memory and processor, address and data buses, stored program concept. Basic electrical safety, Motherboards, Start of boot sequence, Power on Self Test (POST), BIOS and CMOS, MSDOS, Windows 95/98/ME, Windows NT/2000/XP and Mac operating systems.</p> <p><b>Methods of storing data:</b> Number systems, character codes, record structures, file formats and file signatures. Word processing and graphic file formats.</p> <p><b>Hardware:</b> Development of the hard disk, Physical construction, CHS and LBA addressing, Encoding methods and formats, IDE and ATA specifications, overcoming the 528 MB, 8 GB and 127 GB limitations, Dynamic drive overlays. Boot sector, partition table, slack space and free space, Disk mapping.</p> <p><b>Overview of Computer Forensic Technology:</b> Computer forensic fundamentals, computer forensic services, forensic methodology, types of computer forensic technology: military, law, enforcement and types of business computer forensic technology, computer forensic software and hardware: visual time analyzer, x-ways forensic, image mastersolo-3 forensic, rodmaster-3, disk jockey IT.</p>
<b>Section - B</b>	<p><b>Digital Evidence:</b> increasing awareness of digital evidence, challenging aspects of digital evidence, challenging aspects of cyber trail, forensic science and digital evidence, computer image verification and authentication, digital image watermarking and its application in forensic science, Various techniques for digital watermarking.</p> <p>The logical structures of the Microsoft operating system FAT file system. The DOS and Windows boot process. How to recover deleted files. The significance and determination of the creation date and time.</p> <p><b>Passwords and encryption techniques:</b> Importance of keeping a log, Explanation of passwords keys and hashes,</p> <p><b>Seizure of computers:</b> Preparations to be made before seizure, Actions at the scene, Treatment of exhibits. How to make bitstream (exact copies) of the original media.</p> <p><b>Investigation:</b> Investigating on various imaging methods. Lay down the image provided onto a hard disk and provide a disk map of the suspect drive. Extraction of all relevant information from a hard disk. Instruction on the acquisition, collection and seizure of magnetic media. How to best acquire, collect or seize the various operating systems. Legal and privacy issues, Forensic examination procedures,</p>

	Preparing and verifying forensically sterile storage media.
<b>Section - C</b>	<b>Database and its security:</b> Introduction to database, concepts of database, components of database, advantages of using databases. Security requirements, reliability and integrity of database: Redundancy, back up and recovery techniques, concurrency control: optimistic and pessimistic techniques, attacks on databases: Direct and indirect attack, multilevel security, data recovery tools, file integrity checker.
<b>Section - D</b>	Introduction to digital image and its processing, its steps, components of image processing systems, image sensing and acquisition, image sampling and quantization, mathematical tools used in digital image processing, Intensity transformation and spatial filtering: some basic intensity transformation function, histogram processing, fundamentals of spatial filtering.

**Suggested Readings:**

1. Computer Forensics and Cyber Crime: An Introduction (2003) Marjie T. Britz
2. Security In computing By Charles P. Pfleeger, Shari Lawrence Pfleeger. Forwerd by Wouldis H. ware.
3. Fundamentals of Database Systems, By Ramez Elmasri, Sham Navathe, Pearson publication
4. Computer forensics: computer crime scene investigation, Volume 1 By John R. Vacca, Charles River media
5. Scene of the Cybercrime By Michael Cross, Debra Littlejohn Shinder
6. Computer Forensics For Dummies by Linda Volonino and Reynaldo Anzaldua (2008)
7. Handbook of Digital Forensics and Investigation by Eoghan Casey (2009)
8. Computer Forensics: Incident Response Essentials by Warren G. Kruse II and Jay G. Heiser (Paperback - 26 Sep 2001)

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 402D	Program Core	4
Semester: IV <b>ADVANCED COMPUTER FORENSICS</b>		Time: 3 hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper would consist of five sections A, B, C, D and E. Section A, B, C and D would have two questions from the respective sections of the syllabus carrying equal marks. Section E would consist of ten short answer type questions which would cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

**INSTRUCTIONS FOR THE CANDIDATE**

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

<b>SECTION</b>	<b>TOPICS</b>
<b>Section - A</b>	Definition and types of Cyber crimes, HTML and other Internet protocols, Internet History and Topology, Internet Services and Access, Internet Protocols and Addressing, E-Mail and Header Interpretation, E-Mail Attachments, FTP, Telnet and IRC, Internet Chat, HTTP. Outlook Express, Virus and Trojan infection, Different types of attacks, Internet Research & Investigative Tools Network security: Types of communication and its medium, OSI/TCP reference models. Internet security systems, email and email forensic, tracing domain name or IP address, intrusion detection system(IDS), firewall security systems, browser security, wireless network security, biometric security system, website history and favorites, attacking with Trojan, viruses and worms, hacking, denial of service attack, spoofing.
<b>Section - B</b>	Security using Cryptography: introduction, types of Cryptography, different types of ciphers like caesar cipher, mono alphabetic cipher, poly alphabetic cipher etc. Diffie-Hellman key exchange, and key management protocols. Steganography: Introduction, History, Steganography types: Image steganography, video steganography, audio steganography, text steganography. Various methods for hiding the message into images. Use of steganography in Biometrics, parameters affecting steganography, steganalysis.
<b>Section - C</b>	Fraud detection in computer forensic: detecting fraud, what is fraud, types of fraud, technologies used for fraud detection: data mining and fraud detection, analysis of fraud detection, fraud detection tools, technique of fraud detection, visual analysis techniques: link or relationship analysis, time line analysis, clustering.
<b>Section - D</b>	General Forensic Principle, Evidence Acquisition Manner, Shutdown Procedures while Preserving Evidence, Acquiring A Drive Safely, Disk Imaging, Collecting Volatile Data, Evidence Analysis, Timeframe Analysis. Data retrieval tools (Simmi and En-Case etc.) from SIM, Hard drives and other storage media. Retrieval of data from damage storage devices.

**Suggested Readings:-**

1. Digital evidence and computer crime: forensic science, computers and the internet By Eoghan Casey, Elsevier
2. Computer and intrusion forensics By George M. Mohay, artech house
3. Information hiding techniques for steganography and digital watermarking by [Stefan Katzenbeisser](#), [Fabien A. P. Petitcolas](#)
4. Digital image processing by Rafael C. and Gonzalez Richard E. Woods, Pearson Publication.
5. Computer Forensics by Nathan Clarke (Paperback - 8 Apr 2010)
6. EnCase Computer Forensics: The Official EnCE: EnCase Certified Examiner Study Guide: The Official EnCE - EnCase Certified Examiner Study Guide by Steve Bunting (Kindle Edition - 5 Dec 2007) - Kindle eBook
7. Computer Forensics: Evidence, Collection and Management by Robert C. Newman (Hardcover - 9 Mar 2007)
8. Computer Forensics and Privacy (Artech House computer security series) by Michael A. Caloyannides (Hardcover - 31 Aug 2001)
9. Handbook of Computer Crime Investigation: Forensic Tools and Technology by Eoghan Casey BS MA (Paperback - 22 Oct 2001)

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 403D	Program Core	4
Semester: IV	<b>LAB COURSE –VII</b>	Time: 3 hours

1. Study of PC laboratory.
2. Basic operations on Binary numbers.
3. To examine the hard disk and to draw an appropriate conclusions
4. Imaging of different types of storage media
5. Password recovery for Microsoft Office files
6. Concepts of Accessed, deleted, modified and created file folders
7. Retrieval and analysis of e-mails
8. Retrieval of data from SIM and other storage devices.
9. Study of Various image processing techniques.
10. Study of various database commands
11. Study of the basic concepts of C or C++
12. Study of UNIX operating system and its various commands.
13. Implementation of various spatial operations on image using matlab.
14. Implementation of least significant technique in steganography using matlab.
15. Insertion of message in digital image using Matlab
16. Retrieval of message in digital image using Matlab

-----**Special Note:** For optional papers students would be attached to a Forensic Science laboratory for about a fortnight. For the evaluation of practical paper, the comprehensive attachment report is also to be submitted by each student.

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 404D	<b>DISSERTATION</b>	20

<b>Paper Code</b>	<b>Paper</b>	<b>Credits</b>
FS: 405D	Self Study	-