Maulana Abul Kalam Azad University of Technology (MAKAUT)

[Formerly Known as WBUT]

MASTER of Forensic Science (M.Sc. in FORENSIC SCIENCE)

Syllabus as per UGC Guidelines

The Institute proposed the following courses:

M.Sc in Forensic Science	
Course Duration	**2 Years (4 Semesters)**
Course Value	**108 CP (Credit Points)**

	Lecture / Theory	Practical / Field Work	Dissertation	Total
Core Papers	**61 Credits**	**23 Credits**	**NIL**	**84 Credits**
Elective Papers	**4 Credits**	**0 Credit**	**20 Credit**	**24 Credits**
TOTAL				**108 Credits**

Course Fees:

M.Sc. in Forensic Science	
Semester / Year	**Total Course Fees (in INR.)**
IV semesters / 2 years	**92,400/-**
Hostel Charges	**Extra (As per University Rules)**

The Specialization start from Third Semester and the choice available in the following streams as mentioned hereunder;

a) **Forensic Ballistics**
b) **Forensic Finger Print**
c) **Forensic Toxicology and Chemistry**
d) **Forensic Biology, Serology, DNA Profiling**
e) **Forensic Documents Examination**
f) **Forensic Physics**
g) **Cyber Forensic**

The Elective Papers in 3rd Semester and the choice is available in the following streams as mentioned hereunder;

a) **Criminal Justice System**
b) **Police and Law Enforcement**
c) **Forensic Questioned Documents and Allied Problems**
d) **Investigation of Crime Scene and Fire Arms**
e) **Explosion Investigation techniques**
f) **Forensic Evidence and Crime**
g) **Forensic Photography**
h) **Forensic Psychiatry and Human Criminal Mind**
i) **Criminology**

Note:

a) **Academic Sessions Starts in August.**
b) **There are 2 semesters in each Academic Session. Semester I (August to November) and Session II (January to April).**
c) **University examinations are usually held in May and December.**
d) **Each Semester has 17 (Seventeen) weeks of teaching.**
e) **Teaching is held from Monday to Friday every week.**
f) **The entire specialized stream may not be taught in every session.**
g) **Allotment of the specialized stream is restricted by student's academic background at Graduation Level.**

Credit Distribution Matrix

Master of Forensic Science

First Semester Examination

Paper Code	Course Contents	Marks	Credit			
			L	T	P	C
MSFS-101	Introduction to Forensic Science and Criminal Justice System	100	3	1	0	4
MSFS-102	Analytical Instruments and Techniques	100	3	1	0	4
MSFS-103	Evidence and It's Pattern	100	3	1	0	4
MSFS-104	Crime Scene Management and Quality Assurance	100	3	1	0	4
MSFS-105	Essentials of Statistics and Mathematics in Forensic Science	100	3	1	0	4
Practical Course						
MSFS-106	Pattern Evidence at Crime Scene and Photography	100	0	0	4	2
MSFS-107	Field Tests	100	0	0	4	2
MSFS-108	Tools and Techniques	100	0	0	4	2
Total		800	15	5	12	26

Second Semester Examination

Paper Code	Course Contents	Marks	Credit			
			L	T	P	C
MSFS-201	Forensic Chemistry and Toxicology	100	3	1	0	4
MSFS-202	Forensic Biology and Forensic Medicine	100	3	1	0	4
MSFS-203	Forensic Questioned Documents	100	3	1	0	4
MSFS-204	Forensic Ballistics and Forensic Physics	100	3	1	0	4
MSFS-205	Cyber Crime	100	3	1	0	4
Practical Course						
MSFS-206	Forensic Toxicology, Chemistry, Biology and Forensic Medicine	100	0	0	4	2
MSFS-207	Ballistics and Photography	100	0	0	4	2
MSFS-208	Questioned Documents Examination	100	0	0	4	2
Total		800	15	5	12	26

Third Semester Examination

Students will choose one specialization, out of the six specializations beginning with the 3rd Semester

Specialization in Forensic Ballistics (MSFS-310):

Paper Code	Course Contents	Marks	Credit			
			L	T	P	C
MSFS-311	Firearms, Ammunitions & Instrumentation Techniques	100	3	1	0	4
MSFS-312	Identification of Firearms, Range of Firing and Chemical Tests	100	3	1	0	4
MSFS-313	Internal, External Ballistics & Gun-shot Residue	100	3	1	0	4
MSFS-314	Wound Ballistics, Reconstruction & Report Writing	100	3	1	0	4
Elective	To be selected from the pool of the papers*	100	3	1	0	4
Practical Course						
MSFS-316	Applications of Instrumentation Techniques in Forensic Ballistics	100	0	0	4	2
MSFS-317	Forensic Ballistics- Identification of firearms, Range of firing, Chemical Tests	100	0	0	4	2
MSFS-318	Documentation of Crime Scene involving Firearm, handling or Evidentiary Clues	100	0	0	4	2
Total		800	15	5	12	26

Specialization in Forensic Toxicology and Chemistry (MSFS-320):

Paper Code	Course Contents	Marks	Credit			
			L	T	P	C
MSFS-321	Advance Forensic Chemistry	100	3	1	0	4
MSFS-322	Advance Forensic Toxicology	100	3	1	0	4
MSFS-323	Forensic Analysis of Drugs	100	3	1	0	4
MSFS-324	Advance Instrumental Techniques	100	3	1	0	4
Elective	To be selected from the pool of the papers*	100	3	1	0	4
Practical Course						
MSFS-326	Forensic Chemistry and Instrumental Techniques	100	0	0	4	2
MSFS-327	Forensic Toxicology and Instrumental Techniques	100	0	0	4	2
MSFS-328	Forensic Analysis of Drugs and Instrumental Techniques	100	0	0	4	2
Total		800	15	5	12	26

Specialization in Forensic Biology, Serology, DNA Profiling (MSFS-330):

Paper Code	Course Contents	Marks	Credit			
			L	T	P	C
MSFS-331	Forensic Anthropology	100	3	1	0	4
MSFS-332	Forensic Biology and Wildlife Forensics	100	3	1	0	4
MSFS-333	Forensic Genetics & Forensic Serology	100	3	1	0	4
MSFS-334	Forensic DNA Profiling and Bioinformatics	100	3	1	0	4
Elective	To be selected from the pool of the papers*	100	3	1	0	4
Practical Course						
MSFS-336	Forensic DNA Profiling	100	0	0	4	2
MSFS-337	Forensic Serology	100	0	0	4	2
MSFS-338	Forensic Anthropology	100	0	0	4	2
Total		800	15	5	12	26

Specialization in Forensic Documents Examination (MSFS-340):

Paper Code	Course Contents	Marks	Credit			
			L	T	P	C
MSFS-341	Questioned Documents and Handwriting Analysis	100	3	1	0	4
MSFS-342	Mechanical Impressions	100	3	1	0	4
MSFS-343	Digital & Security Documents	100	3	1	0	4
MSFS-344	Bank Frauds and Forensic Accounting	100	3	1	0	4
Elective	To be selected from the pool of the papers*	100	3	1	0	4
Practical Course						
MSFS-346	Handwriting and Mechanical Impressions	100	0	0	4	2
MSFS-347	Examination of Electronically printed documents and counterfeits	100	0	0	4	2
MSFS-348	Analysis of Digital Documents and Bank Instruments	100	0	0	4	2
Total		800	15	5	12	26

Specialization in Forensic Physics (MSFS-350):

Paper Code	Course Contents	Marks	Credit			
			L	T	P	C
MSFS-351	Forensic Voice Authentication	100	3	1	0	4
MSFS-352	Forensic Video Analysis	100	3	1	0	4
MSFS-353	Criminalistics and Forensic Engineering	100	3	1	0	4
MSFS-354	Collision Investigation & Reconstruction	100	3	1	0	4
Elective	To be selected from the pool of the papers*	100	3	1	0	4
Practical Course						
MSFS-356	Forensic Audio Analysis	100	0	0	4	2
MSFS-357	Image and Video Analysis	100	0	0	4	2

MSFS-358	**Trace Material Analysis & Reconstruction**	**100**	**0**	**0**	**4**	**2**
Total		**800**	**15**	**5**	**12**	**26**

Specialization in Computer Forensic and Cyber Crime (MSFS-360):

Paper Code	Course Contents	Marks	Credit			
			L	T	P	C
MSFS-361	**Advanced Digital Forensics**	**100**	**3**	**1**	**0**	**4**
MSFS-362	**Networks Security & Forensics**	**100**	**3**	**1**	**0**	**4**
MSFS-363	**Mobile & Wireless Device Forensics**	**100**	**3**	**1**	**0**	**4**
MSFS-364	**Cyber Laws & Intellectual Property Rights**	**100**	**3**	**1**	**0**	**4**
Elective	**To be selected from the pool of the papers***	**100**	**3**	**1**	**0**	**4**
Practical Course						
MSFS-366	**Advanced Digital Forensics**	**100**	**0**	**0**	**4**	**2**
MSFS-367	**Networks Security & Forensics**	**100**	**0**	**0**	**4**	**2**
MSFS-368	**Mobile & Wireless Device Forensics**	**100**	**0**	**0**	**4**	**2**
Total		**800**	**15**	**5**	**12**	**26**

Student will also have to select one Elective Paper from the pool of 8 Elective papers.

Paper Code	Elective Paper Contents	Credit			
		L	T	P	C
MSFS315	**Reconstruction of Crime Scene involving Firearms**	**3**	**1**	**0**	**4**
MSFS325	**Allied Problems in Forensic Document Examinations**	**3**	**1**	**0**	**4**
MSFS335	**Post Blast Investigation Techniques**	**3**	**1**	**0**	**4**
MSFS345	**Forensic Evidence in Crime against Human Body**	**3**	**1**	**0**	**4**
MSFS355	**Photography and Forensic Image Analysis**	**3**	**1**	**0**	**4**
MSFS365	**Cyber Crime and IT ACT**	**3**	**1**	**0**	**4**
MSFS375	**Criminal Justice System**	**3**	**1**	**0**	**4**
MSFS385	**Policing and Law Enforcement**	**3**	**1**	**0**	**4**

Fourth Semester Examinations

Practical / laboratory Based Courses

Specialization in Forensic Ballistics (MSFS 410)

Paper Code	Paper Contents	Credit			
		L	T	P	C
MSFS411	Research Methodology and Communication Skills	3	2	0	5
MSFS412	Dissertation	0	0	20	20
MSFS413	Internship	0	0	5	5
Total Credit		3	2	25	30

Specialization in Forensic Toxicology and Chemistry (MSFS430)

Paper Code	Paper Contents	Credit			
		L	T	P	C
MSFS411	Research Methodology and Communication Skills	3	2	0	5
MSFS422	Dissertation	0	0	20	20
MSFS423	Internship	0	0	5	5
Total Credit		3	2	25	30

Specialization in Forensic Biology, Serology and DNA Profiling (MSFS440)

Paper Code	Paper Contents	Credit			
		L	T	P	C
MSFS411	Research Methodology and Communication Skills	3	2	0	5
MSFS432	Dissertation	0	0	20	20
MSFS433	Internship	0	0	5	5
Total Credit		3	2	25	30

Specialization in Forensic Documents Examinations (MSFS450)

Paper Code	Paper Contents	Credit			
		L	T	P	C
MSFS411	Research Methodology and Communication Skills	3	2	0	5
MSFS442	Dissertation	0	0	20	20
MSFS443	Internship	0	0	5	5
Total Credit		3	2	25	30

Specialization in Forensic Physics (MSFS460)

Paper Code	Paper Contents	Credit			
		L	T	P	C
MSFS411	Research Methodology and Communication Skills	3	2	0	5
MSFS452	Dissertation	0	0	20	20
MSFS453	Internship	0	0	5	5
Total Credit		3	2	25	30

Specialization in Cyber Forensic (MSFS470)

Paper Code	Paper Contents	Credit			
		L	T	P	C
MSFS411	Research Methodology and Communication Skills	3	2	0	5
MSFS462	Dissertation	0	0	20	20
MSFS463	Internship	0	0	5	5
Total Credit		3	2	25	30

Semester – I

Semester – I, Paper – I
M.Sc. in Forensic Science
MSFS101 – Introduction to Forensic Science and Criminal Justice System

Unit – I – Forensic Science

Definition, Principles, History and Development, Scope of Forensic Science, FSLs and Forensic Science Institutions in India, Services provided by Forensic Science Investigators, Functions and Responsibilities of Forensic Scientists, Laboratory Information Management System, Chain of Custody of Samples, Security System and Safety Equipments.

Unit – II – Criminal Justice System

Crimes - Definition, Types, Causes, Theories and Prevention; Characteristics of Criminals.

Criminal Justice System – Structure of Police, Prosecution, Judicial Organization in India, Police and Forensic Scientist relationship w.r.t crime Investigation, Modus Operandi and its role in crime records, Court Testimony.

Unit – III – Laws Related to Forensic Science

Overview of IPC, Cr.P.C, Indian Evidence Act, IT Act, POSCO, RTI Act and Relevant sections of Cr.P.C – Section 291, 292, 293.

Sections of IPC related to Document examination- 29, 113b, Punishment of criminal conspiracy- 120b, IPC – 407, 413.

Prevention of Corruption Act Sections 7, 11, 13(1) (a) and 13(1) (b).

Other Related Laws - Explosive Substance Act, Excise Act, Petroleum Act, NDPS Act, Poison Act, Wildlife Protection Act, Environmental Protection Act, Arm Act, Drug and Cosmetic Act, Dowry Prohibition Act, Consumer Protection Act, Essential Commodities Act, Food Safety and Standards Authority of India Act.

Unit – IV – Psychology and Investigative Techniques

Definition, meaning and scope of forensic psychology. Role of Forensic Psychology in the investigation of crime. Psychology and the Police. Overview of Polygraph (Lie-detection), Narco Analysis, Brain Mapping, their applications and legal implications. Criminal Behaviour, Criminal Profiling.

Reference Books:

1. S. H. James, J. J. Forensic science; “An introduction of Scientific and Investigative Technique”, CRC press 2003 and 2005
2. B. R. Sharma; “Forensic Science in criminal Investigation and Trails”, Universal pub., 2013
3. J. M. Brown & Campbell, E. A; “The Cambridge handbook of Forensic Psychology”, Cambridge, England: Cambridge University Press, 2010
4. Belmont, CA; “Justice, 7th Ed”, Thomson Wordsworth
5. H. Lee; “Physical Evidence”, Elsevier, 2000
6. Indian Evidence Act
7. Indian Penal Code
8. Code of Criminal Procedure
9. James, S.H. And Nordby, J. J.; “Forensic Science; An Introduction to Scientific and Investigative Techniques”, 4th Edition, CRC Press USA, 2014
10. Richard Saferstein; “Criminalistics: An Introduction to Forensic Science”, Prentice Hall Inc. USA.
11. Richard Saferstein; “Forensic Science: An Introduction”, Prentice Hall Inc., USA, 2010
12. William Eckert; “Introduction to Forensic Sciences”, 2nd Edition, CRC Press London, 1997

Semester – I, Paper – II
M.Sc. in Forensic Science
MSFS102 – Analytical Instruments and Techniques

Unit – I – Basic Concepts of Method Validation

Introduction to measurement and instrumentation, methods of measurement. Performance characteristics of Instruments: static characteristics- accuracy, precision, sensitivity, linearity, reproducibility, repeatability, resolution, threshold, drift, stability, tolerance, range or span & dynamic characteristics -speed of response, measuring lag, fidelity, dynamic error, Limit of Detection, Limit of Quantitation.

Signal and Data: signal-to-noise ratio, source of noise, signal- to- noise enhancement.

Unit – II – Microscopy Techniques

Microscope, Compound Microscope, Polarized Light Microscopy, Fluorescence Microscopy, Comparison Microscope, Stereo-zoom Microscope. Transmission Electron Microscope, Video-zoom Microscope. Scanning Electron Microscope – Energy Dispersive X-Ray. Atomic Force Microscope.

Unit – III – Basic concepts of Spectroscopic techniques

Introduction to spectrophotometry, Interaction of electromagnetic radiations with matter: phenomena of absorption, emission, reflection, fluorescence, phosphorescence.

Detection of radiations: Photographic detectors, thermal detectors, photoelectric detectors.

Basic concepts of atomic spectra, energy levels, quantum numbers, designation of states, selection rules, atomic spectra.

Ultraviolet and visible spectrophotometry: types of sources, stability, wavelength selection, filter cells, sampling devices, Lambert and Beers Law, calibration of instrument, Infrared spectrophotometry, Raman Spectroscopy, High Resolution Hyper Spectral Comparator. Detectors. Atomic Absorption Spectrophotometry

Unit – IV – Separation and Detection Techniques

Chromatographic Techniques: General Principles, stationary phase, mobile phase, Classification of chromatographic techniques, Column chromatography, High Performance Liquid Chromatography.

Radio chemical techniques: Basic principles and theory introduction about nuclear reactions and radiations, Neutron sources, Neutron Activation Analysis. Basics of

Electrostatic Detection Apparatus, Centrifugation techniques, Electrophoretic techniques.

Reference Books:

1. Hobart Willard; “Instrumental Methods of Analysis”, Wadsworth Publishing Company, 1988.
2. Douglas Skoog, James Holler and Stanley Crouch; “Principles of Instrumental Analysis” 7th Edition, Cengage Learning, 2017.
3. W.R. James; “Atomic Spectroscopy”, 2nd Edition, Marcel Dekkar, In, NY, 1966.
4. V.B Patania; “Spectroscopy”, Campus Books International, 2004.
5. R.S Khandpur; “Handbook of Analytical Instruments”, Tata Mac Graw Hill Publ. Co., 2004.
6. G.R Chatwal & S.K Anand; “Instrumental Methods of Chemical Analysis”, Himalaya Publ. House, 2004.
7. K.C Thomson & R.J Renolds; “Atomic Absorption Fluorescence & Flame Emission Spectroscopy: A Practical Approach”, 2nd Edition, Charles Griffin & Co., 1978.
8. Silverstein R. M Webster F. X; “Spectrometric Identification of Organic Compounds”, 6th Edition, John Wiley & Sons, Inc. 1997.
9. C.G.E Clark; “Isolation and Identification of drugs”, Vol.1 and Vol.2, Academic Press, 1986.
10. C.N Banwell & M.M.C Elani; “Fundamental of Molecular Spectroscopy”, 4th Edition, Tata McGraw Hill Pub. Co., 1995.
11. G.R Chatwal; “Analytical Spectroscopy”, 2nd Edition, Himalaya Publishing House, 2002.

Semester – I, Paper – III
M.Sc. in Forensic Science
MSFS103 – Evidence and It's Pattern

Unit – I

Introduction: Biometrics and Forensic Science- face, Iris & retinal imaging, speech recognition, Fingerprint patterns and Ridge Characteristics, Comparison of Fingerprint, Development & lifting of Latent Fingerprint, Automated Fingerprint Identification System (AFIS), Identification of Lip prints, ear prints, Gait pattern, Bloodstain Patterns, Footprints, Footwear Impressions.

Unit – II

Definition of documents under sec 29 IPC and Section 3, 45, 47 and 73 of IEA and Sections 292 and 293 of Cr.P.C, Forgery and its related sections of IPC. Scope of forensic document examination, classification of important and valuable documents, observation tests, Care, handling, preservation, marking, packing and forwarding of forensic documents- Do"s and Don"ts, maintaining chain of custody at crime scene and in the FSLs/CFSLs.

Unit – III

Tool marks- Types, Class and Individual Characteristics, Comparisons, Impression Marks, Compression Marks, Striated Marks, Combination of Impression and Striated Marks, Repetitive Marks, Materials for making Test Tool Marks, Methods of preparation of Test Tool Marks, Comparison of test and evidence tool marks, Rubber Stamp Impressions, Metallic Seal Impressions, Embossed Impressions and Indentation marks, Mechanical Impressions.

Cast, Engraved and Punched Marks – Methods of their restoration.

Glass: types of glass and their composition, manufacturing of various types of glass and their properties.

Soil- Formation, Types, Composition and physical properties.

Paints- Composition, Types, Manufacturing and physical properties of paints.

Fibre- Types, Constituents &their forensic importance.

Unit – IV

Impression Evidence: Types of Impression Evidence, Significance of Impression Evidence. Tyre Marks Comparison. Skid marks, Serial numbers restoration.

Audio: Basics of sound, human ear and voice, Sound recording and reproduction, Forensic significance of voice.

Basic principles and techniques of black & white and colour photography; Camera and lenses, exposing, development & printing, different kinds of developers & fixers, modern developments in photography; Digital photography, Working of SLR & DSLR Cameras and basics of Digital Imaging Photography, photomorphing, Crime Scene photography, Laboratory photography; Brief about speaker identification & tape authentication techniques and their applications in forensic science, Data Mining Techniques.

Videography: types of video cameras, recording of playback technique of analog video, recording and playback technique of analog video, basics of video codecs and file formats.

Steganography- Detection of steganography from media files.

Reference Books:

1. B.C Bridges; "Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting expert Testimony, Opinion Evidence", Univ. Book Agency, Allahabad, 2000.
2. James Cowger; "Friction Ridge Skin- Comparison & Identification of Fingerprints", CRC Press, NY, 1993
3. M.J Cossidy; "Footwear Identification", Royal Canadian, Mounted Police, 1980.
4. A.V Iannavelli; "Ear Identification, Forensic Identification Series", Paramount,1989.
5. C.L Henry & R.E Ganesslen; "Advances in Fingerprint Technology", CRC Press, London,1991.
6. H.R Hardless; "Disputed Documents Examinations & Fingerprint Identification", Law Book Company, Allahabad,1995.
7. Richard Saferstein; "Criminalistics: An Introduction of Forensic Science", Prentice Hall Inc, USA, 2007.
8. C.E O"Hara & J.W Osterburg; "An Introduction to Criminalistics", Indiana Univ. Press, London, 1972.

9. R.N Morris; “Forensic Handwriting Identification”, Academic Press, London, 2001
10. M.M Houck & J.A Siegel; “Fundamentals of Forensic Science”, Academic Press, London, 2006.
11. M. Jauhri; “Identification of Firearms, Ammunition & Firearm Injuries”, BPR&D, New Delhi.
12. H.L Blitzer & J. Jacob; “Forensic Digital Imaging and Photography”, Academic Press, 2002
13. H. Henry; “Color photography – A Working Manual”, Little Brown Co. Boston, 1995
14. John R. Vacca; “Computer Forensics”, Firewall Media Pub. New Delhi, 2002.
15. Phillip Rose; “Forensic Speaker Identification”, Taylor & Francis, Forensic Science Series, London, 2002 16. B.R Sharma, “Forensic Science in Criminal Investigation & Trials”, Universal Publishing Co., New Delhi, 2003. 17. S.H James and John Nordby; “Forensic Science- An Introduction to Scientific and investigative Techniques”, CRC Press, USA, 2003.

Semester – I, Paper – IV
M.Sc. in Forensic Science
MSFS104 – Crime Scene Management and Quality Assurance

Unit – I – General Principles of Crime Scene Investigation

Crime Scene Investigation - Process, Planning, Organization and Coordination, Preservation of the Scene and its evidence, Response to Radiological Crime Scene, Documentation of the Scene – Photography/Videography and Sketching of SOC, Recognition and Recovery of Physical Evidence, Significance of Physical Evidence and „Chain of Custody", Legal and Human Considerations during Investigations, Health and Safety Considerations, First-Responder Procedure for isolation and seizure of Digital Exhibits.

Unit – II – General Guidelines for Evidence Collection

Evidence collection from crime scene, victim & deceased in cases of - Homicide Investigation; Investigation of - Death due to fall from height, Death due to burning, Rape, sexual offences and sex related homicide, Hanging (suicidal, accidental and homicidal), Drowning, Maternity/Paternity dispute cases, Deceased/Un-identified body, human remains, Human poisoning (fatal poisoning/survival), Animal Poisoning, Alcohol Poisoning, Fire/Arson, Petrol Adulteration, Trap Cases, Acid Attack Cases, Murder by Firearm, Forged Documents, Torn Documents, counterfeiting bank notes, Forgery in Passport, Charred Documents, Write Blockers, Imaging of Storage media and Capturing of volatile evidence in Computer fraud & Cybercrime, Audio & Video, CCTV footage, Paint, Glass, Soil, Fibre, Metals, Wildlife Crime.

Medico-legal aspects of firearm injury; Search, Seizure and Arrest under NDPS Act – Guidelines for IOs; Identification of Rapist in sexual assault cases, Mutilated bodies in mass disaster cases, Species of biological evidences material in poaching cases; Medico-legal aspects of hanging and strangulation. Reconstruction of Scene of Crime, Simulation of Crime Scene.

Unit – III – General Principles of Preservation and Packaging of Exhibits

Sources of Exhibits, Goals of Evidence Packaging- Protection of Evidence from possible hazards; Elements of Packaging Evidence – Packing Material, Sealing of Evidence; Precautions, General Directions, Directions for Specific type of Exhibits – Weapons and tools, Hair and Fibres, Blood and Bloodstains, Semen, Saliva, Dust or Soil, Arson Cases and Cases of Burning, Tool Marks, Exhibits for Ballistics

Examination, Glass, Paint, Questioned Documents, Latent Fingerprints, Drug Samples. Packaging and transportation of Digital & Electronic Evidence

Unit – IV – Quality Assurance and Accreditation

Introduction, Quality Assurance and Accreditation; Importance of accreditation in Forensic science laboratories, NABL Guidelines for Accreditation of FSLs; Notification of Cyber Forensics labs of FSLs/CFSLs u/s 79A of IT Act.

Traceability and Validation of new methods, measurement of uncertainty, Equipment maintenance and Calibration, Standard Reference Materials and Certified Reference Material and their availability, Sampling Procedure and Data Handling in the lab, Sample disposal, Assessment, Interpretation and reporting of results; Proficiency testing.

Reference Books:

1. Michael Malony, Donald Housman & Ross Gardner; "Crime Scene Investigation: A Procedural Guide", CRC Press, Taylor & Francis Group, 2014.
2. B. A. J. Fisher, D. R. Fisher; "Techniques of Crime Scene Investigation, 8th Edition", CRC Press London, 2012.
3. Randal Davis; "Evidence Collection and Presentation", 2nd Edition, LawTech Publishing Group, 2016.
4. John Lewis; "Criminalistics for Crime Scene Investigators", LawTech Publishing Group, 2014.
5. ISO/IEC 17025:2005, NABL 113,113A, 131, guidelines of NABL.
6. John J. Nordby "Deed Reckoning: The Art of Forensic Science Detection", CRC Press LLC, Boca Raton FL, 1999.
7. Richard Saferstein; "Forensic Science Handbook", Vol. I, II, III.
8. Raul Sutton, Keith Trueman and Chris Moran; "Crime scene management: Scene Specific Methods", John Wiley & Sons, 2016.
9. S. H. James, J. J. Nordby; "Forensic science: An introduction of Scientific and Investigative Technique", CRC press 2003 and 2005.
10. Robert C. Shaler; "Crime Scene Forensics: A Scientific Method Approach", CRC Press London, 2012.
11. Ian Pepper; "Crime Scene Investigation: Methods and Procedures" 2nd Edition, McGraw Hill, Open Press University, 2010.
12. Giriraj Shah; "Scientific Aids to Investigation", Anmol Publications, 1999.
13. Henry Lee, Timothy Palmbach & Marilyn Miller; "Henry Lee"s Crime Scene Handbook", Elsevier, Academic Press, 2001.

Semester – I, Paper – V
M.Sc. in Forensic Science
MSFS105 – Essentials of Statistics and Mathematics in Forensic Science

Unit – I – Introduction to Mathematics and Statistics

Number systems and their Representations, Units of measurement and their conversion, Dealing with Uncertainties in measurement, Basic Chemical calculations.

Types of Data, Basic concepts of frequency distribution, Measure of Central Values – Mean, Median and Mode, Measures of Dispersion, Range, Mean Deviation and Standard Deviation, Correlation and Regression Analysis.

Variance – Coefficient of variation, Moment, Coefficient of Regression, Correlated Measurements.

Unit – II – Mathematical Functions in Forensic Science

Mathematical Functions – Algebraic Functions, Polynomial Function, Quadratic Functions, Logarithmic Functions – Origin and Definition, Exponential Functions – Origin and Definition, Applications – pH Scale, Forensic Pharmacokinetics;

Trigonometric Functions: Trigonometric functions and rules in Forensic Science, Applications – Ricochet Analysis, Suicide, accident or murder, Bloodstain pattern and shape analysis, Aspects of Ballistics.

Unit – II – Probability and Graph Theory in Forensic Science

Probability Theory: Overview and Basic terms – Events, Trials, Mutually Exclusive events, Favorable Events, Exhaustive Events etc., Baye‟s theorem, Addition and Multiplication theorem, Conditional Probability, Binomial Probability distribution, Normal Distribution, Hyper-geometric distribution, Applications – Matching of hair evidence, Uniqueness of Fingerprints, Human teeth marks, Forensic Genetics etc.

Graph Theory: Representation of data using graph, Linearizing equations, Construction and Calibration of graphs, Application – Shotgun pellet patterns in firearm incidents, Bloodstain formation, Determining time since death, Determining age from bone or tooth material.

Unit – IV – Statistical Evaluation of Data and Evidence Significance

Tests of Hypothesis – Test of Significance of attributes, sample test, t-test and comparison of datasets, Paired Test, Chi-Square test, F-test for equality of variance, Large sample test, Normal Test, Pearson‟s □2 test. Discriminating Power and Evidence Significance: Derivation, Evaluation of evidence, Transfer of evidence – Likelihood Ratio, Probability of guilt, Correspondence probabilities, Weight of Evidence.

Reference Books:

1. Craig Adam; “Mathematics and Statistics for Forensic Science”, Wiley Blackwell, 2010
2. C.G.G. Aitkens and D. A. Stoney; “The Use of Statistics in Forensic Science”, Ellis Harwood Limited, England 2011.
3. F. Toroni, S. Bozza, A. Biedermann, P. Garbolino; “Data analysis in Forensic Science”, Wiley, 2010.
4. David Lucy; “Introduction to Statistics for Forensic Scientists”, John Wiley & Sons Ltd., London, 2005.
5. C.G.G Aitkens and Franco Taroni; “Statistics and Evaluation of Evidence for Forensic Scientists”, 2nd Edition, John Wiley & Sons, 2004.

Semester – I, Paper – VI (Practical – I)
M.Sc. in Forensic Science
MSFS106 – Pattern Evidence at Crime Scene and Photography

1. Recording of evidence and collection of clues in hit and run cases by forensic photography and Sketching.

2. Lifting of Fingerprints & Footprints from different surfaces and analysis of the pattern details.

3. Recording of various evidences in cases of sexual offences/homicide/ property offence cases by forensic photography and Sketching.

4. Analysis of skid marks and tire tread impressions using photographic evidence and Sketching.

5. Blood spatter evidence analysis in the crime using forensic photography.

6. Photography of crime-scene involving firearms.

7. Use of oblique light, transmitted light and side light photography in cases of indented writing and document examination.

8. Photography of writings on unusual surfaces.

9. Determination of the fracture pattern, perforation and direction in glass evidence in burglary, firearms and hit & run cases.

10. Analysis of the impressions made by different tools on different surfaces using forensic photography.

11. Crime-scene photography, screenshots, capturing of screen video for collection of Digital Evidence in Cyber-crime Investigation.

12. Analysis of pattern evidence in fire, arson and sabotage cases.

Semester – I, Paper – VII (Practical – II)
M.Sc. in Forensic Science
MSFS107 – Field Tests

1. Field tests for the detection and identification of narcotic drugs.

2. Field tests for the detection and identification of blood stain evidence.

3. Field tests for the detection and identification of seminal stains.

4. Development of latent fingerprints on different surfaces followed by their lifting, preservation and comparison.

5. Recording of the fingerprints/palm prints/lip prints/bite-marks from the suspects in cases of forensic importance.

6. Lifting of gun-shot residue from shooter's hand or clothing and identification of the powder residue by chemical test.

7. Field test for the detection of explosive material.

8. Field test for detection of indentation marks.

9. Field test for the secret/invisible writings.

10. Field test for detection of counterfeit bank notes.

11. Lifting of Paint Samples from accident cases.

12. Collection of the broken glass evidence in burglary case to determine the direction of force.

Semester – I, Paper – VIII (Practical – III)
M.Sc. in Forensic Science
MSFS108 – Tools and Techniques

1. Preparation of the Normal, Molar and Standard & buffer solutions.

2. Determine the density of alcohol by using pyknometer.

3. Determination of pH of a solution using pH meter.

4. Comparison of soil samples using microscopic and density-gradient distribution of particles method.

5. Microscopic examination of hair and fibres.

6. Examination of documents under stereo zoom microscope, UV rays, IR rays and oblique light.

7. To separate the dyes and inks/plant pigments/body fluids/explosives by thin layer chromatography.

8. Care, handling, preservation, marking, packing and forwarding of documents.

9. Laboratory equipment-handling of Stereo microscope, Stereo zoom Microscope, comparison microscope, Raman spectrophotometer.

10. Use of Vernier Callipers for internal & external diameter, Screw Gauge for thickness, Spherometers for curvature of surface and Laser device for accurate Distance Measurements.

11. Determination of GSM and thickness of papers.

12. Use of breath analyzer for measuring blood alcohol concentration.

Semester – II

Semester – II, Paper – I
M.Sc. in Forensic Science
MSFS201 – Forensic Chemistry and Toxicology

Unit – I – Forensic Chemistry

Scope & significance of Forensic Chemistry, Types of cases/exhibits received for analysis.

Trap Cases: Collection, and Preliminary analysis of evidence in trap cases.

Alcoholic Beverages: Types of alcohols, country made liquor, illicit liquor, denatured spirits, Indian made foreign alcoholic and non-alcoholic beverages. Dyes: Scope & Significance of dyes in crime investigation, analysis of ink by TLC and UV visible spectrophotometry.

Petroleum products and their adulterations: Chemical composition of various fractions of Petroleum Products, Analysis of petrol, kerosene, diesel.

Unit – II – Forensic Toxicology

Forensic Toxicology - Scope and Significance. Classification of Poisons based on their mode of action, uses and origin. Poisons - Types, routes of administration, toxicity, sign and symptoms. Factors affecting the effect of poison, medico-legal aspects of poisoning cases. Common Poisoning in India: Pesticides: Different types and their formulations, identification of pesticides, standard or sub-standard or substituted pesticides.

Guidelines for collecting forensic evidences in poisoning cases at crime scene. Importance of Post mortem examination in poisoning cases. Sample preparation for the analysis of poisons in body tissues/fluids and analysis by various instrumental techniques.

Unit – III – Narcotic Drugs and Psychotropic Substances

Scope and significance NDPS drugs in forensic science, NDPS Act, Classification and characterization of NDPS drugs, Drug Law Enforcement, Search & Seizure, Sampling procedure, Forwarding of sample to FSL, Sample preparation for analysis, Preliminary analysis of drugs, Reporting of drug cases, Drug abuse, Drug addiction and its problems.

Unit – IV – Fire /Arson and Explosives

Fire: Introduction to Fire & Arson, origin of fire, Chemistry of Fire, Fire fighting operations, preservation of fire scene, collection of evidences, Seat of fire, cause of fire, motives, Analysis of fire debris, Case studies related to fire and Arson.

Explosive and Explosion: Scope & significance of explosive analysis in forensic science, Types of explosives, deflagration and detonation, explosive trains, collection, preservation and forwarding of exhibits, preliminary analysis of explosives. Do's and Don'ts. Case studies related to explosives.

Reference Books:

1. Finar I.L; "Organic Chemistry: Vol. I Fundamental Principle", Pearson Education, Singapore, 1967.
2. Pearson D; "Chemical Analysis of Food", Chemical Publ. Co. New York, 1971.
3. Morrison R.T and Boyd R. N.; "Organic Chemistry", 6th Edition, Prentice Hall, 2003.
4. "Laboratory Procedure Manual: Petroleum Products", Directorate of Forensic Science, MHA, Govt. of India, 2005.
5. "Working Procedure Manual on Chemistry", Directorate of Forensic Science MHA Govt. of India, 2005.
6. Bureau of Indian Standard Specifications related to Alcohols and Petroleum Products.
7. Welcher Frank; "Standard Methods of Chemical Analysis", 6th Edition, Van Nostrand Reinhold,1969.
8. Watson C.A; "Official and Standardized Methods of Analysis", Royal Society of Chemistry, UK, 1994.
9. "Laboratory Procedure Manual: Forensic Toxicology", Directorate of Forensic Science, MHA, Govt. of India, 2005.
10. Narayanan, T.V; "Modern Techniques of Bomb Detection and Disposal", R. A. Security system, 1995.
11. Jacqueline Akhavan; "The chemistry of explosives", Royal Society of Chemistry, UK, 1998.
12. "Working Procedure Manual- Chemistry, Explosives and Narcotics", BPR&D, 2000.
13. Niesink, RJM; "Toxicology- Principles and Applications", CRC Press, 1996.
14. Chadha, PV; "Handbook of Forensic Medicine & Toxicology", Jaypee Brothers, New Delhi, 2004.
15. Modi, JP; "Textbook of Medical Jurisprudence & Toxicology", N.M. Tripathi Pub, 2001.

Semester – II, Paper – II
M.Sc. in Forensic Science
MSFS202 – Forensic Biology and Forensic Medicine

Unit – I

Identification of blood stains: Presumptive tests- Benzidine test, Phenolphthalein test, Leucomalachite test, Tetra-Methylbenzidine test and O-Tolidine, Luminol test. Confirmatory tests- Haemochromogen test, Haematin test and Haemin test. Identification of seminal stains- Presumptive Tests-Acid Phosphatase Test, Barberios Test and Florence Crystal Test. Confirmatory Test -Sperm Detection. Identification of saliva stains: Starch iodine test, Radial gel diffusion and examination of buccal epithelial cells.

Identification of Urine stains: Physical examination, Odor Test, Urea nitrate crystal test and creatinine test.

Identification of vomit stains: Detection of Mucus, Free HCL and Endothelial cells.

Identification of faecal stains: Microscopic detection of undigested food particles, vegetables material and muscle fibers, Urobilinogen Test.

Diatoms and Pollen grains- their identification and Forensic Significance. Microorganism in biological warfare.

Unit – II

Human Body – External Morphology. Introduction to adult human skeleton. Terminology associated with skeletal direction, gross morphology of long bones and human dentition. Bite marks- Forensic significance.

Hair structure. Hair growth. Phases of growth and growth rate. Hair characteristics from various body parts. Sex, age and race from hair. Forensic examination and comparison of hair. Human vs. animal hair. Forensic significance of hair. Types of vegetable fibers and their identification.

Unit – III

Thanatology- Stages of death. Suspended animation. The moment of death. Modes of death. Signs of death and changes following death. Estimation of PM Interval. Entomological evidence and their collection.

Microorganism responsible for food poisoning. Collection, preservation and forwarding of samples – vomit, stool, stomach wash and residual food.

Unit – IV

Injuries –Classification and Medico-legal Aspects. Mechanical Injuries. Firearm Injuries. Thermal Injuries. Explosion Injuries. Electrical Injuries. Atmospheric Lightning. Radiation Injury. Regional Injuries. Traffic Accidents.

Reference Books:

1. Houck, M.M. & Siegel, JA; "Fundamentals of Forensic Science", Academic Press, London, 2006.
2. Sharma, B.R.; "Forensic Science in Criminal Investigation & Trials", Universal Publishing Co., New Delhi, 2003.
3. Barry, A.J. Fisher; "Techniques of Crime Scene Investigation", 7th Ed, CRC Press, NY, 2003.
4. Eckett, WG & James, SH; "Interpretation of Blood Stains Evidence of Crime Scene", Elsevier Pub. NY,1989.
5. Chadha, PV; "Handbook of Forensic Medicine & Toxicology", Jaypee Brothers, New Delhi, 2004.
6. O"Hara CE and Osterburg, JW; "An Introduction to Criminalistics", Indiana Univ. Press, London, 1972.
7. James SH; "Scientific and Legal Applications of Blood Stain Pattern Identification", CRC Press,1998.
8. Smith, BC, Holland MM, Sweel, DL & Dizzino, A; "DNA & Forensic Odontology- Manual of Forensic Odontology", Colorado Springs, USA, 1995.
9. Biology Method Manual, Metropolitan Police Forensic Science Laboratory, London, 1978
10. Catts, EP & Haskell NH; "Entomology and Death- A Procedural Guide", Joyce"s Print shop, 1990.
11. Working Procedure Manual – DNA, BPR&D Pub, 2000.
12. Kirbylorne T; "DNA Fingerprinting - An Introduction", WH Freeman & Co., NY, 1990.
13. Hillson, S; "Dental Anthropology", Cambridge University Press, UK, 1996

Semester – II, Paper – III
M.Sc. in Forensic Science
MSFS203 – Forensic Questioned Documents

Unit – I

Working and applications of KAPPA, Nirvis, SEM-EDXA, Docucenter, ESDA, High Resolution Video Spectral Comparators. Classification of Forensic Documents- disputed/questioned/suspected documents, Specimen documents and contemporaneous/admittedly genuine documents, principle of comparison of "Like with Like," method of procurement of specimen/contemporaneous writings/signatures, suitability of standards for comparison with disputed documents. Preliminary examination of documents.

Unit – II

Handwriting Examination- Development of handwriting, master pattern, physiology of handwriting, different handwriting systems, matured/immature writings, different vernacular Indian languages and scripts, Simon New Comb theory of probability. Definition of natural variations and disguise. Various methods adopted for disguise. Importance of natural variation and disguise in handwriting examination.

Unit – III

Cameras- SLR &DSLR, lenses, filters, films, exposing, development& printing, different kinds of developers and fixers. Specialized photography- UV, IR, close up, transmitted light, side light, trick photography, contact print photography, oblique light photography. Photography using scientific equipment, preparation of demonstrative images and juxta pose charts, Faro technology for 3D documentation of crime scene, image enhancement of mutilated/soiled/old documents. Detection of manipulated digital image for identification, photography as secondary evidence. Crime scene photography, portrait building photography.

Unit – IV

Digital photography, software for digital photography, file formats-jpg, gif, bmp, tiff, raw etc., digital watermarking, digital imaging, photogrammetry, radiography, photomicrography, microphotography, Reprovit unit, dark room. Scope of photography in various disciplines of forensic science- finger prints, foot prints, physics, chemistry, biology, ballistics, computer forensics etc. Videography-basics of video camera and their function, video standard formats, application of videography

in police work. CCTV image enhancement, processing of digital images and its manipulation. Case studies. Laws relating to digital evidence and its admissibility.

Reference Books:

1. Ordway Hilton; “Scientific Examination of Questioned Documents”, Revised Edition, Elsevier, NY, 1982.
2. Albert S. Osborn; “Questioned Documents”, 2nd Ed., Universal Law Pub., Delhi, 1998.
3. Albert S Osborn; “The Problem of Proof”, 2nd Ed., Universal Law Pub. Delhi, 1998.
4. Charles C. Thomas; “I.S.Q.D. Identification System for Questioned Documents”, Billy Prior Bates Springfield, Illinois, USA, 1971.
5. Wilson R. Harrison; “Suspect Documents and their Scientific Examination”, Universal Law Pub. Delhi Indian Reprint, 2001.
6. Working manual of VSC-5000.
7. Morris Ron N; “Forensic Handwriting Identification”, Academic Press, London, 2001.
8. Jan Seaman Kelly & Brian S Lindblom; “Scientific Examination of Questioned Documents”, Taylor Francis Group, London and New York, 2006.
9. Henry Horeustein; “Colour Photography- A working Manual”, Little Brown Co. Boston,1995.
10. B.H.E. Jacobson, Ray GG Attridge; “The Manual of Photography”, Focal Press, London,1988.
11. Jahne B; “Digital Image Processing”, Heidelberg Springer, 1996.
12. Workinson J; “Art of Digital Video”, Oxford Focal Press, 1994.

Semester – II, Paper – IV
M.Sc. in Forensic Science
MSFS204 – Forensic Ballistics and Forensic Physics

Unit – I

History and development of firearms – their classification and characteristics, various components of small arms, smooth bore and rifled firearms, bore and caliber, shotgun barrels, chokes - their degrees and types; different automatic mechanisms used in small arms – blow back, recoil operated and gas operated mechanisms, rifling, class characteristics of rifled bore, purpose of rifling, methods to produce rifling; trigger and firing mechanism, trigger pull, accidental discharge of firearms, country-made firearms, improvised and imitation firearms.

Types of ammunition, nomenclature, percussion caps and their types, various priming composition, propellants, types of cartridge cases, their heads, various types of bullets and their compositional aspects.

Safety aspects about handling of firearms and ammunition.

Unit – II

Physical evidence available in crime involving firearms, handling of physical evidence at crime scene, principles and practice of identification of firearms, class and individual characteristics, various marks on fired cartridge cases and bullets, test firings, techniques of obtaining test materials, comparison microscope and matching of marks on evidence and test exhibits, automated bullet-cartridge identification system – IBIS and NIBIN.

Estimation of range of firing: burning, blackening, tattooing, spread of pellets, Walker's test.

Gun-Shot Residue: Dermal nitrate test, why was it abandoned, mechanism of formation of gunshot residue, various methods of lifting of gunshot residue, detection of GSR by AAS.

Gun-Shot Injuries – caused by shotguns, rifles, revolvers, pistols, evaluation of gunshot injuries.

Knowledge of Arms Act.

Unit – III

Criminalistics and Forensic Engineering: Role of trace evidence analysis and source correspondence, Arson Investigation, Introduction to Nano-science

Advanced Physical Techniques: Introduction to Lasers, Advanced microscopy & 3D scanning; Introduction to Atomic Absorption & Emission Spectroscopy, Fourier transform and X-ray spectroscopy

Collision Investigation and Reconstruction: Causes and Prevention of Road Accidents, Liability to accidents, Communication on the road, Reconstruction and proactive measures.

Unit - IV

Forensic Voice Identification: Resonance and overtones, synthesis of complex waves, Place Theory of Hearing, Anatomy of Vocal Tract, Vocal Formants, analysis and recording of voice samples in trap/sting investigation.

Photography and Forensic Image analysis: Light and Illumination, Optics and Lenses, Zoom and close-up Photography, Introduction to forensic use of digital images, resolution, colour space, file formats, photo sensors, memory and media, computing images.

Forensic Video Analysis: Introduction to video, Video Cameras, Video images, Video Captures, CCTVs, Retrieval of images and their evidence analysis.

Reference Books:

1. Sharma, B.R.; "Firearms in Criminal Investigation & Trials", Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edition, 2011.
2. Hatcher, Jury and Weller; "Firearms Investigation, Identification and Evidence", Stackpole Books, Harrisburg, Pa, 1997.
3. Heard, B.J; "Handbook of Firearms and Ballistics", John Wiley, England, 1997.
4. Jauhari M; "Identification of Firearms, Ammunition, & Firearms Injuries", BPR&D, New Delhi.
5. Hogg, I.V; "The Cartridge guide – A Smallarms Ammunition Identification Manual", The Stackpole publishing Co., Harrisburg, Pa, 1982.
6. Atkins, P.W.; "Physical Chemistry", 6th Edition, Oxford University, 1998.
7. Fifield, F.W. and Kealy, D.; "Principles and practice of Analytical Chemistry", 5th Edition, Blackwell Science, 2000.
8. Christian, G.D.; "Analytical Chemistry", 6th Edition., John Wiley, 2004

9. Silverstein, R.M., and Webster, F.X.; “Spectroscopic Identification of Organic Compounds”, 6th Edition., Wiley, 1997.
10. Svehla, G.; “Vogel‟s Qualitative Inorganic analysis”, Longman, 1998.
11. Townsends Allen (ed.); “Encyclopaedia of Analytical Science”, Academic Press, 1995.
12. Saferstein, R.; “Criminalistics, An Introduction to Forensic Science”, 5th Edition, Prentice Hall, 1998.
13. Jeffery, G. H., Bassett, J, Mendham, J, Denny, R.C.; “Vogel‟s Text Book of Quantitative Chemical Analysis”
14. Kealey, D. and Haines, P.J.; “Analytical Chemistry”, Bios Scientific/ Viva Books, 2002.
15. Harris, D.C.; “Quantitative Chemical Analysis”, 5th Edition., Freeman,1999.
16. Parikh C.K; “Text Book of Medical Jurisprudence, Forensic Medicine and Toxicology”, CBS Publ. New Delhi, 1999.

Semester – II, Paper – V
M.Sc. in Forensic Science
MSFS205 – Cyber Crime

Unit – I – Introduction to Cyber Crime

Cyber Crime- Overview, Internal and External Attacks, Online and offline attacks.

Cybercrimes against Individuals – E-mail spoofing and other online frauds, Phishing and its forms, Spamming, Cyber defamation, Cyberstalking and harassment, Computer Sabotage, Pornographic offenses, Password Sniffing.

Cybercrime against organization – Unauthorized access of computer, Denial-ofservice (DOS) attack, Distributed Denial of Service (DDoS) attack, Backdoors and Malwares (virus, Trojan horse, worms), E-mail Bombing, Salami Attack, Software Piracy, Industrial Espionage.

Cyber Security Policy, Security policies violations, Crimes related to Social Media, ATM, phishing/vishing frauds, Online and Banking Frauds. Intellectual Property Frauds. Cyber Crimes against Women and Children, Phases of cyberattack.

Unit – II – Introduction to Computers and Networking

Introduction to Computer Hardware - Various Components of a Computer, Motherboard, Micro-Processor, Memory, Data Storage Devices and Networking components. Understanding Computer Operating Systems (OS), Booting process of computers. Introduction to File Systems and its types.

Networking- Digital and Analog Signaling Methods, Network Types and Topologies, Different types of IP Addresses, Network Hardware Devices and Client/Server Computing.

Unit – III – Basics of Information Security

Information Security - Overview of Information security, CIA Triad, Threats and Vulnerabilities and Risk, Policy, Standards, Procedures, Guidelines and Baselines. Information Asset Classification: Classification of Information, Information Assets – Owner, Custodian, User. Access control, Authentication and Authorization. Information assurance and defensive measures. Digital Document Security.

Cryptography: Definitions and Concepts, Symmetric and Asymmetric Cryptosystems, Classical Encryption Techniques – Substitution Techniques, Transposition Techniques, Block Ciphers and Stream Ciphers, Hybrid Encryption Techniques, One-Time Pad. E-mail security, Internet and Web Security. Steganography and Steganalysis.

Unit – IV – Introduction to Digital Forensics

Digital Forensics- Introduction, Objective and Methodology, Rules of Digital Forensics, First responder - role, toolkit, do's & don'ts; Search and Seizure of Volatile and Non-volatile Digital Evidence. Imaging and Hashing Digital Evidence, Introduction to deleted file Recovery; Overview of types of Computer Forensics – Network Forensics, Mobile Forensics, Social Media Forensics and Email Forensics. Seizing and preserving mobile devices. Methods of acquisition of evidence from mobile devices. Data Acquisition and Evidence Gathering from Social Media. Introduction to IT Act.

Reference Books:

1. Nina Godbole and Sunit Belapore; "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publications, 2011.
2. Shon Harris, "All in One CISSP, Exam Guide Sixth Edition", McGraw Hill, 2013.
3. Bill Nelson, Amelia Phillips and Christopher Steuart; "Guide to Computer Forensics and Investigations" – 3rd Edition, Cengage, 2010 BBS.
4. William Stallings; "Cryptography and Network Security: Principles and Practices", Fifth Edition, Prentice Hall Publication Inc., 2007.
5. Atul Jain; "Cyber Crime: Issues, Threats and Management", 2004.
6. Majid Yar; "Cybercrime and Society", Sage Publications, 2006.
7. Michael E Whiteman and Herbert J Mattord; "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.
8. Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.
9. Peter Singer and Allan Fredman; "Cybersecurity and Cyberwar: What Everyone needs to know", Oxford University Press, 2014.
10. Raef Meeuwisse; "Cybersecurity for Beginners", Icutrain Ltd., 2015.

Semester – II, Paper – VI (Practical – I)
M.Sc. in Forensic Science
MSFS206 – Forensic Toxicology, Chemistry, Biology and Forensic Medicine

1. Identification of blood stains using enzymatic and crystal tests
2. Identification of seminal stains using presumptive test, crystal test and detection of spermatozoa
3. Identification of saliva stains
4. Identification of urine stains
5. Microscopic Examination of Human and Animal Hairs
6. Microscopic Examination of Vegetable Fibers
7. Identification of commonly encountered inorganic poisons Arsenic, Antimony, Bismuth, Mercury by colour test and microscopic examination.
8. Identification of ethyl alcohol and methyl alcohol by colour tests and microscopic examination.
9. Identification and comparison of inks by TLC and UV visible spectrophotometry.
10. Analysis of accelerants and incendiary in Arson cases by TLC and UV visible spectrophotometry.
11. Identification of explosives by colour tests & group analysis.
12. Identification of NDPS drugs by colour tests and TLC.

Semester – II, Paper – VII (Practical – II)
M.Sc. in Forensic Science
MSFS207 – Ballistics and Photography

1. Identification of measure and minor constituents of heterogeneous material evidence
2. Recording of speech samples using cassette and digital voice recorder
3. Sample preparation of calibration curve for UV studies
4. Wet chemical print photography from film negatives
5. Identification, measurement & photography of various components of a road
6. Crime scene videography of simulated crime scene and recording logs of video camera settings
7. Study of details of various small arms – caliber, choke, firing mechanisms, trigger pull, proof marks, etc.
8. Study of details of Shotgun ammunitions and rifle ammunitions
9. Determination of shot-size from diameter and weight of shots.
10. Examination of comparison of class and individual characteristics of fired bullets.
11. Examination and comparison of fired cartridge cases (caliber, firing pin marks, breech face marks, chamber marks, extractor and ejector marks)
12. Chemical tests for powder residue – Walker‟s Test & barrel wash
13. Test for lead, copper around gunshot holes in different targets.

Semester – II, Paper – VIII (Practical – III)
M.Sc. in Forensic Science
MSFS208 – Questioned Documents Examination

1. Instrumentation Techniques – Documents Examinations
2. Preliminary examination of documents, identification of natural variations and disguise writings.
3. Secure configuration of ports and services of Windows.
4. Encrypting and Decrypting the partition using Bit locker.
5. Collection and preservation of Volatile data from standalone computer.
6. Imaging and recovery of deleted files and folders from storage media.
7. Secure Configuration of Ports and Services of Windows 7, 10 and onwards latest versions.

Semester – III

MSFS310
Specialization in Forensic Ballistics

Semester- III, Paper – I
M.Sc. Forensic Science
MSFS311 – Firearms, Ammunitions & Instrumentation Techniques

Unit – I

Classification and characteristics of firearms, various components of small arms, smooth bore and rifled firearms, relation between bore-number of shotguns and internal cross-sectional diameter of their barrel in inches, chokes: purpose, degrees & types, different types of shot guns – SBBL, DBBL, repeating shot guns and automatic shot guns, various automatic mechanisms used in rifled firearms – blow back, retarded blow back, short recoil operated, long recoil operated firearms, gas operated firearms, Assault rifles, class characteristics of rifled bore, purpose of rifling, types of rifling, methods to produce rifling, trigger and firing mechanism, trigger pull, accidental discharge of a firearm, cartridge feed mechanisms, barrel steels, proving of small arms - provisional and final, measurement of strength of barrel, techniques of dismantling and assembling of firearms, improvised/ country-made /imitative firearms and their constructional features.

Various marks on firearms, identification of firearms.

Comparative merits of shot guns of different bores, head space and its importance.

Unit – II

Types of ammunition, classification and constructional features of different types of cartridges, percussion cap and its various types, priming composition, modern developments.

Propellants and their compositions-black, smokeless and semi – smokeless powders, various chemicals added to propellants for their stabilization, for reducing flash, for making them non-hygroscopic and for conversion of degressive to progressive burning powders.

Use of brass/ copper for manufacture of cartridge cases, different shapes of cartridge cases and their heads-rimmed, rimless, semi-rimmed, belted and rebated. Shot gun ball ammunition.

Various types of bullets and compositional aspects, jacketed, non-jacketed, round nose, sharp pointed, boat-tailed, stream-lined, soft point, hollow point and other expanding bullets, Dum-Dum, pencil point, armor-piercing, tracer and incendiary bullets. Various types of wads loaded in shotgun cartridges, various processes associated with manufacture of small arms ammunition - both shot guns and all metal - drawing, cleaning, washing, cutting, construction of head etc.

Physical, ballistic and functional tests of ammunition - velocity, accuracy, pressure, sensitivity tests etc. calculation of figure of merit for various standard cartridges, various defects produced in cartridge cases as a result of firing. Headstamp markings – identification of origin.

Unit – III

Crimes committed by firearms, Various types of visible/invisible physical evidences available in crime involving firearms, Photography/Videography/ Sketching of crime scene, location, documentation, collection, packing, sealing, preservation and forwarding of exhibits in firearm cases, maintaining the authenticity and integrity of physical evidence, various legal requirements in the handling of clue materials, various precautions to be taken while handling the physical evidence, various problems including medico-legal problems arising in crime involving firearms, chain of custody, Reconstruction and enactment of scene of crime.

Unit – IV

Atomic Absorption Spectrometry: Instrumentation and techniques, interference in AAS, background correction method, quantitative analysis.

Atomic Emission Spectrometry (AES): Instrumentation and techniques, arc/spark emission, ICP-AES, Comparison of ICP vs AAS methods, quantitative analysis, applications.

Fluorescence and phosphorescence spectrophotometry: Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods.

Infra-red spectrophotometry: Dispersive and Fourier Transform Spectrophotometry (FTIR). Sample handling, quantitative analysis, interpretation of IR spectra, applications.

Raman Spectroscopy: Theory, instrumentation and sample handling, correlation of IR and Raman Spectroscopy, applications.

X-ray Spectroscopy: X-ray absorption and fluorescence methods, X-ray diffraction, EDX, Augur Emission Spectroscopy.

Reference Books:

1. Sharma, B.R.; "Firearms in Criminal Investigation & Trials", Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edition, 2011.
2. Hatcher, Jury and Weller; "Firearms Investigation, Identification and Evidence", Stackpole Books, Harrisburg, Pa, 1997.
3. Heard, B.J; "Handbook of Firearms and Ballistics", John Wiley, England, 1997.
4. Jauhari M; "Identification of Firearms, Ammunition, & Firearms Injuries", BPR&D, New Delhi.
5. Hogg, I.V; "The Cartridge guide – A Smallarms Ammunition Identification Manual", The Stackpole publishing Co., Harrisburg, Pa, 1982.
6. Janes, T.J.G; "Infantry Weapons", Janes Information Group, Sentinal House, Surrey, U.K. (2004-05)
7. Burrard; "The Identification of Firearms and Forensic Ballistics", Herbert Jenkins, London, 1956.
8. Gunther and Gunther; "The Identification of Firearms", New York, 1935.
9. Wilber; "Ballistic Science for the Law Enforcement Officer", Charles C. Thomas, USA, 1977.
10. Hayes, T.J; "Elements of Ordnance", John Wiley & Sons, Inc, London, 2013.
11. Smith and Smith; "Book of Rifles", Stackpole Books, Harrisburg, Pa, 1972.
12. Smith and Smith; "Book of Pistols and Revolvers", Stackpole Books, Harrisburg, Pa, 1968.
13. Nelson; "The World‟s Submachine Guns", Vol I, Arms & Ammunition Press, London, 1977.
14. Greener; "Gun and its Development", Arms & Ammunition Press, London, 1910.
15. Ezell; "Small arm Today", Stackpole Books, Harrisburg, Pa, 1988.
16. Hobart Willard; "Instrumental Methods of Analysis", Wadsworth Publishing Company, 1988
17. Douglas Skoog, James Holler and Stanley Crouch; "Principles of Instrumental Analysis" 7th Edition, Cengage Learning, 2017.
18. James W R; "Atomic Spectroscopy", 2nd Edition, Marcel Dekkar, In, NY, 1966.
19. Patania V. B; "Spectroscopy", Campus Books International, 2004.

Semester- III, Paper – II
M.Sc. Forensic Science
MSFS312 – Identification of Firearms, Range of Firing & Chemical Tests

Unit – I

Principles and practice of identification of firearms, ammunition and their components, how different parts of firearms acquire individual characteristics during their manufacture, types of marks produced during firing process on cartridge cases – firing pin marks, breech-face marks, chamber marks, extractor and ejector marks, marks on bullets, striation marks of lands and grooves, various factors affecting nature of these marks, measurement of rifling details, i.e., number/direction of lands and grooves, pitch of rifling etc. imprinted on fired bullets, determination of make/model of the suspected firearm, techniques of obtaining test materials from various types of weapons and process of their linkage with the fired ammunition, comparison microscope, photomicrography, non-submission of photomicrographs along with the report, presence of matching and non-matching characteristics on evidence and test cartridge cases and bullets, source correspondence, number of matching points, furnishing of opinion - definite positive, definite negative, no definite etc. writing of reports, automatic bullet and cartridge comparison systems, IBIS and NIBIN, linkage of fired shots with suspected shot gun, effects of erosion, corrosion etc., effect of human decomposition on bullet striations.

Unit – II

Determination of range of firing, burning, scorching, blackening, tattooing, metallic fouling, GSR distribution and dispersion of pellets, factors affecting these phenomena, the stringing of shots, effect of stringing on pattern, cartwheel pattern, balling, determination of range of firing in case of country-made firearms, characteristics of contact shots, distinction between blackening and lead/dirt ring, abrasion, Walker‟s test around gun-shot holes in clothes, tests of presence of tattooing around gun-shot holes in skin/head, IR photography of tattooing around gun-shot holes in dark-coloured clothes, use of various instrumentation techniques for estimation of range of firing, effective, killing and extreme ranges.

Unit – III

Testing of barrel wash, chemical tests for testing of lead/copper around gun-shot holes in clothes, skin and other objects, use of instrumentation techniques in identification of gun-shot holes.

Determination of time elapsed since firing, usefulness, different methods employed and their limitations, attempts based on analysis of residue inside the barrel left after the firing of cartridges loaded with black/smokeless powders, attempts based on

analysis of CO, CO2, nitrogen oxides, etc., reasons for not being able to estimate time elapsed since firing.

Use of instrumentation techniques for analysis of propellant particles found on hands of shooter, fired cartridge case, barrel and target

Unit – IV

Restoration of erased numbers, methods of marking-cast, punch and engraved, methods used for removal of serial numbers, theory behind number restoration, restoration of marks on cast iron, Aluminum, brass, wood, leather etc., chemical methods of restoration (etching), reagents used for various metals, electrolytic methods of restoration-reagents used, ultrasonic cavitation for restoration, magnetic particle method for restoration, other methods of restoration, laser etched serial numbers and bar codes and their restoration, recording of restored marks.

Ballistics Data Measurement System.

Reference Books:

1. Sharma, B.R.; "Firearms in Criminal Investigation & Trials", Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edition, 2011.
2. Mathews, J.H; "Firearms Identification", Vol I, II and III, Charles C. Thomas, USA, 1977.
3. Hatcher, Jury and Weller; "Firearms Investigation, Identification and Evidence", Stackpole Books, Harrisburg, Pa, 1997.
4. Heard, B.J; "Handbook of Firearms and Ballistics", John Wiley, England, 1997.
5. Warlow, T.A.; "Firearms, The Law and Forensic Ballistics", Taylor and Francis, London, 1996.
6. Jauhari M; "Identification of Firearms, Ammunition, & Firearms Injuries", BPR&D, New Delhi.
7. Burrard; "The Identification of Firearms and Forensic Ballistics", Herbert Jenkins, London, 1956.
8. Gunther and Gunther; "The Identification of Firearms", New York, 1935
9. Wilber; "Ballistic Science for the Law Enforcement Officer", Charles C. Thomas, USA, 1977.
10. Lucas; "Forensic Chemistry and Scientific Criminal Investigation", London, 1945.
11. Williams; "Practical Handgun Ballistics", Charles C. Thomas, USA, 1980.
12. Nonte, Jr, "Firearms Encyclopaedia", Wolfe Publishing Limited, London, 1973.
13. Davis, J.E; "An Introduction to Tool marks, Firearms & the Striagraph", Charles C. Thomas, USA, 1958.

14. Hueske; “Practical Analysis and Reconstruction of Shooting Incidence”, CRC Press, NY, 2006.
15. Richard Saferstein; “Criminalistics”, Prentice Hall, NJ, 1995.
16. Lindsay S; “High Performance Liquid Chromatography”, Wiley & Sons New York, 1992.
17. “Handbook of TLC”, 2nd Ed, Marcel Dekker; NY, 1995.
18. Jarris, KE, A.L. Gray et al; “Handbook of Inductively Coupled Plasma Mass Spectrometry”, Glasgow Blockie, 1992.
19. Maclaffrty F.W. & F. Turecek; “Interpretation of Mass spectra”, 4th Ed., Mill Valley, CA University Science Books, 1993.
20. Chapmen JR; “Practical Organic Mass Spectrometry- A Guide for Chemical and Biochemical Analysis”, Wiley & sons, NY, 1993.

Semester- III, Paper – III
M.Sc. Forensic Science
MSFS313 – Internal, External Ballistics & Gun-shot Residue

Unit – I

Ballistics – Definition and its branches: Internal, Intermediate, External, Terminal.

Thermochemistry of propellants – Calculation of heat of explosion, specific heats of propellant gases, explosion temperature, pressure and volume of gases produced by burning of single-base and double-base propellants.

Unit – II

Internal Ballistics of Firearms: Definition, ignition of propellants, shape and size of propellant grains, degressive and progressive shapes, degressive and progressive burning, manner of burning, all-burnt position. Force constant – energy equation, various factors affecting internal ballistics, lock time, ignition time, barrel time, erosion, corrosion and gas cutting, theory of recoil, methods of measurement of recoil, internal ballistics of shot-guns. Le Duc‟s Method.

Intermediate Ballistics: Definition. Effects on the motion of projectile and firearm, gas flow field near the muzzle, flash, blast, silencers.

Unit – III

External Ballistics: Equations of motion of projectile, principal problem of exterior ballistics, vacuum trajectory – calculation of various elements, effect of air resistance on trajectory, points of difference between trajectories in air and vacuum, Nature of air-resistance phenomena, base-drag, yaw, cross-wind force, over-turning moments, stability – fin stabilization and gyroscopic stability, stability factor, nutation and precessional motions of bullets, drift, Magnus effect, Greenhill formula, shape of projectile –form factor, ballistic coefficient, calculation of trajectories of various small arm bullets, calculation of trajectories of shotgun projectile, use of Ballistic tables, Automated system of trajectory computation. Falling bullets – limiting velocity, drop, use of lead as bullet material.

Unit – IV

Gun-shot Residue: Identification of shooter– dermal nitrate test and its abandonment, Harrison and Gilroy test, Price test, mechanism of its formation, plume, morphology and size of GSR particles– regular, nodular and unique, source of GSR, specific areas of GSR deposition, collection of GSR – various methods, GSR retention, analysis of AAS, NAA, SEM/EDXA, ICP-MS, ASV. Environmental

contaminants in GSR considerations, time taken for GSR particles to remain air-borne, importance in chemical investigation.

Reference Books:

1. Carlucci DE and Jacobson, SS; "Ballistics", CRC Press, London, (2008)
2. Sharma, B.R.; "Firearms in Criminal Investigation & Trials", Universal
3. Law Publishing Co Pvt Ltd, New Delhi, 4th Edition, 2011.
4. Heard, B.J; "Handbook of Firearms and Ballistics", John Wiley, England, 1997.
5. Wilber; "Ballistic Science for the Law Enforcement Officer", Charles C. Thomas, USA, 1977.
6. Hayes, T.J; "Elements of Ordnance", John Wiley & Sons, Inc, London, 2013
7. Robinson, C.S; "The Thermodynamics of Firearms", McGraw Hill Book Company, Inc; NY, 1943.
8. Whelen; "Small arms Design and Ballistics", Vol II, Small arms Technical Publishing Company, USA, 1946.
9. Hatcher, Jury and Weller; "Firearms Investigation, Identification and Evidence", Stackpole Books, Harrisburg, Pa, 1997.
10. Warlow, T.A.; "Firearms, The Law and Forensic Ballistics", Taylor and Francis, London, 1996.
11. Sellier, K.G. et al; "Wound Ballistics and the Scientific Background", Elsevier Pub. Co., London, 1994.
12. Jauhari M; "Identification of Firearms, Ammunition, & Firearms Injuries", BPR&D, New Delhi.
13. Ordog, G.J; "Management of Gunshot wounds", Elsevier Pub. Co., NY, 1983.
14. Schooeble, A.J. and Exline, L.D; "Current methods in Forensic Gunshot Residue Analysis", CRC Press, NY, 2000.
15. Beyer, J.C. (Ed); "Wound Ballistics", US Printing Office, Washington, 1962.
16. Wilber; "Ballistic Science for the Law Enforcement Officer", Charles C. Thomas, USA, 1977.
17. Di Maio, JM; "Gunshot Wounds", CRC Press, NY, 1999.
18. Richard Saferstein; "Criminalistics", Prantice Hall, NJ, 1995.
19. Hueske; "Practical Analysis and Reconstruction of Shooting Incidence", CRC Press, NY, 2006.

Semester- III, Paper – IV
M.Sc. Forensic Science
MSFS314 – Wound Ballistics, Reconstruction & Report Writing

Unit – I

Anatomy of human body, over view of organ systems, cavities and planes, skeleton system, naming of all bones of axial and appendicular skeleton. Terminal / Wound Ballistics: Of what does a human body die of after being hit? Effects of projectile on hitting the target, penetration of projectiles in metals, glass, human body, threshold velocity of penetration of skin, flesh and bone, threshold energy, casualty criteria, specific threshold velocity, energy density, penetration depth of handgun bullets in gelatin, soap and muscle tissues. Gun-shot wounds – entrance, exit & bullet track – as a function of bullet shape, striking velocity, striking angle, nature of target, tumbling of bullets, effect of instability of bullets, effect of intermediate target, influence of range, Billiard ball ricochet phenomena, ricochet phenomena.

Unit – II

Physical Aspects of Gun-shot Injuries: Analysis of gun-shot wound production, motion of projectile in dense medium – both spherical and elongated projectiles, cavitation – temporary and permanent cavities, tissue simulants, preparation of gel-block, methods of measurement of various wound ballistics parameters, drag coefficients, diameter of temporary and permanent cavities and their volumes as a result of energy lost in wound production, stopping power, relative stopping power.

Unit – III

Reconstruction of sequence of events involved in a shooting case, theory and practice of shooting reconstruction, scientific method of shooting reconstruction, suicidal/ murder/ accident/ self-defence/ encounter cases/ self-inflicted injuries caused by friendly hands. All considerations during direct investigation of shooting incident or without the benefit of original crime scene investigation. Importance of scene of occurrence, photographs, sketching, medico-legal reports, firearms and ammunition, basic ballistic facts, laboratory examination reports, high velocity impact blood splatter, etc.

Study of X-ray plates in firearm cases.

Documentation and evaluation of bullet holes in various targets, ricochet marks, pellet pattern, estimation of angle of impact, bullet holes in tires and other plastic markings, shooting in glass – fractures, determination of entry/ exit holes, direction of firing, sequence of shots.

Plotting of gun-shot injuries on body – diagrams, evaluation of gun-shot injuries to determine wounds of entry/ exit, direction of firing, number of rounds fired, etc. Determination of number of participants / firearms involved, their locations, positions, orientation at the moment of firing, discussion of some important & complicated cases.

Unit – IV

Report writing, work-sheet writing, components of reports, report formats in respect of visits to crime scene involving firearms and with respect to laboratory findings.

Court testimony, admissibility of expert testimony. Pre-court preparations and court appearance, examination - in chief, cross-examination, re-examinations, discussion of complicated cases.

Arms Act, Arms Rules, Prohibited and Non-prohibited firearms and ammunition. All sections of Arms Act, Examination and Reporting of cases under the Arms Act. Various court rulings relevant to Forensic Ballistics.

Reference Book:

1. Hatcher, Jury and Weller; “Firearms Investigation, Identification and Evidence”, Stackpole Books, Harrisburg, Pa,1997.
2. Heard, B.J; “Handbook of Firearms and Ballistics”, John Wiley, England, 1997.
3. Warlow, T.A.; “Firearms, The Law and Forensic Ballistics”, Taylor and Francis, London, 1996.
4. Sellier, K.G. et al; “Wound Ballistics and the Scientific Background”, Elsevier Pub. Co., London, 1994.
5. Jauhari M; “Identification of Firearms, Ammunition, & Firearms Injuries”, BPR&D, New Delhi.
6. Ordog, G.J; “Management of Gunshot wounds”, Elsevier Pub. Co., NY, 1983.
7. Schooeble, A.J. and Exline, L.D; “Current methods in Forensic Gunshot Residue Analysis”, CRC Press, NY, 2000.
8. Beyer, J.C. (Ed); “Wound Ballistics”, US. Printing Office, Washington, 1962.
9. Wilber; “Ballistic Science for the Law Enforcement Officer”, Charles C. Thomas, USA, 1977.
10. Di Maio, JM; “Gunshot Wounds”, CRC Press, NY,1999.
11. Richard Saferstein; “Criminalistics”, Prantice Hall, NJ, 1995.
12. Aitken and Stoney; “The Use of Statistics in Forensic Science”, Ellis Horwood, NY, 1991.
13. Robertson and Vignaux; “Interpreting Evidence”, John Wiley, NY, 1995.
14. Meyer, “Expert Testimony”, CRC Press, NY, 1999.
15. Carlucci DE and Jacobson, SS; “Ballistics”, CRC Press, London, (2008)

16. Sharma, B.R.; “Firearms in Criminal Investigation & Trials”, Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edition, 2011.

Semester- III, Paper – V (Practical – I)
M.Sc. Forensic Science
MSFS316 – Applications of Instrumentation Techniques in Forensic Ballistics

1. Photography and sketching of crime scene involving firearms (3 practical).
2. Collection, preservation and packing of exhibits.
3. To dismantle and assemble all types of small arms, and to record their data, lock mechanism and trigger pull.
4. To open all types of cartridges, study and record their data.
5. Determination of shot size from diameter and weight of shots/pellets.
6. To prepare sulphur cast of inside of barrels and study the rifling details, caliber, size of bore, etc.
7. Opening of parcels, various precautions, preparations of observation sheet, marking of exhibits.
8. To determine / measure rifling details on fired bullets – determination of make/model of suspected firearms firing the bullet.

Semester- III, Paper – VI (Practical – II)
M.Sc. Forensic Science
MSFS317 – Forensic Ballistics-Identification of Firearms, Range of Firing, Chemical Tests

1. Restoration of erased serial numbers on firearms.
2. To perform chemical tests of powder residues (Walker‟s Test) around gunshot holes in fabrics.
3. To perform spot tests around holes suspected to have been caused by passage of jacketed/ non-jacketed projectiles.
4. To test barrel wash.
5. Linkage of evidence cartridge cases with suspected firearm – examination under Comparison Microscope.
6. Linkage of evidence bullets with suspected firearm – examination under Comparison Microscope.
7. Measurement of spread of pellets fired from shotguns and determination of range of firing.
8. Given evidence pattern of tattooing, suspected firearm and ammunitions recovered from accused – to conduct test firings and estimate range of firing.
9. Reconstruction of sequence of events in shooting incidents.
10. To conduct firing in plate glass and study direction of firing, sequence of shots.
11. Determination of distance/ direction of firing from deceased / injuries.

Semester- III, Paper – VII (Practical – III)
M.Sc. Forensic Science
MSFS318 – Documentation of Crime Scene involving Firearm, handling or Evidentiary Clues

1. TLC/ HPTLC of propellants loaded in shotguns, rifle and handgun cartridges.
2. Identification of shooter – gun-shot residue analysis by AAS.
3. Identification of suspected gun-shot holes by AAS.
4. IR spectra of propellants loaded in shotgun, rifle and handgun cartridges.
5. Analysis of propellants by HPLC.
6. FTIR analysis of propellants loaded in shotgun, rifles and handgun cartridges.
7. FTIR analysis of propellant particles found inside the barrel, fired cartridge case and around gun-shot hole in targets – comparison of results.
8. GC Analysis of propellants.
9. Firing in gelatin gel blocks – determination of volume of permanent cavity.

MSFS-320 – Specialization in Forensic Toxicology and Chemistry

Semester- III, Paper – I
M.Sc. Forensic Science
MSFS321 – Advance Forensic Chemistry

Unit – I

Analysis of Alcoholic & Non- alcoholic beverages: Analysis of various types of denaturants of alcohols, country made liquor, illicit liquor, medicinal preparations and liquor of forensic importance as per BIS specifications, by colour test and Instrumental technique.

Petroleum products and their adulterations: Chemical composition of various fractions of Petroleum Products, Marketing Disciplinary Guidelines for sampling of petrol and diesel. Analysis of petrol, kerosene, diesel, lubricants by BIS methods and ASTM methods. Detection of adulterants of Gasoline, Diesel and Engine oils. Analysis of adulterants in forensic exhibits by Gas Chromatography, Analysis of dyes of Petrol, Kerosene and Engine oils. Essential Commodity Act & Petroleum Act.

Unit – II

Analysis of Milk product: Detection of adulterants in milk and milk products by physical, chemical and instrumental techniques.

Oils and Fats: Chemical composition and analysis of different common oils and their adulterants by physical, chemical and instrumental technique.

Bride burning cases and acid attack cases: Evidence collection and analysis

Analysis of trap case: Mechanism of colour reaction, factor affecting the colour, detection of phenolphthalein and alkali used, method of detection of colourless solution by TLC and UV visible spectrophotometer.

Dyes: Classification of dyes, their uses in fiber and pharmaceutical industries Chemical analysis and Instrumental methods of analysis.

Unit – III

Fire and Arson: Extraction of fire accelerants from fire debris, advantages and their limitations. Methods and techniques used in identification of fire accelerant, Analysis of fire accelerants by UV visible spectrophotometry, TLC and Gas Chromatography-Head space.

Explosives &Explosions: Different types of explosives, their chemical structure. Atomic explosion, Physical explosion, Chemical explosion, Explosion and its effects, Type of hazards, Effect of blast wave on structures and humans. IEDs and firing mechanisms of IEDs.

Collection of samples, Methods for extraction of explosive from post blast material/ debris, Qualitative analysis of explosives and explosion residue by preliminary analysis and Instrumental techniques.

Unit – IV

Chemical warfare agents: Classification, physical and chemical properties, toxic effects, detections and protection.

Metals and Alloys: Scope & Significance of metal and alloy analysis in forensic science. Identification & composition of metals and alloys, purity of metals including precious metals such as gold, silver and platinum. Different types of metals and alloys commonly encountered for forensic analysis. Hall marking of precious metal according to BIS.

Reference Books:

1. "Laboratory Procedure Manual: Petroleum Products", Directorate of Forensic Science, MHA, Govt. of India, 2005.
2. "Working Procedure Manual on Chemistry", Directorate of Forensic Science MHA Govt. of India.
3. Bureau of Indian Standard Specifications related to Alcohols and Petroleum Products.
4. Welcher Frank; "Standard Methods of Chemical Analysis", 6th Edition, Van Nostrand Reinhold, 1969.
5. Watson C.A; "Official and Standardized Methods of Analysis", Royal Society of Chemistry, UK, 1994.
6. "Laboratory Procedure Manual Forensic Toxicology", Directorate of Forensic Science, MHA, Govt. of India, 2005.
7. Narayanan, T. V; "Modern Techniques of Bomb Detection and Disposal", R. A. Security system, 1995.
8. Jacqueline Akhavan; "The chemistry of explosives", Royal Society of Chemistry, UK, 1998.
9. Pearson D; "Chemical Analysis of Food", Chemical Publ. Co. New York, 1971.
10. Somani S M; "Chemical Warfare Agent", CRC Press, 2000.
11. Sun Yin and Kwok Yong; "Detection Technologies for Chemical Warfare Agent and Toxic Vapours", CRC Press, Washington DC, 2004.
12. Yinon, J. and Zitrin, S; "The Analysis of Explosives", Oxford, Pergamon, 1981.
13. Beveridge, A; "Forensic Investigation of Explosives", Taylor & Francis, 2000.
14. Yallop, H. J: "Explosion Investigation", Forensic Science Society & Scottish Academic Press, 1980.
15. Siegel, J. A, Saukko, P. J. and Knupfer, G.C; "Encyclopedia of Forensic Sciences", Academic Press, 2000.
16. Feigl F; "Spot Test in Inorganic Analysis", Elsevier Publication, New Delhi, 2005.

17. Feigl, F; Spot Test in Organic Analysis", Elsevier Publication, New Delhi, 2005.

Semester- III, Paper – II
M.Sc. Forensic Science
MSFS322 – Advance Forensic Toxicology

Unit – I

Toxicology: Commonly encountered poisons in cases of poisoning in India. Shelf life of poisons. Detection of drugs and their metabolites on the spot in body fluids and tissues.

Plant Poisons: Introduction, classification, identification by microscopic technique, colour test, thin layer chromatography and other instrumental techniques.

Animal Poisons: Commonly encountered animal poisons in India. Snake venom active constituents of snake venom, collection of samples for analysis, pharmacological action on human body, Analysis of snake venom by precipitin test.

Water Soluble Drugs/ Poisons- Pharmacological action, problems associated with extraction from pharmaceutical products and biological material. Method of extraction using Ion pair (drug –dye complexometry). Isolation and Identification by TLC, and UV Visible spectrophotometry.

Ptomaines: Introduction, interference caused in analysis of poison, especially in putrefied viscera, poisoning due to ptomaines.

Unit – II

Methods of Extraction- Classification of matrices: biological and non-biological matrices. Modern methods of Extraction: Solid phase extraction, solid phase micro extraction. Different methods of extraction for volatile and non-volatile poisons: Solvent extraction and isolation, distillation /steam distillation, micro diffusion, dialysis, dry ash, wet digestion. Extraction of poison by stas-otto method, ammonium sulfate method from viscera, blood, urine, stomach wash and vomit, cold drink, food material and from other matrices of forensic importance.

Unit – III

Pharmacology of Forensic Drugs & Poisons: Studies on absorption, distribution, pharmacokinetics, metabolism pathways of common drugs and poisons, Drug toxicity, excretion of drugs and poisons.

Study of Metabolites of methanol and ethanol, acetyl salicylate, DDT, Parathion, Pentothal, carbaryl, phenobarbitone, diazepam, amphetamine and heroin, ketamine. Identification of the drugs & their metabolites by GC-Mass & LC Mass.

Unit – IV

Analysis of Gases and volatile poisons: Alcohols, aldehydes, ketones, hydrocyanic acid, chlorinated hydrocarbon, benzene nitrobenzene, turpentine, carbon dioxide, carbon monoxide, ammonia, phosphine, sulfur dioxide, hydrogen sulphide, chlorine in Biological fluids.

Heavy metal poison and their Chemical Analysis (Arsenic, antimony, mercury, bismuth).

Analysis of pesticides: Organochloro, organophosphorous, carbamates and synthetic pyrethroids.

Method of analysis of acidic/ basic/ neutral drugs in viscera

Toxicological findings- Significance of analytical studies with forensic examination, interpretation of toxicological finding and preparation of reports, toxicological analysis of decomposed materials.

Reference Books

1. Curry A.S; “Analytical Methods in Human Toxicology: Part II”, CRC Press Ohio, 1986.
2. Curry, A.S; “Poison Detection in Human Organs”, C Thomas Spring field CRC Press, 1976.
3. Clark E.G.C; “Isolation and Identification of drugs”, Vol.1 and Vol.2, Academic Press, 1986
4. Niesink R J M; “Toxicology - Principle and Application”, CRC Press, 1996.
5. Sunshine I; “Handbook of Analytical Toxicology”, CRC Press, 1969.
6. Parikh C. K; “Text Book of Medical Jurisprudence, Forensic Medicine and Toxicology”, CBS Publ. New Delhi, 1999.
7. “Laboratory Procedure Manual, Forensic Toxicology”, Directorate of Forensic Science MHA Govt, 2005.
8. Steward and Stolman; “Toxicology”, Vol.1 and Vol. 2
9. Michel J D et al; “Handbook of toxicology”, CRC Press Publication, USA 1995.
10. Casarett, L J and Doul John; “Toxicology: The Basic Science of Poison”, Macmillan Publishing Co. New York, 1975.
11. Carvey R.H & Baselt R.C; “Introduction to Forensic Toxicology and Biochemicals”, Publ. Davis C.A, 1981.
12. Chadha PV; “Handbook of Forensic Medicine and Toxicology”, J.P Brothers New Delhi, 2004.

13. Modi Jaisingh P; “Textbook of Medical Jurisprudence and Toxicology”, M.M. Tripathy Publications, 2001.
14. Zweig G; “Analytical Methods of Pesticides”, Academic Press, 1966.
15. Paranjape, H.M., Bothara, G.K., Jain, M.M; “Fundamentals of Pharmacology”, 1st edition, Nirali Prakashan, 1990.
16. Budhiraja, R.D; “Elementary Pharmacology and Toxicology”, Popular Prakashan, 2nd edition, 1999.
17. Hardman, J. G. and Limbird, L.E; “Goodman and Gilman‟s The Pharmacological Basis of Therapeutics”, 9th edition, McGraw-Hill, 1996
18. Moffat, A.C, Osselton, D. M, Widdop, B; “Clarke‟s Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and postmortem material”, 3rd edition, Pharmaceutical Press, 2004.

Semester- III, Paper – III
M.Sc. Forensic Science
MSFS323 – Forensic Analysis of Drugs

Unit – I

Scope and significance of the analysis of controlled substances in forensic science, Classification of NDPS Drugs and their characterization.
NDPS Act- Relevant Sections
Drug dependence, drug addiction and its problems.

Unit – II

Analysis of Narcotic Drugs: opium and its major alkaloids, heroin and other synthetic narcotics.

Analysis of Psychotropic substances: Barbiturates, methaqualone, benzodiazepines, and Z- drugs.

Analysis of Stimulants: Cocaine and amphetamines and ephedrine, pseudoephedrine, mephedrone related derivatives and cathinone.

Analysis of Hallucinogens: Ganja, hashish (Charas), LSD, Mushroom and cactus.

Define precursor, commonly encounter precursors of NDPS drugs, Search of clandestine laboratory, precursors and their analysis

Analysis of Designer drugs, club drugs, date rape drugs by Field test, colour test, micro crystal test, thin layer chromatography.

Analysis of NDPS drugs in biological samples and their importance, methods of extraction of drugs from urine, blood, and saliva.

Excretion of drugs through hairs and nail and their examination. Procedure for collection, of hair sample, storage preservation. Method of extraction of drugs from hair and nails and their identification using instrumental techniques.

Unit – III

Confirmation of drugs through instrumental techniques: Analysis of Narcotic drugs, depressants, tranquillizers, stimulants, hallucinogens, club drugs & other drugs of abuse through High Performance Thin Layer Chromatography, Gas liquid chromatography, High Pressure liquid chromatography, , UV-visible spectrometry,

IR/FTIR and Raman spectroscopy, Mass Spectrometry, GC- Mass and LC-Mass, HPTLC-Mass. Method validation and calibration of instruments.

Unit – IV

Detection of adulterants: NDPS drugs and their commonly encountered adulterant. Determination of nature of adulterant, diluent, and additives.

Percentage purity determination: Estimation of % purity of the NDPS drugs and detection in seized samples such as opium charas, amphetamine, cocaine, and tranquilizers in seized sample.

Reporting of cases and court testimony: Laboratories authorized to conduct examination an expert authorized to report NDPS substances, Limitation of chemical analysis of drugs. Report writing and interpretation of drugs analysis. Court testimony in NDPS Act cases. Case studies and ground for acquittal. Moot Court.

Reference Books

1. Clark E.G.C; "Isolation and Identification of drugs". Vol.1 and Vol.2, Academic Press 1986.
2. NDPS Act, 1985.
3. Feigl; "Spot Test in Organic Analysis", Elsevier Pub. New Delhi.
4. "Working Procedure Manual – Chemistry, Explosives & Narcotics", BPR&D Publications.
5. Feigl, F; "Spot Test in Inorganic Analysis", Elsevier Publication. New Delhi, 2005.
6. Tewari, S.N; "Liquor and Narcotic Drugs".
7. Houck Max & Siegel J; "Fundamentals of Forensic Science", Academic Press, 2006.
8. Sethi P D; "Quantitative Analysis of Drugs in Pharmaceutical Formulation" 3rd Edition, CBS Publisher, 2005.
9. Kintz Pascal; "Analytical and Practical Aspect of Drug Testing in Hair", CRC Press, 2007.
10. Sunshine Irvin; "Handbook of Mass Spectra of Drugs" CRC Press, 1981.
11. Fred Smith; "Handbook of Forensic Drug Analysis", Elsevier Academic Press, 2004.
12. Teresa Kowalska, "Chromatographic Techniques in the Forensic Analysis of Designer Drugs", CRC Press, Taylor & Francis Group, 2017.
13. "Laboratory Procedure Manual, Forensic Toxicology", Directorate of Forensic Science, MHA, Govt. of India, 2005.
14. Robinson James; "Atomic Spectroscopy" 2nd Edition, Marcel Dekker 1996.
15. Angelis GGD; "Testing and Screening of Drugs of Abuse", Marcel Dekker 1996.

16. Yinon J; “Advances in Forensic Application of Mass Spectrometry”, CRC Press, 2004.
17. Recommended Methods for Testing Drugs, United nations Office of Drugs and Crime, Vienna, Austria.

Semester- III, Paper – IV
M.Sc. Forensic Science
MSFS324 – Advance Instrumental Techniques

Unit – I – Molecular Spectroscopy

Ultra violet and visible spectroscopy: Qualitative discussion of molecular binding, molecular orbital, types of molecular energies, qualitative discussions of rotational, vibrational and electronic spectra, spectra of polyatomic molecules.

Effect of Chemical Structure and solvent on absorption spectra, qualitative and quantitative analysis and limitations. Applications in forensic chemistry and toxicology.

Infrared spectrophotometry: Basic principle, components, Sample handling, Dispersive and Fourier transform spectrophotometry, (FTIR). Qualitative analysis and interpretation of IR spectra, correlation of infrared spectra with molecular structure and applications in forensic chemistry and toxicology.

Raman Spectroscopy: Basic principles, Instrumentation, sample handling and illumination, structural analysis, polarization measurements and Dispersive & FT analysis and Applications in Forensic Chemistry and Toxicology. Advantage of Raman over IR and vice versa, Role of microscope.

Unit – II – Atomic Spectroscopy

Atomic Absorption Spectroscopy (AAS): Instrumentation, interference in AAS, background correction methods, graphite furnace quantitative analysis and applications. Detection limit and sensitivity.

Atomic Emission Spectroscopy (AES): Instrumentation and techniques, arc/spark emission, ICP-AES, comparison of ICP vs AAS methods, quantitative analysis, ESCA and its applications.

Fluorescence and phosphorescence spectroscopy: Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods and applications.

Nuclear Magnetic Resonance Spectroscopy: Basic principles, theory and Instrumentation and applications.

Unit – III – Chromatographic Techniques

General principles of Adsorption chromatography, partition chromatography, Size Exclusion (permeation) chromatography, Affinity chromatography. Ion-exchange chromatography, Capillary Chromatography, column chromatography
Gas Chromatography: Gas solid chromatography, Ga Gas-liquid chromatography, types of columns, types of detectors used. Advantages and Limitations of different Detectors, GC-HS. Applications of GC in forensic chemistry & toxicology.

High Performance Liquid Chromatography: Basics of LC, types of columns and stationary phase, mobile phase, column conditioning, types of detectors, interpretation of chromatogram. Application of HPLC in Forensic chemistry and toxicology. Limitations and Advantages of HPLC over GC. Basics of HPTLC and their applications in Forensic chemistry and Toxicology.

Unit – IV – Spectrophotometric Techniques

Elements of X-ray spectrometry: X-ray absorption and fluorescence, Energy Dispersive X-ray Analysis (EDX), wavelength Dispersive X-ray analysis (WDX), X-ray diffraction, Auger emission spectroscopy and applications.

Basics of Mass Spectrometry: Sample flow, Different Ionization methods- chemical ionization, electron spray ionization, Tandem mass spectrometry Vacuum systems, Mass analyser, Ion Microprobe Mass Analyser (IMMA), Data handling, Correlation of mass spectra and molecular structure.

Applications of Mass Spectrometry in Forensic Chemistry and Forensic Toxicology.

Hyphenated techniques: Gas Chromatography coupled with FTIR, Gas Chromatography coupled with mass spectrometry (GC-MS), Liquid Chromatography coupled with mass spectrometry (LC-MS), Fourier transform mass spectrometry (FTIR-MS), Inductively coupled plasma MS (ICP-MS), High Performance Thin Layer Chromatography coupled with Mass spectrometry (HPTLC-MS)

Applications of Hyphenated techniques in Forensic Chemistry and Toxicology.

Reference Books:

1. Hobart Willard; “Instrumental Methods of Analysis”, Wadsworth Publishing Company, 1988.
2. Douglas Skoog, James Holler and Stanley Crouch; “Principles of Instrumental Analysis” 7th Edition, Cengage Learning, 2017.
3. James W R; “Atomic Spectroscopy”, 2nd Edition, Marcel Dekkar, NY, 1966.
4. Patania V.B; “Spectroscopy”, Campus Books International, 2004.
5. Khandpur R.S; “Handbook of Analytical Instruments”, Tata McGraw Hill Publ. Co., 2004.

6. Chatwal G.R & Anand S.K; “Instrumental Methods of Chemical Analysis”, Himalaya Publishing House, 2004.
7. Thomson K. C & Renolds R.J; “Atomic Absorption Fluorescence & Flame Emission Spectroscopy: A Practical Approach”, 2nd Edition, Charles Griffin & Co., 1978.
8. Silverstein R.M Webster F.X; “Spectrometric Identification of Organic Compounds” 6th Edition, John Wiley 7 Sons, Inc., 1997.
9. Clark E.G.C; “Isolation and Identification of drugs”, Vol.1 and Vol.2, Academic Press, 1986.
10. Banwell C.L & Elani M.M.C; “Fundamental of Molecular Spectroscopy”, 4th Edition, Tata McGraw Hill Pub. Co., 1995.
11. Chatwal G.R; “Analytical Spectroscopy”, 2nd Edition, Himalaya Publishing House, 2002.
12. Sunshine I; “Ultraviolet Spectrophotometry”, CRC Press, 1969.
13. Nakanishi Koji; “Infrared Absorption Spectroscopy”, Holden-Day, Inc. 1969)
14. Welcher Frank; “Standard Methods of Chemical Analysis”, 6th Edition, Van Nostrand Reinhold, 1969.

Semester- III, Paper – V (Practical – I)
M.Sc. Forensic Science
MSFS326 – Forensic Chemistry and Instrumental Techniques

1. Analysis of liquor as per, BIS specifications.
2. Analysis of country liquor and denatured spirit by Gas Liquid Chromatography.
3. Detection and identification of phenolphthalein and other constituents in trap cases by colour test, TLC and UV - visible spectrophotometry.
4. Analysis of petrol, kerosene and diesel by physical chemical and gas liquid chromatography
5. Analysis of adulteration of petrol and diesel with kerosene by TLC and instrumental methods.
6. Analysis of dyes by TLC and UV-visible spectrophotometer.
7. Comparison of component of cosmetic stain from crime scene and suspect is clothing by spectrophotometry method UV/FTIR.
8. Analysis of residue material in fire and arson cases by TLC/, UV spectrophotometric and gas chromatography.
9. General analysis and identification of metal and alloys by chemical method and instrumental techniques.
10. Determination of purity of metals by atomic absorption spectrophotometer.
11. Analysis of organic and inorganic explosives by colour test, TLC/HPTLC and instrumental techniques.

Semester- III, Paper – VI (Practical – II)
M.Sc. Forensic Science
MSFS327 – Forensic Toxicology and Instrumental Techniques

1. Analysis of viscera for volatile poisons (Organic and Inorganic) by Conway apparatus.
2. Detection and identification of metallic poisons in viscera and food material by chemical test and instrumental technique.
3. Analysis of viscera for organochloro, organophosphoro, carbamates and pyrethroids by colour test TLC/HPTLC and UV-visible spectrometry method.
4. Determination of alcohol in blood and urine sample.
5. Systematic extraction, and identification of non –volatile drugs and plant poisons by various techniques.
6. Identification of common plant poisons opium and alkaloids, Kaner, Dhatura and Nux Vomica, Aconite by colour test, cannabis and instrumental techniques.
7. Detection and identification of quarternary ammonium drugs and poison in viscera by ion pair method and instrumental method.
8. Determination of phosphine in aluminum phosphide and zinc phosphide in viscera by chemical and instrumental analysis.
9. Identification of psychotropic drugs- barbiturates, benzodiazepines & narcotics in biological fluids by colour test, TLC/HPTLC and instrumental techniques.
10. Detection and identification of major metabolites of ethanol, methanol, parathion, carbryl and heroin.
11. Systematic analysis of unknown poisons.

Semester- III, Paper – VII (Practical – III)
M.Sc. Forensic Science
MSFS328 – Forensic Analysis of Drugs and Instrumental Techniques

1. Identification of common precursors.
2. Identification of narcotic drugs: opium and alkaloids, morphine and heroin, cannabis by colour test TLC, and instrumental techniques.
3. Analysis of Ganja and charas by color test, TLC/HPTLC
4. Determination of barbiturate by UV -visible Spectrophotometric method.
5. Determination of morphine and heroin in a given sample by UV-visible spectrometer/ LC.
6. Determination of morphine and heroin in a given sample by GLC method.
7. Identification of ketamine by color test & TLC.
8. Analysis of stimulants by color tests, TLC/HPTLC.
9. Identification of unknown seized NDPS Drug by chemical methods and Instrumental techniques.
10. Extraction of drugs from hair sample.
11. Study of FTIR spectra of benzodiazepines & Narcotics.

MSFS-330 – Specialization in Forensic Biology, Serology, DNA Profiling

Semester- III, Paper – I
M.Sc. Forensic Science
MSFS331 – Forensic Anthropology

Unit – I

Genesis and Developments in Anthropology. Human Physique: Somatotypes – Ectomorphy, Mesomorphy and Endomorphy. Methods of somatotyping: Sheldon‟s and Heath-Carter‟s Methods. Principles and methods of anthropometry. Measurements on the living and skeletal parts. Land marks on human body and measurement techniques. Somatological characteristics of various parts of the human body. Genetic traits of forensic importance.

Dermatoglyphics- Development of dermal ridges in intra-uterine life. Finger, palm and sole prints, palmer lines and creases, plantar creases, human foot morphological variations. Role of anthropology in identification of person.

Unit – II

Methods of studying human growth- longitudinal cross sectional and mixed longitudinal methods. Distance and velocity curves of body height and weight. Pre-natal and post-natal stages of growth and development. Factors affecting growth and development.

Age assessment -Decimal age calculation, age grouping. Chronological and developmental age-Methods of assessing developmental age, dental age, skeletal age, morphological age and secondary sex character age. Significance of growth studies in forensics.

Unit – III

Osteology of the Human Skeleton. Distinguishing human from non-human bones. Terminology associated with gross morphology of bone, skeletal direction and human dentition. Skeletal trauma and pathology. Human dentition. Dental numbering system. Dental anomalies. Racial differences in skull, mandible, pelvis, long bones and scapula. Studies on stature reconstruction in various population groups. Exhumation- Purpose and Procedure. Maceration- Purpose and Procedure. Recovery and packaging of skeletonised and burnt remains.

Unit – IV

Skeletal age (Earlier years): Criteria of age in human skeleton – Post natal appearance and union of centers of ossification, Pre-natal ossification, differences due to race.

Skeletal age (Later years): Suture closure, pelvis, long bones. Osteon counting. Sexing skeletal remains: Sex differences in skull, pelvis and long bone. Accuracy of sexing and ageing of adult skeleton remains. Calculation of stature from long bones. Use of immature and fragmentary long bones in stature calculation. Restoration of physiognomic details from skull- relation of the skull to photographs. Restoration of the head from the skull. Use of radiography of skull and other bones in skeletal identification.

Reference Books:

1. Maria Teresa, Tersigni-Tarrant, Natalie R. Shirley; "Forensic Anthropology: An Introduction", CRC Press, Taylor & Francis Group, 2012.
2. Angi Christensen, N. Passalacqua, & E. Bartelink; "Forensic Anthropology: Current Methods and Practices", Academic Press, Elsevier, 2014.
3. Anil Mahajan & Surinder Nath; "Application areas of Anthropology", Reliance Publishing House, 1992.
4. Goutam Shubra; "Introduction to Forensic Examination", Selective Scientific Books, 2008.
5. Megan Brickley & Roxanna Ferllini; "Forensic Anthropology: Case Studies from Europe", Charles C. Thomas Publisher, Springfield, Illinois, USA, 2007.
6. Indra P. Singh & M.K. Bhasin; "A Manual of Biological Anthropology", Kamla Raj Enterprises, 2004.
7. Fred Plog, Clifford J. Jolly & Danial Bates; "Anthropology", Alfred A. KNOPF, New York, 1976.
8. Kroeber; "Anthropology", Oxford & IBH Publishing Co., 1972.
9. Robert Pickering & David Bachman; "The use of Forensic Anthropology", CRC Press, 2009.
10. Nirmal Kumar Bose; "Anthropology", Narayan Press, 1972.
11. B.R.K Shukla & Sudha Rastogi; "Physical Anthropology", Palaka Prakashan, 2005.
12. James Robertson; "Forensic Examination of Hair", Taylor and Francis, 1999.
13. Inderbir Singh; "Human Osteology", Jaypee Brothers, 2004.
14. Michael W. Warren, Heather A. Haney & Laurel E. Freas; "The Forensic Anthropology Laboratory", CRC Press, 2008.
15. Fazekas, I Gy; "Forensic in Foetal Osteology", Akademiai Kiado, 1978.
16. "Forensic Recovery of Human Remains", Dupras, T.L. CRC Press.

Semester- III, Paper – II
M.Sc. Forensic Science
MSFS332 – Forensic Biology and Wildlife Forensics

Unit – I

Composition of body fluids - blood, semen, saliva, vaginal fluid, urine, sweat and menstrual blood. Identification of bloodstains, seminal stain, saliva stain, vaginal fluid, urine, sweat and menstrual blood using current and emerging techniques. Distinguishing vaginal acid phosphatase and seminal acid phosphatase using isoelectric focusing technique.

Unit – II

Identification and matching of various types of wood, timber varieties, seeds and leaves. Types of vegetable fibers and methods of their identification. Planktons and Diatoms- Forensic importance. Isolation of diatom from water, body organs and tissues. Identification of pollen grains and starch grains. Paper Pulp examination. Identification of poisonous plants of forensic significanceAbrusprecatorius, Aconitum, Argemone Mexicana, Cannabis sativa, Atropa belladonna, Erythroxylum coco, Lathyrussativus, Manihotutilissima, Neriumindicum, Ricinuscommunis, Strychnosnuxvomica, Ergot, Opium, Dhatura and Psilocybin mushrooms.

Unit – III

Forensic Entomology- History, significance, determination of time since death- Dipterans larval development- life cycle of blowfly, housefly, flesh-fly. Successional colonization of body, determining whether the body has been moved, body disturbance, presence and position wounds, linking suspect to the scene, identification of drugs and toxins from the insects and larvae feeding on the body, entomology as an evidentiary tool in child and senior abuse cases and animal abuse cases, collection and preservation of entomological evidence.

Unit – IV

Introduction and importance of Wild life. Protected and endangered species of animals and plants. Sanctuaries and their importance. Relevant provision of wild life and environmental act. Types of wildlife crimes. Different methods of killing and poaching of wildlife animals.

Reference Books:

1. Hosetti, B.B; “Concept in Wildlife Management”, Daya Publishing House, 2005.
2. Linarce, Adrian; “Forensic Science in Wildlife Investigation”, CRC Press, Taylor & Francis, 2009.
3. Baalu, T.R.; “The Wildlife Protection Act, 1972”, Nataraj Publication, 2001.
4. Universal Publication; “Wildlife (Protection Act, 1972)”, Universal Publication, 2005.
5. Nataraj Publishers; “Wildlife (Protection Act, 1972)”, Nataraj Publishers, 1997.
6. Herbert Stone; “The Timbers of Commerce”, International Book Distributor, 1985.
7. N. Clifford; “Timber Identification”, Leonard Hill Ltd., 1957.
8. G. Erdtman; “Pollen Morphology & Plant Taxonomy: Angiosperms (an introduction to Palynology), Hafner Publishing Co., 1971.
9. Esau Katherine; “Plant Anatomy”, Wiley Eastern Ltd., 1965.
10. Heather Miller Coyle; “Forensic Botany”, CRC Press, 2005.
11. Herbert L. Edlin; “A manual of Wood Identification”, Viking Press, 1976.
12. H.C. Long; “The Poisonous Plants”, Asiatic Publishing House, 1994.
13. Katherine Paddock Hess; “Textile Fibres & their use”, Oxford & IBH Publishing Co., 1974.
14. Simon Ball; “Environmental Law- The Law & Policy relating to Protection of Environment”, Universal Law Publishing Co., Delhi, 1991.
15. B.P. Pandey; “Plant Anatomy”, S. Chand & Co., New Delhi, 1998. 16. X-Ray Manual by WCCB, 2013.

Semester- III, Paper – III
M.Sc. Forensic Science
MSFS333 – Forensic Genetics & Forensic Serology

Unit – I

Human genetic variations. Mendelian Inheritance. Hardy Weinberg Equilibrium. Mutation- their types and causes. Relevance of population genetics. Allele frequency, genotype frequency. Polymorphism and heterozygosity. Measures of genetic variations.

Unit – II

Determination of species of origin-ring test, single diffusion in one dimension and two-dimension, double diffusion in one dimension and two dimensions, immuneelectrophoresis, Rocket immune-electrophoresis, Two dimensional electrophoresis, cross-over electrophoresis, Anti-human globulin serum inhibition test, passive heam-agglutination method, precipitin-inhibition test, mixed agglutination method, sensitized latex particle method. Testing Procedures and factor effecting precipitin tests. Raising of Anti-sera, buffers and serological reagents, Lectins and their forensic significance, methods of sterilization employ for serological work.

Unit – III

Human blood group systems. History, biochemistry and genetics of ABO, Rh, Mn and other forensically significant blood group systems. Methods of ABO blood grouping (absorption-inhibition, mixed agglutination and absorption elution) from blood stains and other body fluids/stains. New approaches in bloodstain grouping. Blood group specific ABH substances. Secretors and non- secretors. Blood groups that make racial distinctions. Lewis antigen. Bombay Blood groups. HLA antigens and HLA typing. Role of sero-genetic markers in individualization and paternity disputes. Pitfalls in red cell typing.

Unit – IV

Red cell enzymes: Genetics, Polymorphism and typing of PGM, GLO-I, ESD, EAP, AK, ADA etc. and their forensic significance. Serum proteins: Genetics, polymorphism and typing of – Hb, HP, Tf, Bf, C3 etc. and their forensic significance. Non-genetic approaches to individualization- biochemical profiling, antibody profiling and persistent disease agents.

Reference Books:

1. Goodwin, William; “An Introduction to Forensic Genetics”, John Wiley & Sons Ltd., 2007.
2. Kapur, V; “Basic Human Genetics”, Jaypee Brothers, 1991.
3. Kothari, Manu L; “Essentials of Human Genetics”, University Press (India) Pvt. Ltd., 2009.
4. Singh B.D.; “Fundamentals of Genetics”, Kalyani Publishers, 2006.
5. Edmund Sinhott; “Principles of Genetics”, McGraw Hill Publications, 1950.
6. Giblett, Eloise R.; “Genetic Markers in Human Blood”, Blackwell Scientific Publications, 1969.
7. Altenburg, Edgar; “Genetics”, Oxford & IBH Publishing Co., 1970.
8. GJV Nossal; “Antigens, Lymphoid Cells and the Immune Response”, Academic Press, 1971.
9. Wiener, Alexander S; “Advances in Blood Grouping II”, Grune & Stratton, 1965.
10. Boorman, Kathleen E & Churchill; “Blood Group Serology”, Livingstone, 1977.
11. Race, R.R, Blackwell; “Blood Groups in Man”, Scientific Publications, 1975.
12. Sussan, Leon N & Charles Thomas; “Paternity Testing by Blood Grouping”, 1968.
13. Prakash, M; “Physicology of Blood”, Anmol Publications, 1998.
14. Gupta, S.K; “Essentials of Immunology”, Arya Publications, 2008.
15. Franklinns Stahl; “The Mechanism of Inheritance”, Prentice Hall, 1969.
16. Gell, P.G.H; “Clinical Aspects of Immunology”, Blackwell Scientific, 1975.

Semester- III, Paper – IV
M.Sc. Forensic Science
MSFS334 – Forensic DNA Profiling and Bioinformatics

Unit – I

Structure and function of DNA, RNA and genome organization. Denaturation and Renaturation of DNA, Milestones in development of DNA technology. History of Forensic DNA Testing. Enzymes used in manipulation of nucleic acids. Probes. Genetic basis of Forensic DNA typing, Technological basis of Forensic DNA typing.

Unit – II

Sample collection and preservation. DNA Extraction Methods. Quantification and Quality assessment methods. PCR amplification – PCR process, components, controls, advantages and disadvantages, types of PCR, PCR inhibitors, optimization and solution to PCR inhibition. Stochastic effect. PCR Primer designing. DNA separation methods: Slab gel and Capillary Electrophoresis. Capillary electrophoresis-Principle and Instrumentation. DNA detection methods: Fluorescent Dyes and Silver–staining.

Unit – III

Forensic DNA typing system – RFLP, Amp-RFLP. STR. Mini STR. Y-STR. XSTR. Mitochondrial DNA. Single Nucleotide Polymorphism. Microbial DNA testing, Non-Human DNA testing, Plant DNA testing. STR allele nomenclature. STR loci of Forensic significance. STR kits. STR typing: Manual and Capillary Electrophoresis. Gender identification. Interpretation of the DNA typing results. CODIS, Statistical evaluation of DNA typing results and preparation of reports. RNA and its application in Forensics, Emerging molecular techniques in Forensics.

Unit – IV

Introduction to bioinformatics and its application in forensics. Integrated information retrieval. Major databases in bioinformatics. Sequence alignment, Phylogenetic analysis and related tools. Gene identification and prediction. FASTA and BLAST algorithm. Bioinformatics analysis of DNA Microarray, Bioinformatics tools of forensic applications- Clustal family, BioEdit, MEGA, Arlequin, Protein structure prediction and visualization tools. Tools used in proteomics, In-silico simulation for molecular biology experiments. Basic theory of probability and statistics. Bayesian analysis. Likelihood ratio. Statistical evaluation of DNA profiles using Bioinformatics tools.

Reference Books:

1. Rudin, Norah; “An Introduction to Forensic DNA Analysis”, CRC Leviw Publishers, 2002.
2. Inman, Keith; “An Introduction to Forensic DNA Analysis”, CRC Press, 1997.
3. Vij, Krishan; “Basics of DNA and Evidentiary Issues”, Jaypee Brothers, 2004.
4. Kirby, Lorne; “DNA Fingerprinting”, W H Freeman and Co., 1992.
5. Nickoloff, Jac A; “DNA Damage and Repair”, Humana Press, 1998.
6. Easteal, Simon; “DNA Profiling”, Harwood Academic Publishers, 1993.
7. Epplen, Jorg T.; “DNA Profiling and DNA Fingerprinting”, Birkhauser Verlage, 1999.
8. Lorne Kirby; “DNA Fingerprinting”, W H Freeman and Co., 1992.
9. Singh, Yashpal; “DNA Tests in Criminal Investigation Trial & Paternity Disputes”, Alia Law Agency, 2006.
10. J.M. Butler; “Forensic DNA Typing”, Elsevier Academic Press, 2005.
11. Mark A. Farley & James J. Harrington; “Forensic DNA Technology”, CRC Press, 1991.
12. S.C. Rastogi, N. Mendiratta & P. Rastogi; “Bio-informatics – Methods and Applications”, PHI learning Pvt. Ltd., 2009.
13. Dr. Westhead, JH Parish & R.M. Twyman; “Bio-informatics”, Viva Books Ltd., 2003.
14. “DNA Technology in Forensic Sciences”, National Research Council, National Academy Press, 1997.
15. G.A O‟Gaal, Medgyeri et al; “Electrophoresis in the separation of Biological Macromolecules”, John Wiley & Sons, 2008.
16. JM Claverie and Cedric Noterdame; “Bioinformatics – A Beginner‟s Guide”, Wiley Publications, 2008.
17. Alcamo, I Edward; “DNA Technology”, Harcourt Academic Press, 1999.
18. T. Burke & Terry; “DNA Fingerprinting: Approaches and Applications”, Birkhauser Verlage, 1999.
19. JP Baride, A.P. Kulkarni & R.D. Muzumdar; “Manual of Biostatistics”, Jaypee Publications, 2003
20. J. Thomas Mcclintock; “Forensic DNA Analysis”, Lewis Publications, 2008.
21. “Methods in Biostatistics”, 7th Edition, Jaypee Publication, 2010.
22. P.S.S Sundar Rao and J.Richard; “Introduction to Biostatistics and Research Methods”, 5th Edition, 2012.

Semester- III, Paper – V
M.Sc. Forensic Science
MSFS336 – Forensic DNA Profiling

1. DNA Extraction from biological samples (Blood and other body fluids and tissues) using Organic (Phenol-Chloroform) Method
2. DNA Extraction from biological samples using Chelax Method.
3. DNA Extraction from biological samples using Salting out Method.
4. DNA Extraction from biological samples using FTA Cards.
5. DNA Extraction from biological samples using commercially available kits
6. Qualitative and Quantitative Analysis using Agarose, UV Spectrophotometer and Real time-PCR.
7. PCR Amplification of DNA samples
8. Post-PCR Agarose gel electrophoresis of PCR products.
9. Amp-RFLP Analysis of biological samples
10. STR typing using vertical poly-acrylamide gel electrophoresis and silver staining.
11. STR typing using Genetic Analyzer.

Semester- III, Paper – VI
M.Sc. Forensic Science
MSFS337 – Forensic Serology

1. Determination of species of origin of blood, semen and saliva.
2. ABO grouping of bloodstains by absorption elution, absorption inhibition and mixed agglutination techniques.
3. ABO grouping from hair root
4. Rh grouping of bloodstains
5. MN grouping of blood stains
6. Determination of secretor status from saliva by inhibition techniques.
7. Experiments on electrophoresis of red cell isozymes viz. PGM, GLO, EsD, EAP, ADA, AK.
8. Experiments on electrophoresis of serum proteins Hp, Tf, C3, Bf, Gc etc.
9. Experiments on separation of SAP/VAP.
10. Preparation of Lectins and titration.
11. Experiments on reactivity of Lectins against body fluids and tissues.

Semester- III, Paper – VI
M.Sc. Forensic Science
MSFS338 – Forensic Anthropology

1. Morphological & microscopic examination of hair.
2. Examination of blood stains: physical and chemical tests; spectroscopic examination.
3. Examination of seminal stains: crystal tests, chemical, biochemical, microscopical and electro-immuno-diffusion test.
4. Examination of saliva and its stains: microscopical and chemical tests.
5. Examination of urine stains.
6. Faecal stains: chemical and microscopical examination, testing of urine and sweat.
7. Menstrual blood and its examination by microscopic and electrophoretic methods.
8. Identification of human bones and determination of their sides.
9. Determination of age from skull, teeth, sex from skull and pelvis
10. Stature estimation from long bones.
11. Taking of finger, palm and sole prints and their analysis.

MSFS-340 – Specialization in Forensic Documents Examination

Semester- III, Paper – I
M.Sc. Forensic Science
MSFS341 – Questioned Documents and Handwriting Analysis

Unit – I

Handwriting/signature examination- principles of handwriting identification, General characteristics and their estimation- line quality, speed ,slant, shading, rhythm, size, skill, movement, alignment, relative size and proportion, pen lifts, pen pressure, pen position, pen pause, hiatus, commencing and terminal strokes, connecting strokes, individual characteristics of handwriting and their estimation, rare/occasional and accidental features in handwriting, effect of posture, emotion, illness, age and drugs/alcohol on handwriting, effect of mother tongue on foreign script, examination and interse comparison of English alphabets and numerals, procurement of handwriting standards- specimens and contemporaneous writings, process of comparison of like with like, best standards for comparison with disputed documents.

Unit – II

Detection and decipherment of various alterations- obliterations, additions, overwriting, mechanical and chemical erasures and secret writings, simple forgery, traced forgery, simulated forgery, forgery by trickery, forgery by transplantation using scanners and colour printers, inherent signs of forgery. Detection and Decipherment of mechanical impressions - rubber stamp impressions, seal impressions, embossed impressions, indentations. Fixing authorship of forged writings and signatures, tremors of forgery and genuineness, case studies. Use of state-of-the art equipment for non-destructive methods of analysis.

Unit – III

Examination of anonymous letters- Identification of writer of the letter, Features indicating religion, region, sex and educational background of the writer, Importance of preserving envelope containing anonymous letters, Types of anonymous letters and various methods used for their communication, Case studies. Linguistics, stylistics, forensic stylistics- Definition, Methodology, Use in personal identification, Application in different Indian vernacular languages, Limitations, Case studies.

Unit – IV

Determination of relative age of writing and signatures, determination of relative age by examination of signatures/rubber stamp impression in chronological order, Determination of relative age of document by - Examination of writing paper and ink, Examination of sequence of intersecting strokes, Addition of text with ink or

typescript, Anachronistic features and their importance. Stabilization of charred documents- Decipherment of charred documents, Reconstruction of torn documents, Case studies.

Reference Books:

1. Ordway Hilton; “Scientific Examination of Questioned Documents”. Revised Edition, Elsevier, NY 1982.
2. Albert S. Osborn; “Questioned Documents”, 2nd Ed., universal Law Pub., Delhi 1998.
3. Albert S Osborn; “The Problem of Proof”, 2nd Ed., Universal Law Pub. Delhi 1998.
4. Charles C. Thomas; “I.S.Q.D. Identification System for Questioned Documents”, Billy Prior Bates Springfield, Illinois, USA 1971.
5. Wilson R. Harrison; “Suspect Documents Their Scientific Examination”, Universal Law Pub. Delhi Indian Reprint, 2001.
6. Working manual of VSC-5000.
7. Hardless H.R; “Disputed Documents. Handwriting and Thumb – Print Identification, profusely illustrated”, Law Book, Allahabad 1988.
8. Morris Ron N; “Forensic Handwriting Identification”, Academic Press, London, 2001.
9. Jan Seaman Kelly & Brian S Lindblom; “Scientific Examination of Questioned Documents”, Taylor Francis Group London and New York.
10. Ellen David; “Questioned Documents – Scientific Examination”, Taylor & Francis, Washington, 1997.
11. Richard L Brunelle & Robert W Reed; “Forensic Examination of Ink and Paper”, Charles C Thomas Springfield, Illinois, USA.
12. Zeev B Alfassi; “Activation Analysis”, CRC Press, 1990.
13. Katherine M Kappenhaver; “CDE-Forensic Document Examination”, Humana Press.
14. Levinson Jay; “Questioned Documents”, Academic Press, London, 2001.
15. Mehta MK; “The Identification of Handwriting & Cross Examination of Expert”, 1970.
16. Malcom Coulthard & Alison Johnson; “An Introduction to Forensic Linguistics”, Taylor & Francis Group London & New York.
17. Memenamin Gerald R; “Forensic Linguistics- Advances in Forensic Stylistics”, CRC Press, Washington Dc, 2002.

Semester- III, Paper – II
M.Sc. Forensic Science
MSFS342 – Mechanical Impressions

Unit – I

Working of standard mechanical and electrical typewriters and examination of typescripts therein, identifying features of standard typewriters, features arising due to defects in main machine and fonts. Working and examination of electric, electronic and daisywheel printer, high speed mainframe line printer (drum and chain print heads), Cheque writers, Identification of typist of typescripts. Use of state-of-the art equipment for non-destructive methods of analysis.

Unit – II

Types of computer printers, Working of computer printers- dot matrix printers, ink jet printer, laser jet printers, thermal printers, digital offset printers, Identifying features of different computer printouts, methods of identification of toners and inks used in printing. Examination and identification of digitally manipulated documents using computers and printers, Case studies.

Unit – III

Principle and working of different conventional printing processes- letterpress, offset printing, Intaglio Printing, Flexography printing, Thermography printing, Digital printing and Screen printing, Various type of security printing, Identifying features of the printed matter of various printing processes.

Unit – IV

Examination of black and white and colour photocopies and their identifying features, process of collection of sample photocopies for the purpose of comparison, examination of fax message, scanned documents, carbon copies and carbonless copies. Difference between Photocopies, Computer Printouts and Scanned copies. Case studies.

Reference Books:

1. Eoghan Casey; “Digital Evidence and Computer Crime”, 2004.
2. Eoghan Casey; “Handbook of Digital forensics and Investigation”, Elsevier Academic Press, 2009.
3. John Sammons; “The basics of Digital Forensics: The Primer for getting started in Digital Forensics”, Elsevier, Syngress, 2014.
4. Ordway Hilton; “Scientific Examination of Questioned Documents”, Revised Edition, Elsevier, NY, 1982.
5. Charles C. Thomas; “I.S.Q.D. Identification System for Questioned Documents”, Billy Prior Bates Springfield, Illinois, USA, 1971.
6. Wilson R. Harrison; “Suspect Documents Their Scientific Examination”, Universal Law Pub. Delhi Indian Reprint, 2001.
7. Ellen Davin; “Questioned Documents – Scientific Examination”, Taylor & Francis, Washington, 1997.
8. Jan Seaman Kelly & Brian S Lindblom; “Scientific Examination of Questioned Documents”, Taylor Francis Group London and New York.
9. Katherine M Kappenhaver; “CDE-Forensic Document Examination”, Humana Press.
10. Levinson Jay; “Questioned Documents”, Academic Press, London 2001.

Semester- III, Paper – III
M.Sc. Forensic Science
MSFS343 – Digital & Security Documents

Unit – I

History of travel documents, International Civil Aviation Organization guidelines for travel documents. Various types of Indian passports and visa and their security features. Detection of Forged passports, Air tickets and travelers cheque. Lottery tickets. Case studies. History and development of banknotes in India, Different denomination of bank notes and their security features. Security features introduced at the time of paper making and printing. Special security features of bank notes of higher denomination. Modus operandi of counterfeiting of bank notes and their detection. Indian coins and their counterfeiting. Case studies.

Unit – II

Examination of judicial/ non-judicial stamp papers, revenue stamps, postal stamps and special stamps and their security features- watermarks, wire marks, UV features, security fibers, security thread, perforations and high-quality printing. Methods of detection of forged stamp papers/security documents. Examination of the security features of plastic cards- credit cards, debit card, PAN card, Aadhar card, smart card and other plastic cards. Methods of detection of fake plastic cards, electronic transactions. Case studies.

Unit – III

Introduction to Computer forensics, pre-search consideration, acquisition, collection and preservation of volatile/non-volatile data, Imaging & hashing of Digital Evidence, Recovery & Analysis of deleted files/Partitions, Overview of Cryptography, bitcoins, cryptocurrency, digital signatures. Automated signature verification system.

Unit – IV

Quality management in document laboratory, safety management in document laboratories, various formats used for recording, chain of custody, Laboratory examination and report writings, NABL guidelines for Accreditation of document laboratories, best practices in document laboratories. Report writing including different types of opinions on handwriting, mechanical impressions, computer printers, photocopies and alterations. Importance of no opinion and qualified opinion, marking of demonstrative photographs and preparation of juxta pose charts, reasons for opinion expressed, Debonair of expert in court room, examination in chief, cross examination by defense and cross examination by expert, moot courts and various court rulings.

Reference Books:

1. Bill Nelson, Amelia Phillips and Christopher Steuart; “Guide to Computer Forensics and Investigations” – 3rd Edition, Cengage, 2010 BBS.
2. Eoghan Casey; “Digital Evidence and Computer Crime”, 2004.
3. Eoghan Casey; “Handbook of Digital forensics and Investigation”, Elsevier Academic Press, 2009.
4. John Sammons; “The basics of Digital Forensics: The Primer for getting started in Digital Forensics”, Elsevier, Syngress, 2014.
5. Ordway Hilton; “Scientific Examination of Questioned Documents”, Revised Edition, Elsevier, NY, 1982.
6. Albert S. Osborn; “Questioned Documents”, 2nd Ed., universal Law Pub., Delhi, 1998.
7. Katherine M Kappenhaver, “CDE-Forensic Document Examination”, Humana Press.
8. Levinson Jay; “Questioned Documents”, Academic Press, London 2001.
9. ISO/IEC 17025:2005, NABL 113,113A, 131, guidelines of NABL.

Semester- III, Paper – IV
M.Sc. Forensic Science
MSFS344 – Bank Frauds and Forensic Accounting

Unit – I

Types of companies and role of key managerial personnel, Basic accounting principles. Types of banks, Bank instruments-legal tenders, bank notes, FDRs, Cheques/drafts, Bank guarantee, Bonds and certificates. Types of accounts – Saving account, Current account, account opening forms, credentials of introducers, guarantor, D Mat accounts, Public Provident fund, Recurring Deposits, and special accounts, Alterations in Pass Books, Credit Debit/ATM card frauds, Ledger entries, Withdrawal slips, Cheques, Documents for loan, Bank guarantee, Corporate frauds and banking frauds-Case studies.

Unit – II

Difference between audit and investigations, skills of a fraud investigator, conducting fraud investigation. Investigation of external fraud schemes-corporate espionage, investment schemes, pyramid or Ponzi schemes, securities fraud, hidden income or assets, insurance fraud and bankruptcy fraud, evaluating frauds, fraud deterrence, money laundering, types of money laundering. Case studies., investigative techniques- corporate background checks, individual background checks, digital data analysis, computer forensics, interviewing witnesses and suspects, confirmation with customers and vendors. File maintenance and professional standards.

Unit – III

Investigation of asset misappropriation schemes- cash receipt schemes, disbursement schemes, non-cash schemes- investigation of financial statement frauds, revenue overstatement, asset overstatement, liability and expense understatement, reserve manipulation, misrepresentation or omission of information, improper recording of mergers and acquisitions, off- balance sheet items, forensic data analytics and tools available for background checks. Scrutiny of forensic documents. Fraud deterrence. Forensic discovery and analysis of digital evidence.

Unit – IV

Reporting and Litigation- Background information, Investigation procedures, opinion, attachments, draft reports. Preparing for testimony, Deposition testimony, Trial testimony & other issues in moving forward as a company. Preventing future frauds, marketing a fraud investigation practice, Litigation processes and examination of financial records.

Reference Books:

1. Madinger J & Zalopany AR; “Money Laundering”, CRC Press, 1999.
2. Manning CA; “Financial Investigation & Forensic Accounting”, CRC Press, 1999.
3. Stephen Pedneault, et al; “Forensic Accounting and Fraud Investigation for Non-Experts”, John Wiley & Sons, 2012.
4. Tommie W. Singleton, Aaron J. Singleton; “Fraud Auditing and Forensic Accounting”, John Wiley & Sons, 2006.
5. Bee-Lean Chew; “Forensic Accounting and Finance: Principles and Practice”, Kogan Page Publishers, 2017.
6. Mary-Jo Kranacher, Richard Riley & Joseph Wells; “Forensic Accounting & Fraud Examination”, John Wiley & Sons Inc., 2010.
7. Michael Crain, William Hopwood, Carl Pacini & George Young; “Essentials of Forensic Accounting”, AICPA, NY, 2015.
8. Steven L. Skalak, Thomas W. Golden, Mona M. Clayton & Jessica S. Pill; “A Guide to Forensic Accounting Investigation”, 2nd Edition, 2011.

Semester- III, Paper – V (Practical – I)
M.Sc. Forensic Science
MSFS346 – Handwriting and Mechanical Impressions

1. Identification of normal / disguised writings.
2. Detection of various types of forgeries.
3. Examination of anonymous letters
4. Application of Forensic Stylistics in personal identification.
5. Effect of writing instruments, posture and emotions on handwriting.
6. Examination of alterations, additions, obliterations, overwriting and erasures, secret writings.
7. Examination of rubber stamp impressions and other mechanical impressions.
8. Examination of typescripts.
9. Examination of charred documents and torn documents.
10. Examination of sequence of strokes.

Semester- III, Paper – VI (Practical – II)
M.Sc. Forensic Science
MSFS347 – Examination of Electronically Printed Documents & Counterfeits

1. Examination of computer printouts.
2. Examination of photocopies and scanned documents.
3. Examination of fax copies.
4. Examination of Security Documents – Indian Bank Notes.
5. Examination of Travel Documents – Indian Passports and Visas.
6. Examination of Plastic Cards.
7. Examination of Stamp Papers and Lottery Tickets.
8. Determination of Relative Age of documents.

Semester- III, Paper – VII (Practical – III)
M.Sc. Forensic Science
MSFS348 – Analysis of Digital Documents and Bank Instruments

1. Pre-search consideration.
2. Imaging and Hashing of Digital Evidences.
3. Recovery of deleted files and folders from storage media and their analysis.
4. Automated signature verification system.
5. Preparation of synopsis
6. Various formats of writing of expert‟s report and reasons thereof
7. Examination of judicial/non-judicial stamp paper.
8. Examination of Bank instruments.

MSFS-350 – Specialization in Forensic Physics

Semester- III, Paper – I
M.Sc. Forensic Science
MSFS351 – Forensic Voice Authentication

Unit – I

Physics of sound: waves and sound, analysis and synthesis of complex waves, Human and non-human utterances, anatomy of vocal tract, vocal formants, analysis of vocal sound, frequencies and overtones
Electronics of Audio Recording, Transmission and Playback devices, noise and distortion, voice storage and preservation

Unit – II

Forensic Linguistics: Phonetics, Morphology, Syntax, Semantics, Stylistics, Pragmatics, Script, orthography and graphology, Difference between language and speech, Psycholinguistics, Neurolinguistics, Sociolinguistics, Scientific approaches; Reliability and admissibility of evidence in the court, linguistic profile, language register.
Discourse Analysis: Connivance, acceptance, listening feedback and rejection in the context of Mens-Rea, Narrative, Dialectology, Linguistic variety as a geographical marker, Idiolects and speaker characterization, Phonology, Morphology and Word formation processes as individual linguistic abilities.

Unit – III

Various approaches in Forensic Speaker Identification, Instrumental Analysis of speech sample, Interpretation of result, Statistical interpretation of probability scale, Objective/Subjective methods, discriminating tests, closed test, open test, likelihood ratio calculation, Concept of test and error in Speaker Identification, case studies.
Techniques and Best Practices for examination of Audio recording authentication and case studies.

Unit – IV

Automatic speaker identification and verification system based on fuzzy logics, neural network, MPCC etc., Voice Biometrics.

VoIP and other modes of speech communication and their forensic analysis.

Reference Books:

1. Bengold & Nelson Moryson; “Speech and Audio signal processing”, John Wiley & Sons, USA (1999)
2. D.B. Fry; “The Physics of Speech, Cambridge University Press”, (2004)
3. Dwight Bolinger et. al.; “Aspects of Language”, Third Edition, Harcourt Brace Jovanovich College Publishers, USA, (1981)
4. Gloria J. Borden et. al.; “Speech Science Primer (Physiology, Acoustics and perception of Speech)”, 6th Ed, a Wolters Kluwer Company, USA, (2011)
5. Harry Hollien; “Forensic Voice Identification”, Academic Press, London. (2001)
6. Harry Hollien; “The Acoustics of Crime- The New Science of Forensic Phonetics”, Plenum Press, New York and London (1990)
7. Oscar Tosi; “Voice Identification-Theory of Legal Applications”, University Park Press, Baltimore (1979)
8. O'Shaughnessy, Douglas; “Speech Communication”, Hyderabad Universities Press (India) Pvt. Ltd. (2001)
9. Patricia Ashby; “Speech Sounds”, 2nd Ed. Routledge, London and New York (2005)
10. Philip Rose; “Forensic Speaker Identification,” Taylor and Francis, Forensic Science Series, London (2002)
11. Simon J. Godsill; “Digital Audio Restoration”, Springer, (1998)

Semester- III, Paper – II
M.Sc. Forensic Science
MSFS352 – Forensic Video Analysis

Unit – I

Introduction to video technology: electronic photography, scanning, synchronizing the analog signal, Digital signal processing, color video, Digital television standard, HD Video, digital scopes, compression, image acquisition and recording formats, optical media, time code, audio for video, displays, Types of video Camera.

Unit – II

Basics of CCTV, scope recognizing CCTV evidence & its nature, types of DVRs, DVR recording, evidence, best practices of CCTV evidence retrieval and storage at scene of crime and laboratory, challenges and precaution at the scene of crime, evidence handling procedure, legal issues, recommended equipments needed.

Unit – III

Watermarking, Interlacing, De-interlacing, Double Compression, Duplication, Re-projection.

Forensic analysis: Best practices of collection, recovery, enhancement, analysis and interpretation of video evidence.

Unit – IV

Facial image recognition, vehicle registration plate image enhancement, foreign object detection, Authentication of Video evidence, video source identification techniques, Case studies.

Reference Books:

1. Kerman Kruggle; "CCTV Surveillance: Practices and Technology", Elsevier, 2007.
2. Austerberg David; "The Technology of Video & Audio Streaming", Focal Press, 2013.
3. Millerson Gerald; "Video Camera Techniques", Focal Press, 2006.
4. Musburger, B. Robert & Michael R. Ogden; "Single Camera Video Production", Focal Press, 2014.
5. Brown Blain; "Cinematography: Theory and Practice Image making for Cinematographers and Directors", Routledge, 2016.

6. Wheeler, Paul; “Digital Cinematography”, Focal Press, 2001.
7. Stan Z Li & Anil Kumar Jain; “Handbook of Face Recognition”, 2nd Edition, Springer, 2011.
8. Michal Kawulok et al.; “Advances in Face Detection & Facial Image Analysis”, Springer, 2016.
9. Qi Peter Li; “Speaker Identification”, Springer, 2012.
10. Kittler Josef & Mark S. Nixon; “Audio and Video based Biometric Person Authentication”, Springer, 2003.

Semester- III, Paper – III
M.Sc. Forensic Science
MSFS353 – Criminalistics and Forensic Engineering

Unit – I

Soil: Physical examinations of soil evidence, Soil mechanics, Structure & Composition, Baking, Compaction and Agro-soil additives, Instrumental analysis of soil, Interpretation of soil evidence, Standard Operating Procedures for examination, Discussion on important case studies of soil evidence.

Glass: Forensic examination of glass fractures, Physical and Microscopic examination of glass evidence, Standard Operating Procedures for examination, Discussion on important case studies of glass evidence.

Unit – II

Paint: Types of paint and their composition, physical examination of paint, instrumental analysis of pigment, interpretation of paint evidence, Standard Operating Procedures for examination, Discussion on important case studies of paint evidence.

Fibre: Classification and properties of textile, paper and fibres, Physical and Instrumental analysis of fibres evidence and dyes, Examination of damage to textiles, yarn, weaving & fabrics, Collection of fibre evidence, Interpretation of fibre evidence, Discussion on important case studies of fibre evidence.

Unit – III

Cement: Cement and other constituents of Building materials and their properties, Identification of adulterated cement and adulterants, Sampling of evidence materials, Physical and chemical analysis of cement, cement mortar and cement concrete.

Methods of analysis of different constituents of Building materials, Steel bars and metal physics.

Unit – IV

Nano-science & Nano-technology: introduction to nanoparticles, nanotubes, utilization of nanotechnology in analysis of physical evidences, selectivity of nanoparticles with compatibility and feasibility, Application of nanotechnology in forensic evidence analysis.

Arson: Faults and failure of evidence of Arson & Fire due to electrical & mechanical faults/failure, Power Physics: Voltage, current generation and transmission, Current and Power Transformers, 3-phase electricity and Earth faults

Reference Books:

1. "AATCC Technical Manual of American Association of Textile Chemists and Colorists", Vol-75 (2000), American Association of Textile Chemists and Colorists, USA
2. B. Caddy; "Forensic Examination of Glass and Paints Analysis and Interpretation", ISBN 0784 05749, 2000
3. B.P.Saville; "Physical Testing of Textiles", The Textile Institute CRC Press and wood head Pub., 2000
4. Bevel, Tom.; "Bloodstain Pattern Analysis", Boca Raton CRC Press, 2008
5. Bodziak, W., "Footwear Impression Evidence", 2nd Ed. CRC Press, Boca Raton, Florida, 2000
6. David A. Crown; "The Forensic Examination of Paints and Pigments", Toylor & Francis, NY, 2001.
7. E.R.Mengel; "Forensic Physics in 2002 year book", McGraw Hill Encyclopedia of Science & Technology.
8. J.Walls; "Forensic Science-An Introduction to Scientific Crime Detection", 2nd Ed., Universal, 1st Indian Reprint, 2002.
9. James Michael Curran, Tachia Natilie Hicks and John S. Buckleton; "Forensic Interpretation of Glass Evidence", CRC Press, 2000
10. James, Stuart H.; "Principles of Bloodstain Pattern Analysis", Boca Raton Taylor & Francis 2005.
11. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Kooupfer; "Encyclopedia of Forensic Science", Academic Press, 2000.
12. Lee,Henry C et. al.; "Advances in Fingerprint technology", New York CRC Press, 2001
13. Wonder, Anita Y.; "Bloodstain Pattern Evidence", USA Elsevier 2007.
14. "Working Procedure Manual", Physics BPR&D Publication 2000.
15. Harold Franck; "Forensic Engineering Fundamentals", CRC Press, Taylor and Francis Group, 2013.
16. Arora, S. P. & Bindra, S. P., "A Text Book of Building Construction", Dhanpat Rai & Sons, Delhi, 2010
17. Boudreau JE, et al; "Arson & Arson Investigation", Survey & Assessment National Institute of Law Enforcement, U.S. Deptt of Justice, US Govt Printing Press, 1977.
18. C P Poole Jr and Franks J Owens; "Introduction to Nanotechnology", WileyInderscience; 1st Ed, 2003.
19. C. Kittel; "Solid-state physics", Wiley 8th Ed, 2008.

20. Chattopadhya, K. K.; “Introduction to Nanoscience and Nanotechnology”, New Delhi PHI Learning Pvt. Ltd. 2009.
21. Gary L. Lewis; “Guidelines for Forensic Engineering Practice”, ASCE Publications, 2003.
22. Jha, J. & Sinha, S. K., “Building Construction”, Khanna Publishers, Delhi. 1977
23. Kenneth L. Carper; “Forensic Engineering”, Second Edition, CRC Press, 2001.

Semester- III, Paper – IV
M.Sc. Forensic Science
MSFS354 – Collision Investigation and Reconstruction

Unit – I

Road evidence, road engineering and design, Grit, Bitumen, soling and paving of cemented roads, identification and interpretation of road obstructions, defects, marks and damage, tyre marks, skid marks.

Vehicle examination: Automobile common component and failure analysis, damage assessment, tyres – types speed and load rating, inflation and failures, brakes –types and brake systems, door lock and speed recording devices, safety restraint system – theory and examination of seat-belt child-seat and air-bag, vehicular fires.

Unit – II

Speed analysis: vehicle and road kinematics, coefficient of friction and drag factor, methods of determining drag factor, influence on braking distance.

Speed determination: skid marks measurement, speed from vehicle yaw, speed calculation on different road surfaces, falls, flips and vault speeds, special speed problem.

Unit – III

Motorcycle accident investigation: types of motor cycle, dynamics rake and turning, acceleration and breaks, mechanical consideration and slide to stop speed determination.

Hit and run investigation- examination of suspect vehicle, collection of evidence & control samples, inter-comparison of analytical result of physical evidence.

Unit – IV

Reconstruction of accident: overview of reconstruction software and techniques, computer aided design techniques, vehicle specification databases, momentum and energy analysis program, collision simulators, photogrammetry software.

Reference Books:

1. Kenneth S. Obenski et. al.; “Motorcycle Accident Reconstruction and Litigation”, Lawyers & Judges Pub. Company. 2011.
2. Lynn B. Fricke.; “Traffic Crash Reconstruction”, Northwestern University Center for Public Safety, 2010.
3. R. W. Rivers.; “Basic Physics: Notes for Traffic Crash Investigators and Reconstructionists: An Introduction for Some, a Review for Others”, Charles C. Thomas Pub Ltd, 2004.
4. R. W. Rivers; “Evidence in Traffic Crash Investigation and Reconstruction: Identification, Interpretation and Analysis of Evidence, and the Traffic Crash Investigation and Reconstruction”, Charles C. Thomas Pub Ltd. 2006.
5. R.W. Rivers and Frederick G. Hochgraf; “Traffic Accident Investigators‟ Lamp Analysis Manual”, Charles C. Thomas Pub Ltd. 2001.
6. R.W. Rivers; “Technical Traffic Crash Investigators' Handbook: (Level 3): A Technical Reference, Training, Investigation and Reconstruction Manual”, Charles C. Thomas Pub Ltd. 2010
7. R.W. Rivers; “Traffic Crash Investigators‟ Manual: A Levels 1 and 2 Reference, Training and Investigation Manual”, 3rd Ed Charles C. Thomas. 2011
8. Thomas Watters; “Traffic Crash Analysis: Court Preparation Manual”, Dream Catcher Publishing. 1999
9. Tony L. Becker; “Lamp Examination for Traffic Collision Investigators”, Institute of Police Technology and Management. 1995
10. E.R. Mengel; “Forensic Physics in 2002-year book”, McGraw Hill Encyclopedia of Science & Technology. 2002
11. “Laboratory procedure manual, Forensic Physics”, Directorate of Forensic Science, MHA, Govt. of India 2005.
12. “Working Procedure Manual”, Physics BPR&D Publication, 2000

Semester- III, Paper – V (Practical – I)
M.Sc. Forensic Science
MSFS356 – Forensic Audio Analysis

1. Recording of specimen speech samples from a suspect.
2. Speaker wise segregation of speech sample of recorded conversation spoken between two speakers.
3. Transfer of audio file from a digital media to other media using standard software and authentication of recorded speech.
4. Comparison of linguistic and phonetic features of audio recording voice samples of two speakers.
5. Spectrographic analysis of voice samples of two speakers using voice spectrograph and comparison of their spectrographic features.
6. Detection of start and stop signature of audio recorders in the audio recordings.
7. Detection of discontinuity(s) of waveform signal(s) in the audio recording.
8. Detection of discontinuity(s) of voice recordings using voice spectrographic methods.
9. Spectrographic analysis of voice samples under different state(s) of mental condition.
10. Comparison of speech samples of males/females and child using voice spectrographic methods.
11. Comparison of speech sample of male/female/child.

Semester- III, Paper – VI (Practical – II)
M.Sc. Forensic Science
MSFS357 – Image and Video Analysis

1. Ultraviolet, Infra Rad & transmitted light photography.
2. Videography of simulated crime scene and its complete documentation.
3. Side light, close up & trick photography.
4. Retrieval of video evidence from DVR.
5. Ultraviolet fluorescence photography of coloured fabrics.
6. Video analysis and detection of tampered video files using Video analyzing tool.
7. Photography of road signs, road signals, pavements and road markings and its documentations.
8. Extracting Facial Identification Evidence from CCTV image.
9. Source correspondence to still camera from digital image.
10. Enhancement of Vehicle Registration Number plate from CCTV image.
11. Source correspondence to CCTV camera from video file.
12. Source correspondence to video camera from video file.

Semester- III, Paper – VII (Practical – III)
M.Sc. Forensic Science
MSFS358 – Trace Material Analysis & Reconstruction

1. Examination of broken pieces of glass bangles to determine the source correspondence.
2. Studies of hackle and rib marks in radial and concentric fractures in a glass sheet caused by pointed tool at different angle.
3. Determination of refractive index of glass by liquid immersion method.
4. Determination of number of layers, sequence of layers and their thickness in paint chip.
5. Physical matching of Cloth piece and/or rope piece and /or garments.
6. Determination of particle size distribution in soil samples using sieve test.
7. Comparison of control soil samples with soil sample taken from victim/suspect by density gradient distribution method.
8. Physical and microscopic studies of affected electric wires, panel boards due to electrical overload and short-circuit.
9. Preparation of measurements and other requisite data for reconstruction of road accident
10. Studies of cut-marks striations on metallic wire cut-ends using cutting pliers and its linkages with cutting plier tools
11. Studies of different characteristics hammer impressions of iron metal sheet and their linkage with the hammers used
12. Simulated SoC examination and collecting & packaging of evidence material in Road Accident. Paint coats/layers and pigment multi-elemental analysis.

MSFS-360 – Specialization in Computer Forensic and Cyber Crime

Semester- III, Paper – I
M.Sc. Forensic Science
MSFS361 – Advanced Digital Forensics

Unit – I – Digital Evidence Analysis

Rules and Services of Digital Forensics, Daubert Standards, Locard‟s Principle of Exchange in Digital Forensic. ISO/IEC 27037: 2012.

Forensics Investigation Process- Pre-search consideration, Collection of Evidences from crime scene, Acquisition, Duplication & Preservation of evidences, Examination and Analysis of evidences, Storing of Evidences, Documentation and Reporting, Maintaining the Chain of Custody. Hashing and its importance. Understanding Storage Formats for Digital Evidences – Raw Format, Proprietary Formats, Advanced Forensic Formats. Data Acquisition of live system, Shutdown Systems and Remote systems. Digital Forensics Standard Operating Procedures. Software and Hardware Tools used in Forensic Analysis – Open Source and Proprietary tools. Challenges and issues in Cyber-crime investigation and Digital forensics.

Unit – II – Windows Forensic

Windows Systems Artifacts: File Systems, Registry, Event logs, Shortcut files, Executables. Alternate Data Streams (ADS), Hidden files, Slack Space, Disk Encryption, Windows registry, startup tasks. Forensic Analysis of the Registry – Use of registry viewers, Regedit. Extracting USB related artifacts and examination of protected storages. Email investigations. Data recovery – Tools and techniques. Malware Analysis.

Unit – III – Linux and Mac Forensics

Linux system and Artifacts – Use of built-in command line tools for forensic investigation – dd, dcfldd, fdisk, mkfs, mount, unmount, md5sum, sha1sum, dmseg; Ownership and Permissions, Hidden files, User Accounts and Logs.

Mounting of hard disk having forensic image, Use of „FIND‟ command for searching and timeline analysis of files.

Mac OS system and Artifacts - System startup and services, Hidden directories, System Logs and user Artifacts.

Unit – IV – Cloud and IoT Forensics

Introduction to Cloud Technology and its various components, Cloud Security Architecture, Secure Cloud based service, Identity and Access Management, Encryption and Key Management. Cloud Forensic Challenges.

Technical Dimension- Data Collection, Live Forensics, Evidence Segregation, virtualized environments and proactive measures. Organizational Dimension- Internal staffing, External Dependency Chains, Service Level Agreement, Multiple Jurisdictions and Tenancy. Investigative tools in the virtualized environment. Analysis- correlation, reconstruction, time synchronization, logs, metadata, timelines.

Reference Books:

1. Bill Nelson, Amelia Phillips and Christopher Steuart; "Guide to Computer Forensics and Investigations" – 3rd Edition, Cengage, 2010 BBS.
2. Nina Godbole and Sunit Belapore; "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publications, 2011.
3. Shon Harris; "All in One CISSP Guide, Exam Guide Sixth Edition", McGraw Hill, 2013.
4. Peter Hipson; "Mastering Windows XP Registry", Sybex, 2002.
5. Harlan Carvey; "Windows Forensic Analysis Toolkit", Syngress, 2012.
6. Anthony Reyes, Jack Wiles; "The Best Damn Cybercrime and Digital Forensic Book", Syngress, USA, 2007.
7. Arshdeep Bagha and Vijay Madisetti; "Cloud Computing: A Hands-on Approach", 2014.
8. Cory Altheide and Halan Carvey; "Digital Forensics with Open Source Tools", Syngress Publication.
9. Kevin Mandia, Chris Prosise and Matt Pepe; "Incident Response and Computer Forensics", McGraw Hill Publications.
10. Eoghan Casey; "Digital Evidence and Computer Crime", 2004.
11. Eoghan Casey; "Handbook of Digital forensics and Investigation", Elsevier Academic Press, 2009.
12. John Sammons; "The basics of Digital Forensics: The Primer for getting started in Digital Forensics", Elsevier, Syngress, 2014.

Semester- III, Paper – II
M.Sc. Forensic Science
MSFS362 – Network Security and Forensics

Unit – I – Overview of Networking

Introduction to Network and Communication technologies – Overview of OSI Model and TCP/IP Protocol. IP Addressing and NAT. Types of IP addresses. IP Addressing Classes, Subnet Masks, Subnetting and Supernetting. Network Topologies. Network Devices – hubs, switches, bridges, repeaters, routers etc. Types of Networks – LAN, MAN and WAN. Routers and Routing Protocols.

Unit – II – Threats, Vulnerabilities and Attacks

Network threats and vulnerabilities, Types of network attacks- eavesdropping, spoofing, modification, Cross-site scripting, DNS Spoofing, Routing Table Poisoning, ARP Poisoning, Web Jacking. Phases of Hacking and Detection – Reconnaissance Phase, Passive Attacks, Active Attacks, Detection Avoidance Phase, Evading anti viruses and firewalls, Tools used; Attacks on Wireless Networks. Social Engineering Attacks and its types.

Unit – III – Network Security

IP security architecture, Security protocols, IPSec, Web Security – Firewalls, IDS, IDPS – Types and Technologies. Trusted systems – Electronic payment protocols. Network Security Applications, Authentication Mechanisms: Passwords, Cryptographic authentication protocol, Kerberos, X.509 LDAP Directory. Digital Signatures. Web Security: SSL Encryption, TLS, SET. Intrusion detection. Securing online payments (OTP). Virtual private networks.

Unit – IV – Network Forensics

Monitoring of computer network and activities, Live Packet Capturing and Analysis. Searching and collection of evidences from the network. Network Intrusion Detection and Analysis. SQL Injection, Event Log Aggregation – role of logs in forensic analysis, tools and techniques. Investigating network attacks. Evidence collection from Routers & CCTV DVRs.

Reference Books:

1. William Stallings; "Network Security Essentials", 3rd Edition, Pearson Education, 2006.
2. Atul Kahate; “Cryptography and Network Security” McGraw Hill Education (India), 2008
3. Beherouz. A Forouzan; “Data Communication and Networking”, 4th Edition, TMH, 2000.
4. Bill Nelson, Amelia Phillips and Christopher Steuart; “Guide to Computer Forensics and Investigations” – 3rd Edition, Cengage, 2010 BBS.
5. Shon Harris; “All in One CISSP, Exam Guide Sixth Edition”, McGraw Hill, 2013.
6. Sherri Davidoff and Jonathan Ham; “Network Forensics – Tracking Hackers through Cyberspace”, Pearson Publications, 2012.
7. Samir Datt; “Learning Network Forensics – Identify and Safeguard your Networks against both Internal and External Threats, hackers and malware attacks”, PACKT Publishing, 2016
8. George Mohey, Alison Anderson, Byron Collie, Olivier De Del, Rod McKemmish; Computer and Intrusion Forensics, Artech House, London, 2003.
9. John R. Vacca; “Network and Systems Security”, Syngress Publications.
10. Kevin Mandia, Chris Prosise and Matt Pepe; “Incident Response and Computer Forensics”, McGraw Hill Publications.

Semester- III, Paper – III
M.Sc. Forensic Science
MSFS363 – Mobile and Wireless Device Forensics

Unit – I – Introduction to Mobile and Wireless Technologies

Asynchronous Transfer Mode (ATM), Wireless Application Protocol (WAP). Cellular technologies including Advanced Mobile Phone System (AMPS), Imode, Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA) and Global System for Mobile Communications (GSM) including features and relative strengths. Functions of Subscriber Identity Module (SIM), International Mobile Equipment Identity (IMEI), Bluetooth and Mobile Payment Gateways. Understanding of the mobile phone operating systems – Android, iOS, Windows.

Unit – II – Mobile and Wireless Devices Security

Security issues in Bluetooth, Mobile phones including SIM cloning and other Bluetooth vulnerabilities. Attacks - Denial of Service (DOS), Packet Spoofing & Masquerading, Eavesdropping, VOIP Spam and Vishing (VOIP Phishing), Toll frauds, Phone Phreaking, Call tampering, Wireless Hack Walkthrough and Manin-the-Middle-attacks. Overview of WEP attack. Attacks on WEP, WPA and WPA-2 Encryption, fake hotspots.

Wireless Public Key Infrastructure. Securing WLAN, WEP Decryption script, Understanding of SQLite Databases. Voice, SMS and Identification Data Interception in GSM. SMS security issues – Availability, Confidentiality and Integrity issues.

Unit – III – Overview of Mobile Forensics

Mobile Forensic, Types of Evidence present in mobile phones - Files present in SIM card, external memory dump, and evidences in memory card. Seizure and Preservation of mobile phones and PDA. Mobile phone evidence extraction process, Data Acquisition Methods – Physical, File System, Logical and Manual Acquisition. Good Forensic Practices, Mobile Forensic Investigation Toolkit. Tracking of mobile phone location. Challenges to Mobile forensics.

Unit – IV – Android and iOS Device Forensics

Android Forensics – Procedures for handling android device, imaging android USB mass storage devices, Logical and physical data extraction techniques. Data recovery techniques. Forensic tools used. CDR and IPDR analysis.

iOS Forensics – File Systems, iOS architecture, Data stored in iPhones, Crosscontamination and Syncing, Data extraction - Extracting Image Geo-Tags, Data Analysis and Recovery - SQLite databases, Forensic Tools used.

Reference Books:

1. Andrew Hoog; "Android Forensics Investigation, Analysis and Mobile Security for Google Android", Syngress, USA, 2011.
2. George Mohey, Alison Anderson, Byron Collie, Olivier De Del, Rod McKemmish; "Computer and Intrusion Forensics", Artech House, London, 2003.
3. Hakima Chaouchi, Maryline Laurent-Maknavicius; "Wireless and Mobile Network Security", Wiley, 2007.
4. Seymour Bosworth, Michel E. Kabay; "Computer security handbook", John Wiley & Sons, Inc. 2008
5. Satish Bommisetty, Rohit Tamma and Heather Mahalik, "Practical Mobile Forensics – Dive into mobile Forensics on iOS, Android, Windows and Blackberry Devices with action-packed, practical guide", PACKT Publishing, 2015.
6. Tara M. Swaminathan and Charles R. Eldon, "Wireless Security and Privacy-Best Practices and Design Techniques", Addison Wesley, 2002
7. Jonathan Zdziarski, "iOS Forensic Investigative Methods", 2012.
8. Iosif I. Androulidakis, "Mobile Phone Security and Forensics – A Practical Approach", Springer New York Heidelberg, 2012.

Semester- III, Paper – IV
M.Sc. Forensic Science
MSFS364 – Cyber Laws and Intellectual Property Rights

Unit – I

The World Wide Web, Web Centric Business, e-Business Architecture, Models of e-Business, e-Commerce, Threats to virtual world. Cyber Crimes- Cyber Squatting, Cyber Espionage, Cyber Warfare, Cyber Terrorism, Cyber Defamation. Social Media-Online Safety for women and children, Misuse of individual information. IT Act 2000 - Objectives, Applicability, Non-applicability, Definitions, Amendments and Limitations.

Unit – II

Digital Signature and its legal recognition, e-signature, Electronic Records and their legal recognition, Electronic Evidence. Electronic Governance. Controller, Certifying Authorities, Cyber Regulation Appellate Tribunal (Rules announced under the Act). Data Security, E Contracts and E Forms.

Unit – III

Information Technology (Amendment) Act 2008 – Objective, Applicability and Jurisdiction; Various cyber-crimes under Sections 43 (a) to (j), 43A, 65, 66, 66A to 66F, 67, 67A, 67B, 70, 70A, 70B, 80 etc. along with respective penalties, punishment and fines. Penal Provisions for Phishing, Spam, Virus, Worms, Malware, Hacking, Trespass and Stalking; Human rights in cyberspace, International Co-operation in investigating cybercrimes. Relevant Sections of Indian Evidence Act and Banker‟s Book Evidence Act.

Unit – IV

Introduction to Intellectual Property Rights, Conventions and Treaties relating to Global Administration of IPR, Jurisdiction Enforcement and Administration of IPRs, Law of Intellectual Property and Ethical Issues, IPR in India and Abroad, Introduction to Copyrights as forms of Intellectual Property, Intellectual Property Issues in Cyber Space – Interface with Copyright Law, Trademarks & Domain Names Related Issues, Metatags, Linking, Framing, Adwords and Trademark Infringement.

Reference Books:

1. Karnika Seth; “Computers, Internet and New Technology Laws”, Lexis Nexis Buttersworth Wadhwa, 2012.
2. Vikas Vashishth.; “Law and practice of intellectual property in India”
3. Jonathan Rosenoer; “Cyber Law: The Law of Internet”, Springer- Verlag, New York, 1997.
4. Sreenivasulu N.S; “Law Relating to Intellectual Property”, Patridge Publishing, 2013
5. Harish Chander; “Cyber Laws and IT Protection”, PHI Learning Pvt. Ltd, 2012.
6. Nina Godbole and Sunit Belapore; “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publications, 2011.
7. Vakul Sharma; “Information Technology: Law and Practice”, Universal Law Publishing Co., India, 2011.
8. The Copyright Act, 1957
9. The Patent Act, 1970

Semester – III, Paper – V (Practical – I)
M.Sc. Forensic Science
MSFS366 – Advance Digital Forensics

1. Acquisition and Preservation of Volatile data from Standalone Computer.
2. Imaging of data storage media devices.
3. Recovery of deleted files and folders.
4. Hiding and Un-hiding of information using Steganography.
5. Windows Registry and Log Data Analysis
6. Investigation and analysis of slack space and ADS.
7. Password recovery of encrypted files and folders.
8. Tracking the source of emails.
9. Collection of evidences from mobile devices.
10. Collection and analysis of evidences from Social Media.
11. Analysis of Malwares.
12. Cloud Evidence Collection using browser app analysis.

Semester- III, Paper – VI (Practical – II)
M.Sc. Forensic Science
MSFS367 – Network Security and Forensics

1. Port Scanning using Nmap.
2. Vulnerability Assessment using Vulnerability Scanner.
3. Traffic Analysis of Network by live packet capturing using Wireshark.
4. Working with Sniffers for monitoring network communications (Ethereal).
5. Performing Vulnerability Assessment of a Website/Web Application.
6. Social Engineering attacks using Kali Linux.
7. Man-in-the-middle attack using Ettercap and Driftnet.
8. Configuration of firewalls.
9. Analysis of Browsing History and Cache files of Web browsers.
10. Collection of evidence from CCTV DVR.
11. Investigation of DDoS attack.
12. Configuration of server security.

Semester- III, Paper – VII (Practical – III)
M.Sc. Forensic Science
MSFS368 – Mobile and Wireless Device Forensics

1. Analysis of evidences in mobile SIM cards, memory cards etc.
2. Call Details Record (CDR) analysis.
3. Internet Protocol Details Record (IPDR) analysis.
4. Tracking the present and past locations of a mobile phone.
5. Analysis of SQLite Databases.
6. Data Acquisition from Android Phones.
7. Analysis of extracted data in Android Phones.
8. Data Acquisition from iOS devices.
9. Analysis of extracted data in iOS devices.
10. Password Cracking of Mobile Phones.
11. Analysis of mobile apps.
12. Cracking password of Wi-Fi routers

Details of Elective Papers

Semester- III, Elective Paper – I
M.Sc. Forensic Science
MSFS315 – Reconstruction of Crime Scene Involving Firearms

Unit – I

Reconstruction of Crime Scene Involving Firearms – Pre, during and post incident investigation, Scientific Method of Investigation.

Importance of firearm and ammunition involved in crime, various types of firearms and ammunition.

Country-made/Improvised firearms, Imitation firearms.

Unit – II

Importance of internal and external ballistics for reconstruction. Theories of internal ballistics, velocity-space curve, pressure-space curve, maximum pressure, muzzle velocity.

Trajectory calculations, Air-resistance, Ballistic Tables, Linkage of fired ammunition with suspected firearms, estimation of range of firing.

Unit – III

Terminal Ballistic and Wound Ballistics. Impact of bullet on various targets like wall, glass, furniture, etc. Traces carried by bullets, ricochet phenomena, passage of bullets in glass.

Gun-shot injuries caused by different firearms, identification of injuries, wounds of entrance, exit and bullet track, direction of firing, number of rounds fired, etc. Relative positions of accused and victims.

Unit – IV

Case studies pertaining to Forensic Ballistics

Reference Books:

1. Heard, B.J; “Handbook of Firearms and Ballistics”, John Wiley, England, 1997.
2. Warlow, T.A.; “Firearms, The Law and Forensic Ballistics”, Taylor and Francis, London, 1996.
3. Jauhari M; “Identification of Firearms, Ammunition, & Firearms Injuries”, BPR&D, New Delhi.
4. Schooeble, A.J. and Exline, L.D; “Current methods in Forensic Gunshot Residue Analysis”, CRC Press, NY, 2000.
5. Ordog, G.J; “Management of Gunshot wounds”, Elsevier Pub. Co., NY, 1983.
6. Wilber; “Ballistic Science for the Law Enforcement Officer”, Charles C. Thomas, USA, 1977.
7. Sharma, B.R.; “Firearms in Criminal Investigation & Trials”, Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edition, 2011.
8. Hatcher, Jury and Weller; “Firearms Investigation, Identification and Evidence”, Stackpole Books, Harrisburg, Pa, 1997.

Semester- III, Elective Paper – II
M.Sc. Forensic Science
MSFS325 – Allied Problems in Forensic Document Examination

Unit – I

Non-destructive, and destructive methods of examination of forensic documents, document consciousness. Examination of charred and torn documents, Paper and inks-Types of writing papers, paper fibers, ingredients of paper, tagging materials. Writing inks-carbon inks, fountain pen inks, ball point pen inks, fiber tip pen ink and gel pen inks and their composition, and their analysis Types of writing instruments and their features.

Unit – II

Various writing features- terminology and definitions. principles of handwriting identifications. General and individual writing features and their definitions, Importance of natural variations and disguise in writings, Effect of various external factors on hand writings- e.g. writing instruments, emotions, illness, posture and intoxication on handwriting. Types of forgeries-Inherent signs of genuineness and forgery. Genuine and forged writings /signatures. Digitally manipulated computer printouts, Simon New Comb theory of probability, Examination of anonymous letters and identification of its sender, forensic stylistics and its application in personal identification.

Unit – III

Types of mechanical impressions- rubber stamp impressions, seal impressions, embossed impressions, indentations, obliterations, additions, overwriting, mechanical and chemical erasures and secret writings, steganography, case studies, Principles and working of standard type writers, classification of standard type writers, Check writers and their identification, features of main machine and fonts. Working and examination of electric, electronic and daisywheel printer, high speed mainframe line printer (drum and chain print heads), Cheque writers, identification of typist of typescripts.

Unit – IV

Working principles and examination of Computer printouts, dot matrix, ink jet and laser jet printouts. Principle and Working of different conventional printing processes-Letterpress, Offset Printing process, Screen Printing Process, Intaglio Printing processes, Flexography Printing, Digital printing Process and their identifying features. Examination of black and white and colour photocopies and

their identifying features, process of collection of sample photocopies for the purpose of comparison, examination of fax message and scanned documents.
Reference Books:

1. Ordway Hilton; “Scientific Examination of Questioned Documents”, Revised Edition, Elsevier, NY, 1982.
2. Charles C. Thomas; “I.S.Q.D. Identification System for Questioned Documents”, Billy Prior Bates Springfield, Illinois, USA, 1971.
3. Wilson R. Harrison; “Suspect Documents Their Scientific Examination”, Universal Law Pub. Delhi Indian Reprint, 2001.
4. Ellen Davin; “Questioned Documents – Scientific Examination”, Taylor & Francis, Washington, 1997.
5. Jan Seaman Kelly & Brian S Lindblom; “Scientific Examination of Questioned Documents”, Taylor Francis Group London and New York.
6. Levinson Jay; “Questioned Documents”, Academic Press, London, 2001.
7. Mehta MK; “The Identification of Handwriting & Cross Examination of Expert”, 1970.
8. Brewster F.; “Contested Documents and Forgeries”, The Eastern Law House, Kolkata.
9. Quirke AJ; “Forged Anonymous & Suspect Documents”, Reorge Rontledge & Sons Ltd, London, 1930.

Semester- III, Elective Paper – III
M.Sc. Forensic Science
MSFS335 – Post Blast Investigation Techniques

Unit – I – Introduction to Effects of Explosions

What is an Explosion, Basic types of Explosions, Explosives and their effects, Detonation Velocity, Deflagration, High-order Detonation, Low-order Detonation, Low Explosives, Nuclear Explosion, Basic Explosive terms, High Explosives, Low Explosive substances, Smokeless powder, Improvised low explosive substances , Flexible Sheet Explosives, HMX, PETN, RDX, Secondary High Explosive Substances, Detonating Cord, Boosters, Blasting Accessories, Initiation of Explosives, Working of Explosives, Explosive Train, Blast Effects.

Unit – II – Improvised Explosive Devices

Introduction to IEDs, Categories of IEDs and their delivery, Bomb Threats, Bomb threat checklist, Initial response to Bomb scene, Explosive Detectors, Seat of Explosion team, Photographer, Physical Evidence and Discovery Search team, Finger-print expert, Evidence Custodian, Immediate area investigative team, Communications Liaisons, Media Relations and Final survey.

Unit – III – Bomb Scene Investigation

Crime Scene Documentation, Search of crime Scene, Collection and preservation of residues and Blast Materials from crime scene and their safety handing. Role of Bomb Squad, Use of field kit for detection of explosives or explosion residues, Evaluation, Assessment and Reconstruction of sequence of events and preparation of reports, Presentation of Evidence in the Court of Law, Queries of Investigating Officers.

Unit – IV – Suspect Identification

Bombing Signature, Sequence of events, Damage caused, IEDs used in the blast, Location of the IEDs, Initiating Device, Footprint, Fingerprint, Sources of Information, Preliminary Reports, Police Reports, Technician‟s Reports, Forensic Laboratory Reports, Photographs, Diagrams, Sketches, Formal Statements, Press Release, Newspaper Articles, Intelligence Reports, Victim of the blast as suspect.

Reference Books:

1. Akhavan Jacqueline; “Chemistry of Explosive”, The Royal Society of Chemistry, 2004.
2. Saferstein R; “Criminalistics: An Introduction to forensic Science”.
3. Asthana N.C and Nirmal Anjali; “The Ultimate Book of Explosives, Bombs and IEDs”, Pointer Publishers, 2008.
4. Suceska, T; “Test Methods for Explosives”, Springer, 1995.
5. “Working Procedure Manual on Explosives”, Directorate of Forensic Science MHA Govt. of India, 2005.
6. Cooper PW and Kurowski S R; “Introduction to the Technology of Explosive”, VCH publisher.
7. Urbanski T; “Chemistry and Technology of Explosives”, Pergamon Press, 1985.
8. Lurie Iras & Witwer JD; “High Performance Liquid Chromatography in Forensic Chemistry”, Marcel Dekker, 1983.
9. Feigl F; “Spot Test in Inorganic Analysis”, Elsevier Publ. New Delhi, 2005.
10. Yallop HJ; “Explosion Investigation”, Forensic Science Society Academy press, 1980.

Semester- III, Elective Paper – IV
M.Sc. Forensic Science
MSFS345 – Forensic Evidence in Crime against Human Body

Unit – I – Scientific Investigation in Murder, Assault, Accident and Death due to fall from height

Observation at the scene of crime and human body for the evidence materials likely to be found, their collection, preservation and packaging. Queries to be raised to the medico-legal expert and forensic expert. Discussion on Illustrative cases

Unit – II – Scientific Investigation in Sexual Offence cases

Handling of Child or differently abled victim (if alive), Observation at the scene of crime for the evidence materials likely to be found, their collection, preservation and packaging. Queries to be raised to the medico-legal expert and forensic expert. Discussion on Illustrative cases.

Unit – III – Scientific Investigation in Burning and Vitriolage cases

Observation at the place of occurrence and body of victim for the evidence material likely to be found, their collection, preservation and packaging. Queries to be raised to the medico-legal expert and forensic expert. Distinguishing homicidal, suicidal and accidental burning. Differences between ante-mortem and post-mortem burns. Discussion on Illustrative cases.

Unit – IV – Scientific Investigation in Drowning, Hanging and Strangulation cases

Types of Drowning, Types of hanging, Observation at the place of occurrence and body of victim for the evidence material likely to be found, their collection, preservation and packaging. Queries to be raised to the medico-legal expert and forensic expert. Differences between hanging and strangulation, Differences between ante-mortem and post-mortem hanging. Discussion on Illustrative cases

Reference Books:

1. B. A. J. Fisher, D. R. Fisher; “Techniques of Crime Scene Investigation, 8th Edition”, CRC Press London, 2012.
2. ISO/IEC 17025:2005, NABL 113,113A, 131, guidelines of NABL.
3. John J. Nordby “Deed Reckoning: The Art of Forensic Science Detection”, CRC Press LLC, Boca Raton FL, 1999.
4. Richard Saferstein; “Forensic Science Handbook”, Vol. I, II, III.
5. Raul Sutton, Keith Trueman and Chris Moran; “Crime scene management: Scene Specific Methods”, John Wiley & Sons, 2016.
6. S. H. James, J. J. Nordby; “Forensic science: An introduction of Scientific and Investigative Technique”, CRC press 2003 and 2005.
7. Robert C. Shaler; “Crime Scene Forensics: A Scientific Method Approach”, CRC Press London, 2012.
8. Ian Pepper; “Crime Scene Investigation: Methods and Procedures” 2nd Edition, McGraw Hill, Open Press University, 2010.
9. S. Shalya; “Human physiology systematic & applied”, CBS publications, 1994.
10. McClintic, J Robert; “Basic Anatomy and Physiology of the Human Body”, Wiley & Sons, 1980.

Semester- III, Elective Paper – V
M.Sc. Forensic Science
MSFS355 – Photography and Forensic Image Analysis

Unit – I

Principle in conventional and digital photography, Advantages and disadvantages of analog and digital photography.

Construction of digital image sensor, pixel, resolution and sharpness, ISO settings, etc., auto focusing, auto winding, burst modes in DSLR and DX coding systems, Photo editing and enhancement software, Digital image file formats.

Unit – II

Image processing, identification of digital/manipulated photograph, photogrammetry, radiography, photography using scientific equipment, demonstrative photography. Modern developments in photography, scanning and printing technologies.

Techniques Attributing an Image to Its Source: Image and Video Source Class, Sensor Defects in Digital Image Forensic, Source Attribution Based on Physical Defects in Light Path.

Unit – III

Photomicrography, microphotography, U. V., I. R., fluorescence, transmitted & oblique light photography, close-up photography, trick photography, Photography of bloodstain, fingerprint, imprints, and micro evidence, linkage of cameras and film negatives, Reconstruction photography, Stereo-photography, Forensic Remote Sensing.

Photography for presentation of evidence in the court of law.

Unit – IV

Techniques Verifying the Integrity and Authenticity of Image Evidence: Natural Image Statistics in Digital Image Forensics, Detecting Doctored Images, Discrimination of Computer Synthesized or Recaptured Images from Real Digital Image Forensics in Practice Courtroom: Considerations in Digital Image, Counter-Forensics-Attacking Image Forensics.

Reference Books:

1. Ang Tom; “The Complete Photographer”, Dorling Kindersley Ltd., 2010.
2. Gernsheim Helmut; “A concise history of Photography”, 3rd Ed., Dover Publications, 1986.
3. Freeman Michael; “The Complete Guide to Digital Photography”, 4th Ed., Lark Books, 1945.
4. Farrell Ian; “Complete Guide to Digital Photography”, Quercus Publications, 2017.
5. Edge Martin; “The Underwater Photographer”, Focal Press, 2010.
6. Bergner Joachim, E. Gelbke, W. Mehliss; “Practical Photomicrography”, Focal Press, 1966.
7. White Laurie; “Advance Infrared Photography”, Amherst Media, 1995.
8. Feininger Andreas; “The Complete Photographer”, Prentice Hall, 1965.

Semester – III, Elective Paper – VI
M.Sc. Forensic Science
MSFS365 – Cyber Crime and IT ACT

Unit – I – Symmetric and Asymmetric Cryptosystem

Introduction to Advanced Cryptography, Classical Encryption Techniques – Substitution Techniques, Transposition Techniques, Advanced Encryption Techniques and Security Issues.

Introduction to Symmetric and Asymmetric Cryptosystems. Introduction to Cryptanalysis - Differential Cryptanalysis, Linear Cryptanalysis.

Various types of attacks including Cipher Text-Only attack, Known-Plaintext Attack, Chosen-Plaintext Attack, Chosen-Cipher Text Attack.

Unit – II – Internet Security and Cryptanalysis

Internet Security - HTTP, HTTP Secure (https), Secure HTTP (s-http), Differences between https & s-http, Secure Electronic Transaction (SET), Internet Security Protocol (IPsec). Email Security – Multipurpose Internet Mail Extension (MIME), Secure MIME, Privacy Enhanced Mail (PEM), Message Security Protocol and Pretty Good Protocol (PGP).

Hashing Algorithms – MD5, SHA-1, SHA-2, SHA-3, One-Way Hash, Hash Message Authentication Code, Digital Signatures, Certificates. Introduction to Key Management – Key Distribution and Key Generation.

Unit – III – Introduction to Information Security Audit

Importance of ISO 27001 & other auditing standards for IT, IS Auditing Standards, IS Auditing Guidelines, Classification of Audits, Audit Programs and Audit methodology, Communication of Audit Results, Audit report Structure and Contents, Requirements for Audit Documentation, Cyber Security Auditors empanelment by CERT-In.

Unit – IV – Risk Management

Introduction. Method and Principles. Classes or Types of Risk. Process, Mitigation - Potential risk treatments - Risk management plan. Implementation, Limitation. Types of risk management in IT - natural and manmade disasters in various industries. Business Continuity and Planning.

Reference Books:

1. William Stallings; “Cryptography and Network Security: Principles and Practices”, Fifth Edition, Prentice Hall Publication Inc., 2007.
2. Michael E Whiteman and Herbert J Mattord; “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003.
3. Atul Kahate “Cryptography and Network Security” McGraw Hill Education (India), 2008.
4. Alfred J. Menezes, Paul. C. Van Oorschot, and Scott A. Vanstone “Handbook of Applied Cryptography”, CRC press, Lib of Congress -2006.
5. Mark Stamp and Richard M Low “Applied Cryptanalysis – Breaking Ciphers in the Real-World Stamp”, 2007.
6. Christopher Swenson “Modern Cryptanalysis: Techniques for Advanced Code Breaking”, Wiley, 2008.
7. Shon Harris, “All in One CISSP, Exam Guide Sixth Edition”, McGraw Hill, 2013.
8. Amjad Umar; “Information Security and Auditing in the Digital Age: A Practical and Managerial Perspective”, NGE Solutions Inc., 2004.
9. Chris Jackson; “Network Security Auditing”, CISCO Systems Inc., 2010.
10. Roobert Moeller; “IT Audit, Control and Security”, John Wiley & Sons, 2010.
11. Sandra Senft, Frederick Gallegos & Aleksendra Davis; “Information Technology Control & Audit”, 4th Edition, CRC Press, Taylor & Francis, 2013.
12. A. Refsdal, B. Solhaug, K. Stølen; “Cyber-Risk Management”, Springer, 2015.

Semester- III, Elective Paper – VII
M.Sc. Forensic Science
MSFS375 – Criminal Justice System

Unit – I – Criminology

Concept, Nature and Scope of criminology, Historical development of Criminology, Criminology and other social sciences, Criminology and criminal justice system.

Unit – II – Crime

Definition of crime (social, legal and psychological), Sin, Tort and Deviance, Crime in ancient and medieval India, Crime in modern India, General and casual factors of crime.

Unit – III – Criminal Typologies and Crime Trends

Criminal Typologies, Crime correlates- Age, Gender and Media.

Sources of Crime Statistics: An overview (Uniform Crime Report (USA), National Incident Based Reporting System (USA), National Crime Victimization Survey, Youth in India (National Youth Survey), National Crime Record Bureau (MHA), National Family Health Survey, Risk Survey, Parliamentary Questions and Right to Information, Dark Figures of Crime Statistics)

Unit – IV – Introduction Criminal Justice System

CJS: Concept, Development and Purpose, Accusatorial and Inquisitorial Models of Criminal, Justice System; Reforms in CJS, Co-ordination in CJS.

Unit – V – Prosecution System

Meaning, Purpose and Relevance, Development & Relevance of Prosecution in India, Prosecution Organization in the States, Relationship between Police and Prosecution, Prosecution in Lower Court and Prosecution in Appellate.

Reference Books:

1. Shweta; “Crime, Justice and Society”, MD Publications, 2009.
2. Schmalleges Frank; “Criminal Justice today”, Prentice Hall, New Jersey, 1999.
3. Albanese Jay S.; “Criminal Justice”, Allyn and Bacon, 2000.
4. Phelps Thomas R, Swanson Charler R. Kenneth Jr and Evans R; “Introduction to Criminal Justice”, Goodyear Publishing Company. Inc., 1979.
5. Commonwealth Secretariat; “Crime and Social Justice”, London, 2002.
6. Mehrajud-din Mir; “Crime and Criminal Justice System in India”, Deep and Deep Publications, New Delhi, 1984.
7. Justice Malimath; “Committee on Criminal Justice Reforms”, Universal Law Publication, 2003.
8. Misra, K.K.; “Police Administration in Ancient India”, K.K. Publications, 1887.
9. Sharma, P.D.; “Police and Criminal Justice Administration in India”, Uppal Publishing House in Delhi, 1985.
10. Gupta, Anand Swarup; “Crime and Police in India”, Sahitya Bhavan, Agra, 2007.
11. Banerjee, D; “Central Police Organizations: Part I and Part II”, Allied Publishers Pvt. Ltd, 2005.
12. Ebbe, Obi N. Ignatius; “Comparative and International Criminal Justice System: Policing, judiciary and Corrections”, Butterworth, Boston, 2000.
13. “Journal of Contemporary Criminal Justice” – By Sage Publications.
14. “Indian Police Journal” Published by the Bureau of Police Research and Development, Delhi.

Semester- III, Elective Paper – VIII
M.Sc. Forensic Science
MSFS385 – Policing and Law Enforcement

Unit – I – Fundamentals of Police Administration

History of Police and Policing in Modern India (1857 onwards), Role of Police in Independent India, Constitutional provisions regarding police in India.

Unit – II – Organization and Structure of Indian Police

Types of Police Organization, State Police: Civil Police, Armed police and other branches, District Police, Police in Police Station, Crime record statistics (State level and National level, Central Police Organizations, Modernization of Police, International Co-operation in Police, International Criminal Police Organization, Investigation under letter rogatory.

Unit – III – Police Investigation: Procedures and Function

Executive powers and duties of police officers in the investigation of crime, Procedure in investigation, Investigation of crimes and relations with Courts/Magistrate, Specialties of Investigation – Homicides, Property Offences, Crimes against women, Economic Offences, Communal violence, Custodial violence, Cybercrime. Use of technology in crime, investigation. Citizen‟s rights during investigation.

Unit – IV – Image of Police

Police Sub-culture, Dimensions of Police accountability in India – Courts, Executive Magistrates, State Government, UNCAC, Citizens/Community. Police public Relations in India and Abroad – Peace Committee, Village Police system, Koban (Japan), Police Board (UK), Sheriff (USA). Need for improving police image, Programmes for redressal of public grievances, Judicial Trend: The Supreme Court on Policing.

Unit – V – Case Connection

How to investigate and write case report.

Reference Books:

1. Misra K.K.; “Police Administration in Ancient India”, K.K. Publications, 1989.
2. Srivastava Aparna; “Role of Police in Changing Society”, APH Publishing House, 1999.
3. Guharoy J T; “Policing in the 21st Century”, Indian Institute of Public Administration, 1999.
4. Gupta, Anandswarup; “Crime and Police in India”, Sahitya Bhavan, Agra, 2007.
5. Banerjee, D; “Central Police Organization: Part I & Part II”, Allied Publishers. Pvt. Ltd., 2005.
6. Ramanjam, T; “Prevention and Detection of Crime”, Madras Book Agency, 1995.
7. James, Vadckumchery; “Crime, Police and Correction”, APH Publishing C., New Delhi, 1998.
8. Reporter of National Police Commission.
9. Justice Mallimath; “Committee on Criminal Justice Reforms”, Universal Law Pub, 2003.
10. K. Padmanabaiah; “Committee on Police Reforms”, 2001.
11. Singh Soibam Ibocha, “Community Policing”, Akansha Publishing House, New Delhi, 2007
12. Doval Ajit and Lal BR, Manas Police Security Year Book 2010-2011, Manas Publications, 2010.
13. Indian Police Journal published by Bureau of Police Research and Development.
14. Police Manual.

Fourth Semester

Semester- IV, Paper – I
M.Sc. Forensic Science
MSFS411 – Research Methodology and Communication Skills

Unit – I – Introduction to Research Methodology

Research Methodology- Introduction, Types of Research (Basic, Applied, & Need based), Importance.

Essential Steps in Research- Identifying and defining the problem, Research Project planning, Information Sources- Scientific Journals, Periodicals, books and other publications. Design of the Experimental Hypothesis, Variables in the Experiment, Evolution and Application of different techniques, Evaluation of Results, Comparison with existing methodologies, Validation of findings.

Need for Literature Review, Fallacy of scenario building, falsification and verification, formulation of research questions, Scope for future research.

Different systems of Citing References- Harvard system, Vancouver system, Chicago system, MLA and APA system, Footnote Reference system.

Introduction to research report & its components, typing and formatting of research report including placement and numbering of figures and tables. Ethical issues in conducting research.

Unit – II – Research Modeling and Experimental Design

Research Modeling: Types of data, data collection methods- Survey method, observation method, experimentation; scaling techniques; types of sampling, steps in sampling, sampling error, advantage and limitations of sampling. Measures of Central tendency- mean, median and mode. Measures of association: correlation and regression. Probability of distributions- discrete and continuous probability distributions. Qualitative and quantitative methods of data analysis.

Experimental Design: Introduction, observation, basic principle of experiments, experimental error, replication, generalization, controls, randomization, measurement, a few common experimental designs. Application of computer in research- MS- Office and SPSS.

Unit – III – Basics of Communication and Presentation Skills

Communication: Meaning, Nature, Importance and Purpose of Communication, Types of Communication, Process of Communication, Communication Network in an

Organization, Strategy for Effective Communication, Vocabulary and Pronunciation, words and terms, Verbal and Non-Verbal Communication, PowerPoint presentation, Barriers to Communication, Essentials of Good Communication, Communication Techniques, Video-conferencing & its applications in court testimony, Communication through Inter-operable Criminal Justice System.

Presentation Skills, Interviews, Public Speaking, Preparing the Speech, Organizing the Speech, Special Occasion Speeches, Group Discussion.

Unit – IV –Writing Skills

Types of writings (Expository, Descriptive, Analytic, Argumentative, Narrative etc.) and their main features; Memos and Notices; Formal Report, Writing of Expert opinion and use of appropriate terminology & words, Writing of Worksheets.

Scientific and Impersonal Attitude; Plain Statements, Definitions; Description and Explanations (of objects, instruments, Processes, Scientific Principles, etc.), Interpretation and use of charts, graphs and tables in technical writing.

Reference Books:

1. "Communication Skills", 3rd Edition, Ferguson Publishing, 2009.
2. Owen Hargie; "The Handbook of Communication Skills", 3rd Edition, Routledge, Taylor & Francis, 2006.
3. C.R. Kothari; "Research Methodology: Methods and Techniques", 2004.
4. Ranjit Kumar; "Research Methodology: A Step-by-Step Guide for Beginners", 4th Edition, SAGE publications, 2014.
5. D K Bhattacharyya; "Research Methodology", 2nd Edition, Excel Books, 2006

Semester- IV, Paper – II
M.Sc. Forensic Science

Project work on forensically significant and need based problems on the area of specialization.

Semester- IV, Paper – III
M.Sc. Forensic Science

Handling of Forensic Science Evidences from Crime Scene to Court Room in actual crime cases through internship.