

**SYLLABUS
OF
MASTER OF FORENSIC SCIENCE
FOR
FORENSIC PHYSICS SPECIALISATION
(Second To Fourth Semester)**



**LNJN National Institute of Criminology & Forensic
Science
Ministry of Home Affairs, Govt. of India
DELHI**

**GURU GOBIND SINGH
INDRAPRASTHA UNIVERSITY**
Sector-16C, Dwarka, New Delhi-110078, INDIA
Tel : + 91-1125302132/131/134
Email : prof.pcsharma@gmail.com
ipu.daa@gmail.com



Prof. P. C. Sharma

DIRECTOR (ACADEMIC AFFAIRS)

Dated : 12/07/2016

Ref. No. GGSIPU/DAA/2016/1481^L

The Dean (Academics),
LNJN National Institute of Criminology and Forensic Science
Outer Ring Road, Sector 3 Rohini, Delhi-110085

**Subject: Regarding addition of new specialization (Forensic Physics) in
M.Sc. Forensic Science Course curriculum.**

Sir,

With reference to your letter dated 28/05/2016, regarding subject as cited above, it is to inform you that the Scheme of Examination and Syllabus of new specialization (Forensic Physics) in M.Sc Forensic Science programme has been approved by the Academic Council of the University in the 41st Meeting of Academic Council held on 25.05.2016 vide agenda Item No. AC41.11 (copy enclosed) to be implemented from Academic Session 2016-17.

P. Sharma

**(Prof P C Sharma)
Director, Academic Affairs**

Copy to:

1. COE(O)
2. Dean, USM&PMHS
3. Guard file

**SYLLABUS OF MASTER OF FORENSIC SCIENCE FOR FORENSIC
PHYSICS SPECIALISATION
(Second To Fourth Semester)**

CONTENTS

COURSE DETAILS.....	3
FS-251 Physical Methods of Analysis.....	4
FS-252 Criminalistics.....	6
FS-253 Forensic Engineering and Photography.....	8
FS-254 Principles of Information Security and Digital Forensics.....	10
FS-255 Practicals: Physical Evidence and Impressions	12
FS-256 Practicals: Forensic Engineering, Criminalistics and Digital Forensics	13
FS-351 Traffic Accidents and Tool Marks.....	14
FS-352 Audio & Video Analysis	16
FS-353 Advanced Digital Forensics.....	18
FS-354 Application of statistics, report writing and relevant sections of law.....	19
FS-355 Practicals: Traffic Accidents and Tool Marks	20
FS-356 Practicals: Audio-Video Analysis and Digital Forensics.....	21
FS- 451 Practical work in-house lab.....	22
FS- 452 Attachment at designated lab outside	22
FS- 453 Dissertation.....	23
SCHEME OF LABORATORY ATTACHMENT	24

COURSE DETAILS

SECOND SEMESTER EXAMINATION

Specialization in Forensic Physics FS-250

Code No.	L	T	P	S	Total Credits
THEORY PAPERS	4	1	0	1	6
FS-251 Physical methods of analysis					
FS-252 Criminalistics	4	1	0	0	5
FS-253 Forensic Engineering and Photography	4	1	0	1	6
FS-254 Principles of Information Security and Digital Forensics	4	1	0	0	5
PRACTICAL/LAB BASED COURSE					
FS-255 Physical Evidence and Impressions	0	0	4	0	2
FS-256 Forensic Engineering, Criminalistics and Digital Forensics	0	0	4	0	2
Total Credits	16	4	8	2	26

THIRD SEMESTER EXAMINATION

Specialization in Forensic Physics FS-250

Code No.	L	T	P	S	Total Credits
THEORY PAPERS	4	1	0	0	5
FS-351 Traffic Accidents and Tool Marks					
FS-352 Audio & Video Analysis	4	1	0	1	6
FS-353 Advanced Digital Forensics	4	1	0	0	5
FS-354 Application of statistics, report writing and Relevant sections of various Acts	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
FS-355 Traffic Accidents and Tool Marks	0	0	4	0	2
FS-356 Audio-Video Analysis and Digital Forensics	0	0	4	0	2
Total Credits	16	4	8	2	26

FOURTH SEMESTER EXAMINATION - PRACTICAL/LAB BASED COURSE

Specialization in Forensic Physics FS-250

Code No.	L	T	P	S	Total Credits
FS-451 Work in- house lab	1	0	8	0	5
FS-452 Attachment at designated lab outside	1	0	8	0	5
FS-453 Dissertation	0	0	0	0	20
Total Credits	16	4	8	2	30
Grand Total Credits of Semester (I+II+III+IV)					108

Semester-II, Paper VII
M.Sc. Forensic Science
FS-251 Physical Methods of Analysis
L-4, T-1, P-0, S-1 CREDITS-6

Unit - I

Introduction, scope, application and limitations of Forensic Physics.

Introduction, Basic concepts-Atomic and molecular spectroscopy

Electromagnetic spectrum, sources of radiations, their utility and limitations-conventional sources for UV, visible and infrared rays, sources for shorter wavelength radiations(X-ray tubes), α -rays and gamma rays, laser (He, Ne, Argon, dye laser, semi-conductor laser) as source of radiation, resolution of radiations, monochromators and wavelength selection.

Interaction of radiation with matter and its consequences. Reflection, absorption, transmission, scattering, emission, fluorescence, phosphorescence.

Advanced Microcopy, Scanning Electron Microscope, Tunneling Electron Microscope, Atomic Force Microscope.

Detection of radiations: photographic detectors, thermal detectors, photoelectric detectors, PMT and semiconductor detectors.

Unit - II

Molecular spectra: Qualitative discussion of molecular binding, molecular orbital, types of molecular energies, qualitative discussions of rotational, vibrational and electronic spectra, spectra of polyatomic molecules, Beer-Lambert's law, derivation and deviations from the law, errors in photometric measurements, photometric accuracy, high precision measurements, calibration of instruments.

Ultra violet and visible spectrophotometry: Types of sources and stability, wavelength selection, filters-cells and sampling devices, detectors, resolution, qualitative detection and quantitative measurement, applications.

Atomic spectra: Qualitative discussion of atomic spectra, energy levels, designation of states, selection rules.

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

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

Unit - III

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

Infrared spectrophotometry: Dispersive and Fourier transform spectrophotometry (FTIR). Sample handling and preparation, quantitative analysis and interpretation of IR spectra, forensic applications.

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

Unit - IV

X-ray spectroscopy: X-ray absorption and fluorescence methods, X-rays diffraction, EDX, Auger Emission Spectroscopy (AES), electron spectroscopy for Chemical analysis (ESCA)

Thermal Analysis Methods: Basic principles and theory, differential scanning calorimetry (DSC) and differential analysis (DTA), thermogravimetry (TGA).

NMR spectroscopy: Principles, theory and instrumentation, forensic applications.

Suggested Readings

1. James W. Robinson; Atomic Spectroscopy, 2nd Edn. Revised & Expanded, Marcel Dekkar, Inc, NY. (1996)
2. V.B. Patania; Spectroscopy, Campus Books International, (2004)
3. Jerry Workman, Jr, Art Springsteen; Applied Spectroscopy- A compact reference for Practitioners, Academic Press (1997)
4. N. Subrahmanyam & Brij Lal; A text Book of Optics, S. Chand & Co. (2004).
5. Gurdeep R. Chatwal & Sham K. Anand; Instrumental Methods of Chemical Analysis, Himalaya Pub. House (2004).
6. Hobart H. Willard, Lynne L. Merrett Jr, John A Dean Frank A. Settle Jr.; Instrumental Methods of Analysis, 7th Edn. CBS pub. & Distributors (1986)
7. R.S. Khandpur; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi (2004)
8. K.C. Thomson & R.J. Renolds; Atomic Absorption Fluorescence & Flame Emission Spectroscopy, A Practical Approach, 2nd Edn. Charles Griffith & Co. (1978)
9. Robert M. Silverstein & Francis X Webster; Spectrometric Identification of Organic Compounds , 6th Edn., John Wiley & sons, Inc. (1997)
10. John C. Lindon, George E. Tranter & John L. Holmes; Encyclopedia of Spectroscopy & Spectrometry, Academic Press (2000)
11. Dudley H, Williams & Ian Fleming; Spectroscopic Methods in Organic Chemistry, 4th Edn, Tata McGraw- Hill Pub.Co. New Delhi, (1994)
12. Colin N. Banwell & Elaine M, Mc. Cash; Fundamentals of Molecular Spectroscopy 4th Edn, Tata McGraw-Hill Pub. Co. New Delhi (1995)
13. R. M urugeshan; Optic & Spectroscopy, S.Chand & Co. (1998)
14. Kamlesh Bansal; Analytical Spectroscopy Campus, Books International (2000)
15. P.S. Kalri; Spectroscopy of Organic Compounds, 4th Edn, New Age International Pub. (2001)
16. Douglas A. Skoog, F.James Holler & Timothy A. Nieman; Principles of Instrumental Analysis, 5th Edn. Thomas Books Co. (2003)
17. E.R.Mengel; Fluorescence in Forensic Science in Encyclopedia of Analytical Chemistry, Wiley & sons (2000)
18. G.R. Chatwal; Analytical Spectroscopy 2nd Edn, Himalaya Pub. House (2002).

Semester-II, Paper VIII
M.Sc. Forensic Science
FS-252 Criminalistics
L-4, T-1, P-0, S-0 CREDITS-5

Unit - I

Glass: Types of glass and their composition, Forensic examination of glass fractures under different conditions, determination of direction of impact, 3R-rules: cone- fracture, rib marks, hackle marks, backward fragmentation, colour and fluorescence, density comparison, physical matching and measurements, refractive index by refractometer, refractive index by Becke line technique, elemental analysis, interpretation of glass evidence, Standard Operating Procedures for examination, Discussion on important case studies of glass evidence.

Unit - II

Soil: Formation and types of soil, composition and colour of soil, particle size distribution and turbidity test, microscopic examination, density gradient analysis, ignition loss, differential thermal analysis, elemental analysis, interpretation of soil evidence, Standard Operating Procedures for examination, Discussion on important case studies of soil evidence.

Paint: Types of paint and their composition, macroscopic & microscopic studies, pigment distribution and colorimetry, micro-chemical analysis- solubility test, TLC, pyrolysis chromatographic techniques, IR absorption spectroscopy of paint samples & X-ray diffraction, elemental analysis, interpretation of paint evidence, Standard Operating Procedures for examination, Discussion on important case studies of paint evidence.

Unit - III

Fibre: Classification of textile fibres - production, structure, and properties, the structure of textiles - an introduction to the basics, ropes and cordage, examination of damage to textiles, recovery & collection of fibre evidence & Standard Operating Procedures for examination protocols, visible & infrared microscopical examination of fibres, instrumental methods used in fibre and dye examination, interpretation of fibre evidence, new fibres types, discussion on important case studies of fibre evidence.

Unit - IV

Impressions: Foot/Footwear/Tyre Impression, Collection, Tracing, Lifting, Casting of impressions, Enhancement of Footwear Impression, Analysis & comparison of foot impressions, Moulds, Gait Pattern and Identification characteristics, Superimposition of impression on footwear and foot imprints, Electrostatic lifting of latent foot/shoes/dust imprints, Standard Operating Procedures for examination.

Blood spatter analysis, Examination of physical properties of Sealing Wax.

Suggested Readings

1. A.B. Wildman; The Microscopy of Animal Textile Fibres. Wool Industries Research Association (1954)
2. AATCC Technical Manual of American Association of Textile Chemists and Colorists, Vol-75 (2000), American Association of Textile Chemists and Colorists, USA
3. B. Caddy; Forensic Examination of Glass and Paints Analysis and Interpretation ISBN 0784 05749 (2001)

4. B.P.Saville; Physical Testing of Textiles, The Textile Institute CRC Press and wood head Pub., (2000)
5. Bevel, Tom.; Bloodstain Pattern Analysis, Boca Raton CRC Press (2008)
6. Bodziak, W., Footwear Impression Evidence (2nd Edn.) CRC Press, Boca Raton, Florida (2000)
7. C.E.O Hara and J.W. Osterburg; An Introduction to Criminalistic, Indiana University Press, Blomington (1972)
8. David A. Crown; The Forensic Examination of Paints and Pigments, Tolyor & Francis, NY (2001)
9. Dorothy Catling and John Grayson; Identification of vegetable Fibres, Chapman and Hall (1982)
10. E.R.Mengel; Forensic Physics in 2002 year book, McGrawhill Encyclopedia of Science & Technology.
11. Elliot B. Grover and D.S. Hamby; Handbook of Textile testing and Quality Control, Wiley Eastern Pvt. Ltd. (1969)
12. J.E.Booth; Principles of Textile Testing-An Introduction to Physical Methods of testing textile Fibres, Yarns and Fabrics. 3rd Ed., CBS Pub. & Distributors (1996).
13. J.Gordon Cook; Handbook of Textile Fibres. Vol-I, Natural Fibres,5th Ed., Merrow (1993)
14. J.Walls; Forensic Science-An Introduction to Scientific Crime Detection 2nd Ed.,Universal, 1st Indian Reprint (2002).
15. James Michael Curran, Tachia Natilie Hicks and John S. Buckleton; Forensic Interpretation of Glass Evidence, CRC Press (2000)
16. James, Stuart H.; Principles of Bloodstain Pattern Analysis, Boca Raton Taylor & Francis (2005)
17. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Koouper; Encyclopedia of Forensic Science, Academic Pres s (2000).
18. Jenkins and White; Fundamentals of Optics 4th Ed., McGraw Hill (1981)
19. John H.Skinkle; Textile Testing- Physical Chemical and Microscopial, 2nd Ed.,Revised and Enlarged, D.B. Taraporevala Sons and Co. (1972).
20. Katharine Paddock Hess; Textile Fibres and their use, 6th Ed.,Oxford & IBH Pub.,Co. (1974)
21. Lee, Henry C et. al.; Advances in Fingerprint technology, New York CRC Press (2001)
22. Nickolls LC; Scientific Investigation of Crime, Bulterw est, London (1956)
23. R.W. Moncrieff; Man-Made Fibres 6th Ed.,Newnes Butterworths (1975)
24. Raymond C Murray & John C.F Tedrew; Forensic Geology, Prentice Hall NJ (1991)
25. Richard Saferstein; Criminalistics-An Introduction to Forensic Science 5th Ed., Prentice Hall (1995).
26. Roger Brown; Handbook of Polymer Testing- Physical Methods, Marcel Dekker, Inc. (1999)
27. W.E.Morton and J.W. S. Hearle; Physical Properties of Textile Fibres, 3rd Ed., The textile Institute, 1993 (Re printed 1997)
28. Wonder, Anita Y.; Bloodstain Pattern Evidence, USA Elsevier (2007)
29. Working Procedure Manual: Physics BPR&D Publication (2000).

Semester-II, Paper IX
M.Sc. Forensic Science
FS-253 Forensic Engineering and Photography
L-4, T-1, P-0, S-1 CREDITS-6

Unit - I

Cement: Types of cement and their composition, sampling of cement evidence material, determination of adulterants in cement, bromoform test, fineness test, loss on ignition test of cement; Physical and instrumental methods of cement analysis: determination of compressive strength, setting times, initial and final setting time, standard consistency, chemical methods of cement analysis, x-ray powder diffraction- identification of adulterated cement and adulterants.

Cement mortar and Cement concrete: Sampling and methods of analysis.

Unit - II

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 science: fingerprinting development, explosives, narcotics, drugs, ballistics, documents and other areas.

Arson: Investigation and evaluation of clue material, collection of evidence in arson investigation; Electrical origin of fire: panel board, fuses, fuse boxes, circuit breakers, electrical insulation in wiring, copper & aluminum wire, overload and short-circuit.

Unit - III

Basic principle in conventional and digital photography, Types of analog and digital camera, characteristics of the lens and lens system, shutter speed, aperture and exposure settings, depth of field, factors affecting DoF, 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, Adobe Photoshop, Corel Photo-Paint, photo enhancement software, file formats for digital photography such as JPEG, TIFF, RAW, BMP, GIF etc.

Unit - IV

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

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.

Suggested Readings

1. Arora, S. P. & Bindra, S. P., "A text book of Building Construction", Dhanpat Rai & Sons, Delhi. (2010)
2. Boudreau JE, etal; Arson & Arson Investigation, Survey & Assessment National Institute of Law Enforcement, U.S. Deptt of Justice, US Govt Printing Press (1977)
3. C P Poole Jr and Franks J Owens; Introduction to Nanotechnology. Wiley-Interscience; 1st Ed, (2003)
4. C. Kittel; Solid-state physics, Wiley 8th Ed (2008)
5. Chattopadhyaya, K. K.; Introduction to Nanoscience and Nanotechnology, New Delhi PHI Learning Pvt. Ltd. (2009)
6. Gary L. Lewis, Guidelines for Forensic Engineering Practice, ASCE Publications, (2003)
7. Jha, J. & Sinha, S. K., "Building Construction", Khanna Publishers, Delhi. (1977)
8. Kenneth L. Carper, Forensic Engineering, Second Edition, CRC Press, (2001).
9. Kulkarni, C.J., "A text book of Engineering Materials", Ahmedabad Book Depot, Ahmedabad. (1968)
10. Kumar Sushil, "Engineering Materials", Standard Publishers Distributors, Delhi. (1994)
11. M. Di Ventura et al; Introduction to Nanoscale Science & Technology, Springer. (2004)
12. McKay W.B., "Building Construction, "Vol.1 to 4, Pearson, 5th Ed (2012)
13. Punmia, B. C., "A text book of Building Construction", Laxmi Publications, Delhi. (1987)
14. Randall Noon, Forensic Engineering Investigation, CRC Press INC, 2001.
15. Singh Surendra, "Engineering Materials", Konark Publishers Pvt. Ltd. (1994)
16. Working Procedure Manual : Physics BPR&D Publication (2000)
17. James; Fundamentals of photographic theory. 2nd Ed. Morgan and Morgan. (1968)
18. Glafkides; Photographic chemistry. Fountain Press (1958)
19. Mitchell; Ilford manual of photography. 4th Ed. (1950)
20. Jon Tarrant Understanding Digital Cameras, Focal Press (2007)
21. Tom Ang Digital Photography An Introduction 4th Updated Edition, DK(Penguin), (2012)
22. Doug Harman The Digital Photography Handbook, 2nd Rev Ed, Quercus Publishing (2007)
23. The 35 mm Hand Book- Michael Freeman, Burlington (1988)
24. Focal encyclopedia of Photography, Michael R. Peres (Editor), 4th Ed. Focal Press. (2013)
25. M.J. Langford; Advanced Photography (Vol.-I & Vol.-II), 8th Ed. Focal Press. (2013)
26. Creative Colour Photography Techniques- Marshall Cavendish. (1990)
27. Making Colour Prints- Jack H.Coote, Focal Press. (1946)
28. Sidney F. Ray; Applied Photographic Optics, 3rd Ed, Focal Press, (2002)
29. Mark Galer; Digital Photography in Available Light- Essential Skills-, 3rd Ed Focal Press (2006)
30. John Child; Studio Photography- Essential Skills, 4th Ed, Focal Press, (2008)
31. John Hedgecoe; The Art of Digital Photography, Dorling Kindersley Publishers Ltd (2009)
32. David D. Bush; Mastering Digital SLR Photography, 4th Ed, Cengage (2014)
33. Robinson, Edward M.; Crime Scene Photography, USA Elsevier academic press (2007)
34. Duncan et. al.; Advanced Crime Scene Photography, London Taylor & Francis (2010)

Semester-II, Paper X
M.Sc. Forensic Science
FS-254 Principles of Information Security and Digital Forensics
L-4, T-1, P-0, S-0 CREDITS-5

Unit – I

Introduction to Information Security. Confidentiality, Integrity and Availability – Triad. Attacks: Threats, Vulnerabilities and Risk. Risk Management, Risk Assessment and Analysis. Information Classification, Policies, Standards, Procedure and Guidelines. Controls: Physical, Logical and Administrative; Security Frameworks, Defence in-depth: Layers of Security. Identification and Authentication – Factors. Authorization and Access Controls- Models, Methods and Types of Access Control.

Unit – II

Cryptography- Types of Ciphers, Methods of Encryption, Symmetric and Asymmetric Cryptography- Types and usage, Hash Functions, Digital Signature and Certificates. Protecting Data – At Rest, In Motion and In Use. Physical Security- Internal Support System and Perimeter Security, Network Security- Network Topology, Network Devices, LAN, WAN, MAN and Wireless Technology, Operating System Security and Application Security – Tools and Techniques, Secure Software Development Best Practices, Malicious software.

Unit – III

System Architecture- CPU, Multiprocessing, Operating System Components, Memory Types, Virtual Memory, Input and Output Devices. File Systems- Types and components. Computer Booting Process, Computer Memory – Volatile and Non-Volatile Memory. Basic Input and Output System (BIOS), and System Applications. Types of Storage Media – Hard Drive, SSD, Optical Devices.

Unit – IV

Computer Forensic – Objective and Methodology. Computer Facilitated Crimes and Reasons of Attacks, Rules of Digital Forensic, Standard Operating Procedure (SOP) of Digital Crime Scene. Incidence Response tools and techniques. Search and Seizure of Volatile and Non-Volatile Data. Imaging and Hashing Digital Evidence, Analyzing and Recovering Deleted files and folders.

Suggested Reading

1. Shon Harris; All In One CISSP Guide, Sixth Edition, McGrawHill, 2011.
2. Seymour Bosworth, M.E. Kabay, Eric Whyne; Computer Security Handbook, Fifth Edition, Wiley, 2009
3. Peter Hipson, Mastering Windows XP Registry, Sybex, 2002
4. Michael E. Whitman; Principles of Information Security, Fourth Editions, Course Technology, 2011
5. D. Parker; Fighting Computer Crime, Wiley, 1998.
6. A.K. Jain, A. Ross, S. Prabhakar; An introduction to biometric recognition, IEEE Trans. Circuits Syst. Video Technol
7. Jason Andress, Russ Rogers; The Basics of Information Security, Syngress, USA, 2011.

8. Anthony Reyes, Jack Wiles; The Best Damm Cybercrime and Digital Forensics Book, Syngress, USA, 2007.
9. Aaron Philipp, David Cowen, Chris Davis; Hacking Exposed Computer Forensics Second Edition, McGrawHill, USA, 2010.

Semester-II, Paper XI
M.Sc. Forensic Science
FS-255 Practicals: Physical Evidence and Impressions
L-0, T-0, P-4, S-0 CREDITS-2

1. Examination of broken pieces of glass bangles to determine the source correspondence.
2. Determination of specific gravity of glass pieces.
3. Florescence examination of glass samples and determination of U.V. absorption cut-off of transparent sheet.
4. Studies of hackle and rib marks in radial and concentric fractures in a glass sheet caused by pointed tool at different angle.
5. Determination of refractive index of glass by liquid immersion method.
6. Determination of number of layers, sequence of layers and their thickness in paint chip.
7. Examination of polymer and solvents in paint sample by using TLC.
8. Casting of Footwear impression.
9. Electrostatic lifting of latent foot/shoe/dust imprints.
10. Microscopic and spectroscopic examination of man-made fibre.
11. Measurement of physical parameters of thread.
12. Microscopic and spectrophotometric examination of textile fabrics.
13. Physical matching of Cloth piece and/or rope piece and /or garments.

Semester-II, Paper XII
M.Sc. Forensic Science
FS-256 Practicals: Forensic Engineering, Criminalistics and Digital Forensics
L-0, T-0, P-4, S-0 CREDITS-2

1. To detect adulteration in cement samples.
2. To determine the ratio of cement, fine aggregate and coarse aggregate in cement concrete sample.
3. Determination of particle size distribution in soil samples using sieve test.
4. Comparison of control soil samples with soil sample taken from victim/suspect by density gradient distribution method.
5. Determination of ignition loss and pH of soil samples.
6. Mineralogical study of soil samples.
7. Physical and microscopic studies of affected electric wires, panel boards due to electrical overload and short-circuit.
8. Ultraviolet, Infra Rad, transmitted light, side light, close up & trick photography.
9. Ultraviolet fluorescence photography of coloured fabrics.
10. Secure Configuration of Ports and Services of Windows 7
11. Encrypting and Decrypting the partition using Bitlocker
12. Collection and Preservation of Volatile data from the standalone computer
13. Recovering the deleted files and folders.

Semester-III, Paper XIII
M.Sc. Forensic Science
FS-351 Traffic Accidents and Tool Marks
L-4, T-1, P-0, S-0 CREDITS-5

Unit - I

Road evidence, road engineering and design, 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.

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

Unit - III

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.

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

Unit - IV

Tool marks: Types of tool marks: compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks, photographic examination of tool marks and cut marks on clothes and walls etc., wounds, cuts & injuries on human body, comparison of tool marks by comparison microscope.

Restoration of erased / obliterated marks: Method of marks making-cast, punch, engrave; methods of obliteration, method of restoration- etching (etchings for different metals), magnetic, electrolytic etc., recording of restored marks – restoration of marks on wood, leather, polymer etc., resuscitation of obliterated numbers in metal surfaces, scope and limitations of techniques.

Suggested Readings

1. Harold Franck; Forensic Engineering Fundamentals, CRC Press, Taylor and Francis Group (2013)
2. James M. Green; Bicycle Accident Reconstruction for the Forensic Engineer, 5th edition Trafford Publishing; (2001)

3. Kenneth S. Obenski et. al.; Motorcycle Accident Reconstruction and Litigation, Lawyers & Judges Pub. Company. (2011)
4. Lynn B. Fricke.; Traffic Crash Reconstruction, Northwestern University Center for Public Safety. (2010)
5. 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).
6. 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)
7. R.W. Rivers and Frederick G. Hochgraf; Traffic Accident Investigators' Lamp Analysis Manual, Charles C. Thomas Pub Ltd. (2001)
8. R.W. Rivers; Technical Traffic Crash Investigators' Handbook: (Level 3): A Technical Reference, Training, Investigation and Reconstruction Manual, Charles C. Thomas Pub Ltd. (2010)
9. R.W. Rivers; Traffic Crash Investigators' Manual: A Levels 1 and 2 Reference, Training and Investigation Manual, 3rd Ed Charles C. Thomas. (2011)
10. Thomas Watters; Traffic Crash Analysis: Court Preparation Manual, Dream Catcher Publishing. (1999)
11. Tony L. Becker; Lamp Examination for Traffic Collision Investigators, Institute of Police Technology and Management. (1995)
12. C.E.O Hara and J.W. Osterburg; An Introduction to Criminalistic, Indiana University Press, Blomington (1972)
13. E.R.Mengel; Forensic Physics in 2002 year book, McGraw Hill Encyclopedia of Science & Technology.
14. Fisher, Barry A J.; Techniques of crime scene investigation, Boca Raton CRC Press (1993).
15. Gardner, Ross M.; Practical Crime Scene Processing and Investigation, Boca Raton CRC Press (2005).
16. J.Walls; Forensic Science-An Introduction to Scientific Crime Detection 2nd Ed.,Universal, 1st Indian Reprint (2002).
17. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Koouper; Encyclopedia of Forensic Science, Academic Press (2000).
18. Laboratory procedure manual, Forensic Physics, Director of Forensic Science (2005).
19. Nabar B. S.; Forensic science, Hyderabad Ashoka Law House (2005).
20. Richard Saferstein; Criminalistics-An Introduction to Forensic Science 5th Ed., Prentice Hall (1995).
21. Sharma, B R.; Forensic science in criminal investigation and trials, Allahabad Central Law Agency (1983).
22. Working Procedure Manual : Physics BPR&D Publication (2000).

Semester-III, Paper XIV
M.Sc. Forensic Science
FS-352 Audio & Video Analysis
L-4, T-1, P-0, S-1 CREDITS-6

Unit - I

Speech Anatomy, Mechanism of speech Production, Acoustic Properties of Vocal Tract, Uniqueness in person's voice, interspeaker and intraspeaker variation.

Articulation- Manner & Place of Articulation, Phonemes, Vowel, Consonant and Glides, Phonetics in Speaker Identification, IPA (The International Phonetic Alphabets), Forensic Phonetics, Effect of context, Supra segmental (Prosodic features).

Audio-enhancement, Sound Recording/Playback Devices: Analog Tape recorders, Digital recorder, Microphone types, Digital audio formats.

Apex Court Judgments on Speaker Identification. Court presentation of report based on speaker Identification.

Unit - II

Digital Signal Processing, A to D Conversion- Sampling, Quantization, Digital Audio Formats, Pulse Code Modulation, Coding and Decoding, Computer Representation of Speech

Speaker Recognition: Principles of speaker recognition/identification, Methods on Speaker Recognition.

Various approaches in Forensic Speaker Identification, 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.

Introduction to Pattern Recognition, Pattern Recognition application in Automatic Speaker Identification and Verification System, Different algorithm of automatic speaker identification.

Unit - III

Audio Evidence Examination: Handling of audio recording evidences, Procedure for preparation of working copies, Phonetic transcription, Analysis of linguistic & phonetic characteristics, Temporal measurement, Text-dependent and text-independent speaker recognition.

Instrumental Analysis of speech sample: Verbatim, Clue words, IPA marking, CSL & Linear predictive coding technique, Fourier transformation, Examination using SPID, Vocal behaviors-alcohol speech relationships.

Authentication of recorded audio: Type of alterations, Auditory Examination by Critical Listening. Waveform analysis, Speech Spectrographic analysis, Magnetic developing, Optical Method.

Unit - IV

Introduction to video technology: Video standards, Recording formats- Analog and Digital, Introduction to video devices, Linear and Non-linear editing, Concept of video film production, Graphics and animation technique.

Image perception, Colour space & representation, Storage, Image processing application. Introduction to image enhancement, Image restoration, Concept of digital water marking, Image compression, Retrieval of video files, Integrity of images, Facial image recognition.

Forensic analysis of audio/video in video recording: Authentication of video recording, Visual examination technique on video frame sequence, Video image analysis- object, costumes, Facial image recognition from video frame image, Video signal analysis.

Suggested Readings

1. Arthur R Weeks Jr; Fundamentals of Electronic Image. SPIE Press, (2003)
2. Bengold & Nelson Moryson; Speech and Audio signal processing, John Wiley & Sons, USA (1999)
3. D.B. Fry; The Physics of Speech, Cambridge University Press. (2004)
4. David Cheshire; The Complete Book of Video Techniques Subjects Equipment, Dorling Kindersley, London (1992)
5. Des Lyver & Graham Swainson; Basics of Video Production, 2nd Ed. Focal Press (1999)
6. Dwight Bolinger et. al.; Aspects of Language, Third Edition, Harcourt Brace Jovanovich College Publishers, USA. (1981)
7. Gloria J. Borden et. al. Speech Science Primer (Physiology, Acoustics and perception of Speech), 6th Ed, a Wolters Kluwer Company, USA. (2011)
8. Harry Hollien; Forensic Voice Identification, Academic Press, London. (2001)
9. Harry Hollien; The Acoustics of Crime- The New Science of Forensic Phonetics, Plenum Press, New York and London (1990)
10. Husrev Taha Sencar, Nasir Memon; Digital Image Forensics: There is More to a Picture than Meets the Eye. Springer (2013)
11. John C. Russ; Forensic Uses of Digital Imaging CRC Press, (2001)
12. Martin Uren; BKSTS Illustrated Dictionary of Moving Image Technology, 4th Ed, CRC Press, (2013)
13. Oscar Tosi; Voice Identification-Theory of Legal Applications, University Park Press, Baltimore (1979)
14. O'Shaughnessy, Douglas; Speech Communication, Hyderabad Universities Press (India) Pvt. Ltd. (2001)
15. Patricia Ashby; Speech Sounds, 2nd Ed. Routledge, London and New York (2005)
16. Philip Rose; Forensic Speaker Identification, Taylor and Francis, Forensic Science Series, London (2002)
17. Randy Crane; A Simplified Approach to Image Processing, Prentice Hall. (1996)
18. Simon J. Godsill; Digital Audio Restoration, Springer, (1998)
19. Gary H. Anderson; Video Editing and Post-Production- A Professional Guide, 4th Ed, Focal Press, (1998)

Semester-III, Paper XV
M.Sc. Forensic Science
FS-353 Advanced Digital Forensics
L-4, T-1, P-0, S-0 CREDITS-5

Unit – I

Principles of Digital Forensics, Collection of Evidence- Single System, Networked System and Remote System. Digital Forensic Evidence Seizure Methodology, Digital Forensic Software and Hardware tools – Proprietary and Open Source Tools. Imaging and Analysis of Storage Media – Tools and Techniques.

Unit – II

Windows Systems and Artifacts: Windows file system, Registry, Event Logs, Shortcuts file, Executables. Linux System and Artifacts: Linux file system: Ownership and Permissions, Hidden Files, User Accounts and Logs. Mac OS X systems and Artifacts: System Startup and Services, Network Configuration, Hidden Directories, System Logs and User Artifacts. Application Password Cracking – Types and Tools for password cracking.

Unit – III

Introduction to Network and Communication Technology- Overview of OSI Model and TCP/IP Protocol. Network Address and NAT, Monitoring Network Activities, Searching for Evidence from the Network. Live Packet Capturing and Analysis. Routers and Routing Protocols, Routing Table Poisoning, Denial of Service Attack (DOS), Distributed Denial of Service Attack (DDOS) and Wireless Attacks.

Unit – IV

Web Browsers: Cookies, Favourites or Bookmarks, Cache, Session Data and Plugins. Email: Types of Email and Protocols. Analysing the Header details and tracking the email, Spoofed Mails. Collection and Preservation of Mobile Phone and PDA, Types of Smart Phones and the Operating Systems, Analyzing Mobile Phone Evidence, Rooting and Jail Braking. Virtual Machine and Cloud Technology Forensics.

Suggested Reading

1. Harlan Carvey; Windows Forensic Analysis Toolkit, Syngress, 2012
2. Anthony Reyes, Jack Wiles; The Best Damn Cybercrime and Digital Forensics Book, Syngress, USA, 2007.
3. Aaron Philipp, David Cowen, Chris Davis; Hacking Exposed Computer Forensics Second Edition, McGrawHill, USA, 2010.
4. Cory Altheide, Harlan Carvey; Digital Forensics with Open Source Tools, Syngress, USA, 2011.
5. Andrew Hoog; Android Forensics Investigation, Analysis and Mobile Security for Google Android, Syngress, USA, 2011.
6. Hakima Chaouchi, Maryline Laurent-Maknavicius; Wireless and Mobile Network Security, Wiley, 2007
7. Dan Kusnetzky; Virtualization: A Manager's Guide, O'Reilly, 2011

Semester-III, Paper XVI
M.Sc. Forensic Science
FS-354 Application of statistics, report writing and relevant sections of law
L-4, T-1, P-0, S-1 CREDITS-6

Unit - I

Probability-theory, classical definition of probability, Basic terms-events, trials, mutually exclusive events, favourable events, exhaustive events etc. Baye's theorem of probability, addition theorem, multiplication theorem, conditional probability, coincidence probabilities, Binomial distribution, normal distribution, hyper geometric distribution, correlated measurements.

Unit - II

Discriminating power- derivation, evaluation of evidence by discriminating power, combination of independent systems, correlated attributes, transfer of evidence, likelihood ratio, probability of guilt, correspondence probabilities, direction of transfer.

Tests of hypothesis-tests of significance of attributes, Z-test of significance and coefficient of correlation, small sample test, T-test, paired test, chi-square test, F-test for equality of variance, large sample test, normal test.

Significant figures, precision indices, statistically reliable differences, rejection of individual readings, probable error.

Applications of statistics in Forensic Physics, Statistical evaluation of data regarding Forensic Physics obtained by instrumental methods. Mathematical considerations of striation matching, etc.

Unit - III

Report writing and evidence evaluation, Components of reports, report formats in respect of crime scene and laboratory findings.

Court testimony, admissibility of expert testimony, pre-court preparations and court appearance, examination- in chief, cross-examination and re-examination, Discussion of complicated cases.

Unit - IV

Indian Penal Code (Sections: 232 - 235, 246, 247, 279, 287, 304A, 337, 338, 425, 427, 440), Indian Evidence Act (Sections: 3, 45, 51, 60 - 65, 73, 74), Explosives Act (Sections: 4, 17), Information Technology Act 2000 (Sections: 2r, 2t, 3, 4, 7, 13, 79), Cr. P. C. Section 293.

Suggested Readings

1. Aitken and Stoney; The Use of Statistics in Forensic Science, Ellis Horwood, NY, (1991)
2. Meyer, Expert Testimony, CRC Press, NY, (1999)
3. Saferstein, Criminalistics, Prantice Hall, NJ, (1995)
4. Robertson and Vignaux; Interpreting Evidence, John Wiley, NY, (1995)

Semester-III, Paper XVII
M.Sc. Forensic Science
FS-355 Practicals: Traffic Accidents and Tool Marks
L-0, T-0, P-4, S-0 CREDITS-2

1. Studies of cut-marks/tear marks characteristic on cloths using different cutting and tearing tools.
2. Studies of cut-marks striations on metallic wire cut-ends using cutting pliers and its linkages with cutting plier tools.
3. Studies of different characteristics hammer impressions of iron metal sheet and their linkage with the hammers used.
4. Studies of cut marks striations using motorized hacksaw blade and hand driven hacksaw tool.
5. Photographic juxtaposition comparison of tool marks striation.
6. Restoration of erased punched marks on the iron sheets using chemical etching method.
7. Blood spatters measurements to determine the heights of blood spattered on ground.
8. Blood spatters measurements to determine the angles of blood spattered on ground.
9. Simulated SoC examination and collecting & packaging of evidence material.
10. Study of microscopic characteristics of fused bulb filaments of vehicle head light.
11. Examination of comparison of tyre marks impressions and their classical and individual/accidental characteristics.
12. Photography of road signs, road signals, pavements and road markings and its documentations.

Semester-III, Paper XVIII
M.Sc. Forensic Science
FS-356 Practicals: Audio-Video Analysis and Digital Forensics
L-0, T-0, P-4, S-0 CREDITS-2

1. Recording of speech samples using tape recorder & digital recorders and measures for keeping it in the safe custody.
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. Video analysis and detection of tampered video files using Video analyzing tool.
7. Videography of simulated crime scene and its complete documentation.
8. Imaging the Seized storage media with different imaging format.
9. Analysing the image file for hidden files and folders including slack space.
10. Collecting Registry, Event logs and Executable files details using Forensic Tools.
11. Capture and Analysis the TCP packet from the LAN.
12. Analysis the browser detail of Internet Explorer and Header details of email.

Semester-IV, Paper - XIX
M.Sc. Forensic Science
Lab Work and Dissertation

FS- 451 Practical work in-house lab
L-1, T-0, P-8, S-0, CREDITS-5

Semester-IV, Paper - XX
M.Sc. Forensic Science
Lab Work and Dissertation

FS- 452 Attachment at designated lab outside
L-1, T-0, P-8, S-0, CREDITS-5

Semester-IV, Paper - XXI
M.SC. Forensic Science
Lab Work and Dissertation
FS- 453 Dissertation
L-0, T-0, P-0, S-0, CREDITS-20

Methods of examination of scene of crime, collection, preservation & forwarding of physical evidence for scientific examinations; Examination and comparison of evidence materials glass, paint, soil, copper & aluminium wires/cables, textile materials like fibres, thread, fabric and other polymeric materials etc. by physical & instrumental methods of analysis and their evidential value; Examination of physical evidence in Traffic Accident with reference to the hit & run case investigation by physical and instrumental methods of analysis and their evidential value; Examination of electronic recordings of audio-video evidence in speaker identification, their integrity & authentication by physical and instrumental methods of analysis and evidential values; Examination and analysis of tool marks / impression evidences and their source correspondence by physical and instrumental methods and presentation of evidence in the court; The physical & instrumental methods of analysis of evidence to determine the cause(s) of failure(s) and their evidence values in the court of law; Methods of writing report based on scientific examination of physical evidence and its testimony in the court of law. Analysis of Human Computer Interaction, Open Source Forensic Tools, Big Data Analytics-modelling techniques, Data mining techniques, Network Analysis.

SCHEME OF LABORATORY ATTACHMENT

FORENSIC PHYSICS

1. Physical & microscopic examination of automobile paints and its spectro-chemical analysis.
2. Documentation of crime scene and search, collection & packing of evidence material.
3. Tool marks examination using comparison/stereo microscope.
4. Auditory and spectrographic analysis of audio evidence for speaker identification.
5. Examination of authentication of audio video recordings.
6. CCTV footage data retrieval and image enhancement.
7. Preparation of formats for experimental observations for evidence materials using microscopic and other instrumental techniques.
8. Documentation and maintenance of the records of material exhibits, preservation and their chain of custody in the division.
9. Identification of storage media and its authentication.
10. Collection of digital evidences using different softwares.
11. Network data collection and preservation.
12. Malware analysis.