MASTER OF FORENSIC SCIENCE
FIRST SEMSESTER EXAMINATION

Code No.	L	T	P	S	Total Credits
THEORY PAPERS					
FS-101 Introduction: Field & Laboratory	4	1	0	1	6
FS-102 Pattern Evidence	4	1	0	0	5
FS-103 Chemical Evidence	4	1	0	0	5
FS-104 Biological Evidence	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
Fs-105 Simulated crime scene exercise & Laboratory analysis of pattern evidence	0	0	4	0	2
FS-106 Laboratory Analysis of Chemical & Biological Evidence	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

Students will select one of the following specializations beginning with the II Semester:

1. **FS-210 : Forensic Ballistics**
2. **FS-220 : Forensic Document Examination**
3. **FS-230 : Forensic Chemistry & Toxicology**
4. **FS-240 : Forensic Biology, Serology and DNA Profiling**

SECOND SEMESTER EXAMINATION
Specialization in Forensic Ballistics FS-210

Code No.	L	T	P	S	Total Credits
THEORY PAPERS FS-211 Physical Method of Analysis	4	1	0	0	5
FS-212 Firearms, Ammunition and Evidentiary clues	4	1	0	1	6
FS-213 Internal, Intermediate and External Ballistics	4	1	0	0	5
FS-214 Forensic Ballistics-I (Identification of firearms and Range of firing)	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
FS-215 Firearms and Ammunition	0	0	4	0	2
FS-216 Scene of Crime, Chemical tests and tool marks	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

Specialization in Forensic Document FS-220

Code No.	L	T	P	S	Total Credits
THEORY PAPERS FS-221 Instrumentation	4	1	0	1	6
FS-222 Techniques of Analysis /Examination	4	1	0	0	5
FS-223 Document Photography	4	1	0	0	5
FS-224 Document Examination Overview	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
FS-225 Instrumentation Techniques	0	0	4	0	2
FS-226 Document Photography	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

Specialization in Forensic Chemistry & Toxicology FS-230

Code No.	L	T	P	S	Total Credits
THEORY PAPERS FS-231 Forensic Chemistry-I	4	1	0	0	5
FS-232 Forensic Toxicology	4	1	0	0	5
FS-233 Explosives & Explosion	4	1	0	1	6
FS-234 Instrumental Techniques	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
FS-235 Forensic Chemistry, Explosives and Instrumentation	0	0	4	0	2
FS-236 Forensic Toxicology and Instrumentation	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

Specialization in Forensic Biology, Serology & DNA Profiling FS-240

Code No.	L	T	P	S	Total Credits
THEORY PAPERS FS-241 Human Anatomy & Physiology	4	1	0	0	5
FS-242 Forensic Osteology and Odontology	4	1	0	0	5
FS-243 Forensic Anthropology	4	1	0	1	6
FS-244 Forensic Botany and Wild Life Forensics	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
FS-245 Forensic Anthropology	0	0	4	0	2
FS-246 Forensic Botany	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

THIRD SEMESTER EXAMINATION
Specialization in Forensic Ballistics FS-210

Code No.	L	T	P	S	Total Credits
THEORY PAPERS FS-311 Chemical Methods of Analysis	4	1	0	0	5
FS-312 Terminal Ballistics	4	1	0	1	6
FS-313 Forensic Ballistics-II (Gun- Shot residue and reconstruction	4	1	0	0	5
FS-314 Application of Statistics, Report writing and Arms Act.	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
FS-315 Use of Instrumentation Techniques	0	0	4	0	2
FS-316 Identification of Firearms and Reconstruction	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

Specialization in Forensic Document FS—220

Code No.	L	T	P	S	Total Credits
THEORY PAPERS FS-321 Principles of Handwriting Examination	4	1	0	1	6
FS-322 Document Forgery and Alterations	4	1	0	0	5
FS-323 Mechanical Impressions & Security Documents	4	1	0	0	5
FS-324 Advances in Document Examination & Quality Assurance	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
FS-325 Handwriting and Mechanical Impression	0	0	4	0	2
FS-326 Examination of Electronically Printed Documents and Counterfeits	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

Specialization in Forensic Chemistry and Toxicology FS-230

Code No.	L	T	P	S	Total Credits
THEORY PAPERS FS-331 Forensic Chemistry-II	4	1	0	1	6
FS-332 Advance Forensic Toxicology	4	1	0	1	6
FS-333 Forensic Analysis of Drugs	4	1	0	0	5
FS-334 Advance Instrumental Techniques	4	1	0	0	5
PRACTICAL/LAB BASED COURSE					
FS-335 Forensic Chemistry to Forensic Analysis of Drugs and Instrumental Techniques	0	0	4	0	2
FS-336 Advance Forensic Toxicology and Advance Instrumental Techniques	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

Specialization in Forensic Biology, Serology & DNA profiling FS-240

Code No.	L	T	P	S	Total Credits
THEORY PAPERS FS-441 Forensic Medicine, Entomology and Microbial Forensic	4	1	0	0	5
FS-442 Forensic Genetics and Bioinformatics	4	1	0	0	5
FS-443 Forensic Serology	4	1	0	1	6
FS-444 Forensic DNA Analysis	4	1	0	1	6
PRACTICAL/LAB BASED COURSE					
FS-445 Forensic Serology	0	0	4	0	2
FS-446 Forensic DNA Profiling	0	0	4	0	2
Total Credits	**16**	**4**	**8**	**2**	**26**

FOURTH SEMESTER EXAMINATION - PRACTICAL/LAB BASED COURSE

Specialization in Forensic Ballistics FS-210

Code No.	L	T	P	S	Total Credits
FS-411Work in- house lab	1	0	8	0	5
FS-412 Attachment at designated lab outside	1	0	8	0	5
FS-413 Dissertation	0	0	0	0	20
Total Credits	**16**	**4**	**8**	**2**	**30**
Grand Total Credits of Semester (I+II+II+IV)					**108**

Specialization in Forensic Document Examination FS-220

Code No.	L	T	P	S	Total Credits
FS-421Work in- house lab	1	0	8	0	5
FS-422 Attachment at designated lab outside	1	0	8	0	5
FS-423 Dissertation	0	0	0	0	20
Total Credits	**16**	**4**	**8**	**2**	**30**
Grand Total Credits of Semester (I+II+II+IV)					**108**

Specialization in Forensic Chemistry & Toxicology FS-230

Code No.	L	T	P	S	Total Credits
FS-431Work in- house lab	1	0	8	0	5
FS-432 Attachment at designated lab outside	1	0	8	0	5
FS-433 Dissertation	0	0	0	0	20
Total Credits	**16**	**4**	**8**	**2**	**30**
Grand Total Credits of Semester (I+II+II+IV)					**108**

Specialization in Forensic Biology, Serology & DNA profiling FS-240

Code No.	L	T	P	S	Total Credits
FS-441Work in- house lab	1	0	8	0	5
FS-442 Attachment at designated lab outside	1	0	8	0	5
FS-443 Dissertation	0	0	0	0	20
Total Credits	**16**	**4**	**8**	**2**	**30**
Grand Total Credits of Semester (I+II+II+IV)					**108**

L= Lecture 1 hour per week gives 1 credit, T= Tutorial 1 hour per week gives 1Credit
P= Practical 2 hours per week give 1 credit S= Seminars 1 hour per week gives 1 Credit

Total Credits of the Programme=108

All the students shall be required to register themselves for all the courses of the Programme and shall also be required to appear in examinations of all the courses; however they shall become eligible for the award of the degree on securing minimum credits equivalent to 100.

Semester-I, Paper I
M.Sc. Forensic Science
FS-101 Introduction: Field & Laboratory
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Criminal Justice System & forensic science in India; What is Forensic Science? Areas of forensic science, Criminalistics, Forensic Pathology, Forensic Anthropology, Forensic Odontology, Forensic Engineering, Toxicology, Behavioural Science, Questioned documents. A bit of forensic science history.

Forensic Science Laboratory: Organisation & services Forensic Science Lab. Administration, Central & State Forensic Science Laboratories in India, Forensic Science Laboratory Services in India, Standard Laboratory services, Evidence intake, analytical sections other laboratory services. Administrative issues with Forensic Science Laboratories; Accountability, Access to Laboratory services. The forensic scientist: Education & training of forensic scientists, Analysis of evidence: Chain of custody, Turnaround time, preservation & spoilages, sampling, reports, expert testimony.

Unit - II

Crime Scene Investigation: Response to Crime Scene, Plan of action, Secure the scene, Preliminary Survey, Photography, sketch, chain of custody, Crime Scene search & evidence collection, Final Survey, Submission of evidence to the Laboratory, safety, Sources & Forms of dangerous materials: Inhalation, skin contact, Ingestion, Injection. Universal precautions, personal protective equipments, transporting hazardous materials.

Court Room; Legal aspects of forensic science– Legal Constraints on the Criminal Investigation process, unreasonable search & seizures, self – incrimination, production of evidence, Expert Witness, Authentication of evidence, Admissibility of evidence, Admissibility of scientific & technical evidence, writing reports, Examples of analysis & reports Testimony; Difference between a civil case & a criminal case, being a witness & an expert consideration for testimony.

Unit - III

Nature of Evidence; What is Evidence? Kind of evidence, Levels of evidence, Forensic science is History, Basis of evidence; Transfer & Persistence, contamination, Identity, class and Individualisation. Known and questioned items, Relationship and context, comparison of evidence, controls, Analysis of evidence: Controls, Analysis of evidence: Some preliminary considerations.

Analytical tools: Microscopy- Introduction, Magnification Systems, The lens, Compound Magnifying Systems, The microscope, Refractive Index, Polarised Light Microscopy, Fluorescence Microscopy, Comparison Microscope.

Unit – IV

Spectroscopic techniques: Introduction: Properties of light, Interaction of Matter and light, Electro-magnetic radiation & it's application in forensic science UV/Visible Spectrophotometry and it's application in Forensic Science, Molecular Fluorescence, Infrared (IR) Spectroscopy, & it's Application in Forensic Science, Raman Spectroscopy, Mass Spectrometry, Atomic Absorption Spectroscopy and it's applications in Forensic Science.

Separation methods - Thin Layer Chromatography, Gas Chromatography for qualitative and quantitative analysis. Application of Gas Chromatography.

Suggested Readings

1. Houck, M.M. & Siegel, JA; Fundamentals of Forensic Science, Acadamic Press, London, 2006.
2. Sharma, B.R., Forensic Science in Criminal Investigation & Trials,Universal Publishing Co., New Delhi, 2003
3. Nanda B.B and Tewari, R.k. Forensic Science in India- A vision for the Twenty First Century, Select publisher, N. Delhi, 2001.
4. James, SH and Nordby, J.J., Forensic Science- An Introduction to Scientific and investigative Techniques, CRC Press, USA (2003)
5. Saferstein; Criminalistics- An Introduction of Forensic Science, Prentice Hall Inc, USA,2007.
6. Bennett, W.W. & Karen, M.Hass, Criminal Investigative, 6th Ed. Worsworth Thompson Learning,2001.
7. Barry, A.J. Fisher; Techniques of Crime Scene Investigation, 7th Ed, CRC Press, NY, 2003.
8. Mordby J. Deed Reckoning; The Art of Forensic Detection, CRC Press NY, 2003.
9. Swansan, CR, Terrbles, L& Taylor,R.W.;. Police Administration, Prentice Hall, USA, 1998.

10. Seigel, JA , Sukoo, R.J, & Knupfer, G.L. Encyclopedia of Forensic Science, Vol I,II and III, Academic Press, 2000
11. Bannet, Waynew; Criminal Investigation, Wadsworth Publishing Co.; California, 2000.
12. Gross; Dr. Hans; Criminal Investigation- A Practical Textbook for Magistrates, Police Officers, and Lawyers; Universal Law Pub. Co., 2000
13. Lyman, M.D; Criminal Investigation – The art & the Science, Prentice Hall, 2002.
14. O'Hara CE and Osterburg, JW; An Introduction to Criminalistics., Indiana Univ. Press,London, 1972.
15. Swansson,CR, Chamelin, NC, & Territ, L., Criminal Investigator, McGrawhill, NY,2000.
16. Gibon, L; Forensic Art Essentials,AP,2008
17. Girard, Criminalistics- Forensic Science & Crime, Jones & Bartlett Publishers, London 2008.
18. Becker; Criminal Investigation, ASPEN Publishing, Inc. Maryland,2000.

Semester-I, Paper II
M.Sc. Forensic Science
FS-102 Pattern Evidence
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Introduction: Biometrics and Forensic Science- face, Iris & retinal imaging, speech recognition, Fingerprinting in India, What are friction ridges? Friction ridges pattern visualization techniques, Taking of finger prints from living & dead persons, preserving prints for analysis, principles of friction Ridge analysis, Classifying Fingerprints, Comparison of finger prints, Automated Fingerprint Identification System (AFIS), Identification, How long do friction ridge prints last, Elimination prints, Lip print, ear print.

Unit - II

Forensic Document Examination and its scope & importance; Classification of documents; Care, handling, preservation of documents; Observation tests and their application in handwriting examination; Preliminary examination of documents; examination of paper & inks, Process of comparison of handwriting; Principle of handwriting examination; Importance of natural variations and disguise in hand writing examination; Latest technological developments in the field of document examination with reference to office automation; Quality Assurance in document Examination; Document Expert in trial courts.

Fundamentals of computers, hardware & accessories, operating system, software. Cybercrimes-Definition, IT Laws-Introduction, internet, hacking, virus, obscenity, pornography, programme manipulation, software piracy, intellectual property & Computer Security: Encryption & Decryption methods. Digital frauds, search, seizure, acquisition of digital evidence, digits signatures, forensic analysis of digital frauds, cell phone forensics.

Unit - III

Firearms and tool marks: Firearms, Types of Firearms, Firearm Barrels, Anatomy of Ammunition, What happens when ammunition is discharged? Tool marks, various types of tool marks, cartridge cases and bullet comparison, Tool mark comparisons. Collection of firearms evidence, Safety and operations testing, Firearm Databases and Automated search system, Distance of firing Determination, shot pattern, Gunpowder Residues, Primer Residues, Serial Character Restoration.

Unit – IV

Impression Evidence: Types of Impression Evidence, Significance of Impression Evidence, Footwear Impressions (General Characteristic), Footwear Impressions at the Crime Scene, Casting three Dimensional Footwear impressions, Lifting imprints, Comparison of footwear impressions, Tire Impressions Evidence skid mark, Serial numbers restoration.

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, How digital camera work and basics of digital imaging videography, photomorphing, Crime Scene photography, Laboratory photography.

Brief about speaker identification & tape authentication techniques and their applications in forensic science.

Suggested Readings

1. Bridges,BC; Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting expert Testimony, Opinion Evidence., Univ. Book Agency, Allhabad,2000
2. Mehta, MK, ; Indentification of Thumb impression & cross examination of Fingerprints, N.M. Tripathi Pub. Bombay, 1980.
3. Chatterjee, S.K; Speculation in Fingerprint Identification, Jantralekha printing Works, Kolkata, 1981.
4. Cowger James F; Friction Ridge Skin- Comparison & Identification of Fingerprints, CRC Press, NY, 1993
5. Cossidy, M.j; Footwear Identification, Royal Canadian, Mounted Police, 1980.
6. Iannavelli, AV; Ear Identification, Forensic Identification Series, Paramount,1989.
7. Henry , CL & Ganesslen, RE; Advances in Fingerprint Technology, CRC Press, London,1991.
8. Hardless,H.R.,; Disputed Documents Examinations & Fingerprint Identification, Law Book Company, Allahabad,1995
9. Saferstein; Criminalistics- An Introduction of Forensic Science, Prentice Hall Inc, USA,2007.
10. O'Hara CE and Osterburg, JW; An Introduction to Criminalistics., Indiana Univ. Press, London, 1972.
11. Morris, R.N,; Forensic Handwriting Identification, Academic Press, London, 2001

12. Houck, M.M. & Siegel, JA; Fundamentals of Forensic Science, Academic Press, London, 2006.
13. Jauhri, M; Identification of Firearms, Ammunition & Firearm Injuries, BPR&D, New Delhi
14. Blitzer, H.L and Jacob, J; Forensic Digital Imaging and Photography, Academic Press, 2002
15. Henry,H; Color photography – A Working Manual, Little Brown Co. Boston,1995
16. Vacca John R; Computer Forensic, Firewall Media Pub. New Delhi, 2002
17. Phillip Rose; Forensic Speaker Identification, Taylor & Francis, Forensic Science Series, London,2002
18. Sharma, B.R., Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi, 2003
19. James, SH and Nordby, J.J., Forensic Science- An Introduction to Scientific and investigative Techniques, CRC Press, USA (2003)
20. Barry, A.J. Fisher; Techniques of Crime Scene Investigation, 7th Ed, CRC Press, NY, 2003.
21. Seigel, JA , Sukoo, R.J, & Knupfer, G.L. Encyclopaedia of Forensic Science, Vol. I,II and III, Academic Press, 2000
22. Swansson,CR, Chamelin, NC, & Territ, L., Criminal Investigator, McGrawhill, NY,2000.
23. Becker; Criminal Investigation, ASPEN Publishing, Inc. Maryland,2000.

Semester-I, Paper III
M.Sc. Forensic Science
FS-103 Chemical Evidence
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Drug of abuse, Introduction and classification why are drugs regulated, preliminary testing of drugs, confirmation of drugs, illicit drugs and clandestine laboratories. Laws related to drugs.

Forensic Toxicology:- Introduction and scope of forensic toxicology. Different types of poisons commonly encountered. Different routes of ingestion, toxicity of poisons. Fate of drug in body. Samples in fatal and non-fatal cases. Packing and preservations of viscera. Extraction and screening of common poisons and methods of analysis of poisons.

Forensic toxicology of Ethyl alcohol. Determination of alcohol in field by breath analyser.

Unit - II

Textile Fibers, Yarns, Fabric construction, Fabric characteristics, Fabric manufacture, Microscopy characteristic, Birefringence, Fluorescence Microscopy, Colors in textile, Color Assessment, Chemical properties, Paint: Introduction, Composition of paint, Paint Analysis, Paint Manufacturing, Collection, preliminary analysis of paints samples, Interpretations.

Soil and Glass:- Introduction-What is Soil, Collection of Soil Evidence, Analysis of Soils, Case Studies related to Soil. What is Glass? Glass manufacture, Forensic examination of Glass, the effects of projectiles on Glass, lamp analysis, Case studies related to Glass.

Unit - III

Fires and Explosions: Introduction- Fires, recognition and collection of fire scene evidence, preliminary analysis of fire scene residue evidence. Case studies related to Arson.

Unit – IV

Explosive and Explosion: Introduction, types of explosives, high and low order explosions, explosive trains, collection and preservation of exhibits, preliminary analysis of explosives. Case studies related to explosives.

Suggested Readings

1. Houck, M.M. & Siegel, JA; Fundamentals of Forensic Science, Acadamic Press, London, 2006.
2. Sharma, B.R., Forensic Science in Criminal Investigation & Trials,Universal Publishing Co., New Delhi, 2003
3. Cowger James F; Friction Ridge Skin- Comparison & Identification of Fingerprints, CRC Press, NY, 1993
4. Cossidy, M.j; Footwear Identification, Royal Canadian, Mounted Police, 1980.
5. Barry, A.J. Fisher; Techniques of Crime Scene Investigation, 7th Ed, CRC Press, NY, 2003.
6. Seigel, JA , Sukoo, R.J, & Knupfer, G.L. Encyclopaedia of Forensic Science, Vol I,II and III, Academic Press, 2000
7. O'Hara CE and Osterburg, JW; An Introduction to Criminalistics., Indiana Univ. Press,London, 1972.
8. Swansson,CR, Chamelin, NC, & Territ, L., Criminal Investigator, McGrawhill, NY,2000.
9. Becker; Criminal Investigation, ASPEN Publishing, Inc. Maryland,2000.
10. Working Procedure Manual- Chemistry, Explosives and Narcotics, BPR&D,2000
11. Feigl; Spot test in Organic Analysis, Elsevier Pub. New Delhi,2005
12. Feigl; Spot test in Inorganic Analysis, Elsevier Pub. New Delhi,2005
13. Dettean,J.D; Kirk's Fire Investigation, 5th Edn, Prentice Hall, NJ, 2002
14. Niesink, RJM; Toxicology- Principles and Applications, CRC Press,1996
15. Modi, JP, Textbook of Medical Jurisprudence & Toxicology, N.M. Tripathi Pub,2001
16. Chadha, PV; Handbook of Forensic Medicine & Toxicology, Jaypee Brothers, New Delhi,2004
17. Parikh, C.K; Text Book of Medical Jurisprudence, Forensic Medicine & Toxicology, CBS Pub. New Delhi,1999
18. Working Procedure Manual- Physics, BPR&D Pub. 2000
19. Dorothy, C and John Grayson; Identification of Vegetable Fibers, Chapman and Hall,1982
20. Katharine Paddock Hess; Textile Fibers and their Use, 6th Edn, Oxford and IBH Pub. Co, 1974
21. Saferstein, R; Forensic Science Handbook, Vol. I and II, Prentice Hall, NJ, 1988
22. Nickolls, LC; Scientific Investigation of Crime ,Bulterwest, London,1956
23. Walls, HJ; Forensic Science- An Introduction to Scientific Crime Detection, 2nd Edn, Universal, 1st Indian Reprint,2002

Semester-I, Paper IV
M.Sc. Forensic Science
FS-104 Biological Evidence
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Pathology: Introduction: Cause and manner of death, medico legal examination, Postmortem examination (AUTOPSY) : the external, or visual, examination, other evidence collected, determining time since death, Laboratory Analysis, consultations.

Unit - II

Anthropology and Odontology, Introduction: The human skeleton, Collecting Human remains, analysis of skeleton materials, facial reproductions, Interpretations, case studies.

Unit - III

Entomology, Introduction: Insects and their Biology, Life cycles of insects, collecting insects at a crime scene, the postmortem interval, the classification of insects, rearing insects, calculating A PMI, other forensic uses for insects, case studies.

Unit – IV

Serology and Bloodstain, pattern analysis, Introduction: Collection Body Fluids, the major body fluids, presumptive tests or blood, confirmatory tests or blood, species origin, semen, presumptive tests for semen, confirmatory tests for semen, saliva, urine, bloodstain pattern analysis, determining point of origin, documenting bloodstains at the scene, case studies.

DNA Analysis, Introduction, the nature of DNA, DNA typing, Mitochondrial DNA (mt DNA), Interpretation of DNA typing results, DNA database the FBI Codis system, codis success stories, case studies.

Forensic hair examinations , introduction: Growth of hairs, Microanatomy, human vs, non human hairs, body area determination, ancestral estimation, damage, disease and treatments, comparison of human hairs, DNA and hairs, case studies.

Suggested Readings

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. James, SH and Nordby, J.J., Forensic Science- An Introduction to Scientific and investigative Techniques, CRC Press, USA (2003)
4. Saferstein; Criminalistics- An Introduction of Forensic Science, Prentice Hall Inc, USA,2007.
5. Barry, A.J. Fisher; Techniques of Crime Scene Investigation, 7th Ed, CRC Press, NY, 2003.
6. Seigel, JA , Sukoo, R.J, & Knupfer, G.L. Encyclopaedia of Forensic Science, Vol I,II and III, Academic Press, 2000
7. O'Hara CE and Osterburg, JW; An Introduction to Criminalistics, Indiana Univ. Press,London, 1972.
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10. Modi, JP, Textbook of Medical Jurisprudence & Toxicology, N.M. Tripathi Pub,2001
11. Chadha, PV; Handbook of Forensic Medicine & Toxicology, Jaypee Brothers, New Delhi,2004
12. Parikh, C.K; Text Book of Medical Jurisprudence, Forensic Medicine & Toxicology, CBS Pub. New Delhi,1999
13. Eckett, WG & James, SH; Interpretation of Blood Stains Evidence of Crime Scene, Elsevier Pub. NY,1989
14. James SH,; Scientific and Legal Applications of Blood Stain Pattern Identification, CRC Press,1998
15. Smith, BC, Holland MM, Sweel, DL & Dizzino, A; DNA & Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA, 1995
16. Hillson, S; Dental Anthropology, Cambridge University Press, UK, 1996
17. William, PL and Warwich, R; Gray's Anatomy, Churchill Livingston, London, 1980
18. Biology Method Manual, Metropolitan Police Forensic Science Laboratory, London, 1978
19. Clifford, BJ; The Examination and Typing of Blood Stains in the Crime Laboratory, US Court Printing Press, 1971
20. Catts, EP & Haskell NH, Entomology and Death- A Procedural Guide, Joyce's Print shop, 1990
21. Smith, DGV; A Manual of Forensic Entomology, Ithaca NY Camstock Univ. Press, USA, 1986
22. Krawczak, M & Schmidtke, J; DNA Fingerprinting, Bios Scientific , Oxford, UK, 1994
23. Kirbylorne T; DNA Fingerprinting - An Introduction, WH Freeman & Co., NY, 1990
24. Working Procedure Manual – DNA, BPR&D Pub, 2000

Semester-I, Paper V
M.Sc. Forensic Science
FS-105 Practical : Simulated crime scene exercise & Laboratory analysis of pattern evidence
L-0,T-0,P-4,S-0 CREDITS-2

Simulated Crime Scene Exercise on:

1. Development of latent finger prints, lifting, preservation and comparison of finger prints.
2. Handling & marking of documents for examination.
3. Detection and decipherment of alterations in documents.
4. Lifting of footprints from different surfaces.
5. Determination of direction of impact on glass.
6. Comparison of soil samples by microscopic and density gradient measurements.
7. To identify whether firearms are country made or factory made.
8. Lifting of gun-shot residues on shooter's hand.
9. To open and draw the diagram of given cartridge & mark it's components for identification.
10. Identification of various components of firearm.

Laboratory Analysis of Pattern Evidence:

1 .General guidelines for lifting of crime scene exhibits.
2. Photography and sketching of crime scene.
3. Collection of evidence in case of rape and murder.
4. Collection of clues in hit & run accident case including marking of skid marks and examination of Head Lights.
5. Cases involving firearms

Semester-I, Paper VI
M.Sc. Forensic Science
FS-106 Practical: Laboratory Analysis of Chemical & Biological Evidence
L-0,T-0,P-4,S-0 CREDITS-2

1. Field test for narcotic drugs
2. TLC of drugs
3. TLC of pesticides
4. Test for ethanol and methanol
5. Preliminary test for explosives
6. Preliminary tests for:
    (a) identification of bloodstain
    (b) identification of seminal stain
    (c) identification of saliva stain.
7. Microscopic examination of semen.

Specialization – Forensic Ballistics

Semester-II, Paper VII
M.Sc. Forensic Science
FS-211 Physical Methods of Analysis
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Basic concepts-Atomic and molecular spectroscopy

What is 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.

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-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, quantitative analysis and interpretation of IR spectra, applications.

Raman spectroscopy: Theory, instrumentation and sample handling, 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 colorimetry and differential analysis, thermogravimetry.

Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and instrumentation, 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-212: Firearms, Ammunition and Evidentiary Clues
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

History and development of firearms, their classification and characteristics, various components of small arms, bore and caliber, relation between bore number of shoguns and internal cross sectional diameter of their barrels, choke-purpose, degrees and types, different automatic mechanisms used in small arms – blow back, retarded blow-back, short-recoil operated, long- recoil operated and gas operated mechanisms; rifling, various class characteristics of rifled bore, purpose of rifling, types of rifling, methods to produce rifling, trigger and firing mechanisms, trigger pull, accidental discharge of firearms, cartridge firing mechanism, Projectile-velocity determination, determination of velocity of shot-charge, techniques of dismantling / assembling of various types of firearms, identification of origin-various marks on firearms, improvised/ Country-made/ imitative firearms, and their constructional features, comparative merits of different bores of shotguns, silencers, Headspace and its importance.

Unit - II

Types of ammunition, classification and constructional features of different types of cartridges, types of primers and priming compositions.

Propellants and their compositions-black, smokeless and semi-smokeless powders, various additives in propellants like stabilisers, chemicals for reducing flash, non- hygroscopic agents, chemicals for conversion of propellants into progressive burning, etc, velocity and pressure characteristics under different conditions.

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

Various types of bullets and compositional aspects, Jacketed, non-jacketed bullets, round nose, sharp-pointed , boat-tailed, streamlined, soft point, hollow point and other expanding bullets, dum-dum, pencil-point, armour- piercing, tracer and incendiary bullets, latest trends in their manufacture, various types of wads loaded in shot-gun cartridges, shotgun ball ammunition. Identification of origin, head stamp markings on cartridges, improvised ammunition, safety aspects for handling of firearms and ammunition.

Unit - III

Manufacture of firearms, barrel steels, proving of guns, proof-marks. Various processes associated with manufacture of ammunition – both shotgun and all metal-drawing, cleaning, cutting, heading, washing etc. Physical, ballistic and functional test of ammunition- velocity, accuracy, pressure, water and ignition tests, calculation of figure of merit for various standard ammunitions, various defects in cartridge cases produced as a result of firing.

Unit – IV

Crimes committed by firearms, Various types of visible/invisible physical evidence available in crime involving firearms, Photography/ Videography/sketching of crime scene; location, documentation, collection, preservation and forwarding of physical evidence, 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.

Suggested Readings

1. Sharma, B.R.; Firearms in Criminal Investigation & Trials, Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edn,(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 Mannual, 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. Janes, T.J.G; Ammunition Handbook, Janes Information Group, Sentinal House, Surrey, U.K. (2004-05)
8. Burrard; The Identification of Firearms and Forensic Ballistics, Herbert Jenkins, London, (1956)
9. Gunther and Gunther; The Identification of Firearms, New York, (1935)
10. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, (1977)
11. Hayes, T.J; Elements of Ordnance, John Wiley & Sons, Inc, London,
12. Smith and Smith; Book of Rifles, Stackpole Books, Harrisburg, Pa,(1972)

13. Smith and Smith; Book of Pistals and Revolvers, Stackpole Books, Harrisburg, Pa,(1968)
14. Nelson; The World's Submachine Guns, Vol I, Arms & Ammunition Press, London,(1977)
15. Greener; Gun and its Development, Arms & Ammunition Press, London,(1910)
16. Ezell; Smallarm Today.,Stackpole Books, Harrisburg, Pa,(1988)
17. Nonte, Jr, Firearms Encyclopedia, Wolfe Publishing Limited, London, (1973)
18. Muller and Olson; Smallarms Lexicon & Encyclopedia, Shooter's Bible Inc. NJ, (1968)
19. Whelen; Smallarms Design and Ballistics, Vol II, Smallarms Technical Publishing Comopany, USA, (1946).

Semester-II, Paper IX
M.Sc. Forensic Science
FS-213 Internal Intermediate and External Ballistics
L-4,T-1,P-0,S-0 CREDITS-5

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 12-bore guns.

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 processional 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 Ballistics tables, Automated system of trajectory computation. Falling bullets- limiting velocity, drop, use of lead as bullet material.

Unit – IV

High speed photography- various techniques, micro-flash photography, sparks source, photography, flash radiography, Doppler effect.

Suggested Readings

1. Carlucci DE and Jacobson, SS; Ballistics, CRC Press, London, (2008)
2. Sharma, B.R.; Firearms in Criminal Investigation & Trials, Universal

Law Publishing Co Pvt Ltd, New Delhi, 4th Edn,(2011).
3. Heard, B.J; Handbook of Firearms and Ballistics, John Wiley, England, (1997)
4. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, (1977)
5. Hayes, T.J; Elements of Ordnance, John Wiley & Sons, Inc, London,
6. Robinson, C.S, The Thermodynamics of Firearms, Mc Graw Hill Book Company, Inc; NY , (1943)
7. Whelen; Smallarms Design and Ballistics, Vol II, Smallarms Technical Publishing Comopany, USA, (1946).

Semester-II, Paper X
M.Sc. Forensic Science
FS-214 Identification of Firearms and Range of Firing
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Tool -marks: Types of tools marks, compression marks, striated marks, combination of compression and striated marks, repetitive marks, class characteristics, individual and pertinent characteristics.

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 fired ammunition, photomicrography, non-submission of photomicrographs along with 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, 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, back scatter effect, 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, restorations 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.

Gun-handling tests-Introduction, Ferrozine test.

Ballistics Data Measurement System.

Suggested Readings

1. Sharma, B.R.; Firearms in Criminal Investigation & Trials, Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edn,(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 Encyclopedia, Wolfe Publishing Limited, London, (1973)
13. Davis, J.E, An Introduction to Toolmarks, Firearms & the Striagraph, Charles C. Thomas, USA, (1958)
14. Hueske, Practical Analysis and Reconstruction of Shooting Incidence, CRC Press, NY,(2006)
15. Saferstein, Criminalistics, Prantice Hall, NJ, (1995)

Semester-II, Paper XI
M.Sc. Forensic Science
FS – 215 Practical: Firearms and Ammunition
L-0,T-0,P-4,S-0 CREDITS-2

1. To separate different components of shotgun cartridges, identify them and record their different measurements.

2. To separate different components of all-metal cartridges, identify them and record their different measurements.

3. To dismantle and assemble various components of firearms.

4. To study the characteristics of firearms-caliber, choke, proof marks etc., to prepare sulphur casts of bore.

5. To study the locks of various firearms, measurement of trigger pull, liability of accidental discharge of firearms.

6. To determine shot number from size and weight of shots

7. To determine/ measure rifling details on fired bullets, determination of make/model of suspected firearm firing the bullet.

8. Determination of velocity and energy of bullets.

9. Examination of air guns / rifles/ handguns as per Arms Act.

Semester-II, Paper XII
M.Sc. Forensic Science
FS – 216 Practical: Scene of Crime, Chemical Test and Tool Marks
L-0,T-0,P-4,S-0 CREDITS-2

1. Photography and sketching of crime scene involving firearms

2. Collection, packing and forwarding of physical clues related to crème involving fire arms.

3. Restoration of erased serial number on firearms

4. Chemical tests of propellants

5. To perform chemical tests for powder residues. (Walker's test) around gun-shot holes in fabrics.

6. To perform chemical tests for powder residues around gun-shot holes in hard targets.

7. To perform spot test around holes suspected to have been caused by passage of jacketted /non-jacketted projectiles.

8. To perform chemical tests of firearms for detection of firearm discharge residues – to find out whether a given firearm has been fired or not.

9. Comparison of compression/ striated tool marks - to prepare cast/sample for study of compression and striated tool-marks.

10. Opening of parcels received in Lab, precaution to be taken and making of records of the exhibits received.

11. To determine whether given ammunition/ components of ammunition are fired or not.

Semester-III, Paper XIII
M.Sc. Forensic Science
FS-311 Chemical Methods of Analysis
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Microscopy: Basic principles, simple and compound microscope, comparison microscope, phase- contrast microscope, stereoscopic microscope, polarizing microscope, fluorescent microscopy, infrared microscopy, scanning electron microscope (SEM) & transmission electron microscope.

Electrochemical Techniques: principles, electron transport processes, ion-selective electrodes (ISE) and gas sensors, oxidation –reduction (Redox) potentials, bio-sensors, anodic stripping voltammetry, applications in analysis of firearm discharge residue.

Radiochemical Techniques: Basic principles and theory, introduction about nuclear reactions, neutron sources, neutron activation analysis (NAA), Applications in Forensic Ballistics.

Unit - II

Chromatographic Techniques: General principles, paper chromatography, column chromatography, TLC, adsorption chromatography, partition chromatography, gas chromatography, gas-liquid chromatography, ion-exchange chromatography, exclusion chromatography, affinity chromatography, HPLC, HPTLC, capillary chromatography, Interfacing GC with IR spectrometry. Applications in analysis of firearm discharge residues.

Unit - III

Mass Spectrometry: Sample flow, ionization methods, mass analyzer, vacuum systems, data handling, correlation of mass spectra and molecular structures, Fourier transform mass spectrometry, tandem mass spectrometry, inductively coupled plasma MS(ICP-MS), ion microprobe mass analyser (IMMA), HR GCMS, LCMS, secondary mass spectrometry, laser mass spectrometry, fast atom bombardment and liquid secondary ion mass spectrometry, high performance liquid chromatography, electrospray ionization mass spectrometry. Applications in analysis of firearm discharge residues.

Unit – IV

Computer-Aided Analysis: Introduction, Computer organization, hardware, circuits for interfacing computers to instruments, computer organisation, software, Data representation, the automated laboratory.

Measurements, Signals and Data: Introduction, signal-to-noise ratio, sensitivity and detection limit, sources of noise, signal-to-noise enhancement, evaluation and measurement, accuracy and instrument calibration

Suggested Readings

1. Lindsay S; High Perfomance Liquid Chromatograpy, Wiley & Sons Ny(1992)
2. Handbook of TLC, 2nd Ed, Marcel Dekker; NY(1995)
3. Jarris, KE, A.L. Gray etal, Handbook of Inductively Coupled Plasma Mass Spectrometry, Glasgow Blockie, (1992)
4. Maclaffrty .F.W. & F. Turecek; Interpretation of Mass spectra, 4th Ed., Mill Valley, CA Univ Science Books, (1993)
5. Chapmen JR; Practical Organic Mass Spectrometry- A Guide for Chemical and Biochemical Analysis, Wiley & sons, NY(1993)
6. H.H Willard etal; Instrumental Methods of Analysis CBS Pub. and Distributors, Delhi (1986)

Semester-III, Paper XIV
M.Sc. Forensic Science
FS-312 Terminal Ballistics
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Anatomy of human body-overview of organ systems, cavities and planes, skeleton system, naming of all bones of axial and appendicular skeleton.

Terminal/Wound Ballistics: What does a human body die of after being hit? Possible causes of death. Effect of projectile on hitting the target, penetration of projectile in metals glass,human body, threshold velocity for penetration of skin, flesh and bone, threshold energy, casualty criteria, specific threshold velocity, energy density, penetration death of handgun bullets in gelatin, soap and muscle tissues. Gun-shot wounds as a function of bullet shape, striking velocity, striking angle, nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate target. Influence of range, –cavitation - temporary and permanent cavities. Tissues simulants .

Unit - II

Physics of shock waves, shock waves within the body, pressure waves in blood vessels. Analysis of gun –shot wound production, physical aspects , behaviors projectile over dense medium-both spherical and elongated, duration of pulsation of temporary cavity, pressure changes as a result of temporary cavity pulsations when the bullet passes through various organs of human body, factors affecting pressure changes, bone fractures in the vicinity of shooting channel.

Quantitative description of temporary cavity, instability of projectile in dense medium and its influence on temporary cavity, dependence of medium resistance upon impact velocity, dependence of length of narrow channel upon angle of incidence at the time of impact, dependence of length of narrow channel upon projectile data (projectile length, transverse moment of inertia, influence of sectional density on the shape of temporary cavity, behaviour of different projectile designs in a target medium, effect of heating of projectile when it moves in side the barrel and when it strikes the target, theoretical consideration – equations for penetration depth in gelatin and muscle tissues (handgun bullets), penetration capacity of handgun bullets in bones.

Unit - III

Preparation of gel block, penetration of projectiles in gel-block and other targets, methods of measurement of various wounds ballistics parameters, drag coefficient, diameters of temporary and permanent cavities and their volumes

as a result of energy lost in wound production, stopping power, relative stopping power, relative incapacitation index, power index rating, effectiveness of rubber projectiles, fluid jets and gas jets as projectiles.

Unit – IV

Nature of wounds of entry, exit and track with various ranges, velocities, various types of projectiles, and in different regions of human body, explosive wounds, Billiard Ball ricochet phenomena, evaluation of injuries caused by shotguns, rifles, handguns, self-inflicted wounds, postmortem and ante-mortem injuries.

Body armour- bullet proof materials, necessary tests.

Suggested Readings

1. Carlucci DE and Jacobson, SS; Ballistics, CRC Press, London, (2008)
2. Sharma, B.R.; Firearms in Criminal Investigation & Trials, Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edn,(2011).
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. Sellier, K.G. et al; Wound Ballistics and the Scientific Background, Elsevier Pub. Co., London, (1994)
7. Jauhari M; Identification of Firearms, Ammunition, & Firearms Injuries, BPR&D, New Delhi.
8. Ordog, G.J; Management of Gunshot wounds, Elsevier Pub. Co. , NY, (1983)
9. Schooeble, A.J. and Exline, L.D; Current methods in Forensic Gunshot Residue Analysis, CRC Press, NY,(2000)
10. Beyer, J.C. (Ed); Wound Ballistics, US. Printing Office, Washington, (1962)
11. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, (1977)
12. Di Maio, JM, Gunshot Wounds, CRC Press, NY,(1999)
13. Saferstein, Criminalistics, Prantice Hall, NJ, (1995)

Semester-III, Paper XV
M.Sc. Forensic Science
FS-313 Gunshot Residue and Reconstruction
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

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 in different types of firearms, specific areas of GSR deposition, collection of GSR-various methods, characterization of different matrices by instrumental techniques and use of appropriated matrix to collect GSR, GSR retention, analysis by AAS, NAA, SEM/EDXA, ICP-MS, ASV, Environmental contaminants in GSR considerations, interpretation of results, terminal velocity of GSR particles, time taken for GSR particles to remain air-borne, and its importance in crime investigation, collection of GSR from inanimate objects.

Unit - II

Blood Spatter : Blood stains and blood spatter at shooting scenes, classification of blood stains – low velocity, medium-velocity, high velocity impact blood spatter, blood characteristics-viscosity, surface tension, specific gravity, Drop formation and travel, shape of falling drop blood spatter associated with gun-shot injuries, blood on and in weapons, blood on hands of shooter, blood on objects at shooting scene, non-gunshot dynamics that resembles high-velocity impact spatter blood, angle of impact.

Unit - III

Types of glass and their composition-plate glass, safety plate glass, tempered glass, radial and circumferential cacks, forensic examination of glass fractures under different conditions, determination of direction of impact and sequence of shots; cone-fracture, rib marks, hackle marks, backward fragmentation.

Bullet ricochet and its effects, mathematical treatment, establishing critical angle, ricochet angle, deflection angle, establishing position of shooter.

Unit – IV

Reconstruction of sequence of events involved in a shooting case, theory and practice of shooting reconstruction, scientific method of shooting reconstruction, suicide, murder, accident, self-deface, encounter cases. All considerations during direct investigation of shooting incident or without the

benefit of original crime scene investigation- the scene of occurrence, photography of crime scene, sketching of crime scene, medico-legal report, basic ballistic facts, laboratory examination reports, firearms and ammunition, clothes of victim etc.

On scene evidence-evaluation and documentation, off –scene evaluation and investigation, limitations of shooting reconstruction, simple mathematics involved in shooting reconstruction.

Documentation & evaluation of bullet holes, ricochet marks, pellet patterns, estimation of angle of impact, bullet holes in tires and other plastic materials determination of bullet path-use of lasers, cartridge case ejection pattern.

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., reconciliation of bullet holes in clothes with underlying wounds, use of blood spatter in reconstruction.

Determination of number of participants/firearms involved, their location, position, orientation at the moment of firing, discussion of some important and complicated cases.

Suggested Readings

1. Sharma, B.R.; Firearms in Criminal Investigation & Trials, Universal Law Publishing Co Pvt Ltd, New Delhi, 4th Edn,(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. Schooeble, A.J. and Exline, L.D; Current methods in Forensic Gunshot Residue Analysis, CRC Press, NY,(2000)
7. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, (1977)
8. Hueske, Practical Analysis and Reconstruction of Shooting Incidence, CRC Press, NY,(2006)
9. Bevel and Gardner; Blood stain Pattern Analysis, CRC Press, (2008)
10. James, S.H. Bloodstain Pattern interpretation, CRC Press, NY, (1999)
11. Saferstein, Criminalistics, Prantice Hall, NJ, (1995)
12. Caddy, B; Forensic Examination of Glass and paint Analysis and Interpretation, 2001

Semester-III, Paper XVI
M.Sc. Forensic Science
FS-314 Application of statistics, report writing and Arms Act
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 Ballistics, Statistical evaluation of data regarding Forensic Ballistics 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

ARMS ACT, Arms Rules, prohibited and Non-prohibited firearms & ammunition – All Sections of Arms Act. Examination and reporting of cases under Arms Act. Various court ruling relevant to Forensic Ballistics.

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 – 315 Practical: Use of Instrumentation Techniques
L-0,T-0,P-4,S-0 CREDITS-2

1. TLC/ HPTLC of propellants loaded in shotgun, rifle and handgun cartridges.

2. IR spectra of propellants loaded in shotgun, rifle and handgun cartridges

3. FTIR analysis of propellant loaded in shotgun, rifle and handgun cartridges

4. Experiments on GC Analysis of propellants

5. Experiments on HPLC Analysis of propellants

6. FTIR analysis of propellants particles found inside the fired cartridge

7. case, barrel and on the target around gun-shot hole- comparison of results

8. Identification of shooter: gun-shot residue analysis by AAS

9. Identification of suspected gun-shot holes in garments, walls, furniture etc. by AAS

Semester-III, Paper XVIII
M.Sc. Forensic Science
FS – 316 Practical: Identification of Firearms , Reconstruction
L-0,T-0,P-4,S-0 CREDITS-2

1. Linkage of evidence cartridge cases with suspected firearms- examination under comparison Microscope

2. Linkage of evidence bullets with suspected firearms- examination under comparison Microscope.

3. Preparation of gel block and study of wound ballistic parameters for bullets fired from handguns and .22-rifle – determination of entry, exit and path of the bullet on fired gel block.

4. Measurement of spread of pellets fired from shot-guns and determination of range of firing

5. Given an evidence shotgun-pattern, suspected firearms and ammunition- to conduct test firings and estimate range of firing.

6. Given evidence pattern of tattooing, suspected firearms and ammunition recovered -to conduct test firings and estimate range of firing.

7. Plotting of gun-shot injuries on body diagrams

8. Reconstruction of sequence of events in shooting incidents.

9. To study glass fractures, determination of direction of firing and sequence of shots.

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

FS- 411 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- 412 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- 413 Dissertation
L-0, T-0, P-0, S-0, CREDITS-20

1. Range determination from spread of pellets fired from country made firearms.
2. To study the effect of range on spread of pellets fired from 12 Bore shot gun using ammunition loaded with power-piston.
3. To study the pattern of tattooing in case of firings from country-made firearms
4. To develop an appropriate method of GSR collection in Indian conditions.
5. Study of GSR using various instrumentation techniques.
6. Study of wound ballistics bullets fired from rifles and handguns.
7. Determination of number of rounds fired.
8. Reconstruction of sequence of events in crime involving firearms.
10. Collection of case laws related to Forensic Ballistics.
11. Linkage of suspected cartridge case, firearm with bullet hole.
12. Study of reasons of acquittals of firearm cases & remedies.
13. Study of mechanisms of country-made pistols manufactured in different parts of the country.
14. To study the effects of variations in bullet weight and propellant weight on interior ballistics of small arms.
15. Determination of position of firer.
16. To study the shot-gun ammunition manufactured by various private companies and their ballistics.
17. Study of IR/FTIR spectra of propellants.
18. Any other problem on Forensic Ballistics.

Specialization – Forensic Document Examination

Semester-II, Paper VII
M.Sc. Forensic Science
FS – 221 : Instrumentation
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Lenses, magnifiers, measuring instruments, Principle and working of Simple -Microscope, Stereo microscope, Zoom stereo microscope, Comparison microscope, light sources - UV , IR , transmitted, oblique light, spot light.

Unit - II

State–of-the-art-equipment :– working & features of Video Spectral Comparators,VSC-6000 & VSC model I , IV, 2000 , 2000/HR, 5000, Docucenter , Poliview.

Unit - III

Principle & working of TLC, HPLC , HPTLC, Electrophoresis , FTIR with ATR and Electrostatic Detection Apparatus.

Unit – IV

Principle & working of SEM-EXDA, Raman Spectrophotometer, GC-MS, Neutron Activation Analysis.

Suggested reading:

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. N.Subrahmanyam & Brij Lal; A text Book of Optics, S. Chand

& Co. (2004).

7. Gurdeep R. Chatwal & Sham K. Anand; Instrumental Methods of Chemical Analysis, Himalaya Pub. House (2004).
8. E.R.Mengel; Fluorescence in Forensic Science -Encyclopedia of Analytical Chemistry, G.R. Chatwal Wiley & sons (2000);
9. Analytical Spectroscopy 2nd Edn, Himalaya Pub. House (2002)
10. MJ Pelletier, Analytical Applications of Raman Spectroscopy, 1999-Blackwell Science Ltd., Oxford, London.
11. Zeev B Alfassi, Activation Analysis, 1990-CRC Press.
12. Working manual of VSC-5000

Semester-II, Paper VIII
M.Sc. Forensic Science
FS – 222 : Techniques of Analysis/Examination
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Luminescence , Fluorescence, Phosphorescence , types of paper and Inks, techniques used in the analysis of paper & inks- raw materials, ingredients, tagging materials etc. including NAA techniques.

Unit - II

Examination of mechanical impressions - examination of indentation marks, secret writings, examination of rubber stamp and seal impressions, embossed impressions.

Unit - III

Determination of sequence of intersecting strokes – all types, examination of creases and folds, determination of sequence of writings over creases & folds.

Unit – IV

Reconstruction and examination of torn documents, stabilization and examination of charred documents, case studies.

Suggested reading:

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. Hard less H.R; Disputed Documents. Handwriting and Thumb – Print Identification, profusely illustrated, Law Book, Allahabad (1988)
7. Morris Ron N; Forensic Handwriting Identification, Acad Press, London (2001)
8. Cornelis R Ronda, Luminescence: From Theory to Application, 2007

9. Zeev B Alfassi , Activation Analysis -1990-CRC Press
10. Jan Seaman Kelly & Brian S Lindblom-Scientific Examination of Questioned Documents-Taylor Francis Group London and New York
11. Ellen Davin; Questioned Documents – Scientific Examination, Taylor & Francis, Washington (1997)
12. Richard L Brunelle & Robert W Reed-Forensic Examination of Ink and Paper-Charles C Thomas Springfield, Illinois,USA.

Semester-II, Paper IX
M.Sc. Forensic Science
FS – 223 : Document Photography
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Basic principles and techniques of black & white and colour photography, cameras and lenses, filters, films, exposing, development and printing, different kinds of developers and fixtures, Reprovit unit, dark room.

Unit - II

Specialized photography - UV, IR, transmitted light and side light photography, close up photography, trick photography, contact photography.

Unit - III

Digital photography, software for digital photography, file formats for digital photographs – jpg, gif , bmp, tiff, mpeg etc. , digital watermarking and digital imaging, photogrammetry, radiography.

Unit – IV

Photomicrography, microphotography, photography using scientific equipment, juxtapose charts and demonstrative photographs, photographs as secondary evidence, case studies.

Suggested reading:

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. Henry Horeustein; Colour Photography -A working Manual, Little Brown Co.Boston (1995).
5. B.H.E. Jacobson, Ray GG Attridge; The Manual of Photography, Focal Press, London (1988).
6. Jahne B; Digital Image Processing, Heidelberg Springer(1996).
7. Workinson J; Art of Digital Video, Oxford Focal Press (1994).
8. Upton Kobre, Brill; Photography, Pearson Education, Inc (2006).
9. H.L. Blitzer and J.Jacobia; Forensic Digital Imaging and Photography, Academic Press (2002)
10. David R.Redsicker; The Practical Methodology of Forensic Photography-2nd Ed. CRC Press LLC (2001)
11. R.E. Jacobson, S.F.Ray, G.G.Attridge, The Manual of Photography-Photographic and Digital Imaging , N.R. Oxford.

Semester-II, Paper X
M.Sc. Forensic Science
FS – 224 : Document Examination - Overview
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Scope and application in crime investigation, various Indian laws with reference to IPC – 34, 120B, 302, 304, 304A, 306, 324, 409, 415, 416, 417, 418, 419, 420, 463,467,468, 470, 471, 489(A to E), Indian Evidence Act – Sec 3, 45, 47, 73 and 114.

Unit - II

Document consciousness, writing instruments, care, handling, preservation, packing and marking of documents - Dos and Don'ts, forwarding of documents.

Unit - III

Nature & problems of Forensic Document Examination – facilities available in Forensic Document Laboratories, limitations of document laboratory.

Unit – IV

Development of handwriting, classification of handwritings, different vernacular Indian languages & scripts, Classification of forensic documents.

Suggested reading:

1. The Indian Evidence Act (1872), Amendment Act (2002) Universal Law Pub. Co. (2003)
2. The Code of Criminal Procedure (1973) Amendment Act, (2001), Universal Law Pub. Co. (2002)
3. Rattan Lal & Dhiraj Lal; The Indian Penal Code, 28th Ed. Wadhwa & Co. Nagpur (2002)
4. Ordway Hilton; Scientific Examination of Questioned Documents. Revised Edition, Elsevier, NY (1982).
5. Albert S. Osborn; Questioned Documents, 2nd Ed., universal Law Pub., Delhi (1998).
6. Albert S Osborn; The Problem of Proof, 2nd Ed., Universal Law Pub. Delhi (1998)
7. Charles C. Thomas; I.S.Q.D. Identification System for Questioned Documents, Billy Prior Bates Springfield, Illinois, USA (1971)

8. Wilson R. Harrison; Suspect Documents Their Scientific Examination, Universal Law Pub. Delhi Indian Reprint (2001)
9. Hard less H.R; Disputed Documents. Handwriting and Thumb – Print Identification, profusely illustrated, Law Book, Allahabad (1988)
10. Morris Ron N; Forensic Handwriting Identification, Acad Press, London (2001)
11. Kurtz Sheila; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA (1983)
12. Lerinson Jay; Questioned Documents, Acad Press, London (2001)
13. Katherine M Kappenhaver, CDE-Forensic Document Examination-Humana Press.
14. Jan Seaman Kelly & Brian S Lindblom-Scientific Examination of Questioned Documents-Taylor Francis Group London and New York.

Semester-II, Paper XI
M.Sc. Forensic Science
FS – 225 Practical: Instrumentation & Techniques
L-0,T-0,P-4,S-0 CREDITS-2

1. Laboratory Equipments : - Working and handling of Stereo Zoom Microscopes , Comparison Microscope , Video Spectral Comparator, Electrostatic Detection Apparatus , UV – Vis , TLC.

2. Examination of Charred Documents.

3. Reconstruction of torn sheets of paper.

4. Examination of creases and folds and determination of sequence of strokes.

5. Examination of paper.

6. Examination of inks.

Semester-II, Paper XII
M.Sc. Forensic Science
FS – 226 Practical: Document Photography
L-0,T-0,P-4,S-0 CREDITS-2

1. Document photographic techniques – Close up photography , UV , IR, Transmitted and oblique light photography
   .
2. Contact and trick photography.

3. Preparation of Juxtapose charts.

4. Photography of Watermarks and wire marks.

5. Photography of secret writings.

Semester-III, Paper XIII
M.Sc. Forensic Science
FS – 321 : Principles of Handwriting Examination
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Various writing features– terminology and definitions , observation tests and their applications , general characteristics of handwriting and their estimation, individual characteristics of handwriting and their estimation.

Unit - II

Natural variations in handwriting , disguise in writing, principle of handwriting identification , comparison of like with like, process of comparison – suitability of standards for comparison.

Unit - III

Simon New Comb theory of probability, examination of vernacular scripts, effect of mother tongue on foreign language , effect of age, illness, posture, emotions and writing instrument on handwriting.

Unit – IV

Preliminary examination of documents- various points to be considered during examination, examination of alphabets and numerals, case studies.

Suggested reading:

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. Hard less H.R; Disputed Documents. Handwriting and Thumb – Print Identification, profusely illustrated, Law Book, Allahabad (1988)
7. Morris Ron N; Forensic Handwriting Identification, Acad Press, London (2001)

8. Kurtz Sheila; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA (1983)
9. Lerinson Jay; Questioned Documents, Acad Press, London (2001)
10. Mcmenamin Gerald R, Forensic Linguistics-Advances in Forensic Stylistics, CRC Press, Washington Dc
11. Ellen Davin; Questioned Documents – Scientific Examination, Taylor & Francis, Washington (1997)
12. Roy A Huber, AM Headrick, Handwriting Identification-Facts & Fundamental, CRC Press (1999)
13. Andrea Mc Nichol, Jeffrey A Nelson; Handwriting Analysis Putting it to work for you, Jaico Books, Delhi (1994)
14. Morris (2000); Forensic Handwriting Identification (fundamental concepts & Principals)
15. Mehta MK; The Identification of Handwriting &Cross examination of Expert-, NM Tripathi, Allahabad, 1970
16. Katherine M Kappenhaver, CDE-Forensic Document Examination-Humana Press.
17. Jan Seaman Kelly & Brian S Lindblom-Scientific Examination of Questioned Documents-Taylor Francis Group London and New York.
18. Malcom Coulthard & Alison Johnson-An Introduction to Forensic Linguistics- Taylor & Francis Group London and New York.

Semester-III, Paper XIV
M.Sc. Forensic Science
FS – 322 : Document Forgery and Alterations
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Corporate frauds, forensic accounting and auditing, forgeries & their detection, examination of signatures – characteristics of genuine & forged signatures examination of built-up documents, identification of writer of forged writings/signatures. Importance of tremor in identification of writings and signatures, difference between tremors of fraud and genuine tremors in writings and signatures.

Unit - II

Examination of anonymous letters and identification of the writer of anonymous letter, linguistics, stylistics, application of Forensic Stylistics in the identification of writer, application of forensic stylistics in different vernacular languages.

Unit - III

Anachronistic features and their importance, detection and decipherment of alterations and erasures including additions , over writings , obliterations , examination of carbon copies and carbonless copies.

Unit – IV

Use of computers in document examination, automated Signature verification system, determination of age of documents- relative and absolute age of documents, case studies.

Suggested reading:

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. Hard less H.R; Disputed Documents. Handwriting and Thumb – Print Identification, profusely illustrated, Law Book, Allahabad (1988)
7. Morris Ron N; Forensic Handwriting Identification, Acad Press, London (2001)
8. Kurtz Sheila; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA (1983)
9. Lerinson Jay; Questioned Documents, Acad Press, London (2001) Vacca John R; Computer Forensics- Computer crime scene Investigation, Firewall Medial, An imprint of Laxmi Pub(2002)
10. Casey Eoghan; Handbook of computer crime Investigation, Forensic Tools & Technology- Academic Press (2002)
11. Ellen Davin; Questioned Documents – Scientific Examination, Taylor & Francis, Washington (1997)
12. Roy A Huber, AM Headrick, Handwriting Identification-Facts & Fundamental, CRC Press (1999)
13. Andrea Mc Nichol, Jeffrey A Nelson; Handwriting Analysis Putting it to work for you, Jaico Books, Delhi (1994)
14. Morris (2000); Forensic Handwriting Identification (fundamental concepts & Principals)
15. Madinger J & Zalopany AR; (1999) -Money Laundering- CRC Press
16. Manning CA;(1999) -Financial Investigation & Forensic Accounting- CRC Press.
17. Brewster F.; Contested Documents and Forgeries," The Eastern Law House, Kolkata.
18. Quirke AJ; Forged Anonymous & Suspect Documents- 1930, Reorge Rontledge & Sons Ltd, London.
19. Katherine M Kappenhaver, CDE-Forensic Document Examination-Humana Press.
20. Jan Seaman Kelly & Brian S Lindblom-Scientific Examination of Questioned Documents-Taylor Francis Group London and New York.

Semester-III, Paper XV
M.Sc. Forensic Science
FS – 323 : Mechanical Impressions & Security Documents
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Examination of type writings & their identification, working and examination of manual , electric and electronic typewriters, cheque writers, identification of typist of manual typewriters.

Unit - II

Working & identification of Dot matrix, Inkjet and Laser jet printers, Thermal printers, identification of printed matter, examination of Letter press, Lithographic and Gravure processes of printing - working and their identification.

Unit - III

Examination of security documents including currency notes, travel documents - passports, visas, air - tickets, identity cards , lottery tickets, different types of security features and their examination including watermarks, security fibre/threads /Ghost/imitated marks/ security printing, holograms etc ,

Unit – IV

Examination of credit, debit and other plastic cards, examination of photocopies, scanned documents, Fax copies etc., case studies.

Suggested reading:

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. Hard less H.R; Disputed Documents. Handwriting and Thumb – Print Identification, profusely illustrated, Law Book, Allahabad (1988)
7. Morris Ron N; Forensic Handwriting Identification, Acad Press, London (2001)

8. Kurtz Sheila; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA (1983)
9. Lerinson Jay; Questioned Documents, Acad Press, London (2001)
10. McMenamin Gerald R, Forensic Linguistics-Advances in Forensic Stylistics, CRC Press, Washington DC
11. Ellen Davin; Questioned Documents – Scientific Examination, Taylor & Francis, Washington (1997)
12. Roy A Huber, AM Headrick, Handwriting Identification-Facts & Fundamental, CRC Press (1999)
13. Andrea Mc Nichol, Jeffrey A Nelson; Handwriting Analysis Putting it to work for you, Jaico Books, Delhi (1994)
14. Morris (2000); Forensic Handwriting Identification (fundamental concepts & Principals)
15. Mehta MK; The Identification of Handwriting &Cross examination of Expert-, NM Tripathi, Allahabad, 1970
16. Katherine M Kappenhaver, CDE-Forensic Document Examination-Humana Press.
17. Jan Seaman Kelly & Brian S Lindblom-Scientific Examination of Questioned Documents-Taylor Francis Group London and New York.
18. Manahar Lotia-All about Modern Printers: Introduction-BPB Publication, New Delhi.
19. Jeff Tyson : How Inkjet Printers Work
20. John Oldshue: The Credit Card Guidebook
21. Rudolf L Van Renesse : Optical Document Security , Artech House Inc., Norwood.

Semester-III, Paper XVI
M.Sc. Forensic Science
FS – 324 : Advances in Document Examination & Quality Assurance
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Advances in Forensic Document Examination , introduction to computer forensics, e-document, digital signature, recovery of deleted files & folders from storage media and their examination.

Unit - II

Quality management in Document Laboratories, safety management in document laboratories, NABL guidelines for accreditation of document laboratories.

Unit - III

Final examination and report writing - opinion writing and writing of reasons for opinion , importance of no opinion / qualified opinion, marking of photographs and their presentation , preparation of juxtapose charts in support of reasons, case studies.

Unit – IV

Debonair of expert and preparation for presentation of evidence in trial courts, examination-in-chief, cross examination by defence and cross examination by expert, limitations of forensic document expert, moot Courts. Daubert guidelines and various court rulings.

Suggested reading:

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. The Indian Evidence Act (1872), Amendment Act (2002),Universal Law Pub. Co. (2003).

7. The Code of Criminal Procedure (1973) Amendment Act,(2001), Universal Law Pub. Co. (2002).
8. Mehta MK; The Identification of Handwriting &Cross examination of Expert-, NM Tripathi, Allahabad, 1970.
9. Jan Seaman Kelly & Brian S Lindblom; Scientific Examination of Questioned Documents-Taylor Francis Group London and New York.
10. Harlan Carvey; Windows Forensic Analysis DVD Toolkit, Second Edition**.**
11. Robert C Newman ; Computer Forensics: Evidence Collection& Management, Georgia Southern University Statesboro, USA.
12. Justice B K Somashekhara; The Principles& Procedures of the Art of Cross Examination , Aiyar & Aiyars.
13. R L Brunelle and K R Crawford; Advances in the Forensic Analysis and dating of writing Ink
14. Ellen Davin; Questioned Documents – Scientific Examination, Taylor & Francis, Washington 3rd Edition

Semester-III, Paper XVII
M.Sc. Forensic Science
FS – 325 Practical: Handwritings and Mechanical Impressions
L-0,T-0,P-4,S-0 CREDITS-2

1. Identification of normal / disguised writings.
2. Detection of Forgeries including freehand and traced forgery.
3. Detection of simulated forgery.
4. Detection of built-up documents.
5. Examination of anonymous letters
6. Application of Forensic Stylistics in personal identification.
7. Effect of writing instruments, posture and emotions on handwriting.
8. Examination of alterations, additions, obliterations, overwritings and erasures.
9. Examination of rubber stamp impressions and other mechanical impressions.
10. Examination of typescripts and printed matters..

Semester-III, Paper XVIII
M.Sc. Forensic Science
Physical Sciences
(Questioned Documents)
FS – 326 Practical: Examination of Electronically Printed Documents and Counterfeits
L-0,T-0,P-4,S-0 CREDITS-2

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

FS- 421 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- 422 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- 423 Dissertation
L-0, T-0, P-0, S-0, CREDITS-20

Basic light sources-use of scientific equipments and their handling; Examination of paper, examination of inks, Detection and decipherment of alterations including additions, overwriting, obliterations and mechanical/chemical erasures, Detection and decipherment of secret writings/indentations, charred documents & torn documents, Examination of Disguised/distorted writings/signatures, Identification of writing and signatures, Detection of forgery and fixing the authorship of forged writings/ signatures. Examination of anonymous letters, Application of forensic stylistics & linguistics in personal identification, Identification of type writings (Standard/electric/electronic typewriters), Identification of computer printouts and printers, Examination of photo copies (Black & White, colour), scanned documents and FAX messages, Identification of mechanical impressions (rubber stamp/seal impressions), Identification of printed matter, determination of age of documents, Forgery in credit cards and their examination, Examination of security documents including currency notes, passports and other travel documents, Computer forensics-recovery of deleted files/folders from storage media, e-mail tracking and documentation, Recent advances in forensic document examination. Opinion writing-reasons for opinion, Expert evidence in trial courts, Moot court & XX-examination.

Suggested reading:

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. The Indian Evidence Act (1872), Amendment Act (2002), Universal Law Pub. Co. (2003).

4. Mehta MK; The Identification of Handwriting &Cross examination of Expert-, NM Tripathi, Allahabad, 1970.
5. Jan Seaman Kelly & Brian S Lindblom; Scientific Examination of Questioned Documents-Taylor Francis Group London and New York.
6. Harlan Carvey; Windows Forensic Analysis DVD Toolkit, Second Edition**.**
7. Manahar Lotia-All about Modern Printers: Introduction-BPB Publication, New Delhi.
8. Robert C Newman ; Computer Forensics: Evidence Collection& Management, Georgia Southern University Statesboro, USA.
9. R L Brunelle and K R Crawford; Advances in the Forensic Analysis and dating of writing Ink
10. Ellen Davin; Questioned Documents – Scientific Examination, Taylor & Francis, Washington 3rd Edition
11. Albert S Osborn; The Problem of Proof, 2nd Ed., Universal Law Pub. Delhi (1998)
12. Justice B K Somashekhara; The Principles& Procedures of the Art of Cross Examination , Aiyar & Aiyars.

Specialization – Forensic Chemistry and Toxicology

Semester-II, PaperVII
M.Sc. Forensic Science
FS – 231 : Forensic Chemistry – I
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

- Analysis of alcohols, alcoholic and non-alcoholic beverages.
- Analysis of country made liquor, illicit liquor and medicinal preparations
- Analysis of various denaturants of alcohol
- Analysis as per BIS specifications, detection and determination of Ethanol, methanol, furfural acetate aldehyde, ester by colour test and instrumental technique,
- Relevant sections of Excise Act.

Unit - II

Petroleum products and their adulterations: Analysis of petrol, kerosene, diesel, lubricants, grease and other fractions by BIS methods and ASTM methods. Detection of adulterants of gasoline, diesel and engine oils.

Analysis of residues in forensic exhibits, Analysis of recycled engine oils, Analysis of dyes of petrol and kerosene, engine oils, Gas chromatography analysis of petrol, kerosene, diesel and other solvents for detection of adulteration.

Essential Commodity Act relevant to petroleum product. Petroleum Act 1919.

Marketing Disciplinary Guidelines 2005 for method of taking samples of petrol diesel. Packing and forwarding of samples to laboratories for examination, procedure for re-examination. Mobile Field Units for testing at the site.

Unit - III

Analysis of trap case:- Mechanism of colour reaction, factor affecting the colour, detection of phenolphthalein and alkali used, method of detection of degraded product on conversion of pink colour to colourless solution by TLC and UV visible spectrophotometer. Photo and videography and voice recording as supporting evidence.

Dyes: Different type of dyes, role of dyes in crime investigation, food colours (edible and non-edible dyes), dyes used in cosmetic and pharmaceutical. Chemical analysis and instrumental methods of analysis of dyes.

Unit – IV

Fertilizers: Introduction to fertilizer, different type of fertilizers and classification, substandard and sub-standard adulterated fertilizers, common adulterants. Chemical and instrumental methods of analysis of fertilizers.

Pesticides: Different types of pesticide, formulation, identification of pesticide, standard or sub-standard or substituted pesticides. Determination of purity by analysis by chemical test, thin layer chromatography, ultra visible spectro-photometry and gas liquid chromatography.

Determination of level of pesticide in water, cold drinks, milk, food materials.

Miscellaneous chemical and Industrial solvent.

Suggested Reading:

1. Finar I. L; Organic Chemistry :Vol. I Fundamental Principle, Pearson Education (Singapore)
2. Pearson D:Chemical Analysis of Food, Chemical Publ. Co. New York (1971)
3. Morrison R.T and Boyd R. N.: Organic Chemistry 6th Ed 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
6. Tewari , S.N : Liquor and Narcotic Drugs
7. Bureau of Indian Standard Specifications related to Alcohols and Petroleum Products.
8. Welcher Frank ; Standard Methods of Chemical Analysis, 6th Edn.Van Nostrand Reinhold(1969)
9. Watson C. A : Official and Standardised Methods of Analysis, Royal Society of Chemistry, UK (1994)
10. Central Excise Act ; Universal Law Publ.
11. Essential Commodity Act 1955
12. Feigl, F;:Spot Test in Inorganic Analysis , Elsevier Publ. New Delhi (2005)
13. Feigl, F ; Spot Test in Organic Analysis , Elsevier Publ .New Delhi (2005)
14. O Hara CE; Fundamentals of Criminal Investigation , 6th Edn. Charles C Thomas (1994)

15. Tuli Satya Prakash etal ; Advance Inorganic Chemistry, S. Chand Co.(2006)
16. Stahl Egon ; Thin Layer Chromatography, George Allen & Univ.(1969).
17. Sharma J. and Fried B : Hand Book of Thin Layer Chromatography, Chromatography Series Vol. 71 Pub. Marcel Becker Inc
18. Clive Tomlin : The Pesticide Manual, Crop Protection publi.(1995)
19. Clive Tomlin : The Pesticide Manual, Crop Protection publi.(1995)
20. Slack A V ; Chemistry and Technology of Fertilizers , Inter Science Publ. (1996)
21. Laboratory Procedure Manual Forensic Toxicology, Directorate of Forensic Science, MHA, Govt. of India (2005)

Semester-II, Paper VIII
M.Sc. Forensic Science
FS – 232 : Forensic Toxicology
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Forensic Toxicological examination and its significance.

Branches of Toxicology: Introduction & Scope, Classification of poisons, based on their origin, mode of action, chemical nature, poisons and poisoning in India, Classification of poisoning: accidental, homicidal, suicidal and miscellaneous, sign and symptoms of poisons and antidotes. Factors affecting the intensity of poisoning. Importance of post-mortem examination in poisoning cases, management and medico legal aspect of poisoning cases.

Information to be collected by Investigating Officers and precautions to be adopted while searching crime scene and collecting evidence material in poisoning cases.

Laws related to Poisons. Poison Act 1919, Drugs Act 1940 and 1955, Drug and Cosmetic Act 1940 and amendments.

Unit - II

Classification of matrices- Biological, non-biological and Viscera

Different methods of extraction for volatile poisons of organic and inorganic nature: Solvent extraction, distillation /steam distillation, micro diffusion, dialysis, dry ashing, wet digestion, modified star-otto method, ammonium sulphate method.

Isolation and clean up procedure, separation of poisons and drugs using chromatographic and electro phoresis techniques identification of and estimation of poisons and drugs using chromatographic and spectrophotometric and other instrumental methods, significance of analytical studies with forensic examination.

Unit - III

Analysis of Gases and volatile poisons: Analysis of volatile poisons, alcohols, aldehydes, ketones, hydrocyanic acid, chlorinated hydrocarbon, benzene nitro benzene, turpentine in Biological fluids.

Analysis of gaseous poisons carbon dioxide, carbon monoxide, ammonia phosphine, sulfur dioxide, hydrogen sulphide, chlorine in Biological fluids.

Analysis of toxic metals: Arsenic, antimony, mercury, bismuth, lead, thallium, zinc, copper, aluminum, barium, chromium, nickel etc. by dry ashing method and wet digestion method.

Analysis of non metallic (Anions): halides, nitrate, nitrite, sulphite and sulphates, sulphide, phosphates.

Analysis of pesticides : Organo chlorinated, organo phosphoro, carbamates and pyrethroids, aluminum phosphide and zinc phosphide

Unit – IV

Method of analysis of acidic/ neutral drugs and poison in viscera: salicylic acid, benzoic acid, cannabinoids aspirin, meprobamate, barbiturates and methaqulone etc.

Method of analysis of basic drugs and poisons from viscera: opium and its alkcoloids, atropine, strychnine, brucine, cocaine amphetamines, benzodiazepines, LSD, ketamine etc.

Mechanical poisons-glass, diamond and hair.

Extraction of poisons from blood, urine, stomach wash and vomit, cold drink, food material, toxicological analysis of decomposed materials.

Interpretation of toxicological finding and preparation of reports, limitation of method and trouble shooting in toxicological analysis, disposal of analysis samples, some interesting and their importance in view of specific approach in examination

Suggested Readings

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.I and Vol.2, Academic Press (1986)
4. Niesink R J M : Toxicology - Principle and Application, CRC Press (1996)
5. Sunshine I : Handbook of Analytical Toxicpology, 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 etal : Handbook of toxicology CRC Press Publ, USA (1995)
10. Casarett, L J and Doul John ; Toxicology :The Basic Science of Poison, Macmillan Publ. Co. New York (1975)
11. Carvey R.H& Baselt R C ;Introduction to Forensic Toxicology and Biochemicals Publ.Davis C.A (1981)
12. Chada 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 Publ.(2001
14. Zweig G ; Analytical Methods of Pesticides, Academic Press (1966)
15. Doesker A S ; Medical Jurisprudence , Toxicology & Forensic Science All India Reporter Pvt. Ltd. (2010).

Semester-II, Paper IX
M.Sc. Forensic Science
FS – 233 : Explosives & Explosion
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Explosives : Introduction, Assessment of explosives, Thermo chemistry of explosives, Oxygen balance, Explosive power and power index, Temperature of chemical explosion, Force and pressure of explosion, Kinetics of explosive reactions.

Unit - II

Types of Explosions : Atomic explosion, Physical explosion, Chemical explosion, Explosion and effects, Type of hazards, Effect of blast wave on structures and human etc.

Classification of explosive materials: Primary explosive material, High or secondary explosion, Detonators and explosives, Pyro technics, Propellants, IEDs and the firing mechanisms of IEDs

Unit - III

Ignition, initiation and thermal decomposition

Combustion and deflagration Detonation.

Development of explosives : Black powder, Nitro Cellulose, Nitro Glycerine, Dynamite, Ammonium nitrate, Commercial explosives (permitted explosives, ANFO and slurry explosives), Military explosives (picric acid, tetry TNT, Nitro guanidine, PETN, RDX, HMX and polymer bonded explosives)

Unit – IV

Role of Forensic scientist in Post blast investigation, Disposal of bombs, Explosions effects, Collection of samples, Technical report frame work, Home made crude bombs, Evaluation and assessment of explosion site and reconstruction of sequence of events., General methods of manufacture of explosives,

Analysis of explosive: Methods for extraction of explosive from post blast material/ debris, Qualitative analysis of explosives and explosion residue by colour test, TLC/HPTLC and High Performance Liquid Chromatography and FTIR, GC-mass. X ray diffraction, ICP for metallic component analysis, equipment used for Detection of explosives and explosive devices

Suggested Readings

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 I E Ds , 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. Cooper P. W; Explosive Engineering, VCH publisher (1997).
8. Urbanski T; Chemistry and Technology of Explosives, Pergamon Press (1985).
9. Lurie Iras & Witwer J D ; High Performance Liquid Chromatography in Forensic Chemistry, Marcel Dekker (1983)
10. Feigl F ; Spot Test in Inorganic Analysis , Elsevier Publ. New Delhi (2005)
11. Feigl, F ; Spot Test in Organic Analysis , Elsevier Publ .New Delhi (2005)
12. Yallop H J ; Explosion Investigation ,Forensic Science Society Academy press (1980)

Semester-II, Paper X
M.Sc. Forensic Science
FS – 234 : Instrumental Techniques
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Basic concepts-Atomic and molecular spectroscopy

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

Detection of radiations: photographic detectors, thermal detectors, photoelectric detectors, PMT and semiconductor detectors. Atomic spectra, energy levels, quantum, numbers and designation of states, selection rules, qualitative discussions of atomic spectra. Elements of X-ray spectrometry-fluorescence, energy Dispersive X-ray analysis (EDX), wavelength Dispersive X-ray analysis (WDX), X-ray diffraction, Augur effect.

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, IR spectroscopy-correlation of infrared spectra with molecular structure, Fourier Transform, infrared and Raman spectroscopy, florescence and phosphorescence spectrophotometry.

Unit - II

Ultra violet and visible spectrophotometry: Types of sources and stability, wavelength selection, filters-cells and sampling devices, detectors, resolution, Lambered and Beers Law, effect of Chemical Structure on absorption spectra, qualitative and quantitative analysis Application in forensic chemistry and toxicology.

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

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

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

Infrared spectrophotometry: Basic principle, components, Sample handling, Dispersive and Fourier transform spectrophotometry, (FTIR). Qualitative analysis and interpretation of IR spectra, applications.

Unit - III

pH metry, Potentiometry, Conductometry.

Electrochemical Techniques: Principles, Electron transport processes, Ion-selective electrodes (ISE) and gas sensors, Oxidation-reduction (Redox) potentials, Biosensor, Polarography, Anodic stripping Voltametry.

X-ray spectroscopy: X-ray absorption and fluorescence methods, X-ray diffraction, Auger emission spectroscopy and applications.

Unit – IV

Chromatographic Techniques: General principles, Paper chromatography, column chromatography, TLC, Adsorption chromatography, partition chromatography, Gas chromatography, Gas-liquid chromatography, Ion-exchange chromatography, Exclusion (permeation) chromatography, Affinity chromatography, HPLC, HPTLC, Capillary Chromatography.

Suggested Readings

1. Willard H H etal; Instrumental Methods of Analysis, CBS publ. (1986).
2. Skoog D.A etal; Principles of Instrumental Analysis, Thomas Book Co. (2003)
3. James W R ; Atomic Spectroscopy, 2nd Edn. Marcel Dekkar, In, NY (1966)
4. Patania V. B ; Spectroscopy, Campus Books International, (2004)
5. Khandpur R.S ; Handbook of Analytical Instruments, Tata Mac Graw Hill Publ. Co. (2004).
6. Chatwal G.R & Anand S. K ; Instrumental Methods of Chemical Analysis Himalaya Publ. House (2004)
7. Thomson K. C & Renolds R. J ; Atomic Absorption Fluorescence & Flame Emission Spectroscopy , A Practical Approach ,2nd Edn. Charles Griffin & Co. (1978).
8. Silverstein R. M Webster F. X; Spectrometric Identification of Organic Compounds 6th Edn. John Wiley 7 Sons, Inc. (1997).
9. Clark E.G. C :Isolation and Identification of drugs . Vol.I and Vol.2, Academic Press (1986)
10. Banwell C. L ;& Elani M. M. C ; Fundamental of Molecular Spectroscopy 4th Edn., Tata MacGraw Hill Pub. Co. (1995).
11. Chatwal G. R ; Analytical Spectroscopy 2nd Edn. Himalaya Publ. House(2002)
12. Laboratory Procedure Manual,Forensic Toxicology :Directorate of Forensic Science MHA Govt (2005)
13. Sunshine I : Ultraviolet Spectrophotometry, CRC Press(1969.
14. Nakanishi Koji ; Infrared Absorption Spectroscopy, Holden- Day, Inc. (1969)

15. Welcher Frank ; Standard Methods of Chemical Analysis, 6th Edn. Van Nostrand Reinhold(1969)
16. Stahl Egon ; Thin Layer Chromatography, George Allen & Univ.(1969)
17. Tebbet I ; Gas Chromatography in Forensic Science (1992)
18. Baker D R; Capillary Electrophoresis, NY (1995)
19. Robinson James ; Atomic Spectroscopy 2nd Edn. Marcel Dekker (1996)
20. Lurie Iras & Witwer J D ; High Performance Liquid Chromatography in Forensic Chemistry, Marcel Dekker (1983Tebbet
21. Lindsay S ; High Performance Liquid Chromatography ,Wiley & Sons NY (1992)

Semester-II, Paper XI
M.Sc. Forensic Science
FS – 235 Practical: Forensic Chemistry, Explosives & Explosion , Instrumental Techniques
L-0,T-0,P-4,S-0 CREDITS-2

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 chemical physical and gas liquid chromatograph for detection of adulteration of petrol and diesel with kerosene

5. Qualitative analysis of explosives and explosive residue by colour test and TLC/HPTLC and HPLC

6. Identification and comparison of explosives by FTIR.

7. Detection and identification of pesticide in a given formulation by colour test, TLC and UV-visible spectrometer/GLC

8. Analysis of dyes by TLC and UV-visible spectrometer.

9. Comparison of component of cosmetic stain from crime scene and suspect is clothing by spectrophotometry method UV/FTIR.

10. Chemical analysis of given fertilizer by chemical test and instrumental techniques.

Semester-II, Paper XII
M.Sc. Forensic Science
FS – 236 Practical: Forensic Toxicology & Instrumental Techniques
L-0,T-0,P-4,S-0 CREDITS-2

1. Analysis of viscera for volatile poisons (Organic and Inorganic).

2. Detection and identification of metallic poisons in viscera and food material by chemical test and instrumental technique.

3. Analysis of non- metallic (anionic) poisons in viscera.

4. Analysis of viscera for organochloro, organophosphoro, carbamates and pyrethroids by colour test TLC/HPTLC and UV-visible spectrometry method.

5. Determination of alcohol in blood and urine sample.

6. Detection & estimation of carbonmonoixide /carbon dioxide in blood by chemical and spectrophotometric method

7. Systematic extraction, and identification and non –volatile drugs and poisons by various techniques.

8. Analysis of blood, urine, stomach wash in emergency cases of poisoning.

9. Determination of barbiturate by UV-spectrophotometric method.

Semester-III, Paper XIII
M.Sc. Forensic Science
FS – 331 : Forensic Chemistry – II
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Arson and Fire: Chemistry of fire, difference between Arson and Fire, Material and Chemicals use in initiating fire and arson

Examination of scene of fire/arson recognition and collection of evidence, packing labeling and forwarding of exhibits, cause of fire and origin of fire.

Methods of extraction from exhibit- direct extraction, distillation and micro diffusion methods, advantage and their limitations.

Methods and techniques used in identification colour tests, UV visible spectrophotometry, TLC and gas chromatography.

Laws related to fire and arsons.

Unit - II

Cement, Concrete and Motar: Chemical compositions Portland cement, and other type of cements, building materials, Methods of samplings of cements, mortar and concrete

Common adulterant of cement and their detection.

Methods of analysis-Chemical analysis of cement, mortar and concrete, Instrumental method of analysis of by ICP, AAS and XRD.

Paint and pigments: General introduction of paints and pigments, types of paints and pigments-paints for building and automotive paint, and their chemical composition, forensic importance of paints and pigments especially in hit and run accidents, transfer on tools in burglary/dacoity, authenticity of brand of paint.

Method of collection of paint and preservation of evidence. Inorganic analysis of paint by chemical and microscopic examination and instrumental methods of analysis laser spectrograph IR spectrophotometer, X ray fluorescence, SEM- EDX and organic component analysis by pyrolysis gas chromatography coupled with mass spectrometer. Case- studies.

Unit - III

Metals and Alloys: Importance of analysis of metals and alloys, different types of metals and alloys commonly encountered for analysis.

Identification & composition of metals and alloys, purity of metals including precious metals such as gold, silver and platinum. Hall marking of precious metal according to BIS.

Trace element analysis: Trace analysis and its importance in forensic analysis, comparison of two pieces of metals, comparison of precious idols in

temples, museum in cases of theft & substitution of statues and idols. Trace element analysis for source correspondence, Analysis of metals and alloys, by chemical methods and instrumental technique, Atomic absorption spectrometer, ICP, XRF and laser spectrograph.

Fibre: Different types of fibres their chemical composition importance of fibre, matching of fibre from crime scene and from the suspect, matching of fibre by FTIR, spectrophotometer comparison of dye component and pyrolysis gas chromatography

Unit – IV

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

Environmental Pollutions:- Common air pollutant, water and soil pollutant, permissible limit.

Oils and fats: Different types of common oils and fats, their chemical composition, identification and purity determination. Detection of adulterants by chemical, TLC and other instrumental methods & analysis.

Acid Alkalies, soap and detergent miscellaneous chemicals.

Suggested Reading:

1. Redsicker D R & Cannor J J ; Practical : Fire and Arson Investigation CRC NY (1997).
2. Almirall J R & Furton K G ; Fire Scene Evidence CRC Press (2004).
3. Safferstein R ; Criminalistics: An Introduction to Forensic Science 9th Edn. Prentice Hall (2007).
4. Welcher Frank ; Standard Methods of Chemical Analysis, 6th Edn.Van Nostrand Reinhold(1969).
5. Laboratory Procedure Manual Forensic Physics Directorate of Forensic Science Ministry of Home affairs (2005).
6. Maehly A & Stromberg L ; Chemical Criminalistics , Springer Verlay (1981)
7. Caddy Brain ; Forensic Examination of Glass and Paint, Taylor and Francis (2000)
8. Watson C A ; Official and Standard Methods of Analysis,3rd Edn. Royal Society Of Chemistry (1994).
9. Crown D A ; The Forensic Examination of Paints and Pigments, Taylor and Francis NY (2001)
10. Cook J G ; Handbook of Textile Fibres Natural Fibres Vol.1 5th Edn Merrow (1993).
11. Houck M M ; Mute Witness : Trace Evidence Analysis, Academic Press (2001).
12. Pearson D : Chemical Analysis of Food ,Chemical Publ. Co. New York (1971)

13. Jeffery G H ;Vogel's Textbook of Quantitative Chemical Analysis, Longman(1999)
14. Vehia G S ,Vogel's Qualitative Inorganic Analysis (2006)
15. Somani S M ; Chemical Warfare Agent , CRC Press (2000) .
16. Sun Yin ; Detection Technologies for Chemical Warfare Agent and Toxic Vapours
17. Working Procedure Manual on Chemistry ; Directorate of Forensic Science MHA Govt. of India (2004)

Semester-III, Paper XIV
M.Sc. Forensic Science
FS – 332 : Advance Forensic Toxicology
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Modern methods of Extraction Isolation: Solid phase extraction, solid phase micro extraction techniques accelerated solvent extraction, ion – pair formation and extraction. Separation of poisons and drugs by chromatography and electro phoretic techniques including column chromatography, preparative TLC & HPLC and micellar technique and size exclusion Chromatography.

Hair analysis: Importance of hair for forensic examination of drugs and poisons, procedure of collection, storage preservation, method of extraction of drugs and poisons from hair and their identification using instrumental techniques.

Unit - II

Forensic Pharmacology: Pharmacology and its branches, Forensic Pharmacological studies, absorption, distribution, pharmokinetic, metabolism pathways of common drugs and poisons, Drug toxicity, excretion of drugs and poisons, method of extraction, isolation, identification of metabolites. Metabolites of methanol and ethanol, acetyl salicylate, DDT, Parathion, carbaryl, pheno barbitone, diazepam, amphetamine and heroin motobolite identification by GC-Mass & LC-Mass.

Unit - III

Food poisons: What is food poison, Food poisoning due to chemical and bacterial, Sign and symptoms of food poisoning, collection and preservation of evidence material, extraction and isolation, from food material, Biological material, detection and identification by colour test, and Instrumental techniques.

Plant Poisons: Introduction, classification of plant poisons and their main active constituent and characterization, method of extraction of plant material from biological samples identification by microscopic, colour test, thin layer chromatography and other instrumental techniques TLC, GLC HPLC and UV-Visible spectrometric method, and mass spectrometer.

Animal Poisons: Commonly encountered poisonous animals, snake venom and insect bite, mode of ejection and transmission of venom, active constituents of venom, action of venom, sign & symptoms, Isolation of poisons from biological material and viscera. Analysis of snake venom for cholinesterase and thromboplastin in around bite, toxicity test, clot quality and precipitant test, gel diffusion and immunoassay, Cantharide and poisonsous scorpion and lizard.

Common poisons used in animal poisoning including wild life animal poisoning cases.

Unit – IV

Radioactive Isotopes and compounds: Introduction nuclear energy and radioactive sources of exposure and contact, acute and chronic effect on the organs of the body methods of detection and measurements handling and disposal of body and tissues containing radioactive material. Medico-legal interpretation.

Environmental Forensic Toxicology: Introduction, principles and application, various pollutants, identification of biased environmental data, ground water characterization, soil, vapour survey, analytical methods. Forensic techniques in environmental litigation.

Quarter nary Ammonium drugs and poisons: Introduction, different type of quarter nary ammonium drugs pesticide and their pharmacological action problem associated with extraction from pharmaceutical products and biological material. Method of extraction using Ion pair (drug –dye complex) method. Isolation and Identification by TLC, and UV Visible photometry.

Ptomaine: Introduction, interference caused in analysis of poison, especially in putrefied viscera, poisoning cases due to ptomaine.

Suggested Reading :

1. Laboratory Procedure Manual Forensic Toxicology Directorate of Forensic Science MHA Govt of India (2005)
2. Stewart C P & Stoleman A : Toxicology Vol.1 and Vol. 2 , Academic Press
3. Clark E.G C ; Isolation and Identification of drugs Vol. I and Vol.2, Academic Press (1986)
4. Kintz Pascal ; Drug Testing in Hair, CRC Press (1996).
5. Hollinger Manfred; Introduction to Pharmacology, Taylor & Francis (1997).
6. Stine K E ; Principles of Toxicology, Lewis Publ. (1990).
7. Turner Paul ; Recent Advances in Pharmacology and toxicology , Churchill Living Stone (1998).
8. Casarett, L J and Doul John, The Basic Science of Poison 4thEdn., Pergamon Press (1991)
9. Robert D. Morrison ; Environmental Forensics (2000).
10. Modi Jaisingh P :Textbook of Medical Jurisprudence and Toxicology , M.M.Tripathy Publ.(2001).
11. Chang L W ; Toxicology of Metals , Lews Publ.
12. Sethi P D ;Quantitative Analysis of Drugs in Pharmaceutical Formulations 3rd Edn. CBS Publ. (2005).
13. Raychaudhry S P ; Environmental Pollution and Toxicology , Today & Tommorrow printer & Publ. (1979)
14. Caius J F ; Medicinal and Poisonous Plant of India Scientific Publisher (India)2003

Semester-III, Paper XV
M.Sc. Forensic Science
FS – 333 : Forensic Analysis of Drugs
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Narcotic Drugs and Psychotropic Substances and other Drugs of Abuse.

Drug dependence, drug addiction and its problems.

Laws related to drug control. Introduction to NDPS Act and amendments related to forensic interest. Common terminologies and NDPS Act. Small quantity and commercial quantity and extent of punishment for repeated offences.

Sampling procedure and relevant notification, circular for collection of NDPS drugs. Laboratories authorized to conduct examination an expert authorized to report NDPS substances, disposal of case property.

Unit - II

Classification of Drugs, commonly encountered for analysis: Narcotic drugs, depressants, stimulants, hallucinogens, designer drugs, club drugs, drugs of sports.

Unit - III

Analysis of Drugs: Analysis of Narcotic drugs, opium and alkaloids, morphine, heroin and opioids.

Depressants: Barbiturates, methaqulone, benzodiazepines

Stimulants: Cocaine and amphetamines and related derivatives

Hallucinogens: ganja, hashish (Charas), LSD, Mushroom and Cactile.

Designer drugs, club drugs, sports drugs and precursors.

Field test, colour test, micro crystal test, thin layer chromatography

Unit – IV

Instrumental analysis of drugs: Gas liquid chromatography, High Pressure liquid chromatography UV-visible spectrometry, IR/FTIR and Raman spectra, GC- Mass and LC-Mass.

Detection of common adulterants and determination of percentage purity in seized samples, detection identification, quantitation of drugs in pharmaceutical products. Analysis of illicit drugs and search of clandestine laboratory, precursors and their analysis. Estimation of morphine in opium and heroin in smack.

Analysis of drugs in biological samples and their importance: Hair, urine, blood, viscera, methods of extraction of drugs/consultation of drugs.

Limitation of chemical analysis of drugs. Report writing and interpretation of drugs.

Court testimony in NDPS Act cases.

Case studies and ground for acquittal and grant of bail.

Suggested Reading:

1. Safferstein R ; Criminalistics: An Introduction to Forensic Science 9th Edn. Prentice Hall (2007
2. Houck Max & Siegel J ; Fundamentals of Forensic Science , Academic Press (2006).
3. Sethi P D ; Quantitative Analysis Of Drugs in Pharmaceutical Formulation 3rd Edn CBS Publ. (2005).
4. Kintz Pascal ; Analytical and Practical Aspect of Drug Testing in Hair, CRC Press (2007).
5. Sunshine Irvin ; Handbook of Mass Spectra of Drugs CRC Press (1981)
6. Angelis GGD ; Testing and Screening of Drugs of Abuse , Marcel Dekker (1996).
7. Clark E.G.C : Isolation and Identification of drugs Vol.I and Vol.2, Academic Press (1986)
8. Thomo J. J etal. ; Guidelines for Analytical Toxicology Programs Vol.1 Vol. 2 , C RC Press , (1997)
9. Working Procedure Manual on Narcotics and Psychotropic Substances Directorate of Forensic Science MHA (2004)
10. The Narcotic Drugs and Psychotropic Substances Act 1985 ,Professional Book Publishers (2010)
11. Stahl Egon ; Thin Layer Chromatography, George Allen & Univ.(1969)
12. Niessen WMA ; Liquid Chromatography- Mass Spectrometry Vol. 79, 2nd Edn. Marcel Dekker
13. Yinon J ; Advances in Forensic Application of Mass Spectrometry CRC Press (2004).
14. Recommended Methods for Testing Drugs, United nations Office of Drugs and Crime , Vienna , Austria.
15. Tebbet I ; Gas Chromatography in Forensic Science (1992)
16. Digest of Narcotic Drugs and Psychotropic Substances Act 1985, Modern Law House (1999)

Semester-III, Paper XVI
M.Sc. Forensic Science
FS – 334 : Advance Instrumental Techniques
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Mass Spectrometry: Sample flow, Ionization methods, Mass analyzer, Vaccum systems, Data handling, Correlation of mass spectra and molecular structure, Fourier transform mass spectrometry, Tandem mass spectrometry, Inductively coupled plasma MS (ICP-MS) Ion Microprobe Mass Analyzer (IMMA), Laser Mass spectrometry, Fast Atom bombardment and liquid secondary Ion Mass spectrometry, High performance liquid chromatography, Electrospray ionization mass spectrometry. Applications in Forensic Chemistry and Forensic Toxicology.

Unit - II

Raman spectroscopy : Basic principles, applications, Instrumentation, sample handling and illumination, structural analysis, polarization measurements and Dispersive & FT analysis. Applications.

Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and Instrumentation, Applications

Unit - III

Radio chemical techniques: Basic principles and theory introduction about nuclear reactions and radiations, Neutron sources, Neutron Activation Analysis (NAA)

Hyphenated techniques: Gas Chromatography coupled with FTIR, Gas Chromatography coupled with mass spectrometry, LC coupled with mass spectrometry, ICP coupled with mass spectrometry and their applications

Unit – IV

Immunological techniques: General principles, Production of antibodies, Precipitin reaction, Gel immune-diffusion, Immuno-electrophoresis, complement fixation, Radio Immuno Assay (RIA), ESISA, Fluorescence immune assay for detection and quantitation of drugs and poisons in biological materials.

Scanning Electron Microscope, (SEM): basic principles, components, SEM, coupled with Energy Dispersive X-ray, and applications in forensic science.

Suggested Readings :

1. Willard H H etal; Instrumental Methods of Analysis, CBS publ. (1986).
2. Skoog D.A etal; Principles of Instrumental Analysis, Thomas Book Co. (2003)
3. Chatwal G.R & Anand S. K ; Instrumental Methods of Chemical Analysis Himalaya Publ. House (2004)
4. Chapman J R ; Practical Organic Mass Spectrometry-A Guide for Chemical and Biochemical Analysis, Wiley & Sons (1993)
5. Maclaffrty F W ; & Tureck F ; Interpretation of Mass Spectra , 4th Edn. Mill Valley , C A Universe Science Book (1993)
6. Sunshine I ; Hand book of Mass Spectra of Drugs , CRC Press
7. Thomo J. J . etal. ; Guidelines for Analytical Toxicology Programs Vol. 2 , C R C Press (1997)
8. Clark E.G. C :Isolation and Identification of drugs . Vol.1and Vol.2, Academic Press (1986)
9. Casarett, L J and Doul John, The Basic Science of Poison 4th Edn., Pergamon Press (1991)
10. Message G M ; Practical Aspect of Gas Chromatography-Mass Spectrometry John Wiley & Sons (1984)
11. Niessen WMA ; Liquid Chromatography- Mass Spectrometry Vol. 79, 2nd Edn. Marcel Dekker
12. Yinon J ; Advances in Forensic Application of Mass Spectrometry CRC Press (2004).
13. Robinson James ; Atomic Spectroscopy 2nd Edn. Marcel Dekker (1996)

Semester-III, Paper XVII
M.Sc. Forensic Science
FS – 335 Practical: Forensic Chemistry-II, Forensic Analysis of Drugs and Advance Instrumental Techniques
L-0,T-0,P-4,S-0 CREDITS-2

1. Analysis of residue material in fire and arson cases by TLC/, UV-spectrophotometric and gas chromatography.

2. Analysis of paint and pigment by microscopic, chemical analysis, TLC/HPTLC, FTIR.

3. General analysis and identification of metal and alloys by chemical method and instrumental techniques.

4. Determinations of purity of method by atomic absorption spectrophotometer.

5. Comparison of fibres by chemical analysis, TLC/HPTLC/ FTIR

6. Detection of adulteration in oils and fats by chemical analysis and TLC/ HPTLC.

7. Identification of narcotic Drugs : opium and alkaloids, morphine and heroin, cannabis by colour test TLC, and instrumental techniques.

8. Identification of psychotropic drugs-Barbiturates, benzodiazepines and bhang, Ganja, charas, by colour test, TLC and instrumental techniques.

9. Determination of morphine in a given sample by UV-visible spectrometer / HPLC

10. Gas chromatography analysis of Ganja and charas

11. Experiment of FTIR spectra of benzodiazepines

Semester-III, Paper XVIII
M.Sc. Forensic Science
FS – 336 Practical: Advance Forensic Toxicology and Advance Instrumental Techniques
L-0,T-0,P-4,S-0 CREDITS-2

1. Analysis of viscera and food material for in case of food poisoning by chemical microscopic and instrumental techniques.

2. Identification of common plant poisons Kaner, Dhatura and Nux Vomica, Aconite by colour test and instrumental techniques.

3. Analysis of animal and insect toxins

4. Detection and identification of quarter nary ammonium drugs and poison in pharmaceutical preparation by colour test and instrumental method.

5. Systematic analysis of viscera & blood in case of plant poisoning and animal poisoning

6. Determination of phosphine in aluminum phosphide and zinc phosphide in viscera (simulated sample) by chemical and instrumental techniques.

7. Extraction of metallic, poison and drugs from hair samples

8. Detection and identification of major metabolites of ethanol and methanol, parathion, acetyl salicylate, carbaryl and heroin.

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

FS- 431 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- 432 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- 433 Dissertation
L-0, T-0, P-0, S-0, CREDITS-20

Role of chemist at Crime, Scene Examination, Receipt and dispatch of cases in the Forensic Chemistry Division of FSL/CFSLs of the Country. Good laboratory practices based on NABL/ISO Guidelines. Significance of using control, reagent blank & reference standeards in chemical analysis of Forensic Exhibits. Latest techniques used for extraction, Isolation and clean up of the samples before analysis, Qualitative and quantitative analysis of chemical compounds including analysis of trace evidence present in different matrixes using state-of-the –art sophisticated equipments. Trouble shooting in chemical analysis at each level: Interpretation of technical/analytical data and forming of expert opinions for the law courts. Testimony of experts in the count.

Specialization- Forensic Biology, Serology and DNA Profiling

Semester-II, Paper VII
M.Sc. Forensic Science
FS – 241 : Human Anatomy & Physiology
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Cell structure and function: Membrane structure, lipids, proteins and carbohydrates in cell membranes. Role of cell membrane in transport of material into and out of the cell. Cell organelles, cytoskeleton, projections from cell membrane. The nucleus. Chromosomes. Basic structure of DNA and RNA. Synthesis of proteins , karyotyping, cell division. Chromosomal sex and sex chromatin. Abnormal cell growth and tumours.

Unit - II

Introduction to body function: External and internal environment, homeostasis. Negative and positive feedback mechanism. Essential body function- procuring and ingestion of food, respiration, excretion of waste products. Need for movement. Mode of communication within the body. Importance of electrolytes, acids and alkalis, carbohydrates, proteins and fats in the body.

Unit - III

Tissues of the body: epithelia and glands. Classification of epithelia, types of glands, their classification and function. Connective tissues- basic component, cell in general connective tissues. Different forms of connective tissues, fibres of connective tissues, cells of connective tissues- adipose tissue. Functions of connective tissues. Cartilage, structure, types of cartilage, gross structure of bones, elements comprising bone tissue. Lamellar bone, woven bone, cancellous bone. Structure of compact bone, periosteum, formation of bone, development of a typical long bone, fracture healing.

Unit – IV

Skin and its appendages- structure and functions, pigmentation, blood and nerve supply. Structure of hair and hair follicle, hair cycle- anagen, catagen, telogen. Arrector pilli, muscles, sebaceous glands, nails, sweat gland. Muscle- skeletal, striated, non-striated, voluntary, involuntary. Organization of muscle fibres in muscle. Tendons. Nerves tissues- neuron structure, type of neurons, synapse, grey and white matter, peripheral nerves, ganglia.

Suggested Readings

1. McClintic, J Robert, Basic anatomy and physiology of the human body; Wiley & Sons, (1980)
2. Ajmani, M.L, Human histology; International Publishers, (2004)
3. Yadav, A, Viva in Anatomy; Brothers Medical Publishers, (2003)
4. C.C.Chatterjee, Human physiology ; New central book agency, (1973)
5. Veena Bharihok, Text book of Histology; AITBS Publishers,(2005)
6. S. Wright, Applied physiology; Oxford University Press,(1961)
7. H.D. Singh, Basic Human Physiology; S.Chand & Company ltd, (2007)
8. S.Shalya, Human physiology systematic & applied; CBS publications, (1994)
9. Inderbir singh, Anatomy & Physiology for Nurses; Jaypee Brothers, (2005)
10. P.R. Ashalatha, Textbook of Anatomy & Physiology for Nurses; Jaypee brothers, (2006)
11. P.L. Williams & R. Warwick; Gray' Anatomy, Churchill Livingston, London,(1980)

Semester-II, Paper VIII
M.Sc. Forensic Science
FS – 242 : Forensic Osteology and Odontology
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Typical skeletal terminology used in forensic reports- Terminology associated with gross morphology of bone, bone features and skeletal direction . Basic adult human skeletal biology, The sub adult skeleton. Number and types of bones in human body. Human dentition- Terminology associated with human dentition, Dental numbering system. Forensic Odontology: tooth structure and growth, estimation of age in young and adults, Population differences in size and morphology. Bite marks. Individualization of tooth pulp.

Unit - II

Exhumation, recovery of fleshed and burnt remains, packaging and storage of human skeletal remains. Distinguishing Humans from other non- human skeletal remains. Nonhuman Animal bones commonly confused with human bones. Laboratory Examination of skeletal and decomposition remains-maceration, skeleton analysis and trauma analysis.

Unit - III

Skeletal age (Earlier years): Prenatal ossification. Postnatal appearance and union of centres ossification. Differences due to race. Skeleton age (Later years): Cranial suture closure , pubic symphysis. Sexing skeletal Remains : General consideration and age factors .Sex differences in skull, Pelvis and long bones. Calculation of stature of long bones: Studies on stature reconstruction in various population groups .Use of fragmentary long bones in stature reconstruction. Racial differences in human skeleton .

Unit – IV

Other techniques of identifying skeletal remains : Facial reconstructions, Cranio facial superimposition, Video superimposition, Osteon counting, Bite mark analysis. Skeletal Trauma and identifying skeletal pathology- Anti-mortem, peri-mortem and post-mortem trauma and Pseudo trauma.

Suggested Readings

1. Harvey, Warren; Dental identification and forensic, Henry Kimption Publishers, (1976)

2. Fazekas, I Gy; Forensic m foetal Osteology, Akademiai Kiado(1978)

3. Singh, Inderbir; Human Osteology, Jayee Brothers, (2004)

4. Joseph, J; Human Osteology, Jaypee Brothers, (1996)

5. Marion, Krogman Wilton; Human skeleton in forensic medicine, Charles C Thomas, (1986)

6. Singh, Inderbir; Textbook of human osteology, Jaypee Brothers, (2002)

7. P.L. Williams & R. Warwick; Gray' Anatomy, Churchill Livingston, London,(1980)

8. Krogman, W.M.. The Human Skeleton in Forensic Medicine, Chalres C Thomas, Springfield, (1973)

9. K.J. Reich; Forensic Osteology: Advances in the identification of Human remains, Charles C Thomas, (1998)

10. William M. Bass;Human Osteology: A Laboratory and Field Manual, Missouri Archaeological Society (1995)

Semester-II, Paper IX
M.Sc. Forensic Science
FS – 243 : Forensic Anthropology
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Genesis and development of forensic anthropology. Personal identification of living persons- Identification through somatometric and somatoscopic observation, nails, occupation marks, scars, tattoo marks and deformities; handwriting and mannerisms. Genetic traits of forensic significance: Colour blindness, ear lobe, brachydactyly, polydachtyly,widow's peak, eye colour, hair colour, face form, frontal eminences, nasalprofile, nasal tip,lips,chin form. Identification of the recently dead and decomposed bodies.

Unit - II

Major stages of human growth and development- Prenatal growth, Postnatal growth and their characteristics, Factor affecting growth- Genetic and Environmental. Methods of studying Human Growth, Significance of age in growth studies Methods of assessing age-chronological age, dental age, skeletal age, secondary sex character age and morphological age .

Unit - III

Techniques for recovering skeletonised human remains. Laboratory analysis of skeletal and decomposing remains; maceration, skeletal analysis. Trauma analysis and identifying skeletal pathology. Antimortem, perimortem, post-mortem and pseudo mortem trauma. Pathological changes in bone.

Unit – IV

Morphology and biochemistry of human and animal hair, hair growth and development, microscopical examination-, determination of origin race, sex, site, Hair types and morphology- hair growth rate, hair distribution, hair growth pattern. Hair colour and its variation. Forensic and microscopic examination of human and non-human hair, common animal hair- wool type fibres, cat and dog hair. Microscopic features- diameter, pigment, cortex, cuticle, cross section. ABO grouping and isozyme typing from hair roots. Collection & preservation of hair samples.

Suggested Readings

1. Anil Mahajan & Surinder Nath; Application areas of anthropology, Reliance Publishing house,(1992)
2. V.Rami Reddy; Dental Anthropology, Inter-India Publication, (1985)
3. Indra P. singh & M.K. Bhasin; A manual of biological Anthropology, Kamla Raj Enterprises, (2004)
4. Fred Plog, Clifford J.Jolly & Danial G.Bates; Anthropology, Alfred A. KNOPF NewYork, (1976)

5. Kroeber; Anthropology, Oxford & IBH Publishing Co., (1972)
6. Robert Pickering & David Bachman; The use of Forensic Anthropology, CRC Press, (2009)
7. Nirmal Kumar Bose; Anthropology, Narayan Press, (1972)
8. B.R.K. Shukla & Sudha Rastogi; Physical Anthropology, Palaka Prakashan, (2005)
9. Robertson, James; Forensic examination of hair, Taylor & Francis, (1999)
10. Goutam, Shubhra; Introduction to forensic examination, Selective Scientific Books,(2008)
11. Michael W. Warren, Heather A.Haney & Laurel E. Freas; The Forensic Anthropology Laboratory, CRC Press,(2008)

Semester-II, Paper X
M.Sc. Forensic Science
FS – 244 : Forensic Botany and Wild Life Forensics
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

General plant classification schemes. Sub specialisation of forensic botany- plant morphology, plant anatomy, plant systematic, palynology, plant ecology, limnology, Plant architecture- roots, stems, flowers, leaves. Practical plant classification schemes:- vegetables and herbs, fruits bearing trees and plants, landscaping plants: trees, shrubs and vines, grasses, plant cell structure and functions. Basic plant tissues

Unit - II

Various types of woods, timbers, seeds and leaves and their forensic importance. . Identification and matching of various types of wood, timber varieties, seeds and leaves. Types of fibres – forensic aspects of fibre examination- fluorescent, optical properties, refractive index, birefringence, dye analysis etc . identification and comparison of man–made and natural fibres. Various types of Planktons and diatoms and their forensic importance Diatoms types morphology, methods of isolation from different tissue. Study and identification of pollen grains, Identification of starch grains, powder and stains of spices etc. Paper and Paper Pulp identification, Microscopic and biochemical examination of pulp material.

Unit - III

Various types of poisonous plants-abrus precatorius, Aconitum, Anacardium occidentale, argemone Mexicana, calotropis, cannabis sativa, claviceps purpuria, cinchona, croton tiglium ,atropa belladonna, erythroxylum coco, gloriosa superb,jatropha curcas, lathyrus sativus, manihot utilissima, nerium indicum, nicotiana tabacum, plumbago, ricinus communis, semicarpus anacardium, strychnos nux vomica, thevetia nerifolia, Types of plants yielding drugs of abuse – opium, cannabis, coco, tobacco, dhatura, Psilocybin mushrooms.

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.

Suggested Readings

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 wild life (protection) act, 1972, Nataraj Publication,(2001)
4. Universal Publication; Wild life (Protection act,1972), Universal Publication,(2005)
5. Natraj Publishers,Wildlife protection act, 1972;, Natraj Publishers,(1997)
6. K.Ramesh Rao & S.K. Purkayastha; Indian woods, FRI Press, (1972)
7. N. Clifford; Timber Identification, Leonard Hill ltd.,(1957)
8. Herbert L. Edlin; A manual of wood identification, Viking Press, (1976)
9. Herbert Stone; The timbers of commerce, International book distributors, (1985)
10. R.W. moncrieff; Man made fibres, Newnes butter worth,(1975)
11. Dorothy catling & John Grayson; Identification of vegetable fibres, Chapman & hall ltd., (1982)
12. Katherine Paddock Hess; Textile fibres & their use, Oxford & IBH Publishing co, (1974)
13. Erdtman, G; Pollen morphology & Plant taxanomy: angiosperms (an introduction to palynology, Hafner Publishing Co., (1971)
14. Coyle, Heather Miller; Forensic botany, CRC Press, (2005)
15. Gangulee, Hirendra Chandra; College botany, New Central Book Agency, (1972)
16. Esau, Katherine; Plant anatomy, Wiley Eastern Ltd, (1965)
17. Chandurkar, P J; Plant anatomy, Oxford & IBH Publishing Co, (2006)
18. Shukla, Anjali; Academic's 1001 Biology Problems, Academic Publishers, (1970)
19. Singh, Jagjit; Systematic botany for degree students, S Chand & Co., (1967)
20. H.C. Long; The poisionous plants, Asiatic Publishing House, (1994)
21. B.P. Pandey, Plant Anatomy, S.Chand & Co., New Delhi,(1998)
22. Ball Simon; Environmental Law- The Law & policy relating to protection of environment, Universal Law Pub Co, Delhi,(1991)
23. Morrison Robert D, Environmental Forensic Principles and Applications,CRC Press, NY (2000)

Semester-II, Paper XI
M.Sc. Forensic Science
FS – 245 Practical: Forensic Anthropology
L-0,T-0,P-4,S-0 CREDITS-2

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

Semester-II, Paper XII
M.Sc. Forensic Science
FS – 246 Practical: Forensic Botany
L-0,T-0,P-4,S-0 CREDITS-2

1. Morphological & microscopic examination of fibres.
2. Microscopic and chemical comparison of paper pulp.
3. Identification of diatoms.
4. identification of pollen grains
5. Identification of starch granules.
6. Common staining techniques and laboratory exercises for identification of different plant cell types.
7. Microscopy of various plants fibres.
8. Differentiation of fibres including sisal, manila, jute and cotton based on ashing.
9. Microscopical examination of man-made fibres.
10. Section and cutting of plant material and their examination.

Semester-III, Paper XIII
M.Sc. Forensic Science
FS –341 : Forensic Medicine , Entomology and Microbial Forensics
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Death : Signs of death and changes after death. Somatic death, molecular death ,early changes after death - Algor mortis, rigor mortis, cadaveric spasm, heat stiffening, cold stiffening, changes in blood, chemical changes in cerebrospinal fluid, changes in vitreous humour, post mortem lividity, fluidity of blood,. Late changes – putrefaction- external and internal changes. Adipocere, mummification, gastric content and bladder content and time of death from growth of hair and nails .destruction of body and tissues by maggots and other insects, rodents, fish and crabs, moulds . Sudden death, post-mortem demonstration of myocardial infarction Medico legal aspects of death- Asphyxia, syncope, coma, death by starvation, drowning, hanging and strangulation. Causes and mechanism of traumatic death, manner of death . Classification of traumatic deaths.

Unit - II

Mechanical Injuries: Abrasions, Bruises, Lacerations, Incised wounds, Stab wounds, Firearm injuries, Defence injuries, fabricated injuries. Traffic accident injuries: vehicular injuries, railway injuries and aircraft injuries. Thermal injuries: Burn and scalds, Lightning, Electricity, Explosions. Chemical trauma. Injuries- Accidental, self-inflicted, or inflicted by others. Ante -mortem and post-mortem, artificial injuries and aging of injuries. Fractures, Dislocations Secondary causes of death Regional injuries- wound of the scalp- incised, contusions, lacerations, firearm injuries. Fractures of the skull from direct & indirect impact, injuries of the brain, face, eyes, nose, ears, lip, teeth and alveoli, neck, spine and spinal cord, chest, rib, sternum, ribs, lungs, heart, blood vessels, diaphragm, oesophagus, abdomen, stomach, liver, intestine, pancreas, spleen, kidneys, adrenals urinary bladder, rectum external genitalia, muscles, bones and joints.

Unit - III

Forensic Entomology- History, significance, determination of time since death- Dipterean larval development & successonal 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 of entomological evidence.

Unit – IV

Structure and function of the major organ systems : digestive, respiratory, endocrine, nervous, excretory, reproductive, cardiovascular and neuromuscular . Microorganism responsible for food poisoning. Times of digestion of foods. Collection, preservation and forwarding of samples – vomit, stool, stomach wash and residual food etc. Microorganism encountered in biological warfare.

Suggested Readings

1. B.V.Subrahmanyam; Modi's Medical jurisprudence, Lexis Nexis butterworth, (1988)
2. WDS. Mclay; Clinical forensic medicine, Greenwich medical media, (1990)
3. Nandy; Principals of forensic medicine, New central book agency, (1995)
4. R.Shepherd; Simpson's forensic medicine, Oxford University press,(2003)
5. A.K.Mant; Taylor's priniciples & practice of medical jurisprudence, Wingking Tong co. ltd., (2003)
6. D.J.Maio & V.J. Maio; Forensic pathology, CRC press, (1993)
7. C.H.Wecht; Legal medicine annual , ACC Press, (1970)
8. C.H. Polson; Essentials of forensic medicine, Pergamon press, (1973)
9. R. Mortiz & R.C. Morris; Handbook of legal medicine, C.V. Mosby company, (1975)
10. S.K. Lahiri; Elements of medical jurisprudence , Prabasi press, (1973)
11. I.Gordon & H.A.Shapiro; Forensic medicine, Longman group ltd., (1982)
12. P.V. Guharaj & R. Chandran; Forensic medicine, Orient Longman Pvt ltd., (1982)
13. Richard J. Flzinga; Fundamentals of Entomology, Prentice hall of India pvt ltd, (1978)
14. Catts E.P & Haskell NH; Entomology & death- A procedural guide, Joyce's print shop (1990)
15. Smith DGV; A manual of Forensic Entomology Ithaca NY Camstock Univ. Press, USA (1986)
16. Byrd J H& Castner JL; Forensic Entomology, The utility of Anthropods in legal Investigation, CRC Press USA(2000)
17. O.W. Richards & R.G.Davis; General text book of Entomology, Chapman & hall ltd, (1973)
18. Dr. P.V. Rama Rao;Essentials of microbiology, CBS Publications, (2004)
19. R.C. Dubey& D.K. Maheshwari, ; A text book of microbiology, S.Chand & company ltd, (2006)
20. S.M. Zaidi; Encyclopedia of general microbiology, Anmol publications, (2007)
21. C.p.Baveja; Concise Microbiology, Arya Publications, (2009)

Semester-III, Paper XIV
M.Sc. Forensic Science
FS –342 : Forensic Genetics and Bioinformatics
L-4,T-1,P-0,S-0 CREDITS-5

Unit - I

Elements of human genetics: Introduction, heritability, human genetic variations, human chromosomes (Normal chromosome set, chromosomal abbration, recent advances), Mendelian inheritances: Dominant inheritance, recessive inheritance, sex-linked inheritances, polymorphic traits. Heritable human diseases. Metabolic/molecular basis and detection of inherited disease, gene mapping and genetic risk assessment.

Unit - II

Mendelian Population, gene pool, Hardy-Weinberg equilibrium, deviation from H-W equilibrium, statistical assessment of deviation from H-W equilibrium, consanguinity, inbreeding, inbreeding coefficient, genotypes, phenotypes, mutation, multiple alleles, genetic variants, biochemical genetics, gene structure, its frequency determination, gene mapping and gene Expression. Genetic markers and their forensic significance. Mutations and their causes, types of mutation, mutation rate, genetic load. Method of mutation detection, population structure and gene flow. Mutatiion – Classification, mechanism, repair, role of genetic analysis and evolution.

Unit - III

Introduction, theory and practice of database searching, integrated information retrieval, internet access, searching for sequence homology and alignment. Concet of UNIX database and programming, computing, concepts of the UNIX operating systems. Basic theory of probability and statistics. Bayesian analysis. Likelihood ratio. Population and statistical aspect of genetics. Statistical issues in paternity testing and mixtures, presenting evidence.Use of common software in molecular genetics. Data analysis like-Dispan, Popgene, Arliquene, Sequence editing tool.

Unit – IV

Gene identification and prediction- Introduction Basics of gene prediction, pattern recognition, gene prediction tools, Tools for microarray analysis and application, FASTA and BLAST Algorithm. Major data basis in bioinformatics.

Suggested Readings

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, Universities Press (India) Pvt .Ltd., (2009)
4. Singh, B.D., Fundamentals of Genetics, Kalyani Publishers, (2006)
5. Lewin, Benjamin; Genes IX, Jones and Bartlett Publishers, (2008)
6. Pfaff, Donald W, Genetic influences on neural and behavioral functions., CRC Press, 2000
7. Giblett, Eloise R.; Genetic Markers in Human Blood, Blackwell Scientific Publications, (1969)
8. Winter, P.C; Genetics, Viva Books Pvt . Ltd., (2003)
9. Altenburg, Edgar, Genetics, Oxford & IBH Publishing Co, (1970)
10. Strickberger, Monroe; Genetics, Prentice Hall of India Ltd., (2005)
11. Hartl, Daniel L.; Genetics, Jones and Bartlett Publishers, (1998)
12. Hedrick, Philip W; Genetics of populations, Jones and Bartlett publishers, (2005)
13. Ohlsson, R.; Genomic Imprinting, Cambridge University Press, (1995)
14. Vogel, Friedrich; Human Genetics, Springer –Verlag Berlin Heidelberg, (1987)
15. Adolph, Kennetth W; Human Genome methods, CRC Press, (1998)
16. Sanghvi, L.D; Human population genetics in India, Orient Longman Ltd, (1974)
17. S.C.Rastogi, N.Mendiratta & P.Rastogi; Bio-informatics- Methods & Applications, PHI learning pvt. Ltd., (2009)
18. Dr. Westhead, J.H. Parish & R.M. Twyman, Bio-informatics, Viva Books Pvt Ltd., (2003)
19. Klug W.S. & Cummings M.R.; Concepts of Genetics, Prentice-Hall
20. Griffith A.F. et al; An Introduction to Genetic Analysis, Freeman
21. K.C. Malhotra; Statistical Methods in Human Population Genetics, Indian Statistical Institute, Calcutta (1998)

Semester-III, Paper XV
M.Sc. Forensic Science
FS – 343 : Forensic Serology
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Immune system, immune response, innate and acquired immunity, antigens, antibodies, haptenes and adjuvants, immunoglobulin- types, physico-chemical properties and function, raising of anti-sera, Lectins - their forensic significance. Buffers and serological reagents, methods of sterilization employed for serological work..

Unit - II

Composition of blood, Formation of blood, Blood groups – history, biochemistry and genetics of ABO, Rh, Mn and other systems. Methods of ABO blood grouping (absorption-inhibition, mixed agglutination and absorption elution) from blood stains and other body fluids/stains viz. menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail etc., 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 - III

Determination of human and animal origin from bones, hair, flesh, nails, skin, teeth body tissue, fluids/ stains viz. blood, menstrual blood, semen, saliva, sweat, tear, pus, vomit, etc., through immunodiffusion and immuno - electrophoresis, cross reactivity among closely related species. Individualization of blood stains: Determination of blood groups, sex age and racial origin from dried bloodstains.

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.

Suggested Readings

1. Wiener, Alexander S; Advances in blood grouping II, Grune & Stratton, (1965)
2. Boorman, Kathleen E,Churchill ; Blood group serology Livingstone,1977
3. Kabat, Elvin A ; Blood group substances,Academic Press, (1956)

4. Race, R R, Blackwell; Blood groups in man, ScientificPublications, (1975)
5. Mourant, A.; Distribution of the human blood groups, E,Oxford University Press,(1976)
6. Sussman, Leon N, Charles C Thomas ;Paternity testing by blood grouping, 1968
7. Prakash, M ; Physicology of Blood, Anmol Publications, (1998)
8. Roitt, Ivan M,Blackwell ;Essential Immunology, Scientific Publications,(1977)
9. Gupta, S.K.; Essentials of Immunology,Arya Publications,(2008)
10. Clark, William R; Experimental foundations of modern immunology,John Wiley & Sons,(1986)
11. Fudenberg, H. Hugh; Basic and clinical immunology,Lange Medical Publications, (1976)
12. Gell, P.G.H.; Clinical aspects of immunology,Blackwell Scientific ,(1975)
13. Nossal, G J V;Antigens, lymphoid cells, and the immune response, Academic Press, (1971)
14. T.J. Kindt, R.A. Goldsby, B.A. Osborne; Kuby Immunology, W.H. Freeman & company,(2004)

Semester-III, Paper XVI
M.Sc. Forensic Science
FS –344: Forensic DNA Analysis
L-4,T-1,P-0,S-1 CREDITS-6

Unit - I

Outline of genetic manipulations, enzymes in genetic manipulation, basic molecular cloning procedures, isolation of specific nucleic acid sequences – complementary DNA, genomic library construction , preparation of plasmid DNA , sub cloning , colony hybridization, Nick translation, Oligo nucleolide probes, expression of genes. Nucleic acid hybridization and DNA sequencing.

Unit - II

An overview of molecules involved in the flow of genetic information, double helical structure of DNA, alternate forms of DNA double helix, denaturation and renaturation of DNA, DNA binding proteins, factors affecting DNA stability, types and structure of RNA, RNA-DNA hybrid helices, DNA repair, direct and indirect evidences for DNA and RNA as the genetic material.Chemical nature of DNA and RNA. Replication of DNA in prokaryotes and enkaryotes, genetic code, degeneracy and universability of genetic code, transcription and translation machinery. Nature and structure of human genome and its diversity. mt-DNA, Y-Chromosomes and the peopling, migration , of modern humans. Concept of gene – Conventional and moderrn views. Fine structure of gene , split gene, pseudogene , non-coding gene, overlapping genes and multiple gene families.

Unit - III

Concept of sequence variation - VNTRs, STRs, Mini STRs , SNPs. Detection techniques - RFLP, PCR amplifications, Amp-FLP, sequence polymorphism, Y-STR, Mitochondrial DNA. Evaluation of results, frequency estimate calculations and interpretation, Allele frequency determination, Match probability – Database, Quality control, Certification and Accreditation.

Unit – IV

History of DNA profiling applications in disputed paternity cases, child swapping, missing person's identity, civil immigration, veterinary , wild life and agriculture cases . legal perspectives – legal standards for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad. limitations of DNA profiling. Population databases of DNA markers –STRs, Mini STRs, SNPs. New & Future technologies: Analysis of SNP, DNA chip technology- Microarrays Cell free DNA , Synthetic DNA.

Suggested Readings

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. Herrmann, Bernd; Ancient DNA,Springer Publishing Co.,(1994)
4. Vij, Krishan ; Basics of DNA and Evidentiary Issues, Jaypee Brothers, (2004)
5. Kobiinsky, Lawrence; DNA, John Wiley & Sons, (2005)
6. Glover, D.M.; . DNA Cloning 4: Mammalian systems,IRL Press,(1995)
7. Nickoloff, Jac A; DNA Damage and repair,Humana Press,(1998)
8. Newton, David E. ; DNA Evidence and Forensic Science,Viva books private limited, (2010)
9. Kirby, Lorne; DNA fingerprinting, W H Freeman and Co,(1992)
10. T.Burke, Terry; DNA Fingerprinting:Approaches and applications., Birkhauser Verlage, (1991)
11. Robertson, J; DNA in forensic science, Ellis Horwood Ltd., (1990)
12. Easteal, Simon; DNA profiling,Harwood academicPublishers,(1993)
13. Epplen, Jorg T.; DNA profiling and DNA fingerprinting,Birkhauser Verlage,(1999)
14. Alcamo, I Edward; DNA technology,Harcourt AcademicPress,(1999)
15. Singh, Yashpal; DNA tests in Criminal Investigation Trial & Paternity Disputes, Alia Law Agency,(2006)
16. 16 J.M. Butler. ; Forensic DNA typing, Elsevier Academic press,(2005)
17. Mark A. Farley & James J. Harrington ; Forensic DNA technology, CRC Press,(1991)
18. J.Thomas Mcclintock; ,Forensic DNA analysis, Lewis Publications, (2008)

Semester-III, Paper XVII
M.Sc. Forensic Science
FS – 345 Practical: Forensic Serology
L-0,T-0,P-4,S-0 CREDITS-2

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 in 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 testing their activities against body fluids and tissues.

Semester-III, Paper XVIII
M.Sc. Forensic Science
FS – 346 Practical: Forensic DNA Profiling
L-0,T-0,P-4,S-0 CREDITS-2

1. DNA – isolation from blood and bloodstains.
2. DNA – Isolation from bones.
3. DNA – Isolation from teeth.
4. DNA – Isolation from organs/tissues.
5. DNA – Isolation from saliva stains.
6. DNA – Isolation from hair root.
7. DNA – Isolation from other seminal stains
8. DNA – Isolation from nails.
9. DNA – Isolation from vegetable material.
10. Quantity and quality assessment of DNA extracted by various methods from different biological samples.
11. PCR – amplifications and STR typing through vertical polyacrylamide gel electrophoresis and silver staining.
12. PCR – amplifications and STR typing with automatic DNA sequencer.

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

FS- 441 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- 442 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- 443 Dissertation
L-0, T-0, P-0, S-0, CREDITS-20

Study of the latest techniques used in Forensic Biology and Serology including DNA profiling with their historical developments. Forensic applications of Anthropological, Botanical, Entomological, Diatom logical and Microbial studies. Identification and characterization of body fluids and tissues using microscopical, chemical, biochemical serological, electrophoretic and iso-electrophoretic techniques. DNA isolation from various biological samples of human, animal & plant origin and DNA profiling for forensically significant markers. Allele frequencies of serogenetic and DNA markers of forensic significance in population groups of India.

Project work on forensically significant and need based problems in the area of Forensic Biology/Serology/DNA Profiling viz. Osteological, Odontological, Physiognomical, Palynological, Diatomological, Entomological and anthrometric. Hair & Fiber characterization, generation of allele frequency data on serogenetic and molecular markers on human population groups. Studies on the stability of Serogenetic and DNA markers in aged and environmentally affected biological samples of human, animal and plant origin.