Placed at the meeting of
Academic Council
held on 30.03.2021

APPENDIX – C
MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)

Syllabus for
M.Sc. (Forensic Science)
CBCS- Semester Pattern
With effect from the academic year 2021-2022
Regulations, Scheme of Examination and Syllabus

I. INTRODUCTION:

Outcome-Based Education is incorporated into the curriculum based on the requirements of NAAC and UGC - Quality Mandate (2018). To fulfill these requirements, the Programme Specific Educational Objectives (PEOs), Program Outcomes (POs) and Programme Specific Outcomes (PSOs) and Course Outcomes (COs) were framed for all programmes in alignment with the Vision and Mission of the respective departments and in-turn with the Vision, Mission and Educational Objectives of the University.

M.Sc. Forensic Science

Introduction of the Programme :M.Sc. Forensic Science is a 2 year Master degree Course which involves the application of scientific knowledge to the investigation of crimes. Professionals in this discipline apply their knowledge of science to analyze the evidence found at a crime scene. It is a unique and creative programme meant for young students to draw insights of the social and behavioral sciences, the physical sciences, statistics, and the humanities to illuminate the issues of maintaining social order in a constitutional democracy committed to individual freedom, equality and justice. After 3 years of intensive study of foundational disciplines, the students train as Cyber Forensic Expert, Forensic Scientist and Criminal Investigator along with the students of the Institute's **2-year** Post Graduate Programme in Science (M.Sc.), undertaking the same course package in Forensic Science in years 4 and 5. The program in Forensic Science and Criminology is intended to prepare students for careers in public security, criminal justice administration, law and paralegal professions, public administration, policy analysis and graduate study in those fields. The M.Sc. program will assist students to develop and apply research expertise towards the resolution of contemporary justice practice and policy issues.

MISSION:

- To improve the skills and critical thinking in the field of Forensic Science and Criminology research.
- To apply their knowledge of science to analyze the evidence found at a crime scene.

- To develop highly skills manpower in the area of Forensic Science.
- To train the students in the field of Cyber Forensic Expert and Criminal Investigator.

NAME OF THE COURSE:

The 2 Year M.Sc. Course is a unique course the first of its kind offered in Madurai Kamaraj University will be a boon to rural youth. The aspiring rural youth can opt their careers as jury consultants, counselors, social workers, and prison psychologists .

COURSE FEATURES

The course is organized on a semester basis with a total of four semesters. In the first three semesters the students will be doing three theories and two practical core papers each. Fourth semester is for project work and Dissertations and one Elective paper. For every semester the students must choose one elective and one soft skill paper on their choice. A list of subjects, their codes, credits and marks of evaluation are compiled in the table.

PREAMBLE

Forensic Science is the use of scientific procedures and the examination of scientific information to assist the legal and law enforcement systems. Bachelor's degree programs in Criminology and Forensic science offer a well-balanced education in mathematics and science, including statistics, biology, and chemistry. Bachelor’s degree programs in forensic science combine lecture and laboratory classes and may include internships and exposure to crime laboratories and related agencies. This programme is designed to introduce students to forensic science and its interdisciplinary nature through an exploration and examination of forensic sub-disciplines and emerging techniques including: DNA forensics and forensic chemistry, among others. Beyond providing students with a broad overview of forensic science, students will be encouraged to explore and develop their own specific interests within the field.

The following are the objectives of this course.

1. To emphasize the importance of scientific methods in crime detection.
2. To disseminate information on the advancements in the field of forensic science.
3. To highlight the importance of forensic science for perseverance of the society.
4. To review the steps necessary for achieving highest excellence in forensic science.
5. To generate talented human resource, commensuration with latest requirements of forensic science.
6. To provide a platform for students and forensic scientists to exchange views, chalk out collaborative programs and work in a holistic manner for the advancement of forensic science.
7. To Fulfill the vision and mission of esteemed both central and state government.

REGULATIONS

1. ELIGIBILITY FOR ADMISSION AND MODE OF SELECTION

A. A Bachelor's degree in any branch of Life Sciences (Botany, Zoology, Microbiology, Biochemistry, Biotechnology, Genetics or Equivalent, Physical and Chemical Sciences (Physics and Chemistry), Medicine (Allopathy. Homeopathy and Siddha), Veterinary and Agriculture from any recognized Indian or Foreign University. Students with B. Tech., Degrees in Biotechnology, Computer Science, Information Technology and Bioinformatics with Biology at +2 level are also eligible.

B. To have national representation, 40% of the seats are reserved for students from other than Tamilnadu, and the remaining 60% seats are filled following the Tamilnadu reservation policy.

C. Total Number of Seats: 20 Other States -8 Tamil Nadu -12

2. PROCESSING OF APPLICATION

The pattern of the entrance test available on our website. The short-listed candidates will be called for an interview/ Seminar / discussion held at Madurai Kamaraj University**.**

3. DURATION OF THE COURSE

The students will undergo the prescribed course of study for a period of not less than two academic years (four semesters)

4. Medium of Instruction: English

5. Subjects of study and Scheme of Examinations: As given in Appendix A

6. Eligibility for the degree: Candidate will be eligible, provided he/she completes the course and pass in the prescribed examinations.

7. GUIDELINES REGARDING PASSING MINIMUM:

To get a pass, should fulfill the following conditions:

A) Theory:

1. 50% of the aggregate (External + Internal).
2. No separate pass minimum of internal
3. 34 marks out of 75 is the pass minimum for the External.

B) Practicals:

1. 50% of the aggregate (External + Internal)
2. No separate pass minimum for the internal
3. 27 marks out of 60 is the pass minimum for the External.

C) Project:

1. 50% of the aggregate (project evaluation + Viva-voce)
2. No separate pass minimum for the viva-voce
3. 34 marks out of 75 is the pass minimum for the project evaluation.

8. QUESTION PAPER PATTERN

The existing pattern of question paper will be as follows:

Time: 3 hours Max Marks: 75

Section A: (10 x 1 =10)

Question No 1 to 10

1. Two questions from each unit.
2. Four choices in each question.
3. Answer all questions. Choose the right answer.

Section B: (5 x 7= 35 marks)

Answer all questions - Either OR types
Answer not exceeding two pages.
(One question from each unit)
Question Nos.
11a or 11b
12a or 12b
13a or 13b
14a or 14b
15a or 15b

Section C: (3 x 10 = 30 marks)

Answers not exceeding four pages
Answer any **THREE** out of Five (one question from each unit)

Question Nos.- 16-20

The pattern for internal valuation may be:

a) Two internal tests of 15 marks each: Average = 15 marks
b) Group discussion/ Seminar/ Quiz = 05 marks
c) Two assignments: %marks each: Average = 05 marks

c) Practical Exams: External (MAX: 60 Marks)

One Major Experiment	= 20 marks
One Minor Experiment	= 10 marks
Two spotters	= 05 marks
Record Book	= 05 marks
Viva-Voce	= 20 marks

The pattern for **internal valuation** for 40 marks may be:

d) Two internal tests of 25 marks each: average	= 25 marks
e) Observation book	= 10 marks
f) One assignment	= 05 marks

d) **Project evaluation: (Maximum 100 Marks)**

External max: 75	
Dissertation work	= 60 marks
Presentation and viva	= 15 marks
Internal max: 25 marks	**=** (Decided by the Guide)

9. Restriction to complete the course:

In order to qualify for the degree, a candidate should complete all the prescribed Theory / Project examinations and secure a minimum of 64 credits in the core examination, 16 credits in elective and 10 credits in SSS course within a minimum period of two years and maximum period of five years counting from the date of admission to the course.

10. Declaration of result:

A candidate should get a minimum of 64 credits in the core examination, 16 credits in elective and 10 credits in SSS course in aggregate should secure 90 credits to pass. On successful completion of the PG programme, a candidate will be declared to have passed the exam with class and grade points that is computed on the basis of cumulative weighted average marks obtained in percentage.

Scheme of Examination

SEMESTER-I

Sl. No.	COURSE TITLE	Credits	Maximum Marks
1	General Forensic Science	4	100 (25+75)
2	Criminology and Criminalistics	4	100 (25+75)
3	Instrumental Methods – I	3	100 (25+75)
4	Forensic Ballistics and Explosives	4	100 (25+75)
5	Forensic Medicine and Anthropology	4	100 (25+75)
6	Practical-Forensic Ballistics and Criminalistics	3	100 (40+60)

SEMESTER-II

Sl. No.	COURSE TITLE	Credits	Maximum Marks
1	Questioned Documents and Fingerprints Examination	4	100(25+75)
2	Digital Forensics	4	100(25+75)
3	Criminal , Evidence, Criminal Procedure Code Special Acts	3	100(25+75)
4	Instrumental Methods – II	3	100(25+75)
5	Practical- Questioned Documents and Fingerprint Examination, Computer Forensics	3	100(60+40)
6	Internship - FSL/CFSL/Police Station /Court Room.	8	100(25+75)

SEMESTER-III

Sl. No.	COURSE TITLE	Credits	Maximum Marks
1	Forensic Chemistry and Toxicology	4	100 (25+75)
2	Forensic Biology and Serology	4	100(25+75)
3	Quality Management and Research Methodology	3	100(25+75)
4	Instrumental Methods- III	3	100(25+75)
5	Practical : Forensic Chemistry and Toxicology	3	100(40+60)
6	Practical : Based on Forensic Biology and Serology including Forensic Physical Anthropology	3	100(40+60)

SEMESTER-IV

Option A	**Specialization in Forensic Biology and Serology (FBS)**	**Credits**	**Maximum Marks**
1	Advanced Forensic Biology	5	100 (25+75)
2	Advanced Forensic Serology	5	100 (25+75)
3	Advanced Practical- Forensic Biology and Serology	3	100 (25+75)
4	Dissertation	10	300 (3 x 100)
Option B	**Specialization in Forensic Chemistry and Toxicology.**		
1	Advanced Forensic Chemistry	5	100 (25+75)
2	Advanced Forensic Toxicology	5	100 (25+75)
3	Advanced Practical -Forensic Chemistry and Toxicology	3	100 (25+75)
4	Dissertation	10	300 (3 x 100)
Option C	**Specialization in Questioned Documents and Finger Print Examination (QDFP).**		
1	Questioned Document Examination	5	100 (25+75)
2	Fingerprints Examination	5	100 (25+75)
3	Advanced Practical- Questioned Document and Fingerprint Examination	3	100 (25+75)
4	Dissertation	10	300 (3 x 100)
Option D	**Specialization in Forensic Physical Sciences (FPS)**		
1	Advanced Forensic Physics	5	100 (25+75)
2	Advanced Digital Forensics	5	100 (25+75)
3	Advanced Practical- Forensic Physics and Digital Forensics	3	100(25+75)
4	Dissertation	10	300 (3 x 100)

SEMESTER-I
GENERAL FORENSIC SCIENCE

Unit-I : Forensic Science: Definition, History and Development, Scope and Need, Basic Principles, Branches of Forensic Science, Tools and Techniques of Forensic Science. Forensic Science Laboratories: Organizational setup of CFSL, FSL, GEQD, FPB, NICFS, CDTS, NCRB, NPA. Mobile Forensic Science Laboratory. Education of Forensic Science, Role of Media, Human Right and Criminal Justice System. Ethics in Forensic Science. Duties of Forensic Scientist, Qualification of Forensic Scientist. Various Police Organizations, Organization of Police Station, Evolution of Police as an Institution, Role and Function of Police Organization in the State and Centre, Police and Forensic Scientist Relationship with reference to Crime Investigation. International Perspective of Forensic Science.

Unit-II : Crime: Definition, various types of crime, causes of crime, prevention of crime, Difference in blue and white collar crime, Introduction of Cyber crime, Criminal Justice System, Criminal behavior Crime Scene : Introduction, Significance, Role of Investigator, Evaluation of crime scene, protection of crime scene, Photography of Crime scene, Tools and techniques, Significance of Photography and Videography, Introduction of Sketching, Purpose of Sketching, Making of Sketches, Types of Sketches, Methods of Sketching, Procedure of Sketching, Searching Methods, Chain of Custody types, Significance and their evaluation..

Unit-III : Narco Analysis: History, Method of investigation, Importance as an investigative tool. Limitations and Legal Aspects. Brain Fingerprinting: History, Method of investigation, Significance, Limitations and Future perspective of the Technique. Voice Identification: Introduction, Significance, Theory of generation of Voice Characteristics, Voice Spectrography, and Voice Analysis Recent development of Computerized Speech Laboratory, legal aspects.

Unit-IV : Counterfeit coins: Blocks and Casts, Importance, Nature, Collection of evidence and their evaluation. Resuscitation: Introduction and importance, Techniques commonly used to obliterate numbers, General experimental procedure and theoretical consideration with special reference to metal deformation and its effects. Methods of restoration: Chemical, electrolytic and Magnetic particle methods, Laboratory procedure, Evaluation and Interpretation of results. Presentation of Expert Evidence: Data, Reports, Evidence in the Court.

Unit V: Forensic Psychology: Psychology of Lying, Various methods of lie detection, Principles of Polygraphy, Limitations and Legal aspects. Modus Operandiand Role of Modus Operandi Bureau in crime investigation. Investigation and Examination of various types of cases (a) Murder (b) Rape (c) Burglary (d) Railway and Air Crashes (e) Road Accidents etc. Location, Collection and Evaluation of various types of Tool Marksand Trace Evidences: Paint, oil, Glass, tective dyes, GSR etc.

Suggested Readings:

1. Nanda, B.B. and Tiwari, R.K. ; Forensic science in India- A vision for the twenty first century, Select Publisher, New Delhi (2001).
2. James, S.H. and Nordby, J.J.; Forensic science: An introduction to scientific and investigative techniques, CRC press, USA (2003).
3. Saferstein:Criminalistics -An introduction to Forensic Science, Prentice Hall inc. USA. (1995).
4. C.G.G. Aitken and D.A. Stoney; The use of statistics in Forensic Science, Ellis Harwood Limited, England (1991).
5. Hess, A.K. and weiner, I.B. handbook of Forensic Psychology 2nd ed. Jhon Wiley and Sons (1999).
6. Bruce A. Arrigo, Introduction to Forensic Psychology Academic press. London (2000).
7. David L. Shapiro, Forensic Psychology Assessment an Investigative Approach; Allyn and Bacon Publisher (1991).
8. Loe Nicharrs; Investigative Forensic Hypnosis CRC Press LLC (1999).
9. Kleiner, Murray; Handbook of Polygraph Testing Academic Press (2002).
10. W.W. Bennett and Karen M. Hass- Criminal Investigation; wordsworth Thompson Learning 6th ed. (2001).
11. Barry, A.J. Fisher- Techniques of Crime Scene Investigation, 7th ed. R.C. Press, New York (2003).
12. Mordby, J. Deed Rrckoning- The art of Forensic Detection- CRC Press LLC, Boca Raton FL CRC Press (2000).
13. Eckett W.G and James S.H; Interpretation of Blood Stains, Evidence of Crime Scene; Elseiver Pub. New York (1989).
14. James S.H; Scientific and Legal Application of Blood Stain Pattern, Identification; Boca Raton FL CRC Press (1998).
15. Jhon, D. Deehan; kirk's Fire Investigation 5thed. Prentice Hall (2002).
16. Turrey, B; Criminal Profiling- An Introduction to behavioural evidence analysis; Academic Press London (1999).
17. Sharma B.R.; Forensic Science in Criminal Investigation and Trails; Universal Pub. Co. (2003).
18. K. Ranakant; Elementary Statistics in a Word of Application, Goodyear, California Pub. Co. (1979).
19. The Indian Evidence Act (1872), Amendment Act (2002), Universal Law Pub. Co. (2003).
20. The Code of Criminal Procedure (1973), amendment act (2001), Universal Law Pub. Co. (2002).
21. Rattan Lal and Dhiraj Lal; The Indian Panel Code, 28th ed. Wadhwa and Co. Nagpur (2002).
22. C.R. Swansan, L Terrib and R.W Taylor; Police Administration; Prentice Hall USA, (1998).
23. Ram Ahuja; Criminology; Rewal Pub. Jaipur (2000).
24. M Meguire, R Morgan and R Reiner; Oxford Handbook of Criminology, 2nded. Biddles Ltd., Lyon (1997).
25. R.k. Beg; Supreme Court on Criminal justice; Asia Law House (1999).
26. R.Deb; Criminal Justice; The Law Book co. Pvt. Ltd. (1998).

27. J.A. Seigel, R.J Sukoo and G.C Knupfer; Encyclopaedia of Forensic Science vol. I, IIand III, Academic Press (2000).
28. Bridges BC; Criminal Investigation, Practical Fingerprinting , Thumb Impression, Handwriting Expert Testimony Opinion Evidence, University book Agency, Allahabad (2000).
29. Bennet, waynew; Criminal Investigation, Wordsworth Pub. Co. (2000).
30. Gross, Dr. Hans; Criminal Investigation- A Practical textbook for Magistrates, Police Officers and Lawyers; Universal Pub. Co. (2000).
31. Bell, William R; Practical Criminal Investigation in correctional facilities, CRC Pres London (2001).
32. Lyman M.D; Criminal Investigation- The art and the Science, Prentice Hall (2002).

CRIMINOLOGY AND CRIMINALISTICS

Unit-I : Concept and Definition of Crime , Causes of Crime , Social Change and Crime , Control and Prevention of Crime in Context with Organization , Industrialization , Family set up, Criminal Behavior and Psychology.

Unit-II : Scene of crime: Types, protection of scene of crime, preservation (recording) of scene of crime- photography and sketching methods. Crime Definition, concept and scope of crime. Types of crime. Causes, effects, control and prevention of crime. Recent developments. Physical evidence: Meaning, Types, search methods, collection and preservation, Forwarding. Chain of custody. Collection, preservation, packing and forwarding of: blood, semen and other biological stains, firearm exhibits, documents, fingerprint, viscera, hair and fiber, glass, soil and dust, petroleum products, drugs and poisons, etc.

Unit-III : Criminology and criminal anthropology Aim and scope of criminology; Criminal behavior and theories of criminal behavior: classic, positivist, sociological. Organized crimes, white collar crime. Juvenile delinquency. Role of correctional institutions. Criminal profiling and modus operandi, portrait parley, voice stress analysis. Victimology.

Unit-IV : Vulnerable groups and Victimology Victims of domestic violence, child sexual abuse caste discrimination, human rights violations Victimology: Definition and Scope, Historical Development, Types: Positivist, Radical and Critical Role and Functions of Victimologists. Who is a Victim? Demographic Characteristics; Victims of Violent Crimes, Typologies of Victims, UN. Declaration on basic principles of justice for victims of crime and abuse of power, 1985.Human Rights: Definition, Historical Development, U.N. Universal Declaration of Human

Unit-V : Police Administration and Investigation : Policing in the early period - Police Act of 1861 and other Police acts - Police Administration during British rule. Indian Police after Independence - change in structure and organisation - The Indian Police service - creation of new branches - and modification of the existing branches City Police and District Police - Investigating Wings - Intelligence Wings and Assault Wings -State and Central Police Forces

- Special Task Forces and Special Units -National Police Commissions. **Investigation (Procedure) :**A. Reporting of crime and registration of F.I.R.- B. Cognizable / Non Cognizable and bailable -Non bailable offences.- C. Specialised investigation of homicides, property offences, white -collar crimes and bomb blasts and death in custody.-D. Completion of investigation and filing of charge sheet etc.

Suggested Readings

1. Arrigo (2002) : Introduction to forensic Psychology.
2. Cooke, G. (1980) : The role of Forensic Psychologist. Chanles C. Thomas.
3. Howitt D : 2002 Forensic and Criminal Psycholgy. Prentic Hall Publications.
4. Constitution of India .
5. Indian Evidence Act.
6. Criminal Procedure code.
7. Indian Penal Code.
8. Bare Acts with short notes on the following : Narcotic Drugs and Psychotropic Substances Act, Drugs and Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Food Adultration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act.
9. Hess, A.K. and Weiner, I.B. (1999) Handbook of Forensic Psychology 2nd Ed. John wiley and sons.
10. Barak, Gregg : Integrative Criminology.
11. Adler, Freda : Criminology.
12. Reid S.T. : Crime and Criminology.
13. Johnson : Crime, Correction and Society.
14. Riderman : The Manipulation of Human Behaviour.
15. Lionel Haward : Forensic Psychology, 1981, Batsford Academic and Education Ltd., London.

INSTRUMENTAL METHODS-I

Unit-I : Light Microscopy-Introduction, Geometrical optics, Image formation, Magnification and Resolution, Lens aberrations, Distortion of image and curvature of field. Basic principles, working and Forensic Applications of Following Microscopes: Compound Microscope - Comparison Microscope - Fluorescence Microscope - Polarized Microscope - Stereomicroscope - Infra-red Microscope .

Unit-II : Electron Microscopy- Introduction, Historical review, Types of Electron Microscopy **Scanning electron microscopy (SEM)**: Theory and Principle, Specific feature, instrumentation, sample preparation, specimen interaction, specimen interaction volume, signal produced by specimen and Forensic applications. **Transmission electron microscopy (TEM): T**heory and basic principles, Instrumentation and Forensic applications.

Unit-III : Photomicrography: Photography, Microscope, Camera, light system, Film, Filters, Photographic papers, Photocapture, Development of film, Positive photograph prepration, Developer, Stop- Bath, Fixing.

Unit-IV : Ultra- Violet Photography - Infra-red Photography - Microphotography .

Unit-V : Radiochemical techniques: Basic principles and theory, introduction about nuclear reactions and radiations, Neutron sources, Neutron Activation Analysis (NAA). **Thermal analysis methods:** Basic principles and theory, differential scanning colorimetry and differential analysis, thermogravimetry.

Suggested Readings

1. James w. Robinson; Atomic Spectroscopy, 2nd ed. Revised and 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 and Brij Lal; A text book of Optics, S. Chand and co. (2004) .
5. Gurdeep R. Chatwal and Sham k. Anand; Instrumental Methods of Chemical Analysis, Himalaya Pub. House (2004) .
6. Hobert H. Willard, Lynne L. Merrett Jr, Jhon A Dean Frank A. Settle Jr; Instrumental Methods of Analysis, 7th ed. CBS Pub and Distributors (1986).
7. R.S. Khandpur; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi (2004).
8. John A Dean; Analytical Chemistry Hand book, Tata Mc Graw Hill Inc. (1995).
9. K.C. Thompson and R.j. Renolds; Atomic Absorption Fluorescence and Flame Emission Spectroscopy, A practical approach, 2nd ed. Charles Griffin and co. (1978).
10. Robert M. Silverstein and Francis X Webster; Spectrometric Identification of organic Compounds, 6th ed. John Wiley and Sons, Inc (1997).
11. John C. Lindon, George E. Tranter and John L. Holmes; Encyclopedia of Spectroscopy and Spectrometry, Academic Press (2000).
12. Dudley H, Williams and Ian Fleming; Spectroscopic Methods in Organic Chemistry, 4th ed. Tata Mc Graw-Hill Pub Co. New Delhi, (1994)
13. Colin N. Banwell and Elaine M, Mc. Cash; Fundamentals of Molecular Spectroscopy 4th ed. Mc Graw-Hill Pub Co. New Delhi, (1995).
14. R. Murugeshan; Optics and Spectroscopy, S. Chand and Co. (1998).
15. Jack L Koeing; Spectroscopy of Polymers, 2nd ed. Elsevier pub. Co. (1999).

FORENSIC MEDICINE AND ANTHROPOLOGY

Unit-I : Forensic Medicine: Medico legal aspects of Death, causes of Death (asphyxial death, starvation, electrocution, Accidents). Determination of time since death by various methods including, histopathological methods. Determination of age of living person, medico-legal investigation of sexual offences, including examination of victim and suspect. Injuries: Types and classification of injuries, anti-mortem and post-mortem injuries, aging of injuries, artificial injuries.

Unit-II : Forensic Anthropology: Definition, scope and objectives, Human skeleton, comparative skeletal anatomy of human and non-human. Identification of bones and determination of side: Age determination from skeletal remains: General considerations, classification of bones, suture closure in skull and ossification in other bones. Sex determination from skeletal remains: skull, Pelvis, and other bones. Estimation of stature from skeletal remains with special reference to long bones.

Unit-III : Personal Identification Techniques (Somatoscopy, Somatometery, Osteometery and Craniometery) and their Importance in Determination of Age and Sex. Portrait Parle/Bertillon system, Introduction and Importance of Photofit/Identi Kit System for Facial Reconstruction. Cranio Facial Super Imposition Techniques (Photographic Super Imposition, Video-Superimposition, Roentgenographic Superimposition). Use of Somatoscopic and Craniometric Methods in Reconstruction. Importance of Tissue Depth to Reconstruct various Facial Features. Genetic and Congenital Anomalies: Causes, Types, Identification and their Forensic Significance.

Unit-IV : Forensic odontology: Development and scope, role in mass disaster. Structural variation in teeth (human and non-human), types of teeth and their functions, determination of age from teeth: eruption sequence, Gustafson's method, dental anomalies, their significance in personal identification. Bites marks: Forensic significance, collection and preservation of bite marks, photography of bite marks, and evaluation of bite marks. Legal aspects of bite marks.

Unit-V : Meaning, Definition and Causes of Death- Natural and Unnatural Types of Death- Somatic/Clinical and Molecular/Cellular. Post Mortem Changes and Determination of Time of Death- Cooling of the body, Post Mortem Lividity, Rigor Mortis, Putrefaction, Adipocer and Mummification; Factors affecting these changes. Determination of time since death, including histo pathological methods. Medico legal aspects of asphyxia deaths (Hanging, Strangulation, Suffocation, Smothering and Drowning – Diatom test), electrocution, thermal trauma, heat burns, starvation, natural death, sudden death, death by accident. **Exhumation:** Definition ,medical and legal aspects, procedure adopted for carrying exhumation, exhumation conducted in India, procedural formalities in exhumation, legal requirements to exhume a body, reasons and methods, exhumation of remains of a deceased person, burial act 1857 and sections.

Suggested Readings

1. Text book of Forensic Medicine by Krishan Vij; B.I. Churchill Livingstone Pvt. Ltd. 2001.
2. Forensic Dentisty by Paul G. Stimson, Curtis A. Mertz; CRC Press, LLC, 1999.
3. Craniofacial Identification in Forensic Medicine, edited by John. G. Clement and David. L. Ranso; Oxiford University, Press; 1998.
4. Forensic Taphonomy, edited by William D. Haglernd, Marculla H. Sorg; CRC Press, LLC, 1997.
5. Beals, R.L. and Hoizir, H. (1985): An Introduction to Anthropology, Macmillan, New Delhi.

6. Krogman, W.M. And Iscan, M. (1986): Human Skeleton in Forensic Medicine, Charles Thomas, U.S.A. Gray'ss Anatomy (1987): Churchill Livingston, Edinburgh.
7. Glaister (Ed)-Rentoul and Smith (1973) : Forensic Medicine and Toxicology, Churchill Livingston, Edinburgh.
8. Modi, J.K. (1988): Medical Jurisprudence and Toxicology, N.M. Tripathi Pvt. Ltd.
9. El Najjar and Mcwilliams (1978) : Forensic Anthropology.
10. Mukherjee, J.B.: Forensic Medicine and Forensic Toxicology.
11. Cummins, H. and Midlo, C. (1961) : Finger Prints, Palms and Soles, Dover Publications, U.S.A.
12. Fraser, Roberts, J.A. (1965): An Introduction to Medical Genetics.
13. Comas, J.A. (1960): A Manual of Physical Anthropology, Charles C. Thomas U.S.A.
14. Whitaker, D.K. and MacDonald, D.U. (1989): Forensic Dentistry, Wolfe Medical Publications Ltd.
15. Robert A. Jensen: Mass falality and Casulity incidents: A field guide
16. Taylor (2000) : Forensic Art and Illustrations CRC Press.
17. Singh, I.P. and Bhasin M. K. (1968): Anthropometery, Kamla-Raj Publications, New Delhi.
18. Hooton, E.A. (1946): Up from the Ape, Macmillan, New York.
19. Whitaker, D.K. and MacDonald, D.U. (1989): Forensic Dentistry, Wolfe Medical Publication Ltd.
20. Nath, S. (1987): An Introduction to Forensic Anthropology. Gian Publishing House, New Delhi.

FORENSIC BALLISTICS AND EXPLOSIVES

Unit-I : Firearms : Early history of firearms, the earliest firearms, the fifteenth century Match lock, sixteenth and seventeenth century small arms, The age of the Flint lock, the percussion lock firearms. **Principles and practice of identification** of firearms, ammunition and their components, different types of marks produced on cartridge during firing process - firing pin marks, breech face marks, chamber marks, extractor and ejector marks band on bullet-number/ direction of lands and grooves, striation marks on lands and grooves, identification of various parts of firearms Analysis of Gunshot Residues Mechanism of formation of Gun Shot Residue (GSR), source and collection, spot test, chemical test, identification of shooter and instrumental methods of GSR Analysis, Classification, Characteristics and firing mechanism of smooth bored firearms Rifled firearms (Pistol, Revolver, Rifles, Machine Guns), Classification, nomenclature and construction of country made firearms. Ammunition: Types, Cartridge Components (Cartridge case primer propellant, Bullets, Pellets and wads).

Unit-II : Internal Ballistics: Definition, Ignition of the propellent, manner of burning, Piobett's law, Shape and Size of the propellent, pressure space curve, shot start pressure. All burnt point, Velocity, Space curve, Le Due's formula, muzzle velocity, Factors affecting muzzle velocity, theory of recoil. External Ballistics: Definition-trajectory drop in the flight of the projectiles force of gravity, air resistance-base drag, Yaw, Shape of bullet (Spherical ball,

Cylinder-conical, flat nose, round nose etc.) effective range, extreme range. Terminal Ballistics: Definition, behavior of various types of bullets on hitting the target, remaining velocity, stopping power, Ricochet.

Unit-III : Matching of crime and test Bullets and cartridge cases in regular firearms, Identification of Bullets, pellets and wads fired from improvised country made firearms. Automated method of cartridge case and bullet comparison.

Unit-IV : Determination of Range of fire, time of fire. Visual and Chemical, instrumental methods with special reference to the applications of Neutron activation, Atomic absorptions, Scanning Electron microscopy and other miscellaneous methods. Gun Shot Residues (GSR): Mechanism of formation of GSR, modern methods of analysis of GSR from the shooting hand and target with special reference to clothings. Firearm injuries: Ballistic aspect of firearm injuries, nature, Effect of target, Velocity, constructional features and range on the wounding, identification of firearm injuries. Evaluation of Firearm injuries, Reconstruction: Accident, Suicide, murder and self defense.

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

Suggested Readings:

1. Howard MATHEWS; Charles C. Thomas, Firearms identification, vols. 1,2 and 3;
2. Springfield, Illinois; (1973)
3. Hatcher, Jury and Weller: Firearms Investigation, Identification and Evidence; Stackpole Books, Harrisburg, PA; (1977).
4. Vincent Di Maio, Gunshot Wounds; CRC press, Washington, DC; (1999)
5. Brain J. Heard; Handbook of Firearms and Ballistics; Jhon Willey, England; (1997)
6. Warlow; Firearms, The Law and Forensic Ballistics; Taylorand Francis, London; (1996)
7. Karl G. Sellier et al; Wound Ballistics and the scientific Background; Elsevier, London; (1994).
8. M. Johari, Identification of Firearms, Ammunition and Firearms Injuries; BPRand D, New Delhi; (1980).
9. I.V. Hogg; The Cartridges Guide- A small arms Ammunition Identification manual; The Stackpole co. Harrisburg, PA (1982) .
10. Gray J. Ordog, Management of Gunshot Wounds; Elseiver, New York (1983) 10. Working Procedures Manual: Ballistics, BPR and D pub. (2000).
11. Boundreau JE, et.al,Arson Investigation , Survey and Assessment National Institute of Law Enforcement, U.S. Deptt.of Justice, US Govt. Printing Press (1977).
12. Dettean J D; Kirk's Fire Investigation, 5th ed. Prentice Hall, Eaglewood Cliffs, N.J (2002).

13. Yinon Jitrin; Modern and Application in Analysis of Explosives, john Wiley and Sons, England (1993).
14. Working Procedure Manual; Chemistry, Explosives and Narcotics, BPRand D Pub. (2000).
15. C.A. Watson; Official and standardized Methods of Analysis, Royal Society of Chemistry, UK (1994).

PRACTICAL - FORENSIC BALLISTICS AND CRIMINALISTICS

1. Sketching and photography of scene of crime.
2. Collection and packing of physical clues at the scene of crime.
3. Reconstruction and evaluation of scene of crime (Hit and Run, Arson and Shooting cases etc.)
4. Determination of density, by density gradient tube techniques.
5. Comparison of paints, Soils and glass.
6. Miscellaneous Examination (Cloth, Bangles, threads etc.)
7. Lifting of prints and impressions by caste and replicas.
8. Sole prints comparison and their lifting from the scene of crime.
9. Identification of firearms, cartridges, bullets, gunpowder, etc.
10. Examination and comparison of fired bullets – Caliber, rifling characteristics, probable type of firearms.
11. Examination and Comparison of fired Cartridge cases (Caliber, firing pin, breech face, Extractor/ ejector marks etc.)
12. Determination of Shot number from size and weight of shots.
13. Determination of range and time of firing.
14. Identification of propellants.
15. Chemical tests for powder residues (Walker's test) and Barrel wash.

SEMESTER-II
QUESTIONED DOCUMENTS AND FINGERPRINTS EXAMINATION

Unit-I : Document in General: Importance, Classification and Preliminary Examination. Nature and Problems of Document Examination. Handling and Preservation of Documents. Basic tools needed for Forensic Document Examination and their use. Writing instruments and their influence on writing. Examination of Paper and Ink. Handwriting: Basic Principle of Handwriting Identification, Handwriting characteristics General and Individual. Development of Individuality in Handwriting, Comparison of Handwriting, Natural variations, Fundamental divergences. Standard for Comparison. Signatures: Characteristics of genuine and forged signatures and their Examination.

Unit-II : Forgery: Definition, types, Characteristics and their detection. Disguised writing and anonymous letters: Definition, Characteristics and Identification of writer. Sequence of strokes: Definition and determination of sequence of strokes. Alteration in the Document: Examination of erasures, additions, overwriting and Obliteration. Decipherment of Secret writing, Indented and Invisible writing, Charred documents. Examination of seal impression and other mechanical impressions. Age of document: Absolute/relative age, determination of age of documents by Examination of Printed Matter, Types Script Writing, Signatures, Paper and Ink.

Unit-III : Type writing: Working of type writer, Various type of typewriting devices, Identification of type Scripts, Typist. Printed matter: Various type of printing processes, Examination of various types of Printed Matter. Preparation of detailed report with reasons and illustrative charts, Use of standard Terminology.

Unit-IV : Photography: Basic principles and techniques, Exposing, Developing and Printing, Modern Developments in Photography, Digital Photography, Videography/High speed videography, Crime scene and Laboratory photography.

Unit-V : History and Development of Fingerprints, Formation of Ridges, Pattern Types, Pattern areas, Classification of Fingerprints- Henry System of Classification, Single Digit Classification, Search of Fingerprints, Fingerprint Bureau. Chance Fingerprints-Types of chance prints, Composition of Sweat, Development of latent Fingerprints. Conventional method of development of Fingerprints. Digital imaging and Enhancement, Application of laser and other radiations to develop latent fingerprints. Photography of Fingerprints, Digital Transmission, Comparison of Fingerprints, Automated Fingerprint Identification System (AFIS).

Suggested readings

1. Huber, A. R. and Headride, A.M. (1999) : Handwriting identification : facts and fundamental CRC LLC.
2. Ellen, D (1997) : The scientific examination of Documents, Methods and techniuqes. 2nd ed., Taylor and Francis Ltd.
3. Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
4. Madinger J. and Zalopany, A.R. (1999) : Money Laundering CRC Press.
5. Manning, C.A (1999) : Financial Investigations and Forensic Accounting CRC Press.
6. Harrison, W.R.(1966) : Suspect Documents and their Scintific Examination, Sweet and Maxwell Ltd., London.
7. Hilton, O(1982) : The Scientific Examination of Questioned Document, Elsaevier North Holland Inc., New York.
8. Brewster, F(1932) : Contested Documetns and Foregeries, The Eastern Law House, Calcutta.
9. Ames : Ames on Foregery(1900), Ames Rellingson Co., New York.
10. Conway, J.V.P. : Evidential Documents(1959), Charles C. Thomas, Illinois.
11. Mehta, M. K.(1970) : The identification of Handwriting and Cross Examination of Experts, N.M. Tripathi, Allahabad.
12. Sulner, H.F.(1966) : Dispated Documents, Oceana Publications Inc., New York.
13. Saxena's : Saxena's Law and Techniques Relating to Finger Prints, Foot Prints and Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
14. Osborn, A. S.(1929) : Questioned Documents , Boyd Printing Co., Chicago.
15. Cummins and Midlo(1943) : Finger Prints, Palms and Soles, The Blakiston office London.
16. Cherril, F.R.(1954) : The Finger Prints. System at Scotland Yard, Her Majesty's office, London.

17. Wentworth and Wilder(1948) : Personal Identification, . R. G. Badger. Boston.
18. Mehta, M. K.(1980) : Identification of Thumb Impression and Cross Examination of Finger Prints, N. M. Tripathi (P) Ltd. Bombay.
19. Moenssens(1975) : Finger Prints Techniques, Chitton Book Co., Philadelphia, New York.
20. Bridges (1942): Practical Finger Printing, Funk and Washalls Co. NewYork.
21. Saferstein, R.(1990) : Criminalistics, Prentice Hall, New York.

DIGITAL FORENSICS

Unit-I : Fundamentals of Computers: History of Computers, Areas of Application, Computers and its components, Advantages and Disadvantages of Computer, Application Software and System Software, The Memory Hierarchy and Cache Memory. Operating System Overview: Introduction, Objectives and Functions of Operating System. Types of Operating system- Windows, Linux, Mac. Basics of Networks: Types of Networks, Networks Topology, OSI Model, TCP/IP and Related Protocols. Concept of Internet: Introduction, Applications and Working of Internet. Search Engines, Chat, E-mails.

Unit-II : Cyber Crimes: Introduction, Classification, Reasons of Cyber Crimes. Types of Cyber Crimes: (a) Crimes Targeting Computers. (b) Online Based Cyber Crimes. Investigation of Cyber Crimes: Investigation of Malicious Applications, Evidence Collection and Seizure Procedures of Digital Mediums, Securing the Scene, Documenting the Scene, Evidence Collection and Transportation. Data Acquisition, Data Analysis and Reporting. Concealment techniques.

Unit-III : Provisions in Indian Laws in dealing with Cyber Crimes and its critical analysis, Information Technology Act, 2000, Penalties under IT Act, Offences under IT Act, Offences and Analysis related with Digital Signature and Electronic Signature under IT Act, Statutory Provisions, Establishment of Authorities under IT Act and their functions, powers.

Unit-IV : Online Frauds: Nature and Characteristics. Types of Internet Frauds: Phishing, Identity Theft, Cyber Stalking, Spam Mails, and Spoofing. Web hacking, website defacing, DoS, DDo Sattacks and website cloning. 2. E-Banking Frauds: Characteristics and types: Fake bank website, Site redirecting, and Social Engineering. Handling and prevention of E-Banking frauds.Credit Card FraudsTypes of Frauds, Investigation and Prevention. Investigation of Cyber Crimes: Incident Response Methodology – Individual System and Networked system. Data collection: live system, stand alone system and networked system Volatile Memory data and Non-volatile memory data. Evidence handling procedure, Preserving digital evidence and Chain of custody, Challenges to Digital Forensic Evidence: Internet Crimes against children.

Unit-V : Trojan horse, trap door, super zapping, logic bombs. Types of computer crimes – computer stalking, pornography, hacking, and crimes related to intellectual property rights, computer terrorism, hate speech, private and national security in cyber space.An overview of hacking, spamming, phishing and stalking. Computer Forensics Investigations: Seizure of

suspected computer. Preparation required prior to seizure. Protocol to be taken at the scene. Extraction of information from the hard disk. Introduction to Cyber Forensics – Storage fundamentals – File systems concepts – Data recovery – Cyber Forensic Investigation – Investigation tools – e-Discovery – Digital evidence collection – Evidence presentation – E-mail investigation – E-mail tracking – IP tracking – E-mail recovery – Encryption and decryption methods – Search and seizure of computers – Recovering deleted evidence – Password cracking – Formatted partition recovery – Data recovery tools – Data recovery procedures and ethics - Preservation and safe handling of the original media – Chain of custody.

Suggested Readings:

1. Cyber Law in India by Farooq Ahmad- Pioneer Books
2. Information Technology Law and Practice by Vakul Sharma- Universal Law Publishing Co. Pvt. Ltd.
3. The Indian Cyber Law by Suresh T. Vishwanathan- Bharat Law House NewDelhi
4. Guide to Cyber and E- Commerce Laws by P.M. Bukshi and R.K. Suri- Bharat Law House, New Delhi
5. Guide to Cyber Laws by Rodney D. Ryder- Wadhwa and Compney, Nagpur
6. The Information technology Act, 2000- Bare Act- Professional Book Publishers, New Delhi.
7. Computer Forensics: Principles and Practices by Linda Volonino, Reynaldo Anzaldua and Jana Godwin -Pearson Prentice-Hall 2007.
8. First Responder's Guide to Computer Forensics by Richard Nolan et al.- Carnegi Mellon, 2005.
9. Digital Evidence and Computer Crime, 2nd ed. By Eoghan Casey- Acdemic Press, 2004.
10. The Regulation of Cyberspace by Andrew Murray, 2006- Routledge – Cavendish.
11. Scene of the Cybercrime: Computer Forensics Handbook by Syngress.
12. Security and Incident Response by Keith J. Jones, Richard Bejtlich and Curtis W. Rose
13. List of Websites for more information is available on: Http://www.garykessler.net.library/forensicsurl.html .
14. Introduction to Forensic Science in Crime Investigation By Dr.(Smt) Rukmani Krishnamurthy.
15. Tiwari, R.K. and Ravikumar, K.V. (2003): Computer Crime and Computer Forensics, Selective publication, New Delhi.
16. Stern, D.L. Preventing Computer Frauds.

CRIMINAL, EVIDENCE CRIMINAL PROCEDURE CODE SPECIAL ACTS

Unit-I : Concept and Definition of Crime, Causes of Crime, Social Change and Crime , Control and Prevention of Crime in Context with Organization, Industrialization, Family set up, Criminal Behavior and Psychology. Criminal Procedure Code 291, 292, 293,154, 155,

156, 157, 158, 159, 160,161,162,172,173,174,175,176. Constitution of Courts, Hierarchy of Courts and their Powers, Evidence in Enquiries and Trials, Lok Adalat, Lok Ayukts and Juvenile Courts. Constitution of India – Preamble, Fundamental Rights Article 20, 21, 22. Indian Evidence Acts – Sections 32,45,46,47,57,58,60,73,135,136,137,159. Criminal Justice System: Structure of Police, Prosecution and Judicial Organizations.

Unit-II : Sections of the Indian Penal Code: (i) Offences against Person: Sections: 299, 300, 302, 304B,306,319,320,326,339,340,351,359,362,357 and 377. (ii) Offences Against Property: Sections: 378, 383, 390, 405, 415, 441, 463, 471, 499, 503, 511., Explosive Substances Acts , Dowry Prohibition Act, Prevention of Food Adulteration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act, I.T. Act(Information Technology Act)-2000.Duties and responsibilities of food inspector, Indian companies act; formation of company, memorandum of understanding and article of association, powers of members, winding up of company.

Unit-III : Criminal Law Indian Penal Code: sections-23, 24, 25, 39, 44, 52, 76-79, 84-86. Criminal Procedure Code: sections-2, 6-35, 41-60, 61-90,154-176, 293, 294. Criminal Law and Charges: bailable/non-bailable offences, cognizable/ non-cognizable, summon case and warrant cases. Indian Evidence Act: sections- 3, 24-30, 45, 135-138, 141. Expert testimony. NDPS Act, Food and Adulteration Act, Drugs and Cosmetic Act, Arms Act, Explosives Act. Police Administration History and development of police administration; Police duties, responsibilities and powers. Organization and structure of police station; maintenance of crime records and accountability of police to law. People and society. Custodial deaths, Police and Human Rights.

Unit-IV : Police Administration and Investigation : Policing in the early period - Police Act of 1861 and other Police acts - Police Administration during British rule. Indian Police after Independence - change in structure and organisation - The Indian Police service - creation of new branches - and modification of the existing branches City Police and District Police - Investigating Wings - Intelligence Wings and Assault Wings -State and Central Police Forces - Special Task Forces and Special Units -National Police Commissions. **Investigation (Procedure) :** A. Reporting of crime and registration of F.I.R.- B. Cognizable / Non Cognizable and bailable -Non bailable offences.- C. Specialised investigation of homicides, property offences, white -collar crimes and bomb blasts and death in custody.-
D. Completion of investigation and filing of charge sheet etc.

Unit-V : Laws related to vulnerable groups: DVact, POCSO act, POSH, SC/ST HRact and JJact. Victimology: Definition and Scope, Historical Development, Types: Positivist, Radical and Critical Role and Functions of Victimologists. Who is a Victim? Demographic Characteristics; Victims of Violent Crimes, Typologies of Victims, UN. Declaration on basic principles of justice for victims of crime and abuse of power, 1985.Human Rights: Definition, Historical Development, U.N.Universal Declaration of Human Rights, 1948.

INSTRUMENTAL METHODS- II

Unit-I : What is spectroscopy , electromagnetic spectrum, Sources of radiation, their utility and limitations, conventional sources for UV, Visible and Infrared rays, sources for shorter wavelength radiations (X-ray tubes) radioactivity, gama rays and β rays. Laser (He, Ne, Argon ion, dye lasers, semi conductor lasers) as source of radiation. Interaction of radiation with matter: reflection, absorption, transmission, fluorescence, phosphorescence and their Forensic applications,

Unit-II : Molecular spectra: Introduction, molecular orbital, types of molecular energies, vibrational and electronic spectra, Atomic spectra, energy levels, quantum numbers and designation of states, selection rules, and qualitative discussions of atomic spectra. Augur effect. Detection of radiations, photographic detectors, thermal detectors, photoelectric detectors, radiation filters etc.

Unit-III : Absorption Spectroscopy Ultra violet and visible spectrophotometry: Types of sources and stability, wavelength selection, filters-cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection. **Fluorescence and phosphorescence spectrophotometry:** Types of sources, structural factors, instrumentation, comparison of luminescence and UV- visible absorption methods. **Atomic absorption spectrometry:** instrumentation and techniques, interference in AAS, background correction methods, quantitative analysis.

Unit-IV : Emission Spectroscopy Raman spectroscopy: Instrumentation, sample handling and illumination, structural analysis, polarization measurements and Dispersive and FT analysis. **Infrared spectrophotometry:** Dispersive and Fourier Transform spectrophotometry, sample handling, quantitative analysis and interpretation of IR spectra.

Unit-V : Atomic emission spectrometry: Instrumentation and techniques, arc/spark emission, ICP-AES, comparison of ICP vs. AAS methods, quantitative analysis, applications. **X-ray spectroscopy:** Elements of X-ray spectroscopy, X-ray absorption and fluorescence methods, X-ray diffraction, Auger emission spectroscopy (AES), and Dispersive X-ray analysis (EDX), Wavelength Dispersive X-ray analysis (WDX) **Nuclear magnetic Resonance spectroscopy**: Basic principles, theory and Instrumentation.

PRACTICAL- QUESTIONED DOCUMENTS AND FINGERPRINT EXAMINATION, COMPUTER FORENSICS

1. Identification of Handwriting General Characteristics.
2. Study of natural variations in handwriting.
3. Study of fundamental divergences.
4. Identification of individual characteristics.
5. Study of Disguised in handwriting.
6. Comparison of handwriting.
7. Detection of Simulated forgery.
8. Detection of traced forgery.

9. To obtain Plain and rolled inked finger prints.
10. To identify the finger Print Patterns.
11. To perform ridge tracing and ridge counting.
12. To identify the ridge characteristics.
13. To Compare the finger Prints.
14. To develop latent finger Prints with powder method.
15. To develop latent finger Prints with fuming method.
16. To develop latent finger Prints with chemical methods.
17. Working in Windows
18. Application of Internet- visiting websites with given URL, searching information using search engine.
19. Investigation of E-mail- Finding senders IP Address of received e- mail, tracing route of e-mail received using tools available on internet e.g. Visual Trace Route etc.
20. To Recover Concealed Data in the form of Altered Data viz. Renamed Files, Manipulated File System, Data Hidden on NTFS.
21. To Take Images from various Storage media.

INTERENSHIP - FSL/CFSL/Police Station /Court room

SEMESTER III
FORENSIC CHEMISTRY AND TOXICOLOGY

Unit-I : Introduction to Forensic chemistry, sampling of chemical evidences, presumptive, screening (color/ spot test), inorganic analysis. Detective dyes- cases and importance in trap cases. Arson Chemistry of fire, searching of fire scene, collection, preservation and examination of arson evidences. Adulteration in Petroleum products. Examination procedures involving standard methods and instrumental techniques, analysis of beverages- alcoholic and nonalcoholic, country made liquor and medicinal preparations containing alcohol as constituents. Significance of alcohol in breath and breath screening devices. Forensic analysis of Fertilizers/ insecticides/ pesticides/ biocides.

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

Unit-III : Study of Analysis of Beverages Introduction, Definition of alcohol and illicit liquor, Alcoholic and non-alcoholic beverages and their composition, Proof spirit, absorption, detoxication and excretion of alcohol, problems in alcohol cases and difficulties in diagnosis, Alcohol and prohibition, Consequences of drunken driving, Analytical techniques used for the analysis of alcohol. Food adulteration: Introduction, Prevention of food adulteration, Analytical techniques for analysis of exhibits involved in food and other material. Forensic medicine

Unit-IV : Natural and synthetic drugs of abuse. Drug dependence, classification of drugs-Narcotics, Hallucinogens, Depressants, Stimulants, Anabolic steroids. Psychotropic and Psychedelic drugs of abuse.Field and laboratory tests of drugs of abuse. Instrumental methods of analysis, collection, preservation and transportation of drug evidences. Forensic Chemistry: Introduction, Types of cases which require chemical analysis, Limitations of forensic samples, conventional methods of chemical analysis, presumptive tests (colour/spot tests), Microcrystal tests, Elemental analysis (organic and inorganic). Examination of contact Traces: Introduction to cosmetics and detective dyes, collection, sampling and analysis.

Unit-V : Forensic Chemistry: Introduction, Types of cases which require chemical analysis, Limitations of forensic samples, conventional methods of chemical analysis, presumptive tests (colour/spot tests), Microcrystal tests, Elemental analysis (organic and inorganic). Examination of contact Traces: Introduction to cosmetics and detective dyes, collection, sampling and analysis. Arson: Introduction, chemistry of fire, scientific investigation and evaluation of clue materials, collection and preservation, analysis of flammable residues. Drugs of abuse: Introduction, drug addiction and its problems, classification of drugs of abuse, Depressants, stimulants, Hallucinogens, Identification, Field tests and laboratory tests. Drug abuse in sports: Introduction, common prohibited substances, analytical approach. Forensic Toxicology: Introduction, Role of the toxicologist, significance of toxicological findings, poisons, definition, classification on the basis of their origin, physiological action and chemical nature, metabolism and excretion of poisons, poisoning in India.

Suggested readings

1. Ret Newman, Micheal Gilbert, Kevin Lothridge; GC-MS Guide to Ignitable Liquids, CRC Press, LLC, 1999.
2. Modi's: Medical Jurisprudence and Toxicology, M. M. Trirathi Press Ltd. Allahabd, 1988.
3. S.N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
4. Saferstein, R: Forensic Science Hand Book, Vol I, II and III, Pretince Hall, 1982.
5. Saferstein, R: Criminalistics, 2002.
6. O Hara and Osterburg : Introduction to Criminalistics, 1949.
7. Sharma, B.R.: Forensic Science in Criminal Investigation and Trials, 2003.
8. Maehly and Stromberg : Chemical Criminalistics, 1980.
9. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
10. Casarett and Doll Toxicology : The Basic Science of poisons.
11. Curry, A.S. : Poison Detection in Human Organs, 1976.
12. Holfmann, F.G.: Handbook of Drug and Alchoho Abuse.
13. Arena Poisoning: Chemistry, Symptoms and Treatment.
14. Froede, R.C.: The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
15. Connors, K.: A text book of Pharmaceuticals analysis, Interscience, New York, 1975.
16. Gleason, M.N. et. al.: Clinical Toxicology of Commercial products, Williams and Williams, Baltimore USA, 1969.

FORENSIC BIOLOGY AND SEROLOGY

Unit-I : Biological evidence: Importance, nature, location, collection and evaluation. Hair and Fibers: Importance, nature, location, collection, evaluation and tests for their identification. Importance and identification of Botanical evidence such as Pollen grains, wood, leaves and seeds.

Unit-II : Blood: Composition and functions, collection and species identification. Human Blood groups: General Principles, theory of their inheritance, Blood group determination from fresh blood - Definition of antigen and antibody, Various Antigen-antibody reactions. Blood grouping from stains of blood, semen, saliva and other body fluids by Absorption inhibition, Absorption-elution and mixed agglutination techniques, determination of secretor/non-secretor status.

Unit-III : Semen: Forensic significance, location, collection, evaluation and tests for identification Forensic significance of other body fluids like saliva, sweat, milk etc. Their collection and identification.

Unit-IV : Polymorphic enzymes: Forensic significance, identification from fresh blood and stains. Paternity disputes: Causes, Various serological and biochemical methods, calculation of paternity index and probability for paternity and maternity.

Unit-V : Forensic examination of Body fluids: 1) Blood: Identification (Preliminary and confirmatory tests), species of origin (Immuno diffusion and Immuno electrophoresis), Individualization: Blood grouping, enzyme typing, 2) Semen: Composition, functions and morphology of spermatozoa, Identification (Preliminary and confirmatory tests including Azoospermic semen stains), Individualization (Blood Grouping, seminal fluid isozymes typing, 3) Composition, functions and forensic significance of saliva, sweat, milk, urine, faecal matter, vaginal secretions and tests for their identification including the presence of blood group specific ABH substances.

Suggested Readings

1. Robertson, J. (1996): Forensic Examination of Hair. Taylor and Francis, USA.
2. Modi, J.K. (1988): Medical Jurisprudence and Toxicology, N.M. Tripathi Pvt. Ltd.
3. Fraser, Roberts J.A (1965): An introduction to Medical Genetics.
4. Chatterjee, C. C- (1975): Human Physiology.
5. Boorman, K. E: Blood Group Serology, Churchill, and Lincolin, P. J. (1988)
6. Race, R. R. and Sangar, R. (1975): Blood Groups in Man. Blackwell Scientific, Oxford.
7. Saferstein, R. (1982): Science Handbook, Vol. I, II and III, Prentice Hall, New Jersey.
8. Barris, H. and Hopkinson, D. A. (1976): Handbook of Enzyme, Electrophoresis, Elsevier, North, Holland, New York.
9. Gilblet, E. (1969): Marker's in Human Blood, Davis, Pennsylvania.
10. Culliford, B. E. (1971), The examination and Typing of Blood Stains, US Deptt. of Justice, Washington.
11. Chowdhuri, S. (1971): Forensic Biology, B P R and D, Govt. of India.
12. Dunsford, I. and Bowley, C. (1967): Blood Grouping Techniques, Oliver and Boyd, London.
13. Eckert, W. G. and James, S.H. (1989): Interpretation of Blood Stain, Evidence, Elsevier, New York.

QUALITY MANAGEMENT AND RESEARCH METHODOLOGY

Unit-I : Quality Management System: Quality, Total Quality, Quality assurance, Quality Control, Quality Planning, and Quality Audit: Internal and External Audit, Accreditation, NABL, ISO, IEC, BIS.

Unit-II : General Requirements for the competence of testing and calibration of laboratories, Management Requirements: organizational, document control, Subcontracting of tests and calibrations, Control of non conforming testing/ calibration work, Corrective and preventive actions, management review.

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

Unit-IV : Selection of Research Problem: Research proposal, literature search, hypothesis, report writing. Sampling population and Sample, Sampling procedures (random and non random), sampling statistics, sampling and physical state, homogenization of samples, sample size and hazards in sampling.

Unit-V : Types of data, Basic concepts of frequency distributions, measure of central Tendency, Mean, Median and Mode, measure of dispersion, range, mean deviation and standard deviation. Correlation and regression analysis. Variance – coefficient of variation, moment, Skewness, and kurtosis, binomial distribution, normal distribution, hyper geometric distribution, correlated measurements. Test of significant of attributes , Z-test of significance and coefficient of correlation , small sample test , t- test , paired test , chi square test, F-test for equality variance , large sample test, Normal test . Significance of statistics in Forensic Science.

Suggested Readings

1. C.G.G. Aitken and D.A Stoney; The use of statistics in Forensic Science, Ellis Horwood Limited, England 1991.
2. Visweswara Rao. K: Biostatistics, A Manual of Statistical Methods for Use in Health, Nutrition and Anthropology.
3. Sokal, R.R and Rolf, F.J: Biometry, Principles and Practices of Statistics in Biological Research.
4. Rao, C. R Advanced Statistical Methods in Biometric Research.
5. Saferstein R. Forensic Science Handbook I, II, III.
6. William L. Duncan: Total Quality, Key Terms and Concepts.
7. Murray S. Cooper: Quality control in the Pharmaceutical Industry.
8. John T. Rabbitt, Peter A Bergh: The ISO 9000 Book.
9. Willard Merritt, Dean and Settle: Instrumental Methods of Analysis.
10. NABL -113
11. NABL -113A
12. Quality Management systems: A Practical Guide Howard S. Gitlow 2001 CRC Press ISBN 1-574-44261-9

13. Crime Laboratory Management: Jami St. Clair 2003. Academic Press. ISBN 12661051-3.
14. ASCLD Guidelines for Forensic Science Laboratory Practices.
15. The laboratory Quality Asurance system: A manual of Quality Procedures and forms. Thomas A Ratliff. 2003 3rd ed. John Wiley and Sons ISBN. 0-471 26918-2.
16. Systematic Quality Management Gary B Clark. 1995 Practical Laboratory Management Series.
17. Quality assessment of chemical Measurments John K. Taylor. CRC Press 1987. 087371-097-5.
18. Quality in the analytical chemistry laboratory E. Prichard. 1995 John Wiley ISBN 0471 955418

INSTRUMENTAL METHODS- III

Unit-I : Chromatography: Introduction, Review of basic principles and types of chromatography Paper Chromatography- Basic Principle, Experimental Procedure, Forensic Application. 2. Thin layer chromatography- Basic Principle, Experimental Procedure, Rf Value, Forensic Application, Advantage of TLC over Paper Chromatography. 3. Column Chromatography: Basic Principle, Experimental Procedure, Advantages and Disadvantages, Forensic Applications.

Unit-II : HPTLC-: Theory and Basic principle, Experimental Procedure, Qualitative and Quantitative analysis, Forensic Application. **Gas chromatography:** Theoretical principles, instrumentations and technique, columns, stationary phases, detectors, Pyrolysis GC, GC-MS, Forensic applications. **Liquid chromatography:** HPLC, Review of theory, Instrumentation, Technique, column, detectors, LC-MS, Forensic applications.

Unit-III : Electrophoresis: Introduction, Basic Principles, Various factors affecting electrophoresis, Instrumentation and Forensic applications of Various electrophoresis techniques- Moving boundary electrophoresis, Zone electrophoresis (Paper electrophoresis, Cellulose acetate membrane electrophoresis.

Unit-IV : Gel electrophoresis, Agrose gel electrophoresis, Polyacrylamide gel electrophoresis), Sodium dodecyl sulphate (SDS) polyacrylamide gel electrophoresis, Two dimensional electrophoresis, Capillary electrophoresis, Immuno electrophoresis, Isoelectric focusing. Haemoglobin electrophoresis.

Unit-V : Immunological Techniques: Introduction, immune system, types of immunity. **Radioimmunoassay:** Basic Principle, Labelling of Antigen and technique of Assay and Applications. **Enzyme linked Immuno Sorbent Assay (ELISA):** Competitive method, Sandwich method, Indirect method and Applications.

Suggested Readings:

1. Lurie and Witturer (1983): High Performance Liquid chromatography in Forensic Chemistry.
2. Gilbert(1997): GC-MS guide to ignitable liquids.

3. Brown, P.R: Advance in chromatography
4. Howard: Forensic Analysis by Gas Chromatography.
5. Grahm D.(1973): The use of X-ray Techniques in Forensic Investigation.
6. Settle, F.A.(1997): Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.

PRACTICAL - FORENSIC CHEMISTRY AND TOXICOLOGY

1. Colour/spot tests for common drugs of abuse.
2. TLC separation of drugs of abuse.
3. TLC separation of pesticides/insecticides.
4. TLC separation of anabolic steroids.
5. Distillation characteristics of gasoline, kerosene, and diesel oil.
6. Analysis of phenolphthalein in trap cases.
7. M.P, B.P and flash point Determination.

PRACTICAL : BASED ON FORENSIC BIOLOGY AND SEROLOGY INCLUDING FORENSIC PHYSICAL ANTHROPOLOGY

1. Determination of Age from Skull Sutures.
2. Determination of Age from Teeth.
3. Determination of Sex from Skull.
4. Determination of Sex from Pelvis.
5. To Perform Osteometric measurements on Long bones.
6. To Perform Craniometric measurements on skull.
7. To perform Somatometric measurement on living.
   (a) Height Vertex, (b) Head Length
   (c) Head Breadth (d) Foot Length
   (e) Foot Breadth (f) Nasal Height
   (g) Nasal Breadth (h) External Biorbital Breadth
   (i) Internal Bi-Orbital Breadth (j) Bigonial Breadth
   (k) Bizygomatic Breadth.
8. To prepare slides of scale patterns of human hair.
9. To examine human hair for cortex and medulla.
10. To examine Barr bodies from hair root.
11. To Identify Blood Stains.
12. To Identify Semen Stains.
13. To Identify Saliva Stains.
14. To Identify Various Type of Fibers.
15. To Determine Species of Origin from Blood.
16. To Determine Blood Group from Fresh Blood and Blood Stains.

SEMESTER - IV

Option -A: Specialization in Forensic Biology and Serology (FBS)

ADVANCED FORENSIC BIOLOGY

Unit-I : Fiber Examination: Introduction, Classification, Fiber transfer and persistence. Fiber Recovery: At the scene, in the laboratory, contamination and its prevention. Fiber, Hair examination: Hair structure, Identification: Species of origin, variation in different major population groups, somatic origin. Individualization: Blood grouping, enzyme typing

Unit-II : Wild Life Forensics: Introduction, importance, protected and endangered species of Animals and Plants. Identification of wild life materials such as skin, fur, bones, nails, horn, teeth, flowers and plants, by conventional and modern methods, Identification of Pug marks of various animals.

Unit-III : DNA Profiling: Structure of DNA, Damage to DNA, Variation in DNA, DNA as excellent polymorphic marker, Basis of DNA typing. DNA typing technique - RFLP, PCR, Amplification, PCR based typing methods such as HLA DQ A1 Ampli-Type (R) PM Polymarkers, D 1580, STR, Gender ID, mt-DNA methods with their merits and demerits. Comparison of RFLP and PCR based method.

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

Unit-V : Botanical evidences: Introduction, types, location, collection evaluation and forensic significance.

1. Wood: Type of wood and their identification and comparison.
2. Leaves: Identification of various types of leaves and their anatomy, methods of comparison.
3. Pollens: Structure, function, methods of identification and comparison.
4. Diatoms: Nature, location, structure, extraction from various body tissues, including bone marrow, preparation of slides, methods of identification and comparison, forensic significance.

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

Suggested Readings

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

ADVANCED FORENSIC SEROLOGY

Unit-I : Immuno diaghnosis . Antigen-Antibody Reactions: Precipitation, agglutination, complement, neutralization, immune fluorescence. ELISA, RIA HLA system: Its applications in paternity testing, pitfalls of HLA system. Forensic significance, buffers and serological reagents, methods of sterilization employed for serological work.

Unit-II : Serology; 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, determination of secretor/non secretor status, Lewis antigen, Bombay Blood group, Polymorphic enzymes typing- PGM, ESD, EAP, AK, etc., and their forensic significance, HLA typing, Role of serogenetic markers in individualization, paternity disputes

Unit-III : DNA Profiling**:** Introduction, History of DNA Typing, human genetics- heredity, alleles, mutations and population genetics, molecular biology of DNA, variations, polymorphism, DNA typing systems- RFLP analysis, RTPCR, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR. Mitochondrial DNA, evaluation of results, frequency estimate calculations, interpretations, allele frequency determination, match probability- database, quality control, certification and accreditation.

Unit-IV : Forensic Significance of DNA profiling: Applications in disputed paternity cases, child swapping, missing person's identity- civil immigration, veterinary, wildlife and agriculture cases, legal perspectives- legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad.

Unit-V : New and future technologies: DNA chips, SNPs and limitations of DNA profiling.NGS, touch DNA, LCR, NASBA,

Suggested Readings

1. Medical immunology by Danniel P. Stites, Abba I. Jerr, Tristram G. Parstow, Ninth edition; Prentice Hall International Inc. 1997.
2. Stern, C. (1964) : Principles of Human Genetics, Freeman, California. 3. Chatterjee, C. C-(1975) Human Physiology.
3. Beerman, K.E.: Blood Group Serology, Churchill, and Lincoin, P.J. (1988)
4. Race, R.R, and Sanger, R. (1975) : Blood Groups in Man. Blackwell Scientific, Oxford.
5. Saferstein, R. (1982): Forensic Science Handbook, Vols. I, II, and III, Prentice Hall New Jersey.
6. Curry, A. S. (1965): Methods of Forensic Science, Vol IV, Interscience, New York.
7. Barris, H. and Hopkinson, D.A. (1976) : Handbook of Enzyme, Electrophoresis Elsevier, North, Holland, New York.
8. Gilblet, E. (1969) : Markers in Human Blood, Davis, Pensylvania.

9. Culliford, B.E. (1971) The Examination and Typing of Blood Stains, US Deptt. of Justice, Washingron.
10. Kirby : DNA Fingerprinting Technology.
11. Furley, M.A. and Harrington, J.J. (1991) Forensic DNA Technology.
12. National Research Council (1992) : DNA Technology in Forensic Science, Washington DC National Academy Press.
13. Chowdhari, S. (1971) : Forensic Biology, B P R and D, Govt, of India.
14. Dunsford, I and Bowley, C. (1967) : Blood Grouping Techniques, Oliver and Boyd, London.
15. Bokert, W. G. and James, S. H. (1989) Interpretation of Blood Stain, Evidence, Elsevaier, New York.
16. Erikson : Blood Group Serology.
17. DNA structure and functions by Richard R. Sinden; Academic Press, Inc. 1994.
18. DNA Structure and functions by Richard R. Sinden; Academic Press, Inc.1994.
19. DNA Profiling and DNA fingerprinting; Edited by Jorg T. Epplen and Thomas Lubjuhn; Birkhauser Verlag, Switzerland, 1999.
20. Forensic DNA Profiling Protocols edited by Patrick J. Lincoln and Jim Thomson; Humana Press, Inc. 1998.
21. DNA and other Polymorphism in Forensic Science by Henry C. Lee and R.E. Gaensslen; Year book Medical Publishers, Inc. 1990.
22. DNA Technology in Forensic Science by committe on DNA Technology in Forensic Science, Board on Biology, Commission on Life Sciences, National Research council; National Academy Press, Washington, D.C. 1992.

ADVANCED PRACTICAL : BASED ON FORENSIC BIOLOGY AND SEROLOGY

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

DISSERTATION

Every student will have to undertake a dissertation based on the option and the actual work carried out on the problem under the guidance of his/her supervisor. The supervisor will be allotted by the HOD to each of the student. The supervisor will be the faculty member of the institute. The institution may decide to send the students to external institution for completion of the experimental work/consultation with the scientist and library for their dissertation work. In that case the HOD of the concerned external institute will allot one of its facility

member/scientist as co supervisor to the student. If a student goes to any external institute for the completion of his dissertation work he/she has to submit one certificate duly signed by the allotted co supervisor and HOD of the external institution. The student will have to submit minimum for copies(04) of his/her dissertation before the last date specified by the department. The dissertation will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and external examiners.

Option - B:
Specialization in Forensic Chemistry and Toxicology (FCT)
ADVANCED FORENSIC CHEMISTRY

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

Unit-II : Adulteration of food and food products and FSSAI regulations and its applications, Health hazards, food poisoning – microbial, chemical and allergic hypersensitivity reactions, venom and antidote chemistry.

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

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

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

Suggested Readings

1. Lundquist and Curry : Methods of Forensic Science, 1963.
2. Saferstein : Criminalistics, 1976.
3. Hara and Osterburg : Introduction to Criminalistics, 1949.
4. Sharma, B.R. : Forensic Science in Criminal Investigation and Trials, 1974.
5. Walb and Brounds : Drunks, Drugs and Driving.
6. Crown : The Forensic Examination of Paint and Pigments, 1968.
7. White : Dynamics of Accident Investigation in criminal cases.
8. Moenssens, Mosses and Inbaw : Scientific Evidence in criminal cases.
9. Hoffman : A Handbook on Drug Alcoholic Abuse.
10. Maehly and Stromberg : Chemical Criminalistics, 1980.
11. Cunliffe and Piazza : Criminalistics and Scientific Investigation.
12. Moffat, A.C. (Editor) : Clark's Isolation and Identification of Drugs, 1996.

ADVANCED FORENSIC TOXICOLOGY

Unit-I : Systematic Extraction, Isolation, Identification, Estimation of following poisons from viscera, blood and urine. (i) Common narcotics (as poisons): opium and its derivatives. (ii) Barbiturates, Benzodiazepines derivatives, Amphetamines. (iii)Insecticides/ Pesticides: Organochloro, organophosphorus and carbamates. (iv)Common inorganic poisons, salts of Arsenic, Mercury, Lead and Cyanides.

Unit-II : Vegetable poisons: Nature, type, mode of action, extraction, isolation, Identification of the following: (i) Poisonous seeds: Abrus precatorius, Atropa belladonna, Argemone mexicana, Cerbera thevetia, Croton tiglium, Datura fastuosa, Ricinus communis. (ii) Poisonous fruits: Semicarpus anacardium, Urginea scilla. (iii) Poisonous roots: Digitalis, Aconitum napellus, Plumbago rosea. (iv) Poisonous Mushrooms. Animal Poisons: Snake venom, composition, site of action, mode of action, effect on the body as a whole, and tests for identifications. Carbon monoxide poisoning: significance, signs and symptoms, methods of diagnosis, tests for identification.

Unit-III : Metabolism and excretion of poisons:- Introduction, Pathways of drug-metabolism-Non synthetic pathway or phase- I reactions like oxidation, hydroxylation, N-and –O de alkylation and sulphoxide formation, Synthetic pathways or phase II reactions like conjugation, acetylation, methylation of drugs/poisons as exemplified by alcohols, aldehydes, ketones, aliphatic amines, carbamates, phenols, cyanides, barbiturates, amphetamines and opiates.

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

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

Suggested Readings

1. Curry : Analytical Methods in Human Toxicology, Part II, 1986.
2. Casarett and Doll Toxicology : The Basic Science of poisons.
3. Clark, E.G.C. : Isolation and identification of Drugs, VI and Vol. II, 1966, 1975- 1986.
4. Curry, A.S. : Poison Detection in Human Organs, 1976.
5. Curry, A.S. : Advances in Forensic Chemical Toxicolo, 1972.
6. Holfmann, F.G. : Handbook of Drug and Alchoho Abuse.
7. Turner : Drugs and Poisons.
8. Samford : Poisons Their Isolation Identification.
9. Dubois and celling : Textbook of Toxicology.
10. Arena : Poisoning Chemistry, Sympto Treatment.
11. Stoleman : Progress in Chemical Toxicology.
12. Sunshine, I : Guidelines for Analytical Toxicology Programme, Vol. I, CRC Press, 1950.
13. Sunshine, I : Handbook of Analytical Toxicology, Press, 1969.
14. Sunshine : Methods for Analytical Toxicology, Press USA, 1975.
15. Curry, A.S. : Poison Detection in Human Organs, C. Tho Springfeild, Illinois USA, 1963.
16. Froede, R.C. : The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
17. Connors, K. : A text book of Pharmaceuticals analysis, Interscience, New York, 1975.
18. Gleason, M.N. et. al. : Clinical Toxicology of Commercial products, Williams and Williams, Baltimore USA, 1969.

ADVANCED PRACTICAL- FORENSIC CHEMISTRY AND TOXICOLOGY

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

(FCT) DISSERTATION

Every student will have to undertake a dissertation based on the option and the actual work carried out on the problem under the guidance of his/her supervisor. The supervisor will be allotted by the HOD to each of the student. The supervisor will be the faculty member of the institute. The institution may decide to send the students to external institution for completion of the experimental work/consultation with the scientist and library for their dissertation work. In that case the HOD of the concerned external institute will allot one of its facility member/scientist as co supervisor to the student. If a student goes to any external institute for the completion of his dissertation work he/she has to submit one certificate duly signed by the allotted co supervisor and HOD of the external institution. The student will have to submit minimum for copies (04) of his/her dissertation before the last date specified by the department. The dissertation will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and external examiners.

OPTION - C
SPECIALIZATION IN QUESTIONED DOCUMENTS AND FINGER PRINT EXAMINATION (QDFP)
(QDFP) QUESTIONED DOCUMENT EXAMINATION

Unit-I : Handwriting: Origin of alphabet, teaching of handwriting, writing systems; Principle of handwriting identification, copy book form Deviations from copy book form Development of individuality in handwriting classification of characteristics: Class and individual characteristics, Natural characteristics in handwriting, accidental characteristics in handwriting. Various types of characteristics contributed due to (a) Element of style as Arrangement, connection, design, size and relative size, slant, spacing (b) elements of execution as Abbreviations, Alignment, Commencement and termination, diacritic and punctuation, embellishment, legibility, pen control leading to pen scope, pen pressure, pen lift, pen pause, writing movements, line quality.

Unit-II : Comparison of handwriting**:** Natural Variations in handwriting range of variations (consistency), fundamental divergences in handwriting. Interpretation of these two in relation of identification of handwriting, individual characteristics, significant individual characteristics, relative weightage of characteristics of handwriting, consideration of various writing instruments used in writing. Forgeries of Signature: Classes of forgery and their examination, Disguise in handwriting, anonymous letters, Handed ness and ambidexterity, examination of numeral and initials

Unit-III : Alterations in the document: Advanced methods of examination of alterations as Projectina, video- spectral comparator (VSC) and ESDA, their working principles and uses. Modern Typewriting devices as check writing machine, electronic type writer, proportional spacing type writer, Computer Printing devices as dot matrix printer, inkjet printer and laser printer, their working, identification and limitations. Composition of ink, paper and their examination.

Unit-IV : Types and working of Photostat Machine, Fax Machines, identification of Photocopies and Photocopier, fax machines. Desktop printing including image processing devices, their role in counterfeit currency and certificate etc.

Unit-V : Plastic currency: Examination of credit cards and similar material, Holographic marks and their examination. Examination of e-documents and Digital signatures Preparation of detailed report with reasons and illustrative charts, use of standard terminology. Crypto currency

Suggested Readings

1. Huber, A. R. and Headride, A.M. (1999) : Handwriting identification : facts and fundamental CRC LLC
2. Ellen, D (1997) : The scientific examination of Documents, Methods and techniuqes. 2nd ed., Taylor and Francis Ltd.
3. Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
4. Madinger J. and zalopany, A.R. (1999) : Money Laundering CRC Press.
5. Manning, C.A (1999) : Financial Investigations and Forensic Accounting CRC Press.
6. Harrison, W.R. : Suspect Documents and their Scientific Examination, 1966, Sweet and Maxwell Ltd., London.
7. Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsaevier North Holland Inc., New York.
8. Brewster, F, : Contested Documetns and Foregeries, The Eastern Law House, Calcutta. 1932.
9. Ames : Ames on Foregery, 1900, Ames Rellingson Co., New York.
10. Conway, J.V.P. : Evidential Documents, 1959, Charles C. Thomas, Illinois.
11. Mehta, M. K. : The identification of Handwriting and Cross Examination of Experts, N.M. Tripathi, Allahabad. 1970.
12. Sulner, H.F. : Dispated Document, 1966 Oceana Publications Inc., Ner York.
13. Saxena's : Saxena's Law and Techniques Relating to Finger Prints, Foot Prints and Detection of Forgery, Central Law Agency, Allahabad (Ed. A.K. Singla).
14. Quirke, A.J. : Forged, Anonymous and Suspet Documents, 1930, Reorge Rontledge and Sons Ltd., London.
15. Osborn, A. S. : Questioned Documents 1929, Boyd Printing Co., Chicago.

(QDFP) FINGER PRINTS EXAMINATION

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

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

Unit-III : Chance Finger Prints: Latent prints, plastic prints and visible prints, causes, composition of sweat. Development of latent finger prints: Conventional methods-fluorescent powders(Black, grey, white, magnetic powder). Fuming methods: Iodine and cynoacrylate methods. Chemical methods: Ninhydrin and its analogue silver nitrate, enhancement of latent prints, application of laser technologies, metal deposition method. Biological methods of development of latent prints on skin.

Unit-IV : Systematic approach to latent print processing, preserving and lifting of finger prints. Photography of Finger Prints, comparison of finger prints: basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics. Automated Finger Print Identification system (AFIS) and its variants, digital Image processing of finger prints and their enhancement. Presentation of expert evidence on finger prints in court.

Unit-V : Examination of Finger Prints and Other Impressions: Biometric frauds Recent advancement in fingerprint verification

Suggested Readings

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

ADVANCED PRACTICAL - QUESTIONED DOCUMENTS AND FINGER PRINTS EXAMINATION

1. To study the handwriting of person suffering from illness.
2. To study the handwriting written on unusual surfaces as wall.

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

(QDFP) DISSERTATIONS

Every student will have to undertake a dissertation based on the option and the actual work carried out on the problem under the guidance of his/her supervisor. The supervisor will be allotted by the HOD to each of the student. The supervisor will be the faculty member of the institute. The institution may decide to send the students to external institution for completion of the experimental work/consultation with the scientist and library for their dissertation work. In that case the HOD of the concerned external institute will allot one of its facility member/scientist as co supervisor to the student. If a student goes to any external institute for the completion of his dissertation work he/she has to submit one certificate duly signed by the allotted co supervisor and HOD of the external institution. The student will have to submit minimum for copies (04) of his/her dissertation before the last date specified by the department. The dissertation will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and external examiners.

OPTION-D
Specialization in Forensic Physical Sciences
(FPS) ADVANCED FORENSIC PHYSICS

Unit-I : Ballistics: History, Types of Firearms and Ammunition. Internal, External and Terminal Ballistics. Types of Evidences found at Crime Scene. Collection, Preservation, Packaging, Forwarding and their Laboratory Examination. Various Marks Produced on Bullets and Cartridge Cases during Firing. Techniques for obtaining Test Material from various types of Weapons. Methodology used in linkage of Fired Bullets/ Cartridge Cases with Firearms. **Integrated Ballistic Identification system (IBIS):** Automated Examination and Comparison of Fired Bullets/ Cartridge cases and Ballistics Imaging Database of the Marking of Fired Bullets/ Cartridge Cases. **GSR:** GSR and its Analysis by advanced methods. Report Writing and Expert Witness.

Unit-II : Tool Marks: Introduction, Types of Tool Marks, Class and Individual Characteristics, Tracing, Photography, Lifting and Casting of Tool Marks, Examination,

Identification and Comparison of Tool Marks. **Foot/Footwear/Tyre Impression:** Introduction, Collection, Tracing, Lifting, Casting of Impressions, Enhancement, Analysis and Comparison of Impressions, Moulds, Identification Characteristics.

Unit-III : Lip Prints: Introduction to Cheiloscopy and History of Lip Prints, Classification, Collection, Development, Identification and Comparison of Lip Prints. **Ear Prints:** Introduction, History, Morphology of the Ear, Procedures of taking Standards from the Suspects, Identification and Comparison of Ear Prints. **Paint:** Introduction, Composition and Use of Paint, Types of Paint, Resins and Binders, Lacquers, Plasticizers, Water Based Polymers and Emulsions, Additives, Solvents, Pigment types, Microscopic and Macroscopic Examination, Micro Chemical Tests, Differential Solubility and TLC, IR Spectroscopy, Pyrolysis GC-MS, Elemental Analysis of the Pigments. **Soil:** Introduction, Formation and Types of Soil, Composition and Colour of Soil, Sample preparation, Removal of Contamination, Microscopic Examination, Particle Size Distribution, Ignition Test, Density Distribution, pH Measurement, Differential Thermal Analysis (DTA), Elemental Analysis, Interpretation of Soil Evidence.

Unit-IV : Glass: Introduction, Types of Glass and their Composition. Forensic Examination of Glass Fractures under different conditions. Physical Measurement of Glass, Colour and Fluorescence, Physical Matching, Density Comparison, Refractive Index Measurement (RI), Elemental analysis and Interpretation of Glass Evidence. Introduction, Location, Collection, Packeging, Forwarding and Laboratory Examination of Fiber, Paper, Ink, Cement and Mortar, Polymers, etc.

Unit-V : Forensic Speaker Identification: Speaker Identification and Tape Authentication: Voice Production Theory, Speech Signal Processing and Pattern Recognition, Acoustic Parameters of Sound, Fourier Analysis, Frequency and Time Domain Representation of Speech Signal, Analogue to Digital Conversion-Sampling and Quantization, Fast Fourier Transform, Speech Enhancement, Authentication of Audio-Video Signal.

Suggested Books

1. Forensic Science hand book by Richard Saferstein.
2. Forensic examination of glass and paint, Brian Caddy, Taylor and Francis.
3. Forensic Science Progress, A. Maehly et all, Vol.1 to 5.
4. Crime Investigation by P.L. Kirk.
5. Forensic Science Hand Book, Vol.-III Chapter-3 (1993), R Saferstein, Prentice Hall International, London.
6. Methods of Chemical Analysis of Hydraulic Cement, Bureau of Indian Standards, ARE: 4032-1985.
7. Elements of X-ray Diffraction, B.D. Cullity, Addision- Weseley Publ.Comp. Inc.
8. ASTM standards, Vol.15-09.
9. Forensic examination of fibers, James Robertson.
10. Gem Testing, B. W. Anderson.
11. Annual Book of ASTM standard, Vol.04.01:1985.
12. Precious stones, Max Bauer (Vol.I and II).
13. The chemistry of cement and concrete, Lea, F.M.1971, Chemical Publication. Comp.Inc. New York (USA).

(FPS) ADVANCED DIGITAL FORENSICS

Unit-I : Digital Forensics: Introduction, Classification of Digital Crimes and Branches of Digital Forensics. Digital Evidences: Types of Digital Evidences, Acquisition, Handling and Chain of Custody. Evidence Imaging and File System Analysis (FAT and NTFS). Various Tools for Disc Imaging and Data Recovery (ENCASE, NUIX), Vulnerability Assessment Tools. Investigations on Various Imaging Methods (RAW, SMART, E01, AFF). Password and Encryption Techniques. Password Recovery Tools.

Unit-II : Cyber Forensics: Definition and Types of Cyber-Crimes. HTML and Internet Protocols, Internet History and Topology, Internet Services and Access, Internet Protocols and Addressing, E-mail and Header Interpretation, E-mail Attachments, FTP, Telnet and IRC, Internet Chat, HTTP. Outlook Express, Virus and Trojan Infection, Different Types of Attacks, Internet Research and Investigating Tools.

Unit-III : Image Analysis: Formation of Image, Image Sampling and Quantization, Basics of Full-color Image Processing, Image Enhancement Techniques, Filters for Image Enhancement, JPEG, PNG, Header Data Analysis, Noise Analysis, Linkage of Camera. Image Steganography, Image Forgery Detection, Detect Steganography from Image, Digital Watermark, Multimedia IPR, Forensic Analysis of Multimedia Files. **Video Analysis:** Forensic Video Analysis, Enhancement Techniques, Specific Frame Analysis, Resolution, Scope and its Forensic Application in the Field of Security.

Unit-IV : Mobile Forensics: History of Mobile Phones, Types of Mobile Phones, Advantage and Disadvantages of Mobile Phones and their Forensic Applications. Operating Systems: Introduction, Objective and Types of Operating System- Java, Symbian, Window, Android and iPhone. Evidence Collection from Mobile Phones and SIM Cards.

Unit-V : Recovering and Reconstructing of Deleted Data (call records, phone books, massages, multimedia files i.e. image, video etc.) from Mobile Phones and SIM Cards. Process of Cloning of SIM Data and Password Extraction from Mobile Phones.

ADVANCED PRACTICAL - FORENSIC PHYSICS AND DIGITAL FORENSICS

1. To examine various marks on bullet and cartridge cases.
2. To Lift GSR and its Analysis by different methods.
3. Various types of Tool Marks and their Comparison.
4. Lifting of different Prints and Impressions and their Comparison.
5. To Examine Paint, Soil and Glass Samples.
6. To Identify Various Types of Fibers by Different Methods.
7. Detailed Analysis of FAT and NTFS File Systems.
8. Practical Recovery of Data using Methods to preserve its Integrity, Methods of Recovering Deleted Files. Copying and Imaging.
9. To unfold Concealed Data from various Storage Media.
10. A series of Practical Lab Exercises by applying NUIX Software.
11. To Recover Passwords by applying Password Recovery Software (Passware).

12. To Understand Dynamic and Static Pages, Viewing HTML Source and HTTP Headers, and to get Header Information.
13. Extraction of Data from various Mobile Phones.
14. Password Extraction from Mobile Phones.
15. Cloning of SIM data.
16. Extraction of Data from SIM Cards.

(FPS) DISSERTATION

Every student will have to undertake a dissertation based on the option and the actual work carried out on the problem under the guidance of his/her supervisor. The supervisor will be allotted by the HOD to each of the student. The supervisor will be the faculty member of the institute. The institution may decide to send the students to external institution for completion of the experimental work/consultation with the scientist and library for their dissertation work. In that case the HOD of the concerned external institute will allot one of its facility member/scientist as co supervisor to the student. If a student goes to any external institute for the completion of his dissertation work he/she has to submit one certificate duly signed by the allotted co-supervisor and HOD of the external institution. The student will have to submit minimum for copies (04) of his/her dissertation before the last date specified by the department. The dissertation will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and external examiners.

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