

*Placed at the meeting of  
the Academic Council  
held on 12.12.2019*

**Appendix- I**  
**MADURAI KAMARAJ UNIVERSITY**  
*(University with Potential for Excellence)*

**Syllabus for New Course**  
**M.Sc. (Forensic Science and Criminology) CBCS - Semester Pattern**  
**(With effect from the academic year 2019-2020 onwards)**

**Regulations, Scheme of Examinations and Syllabus**

**1. Introduction of the Programme :** M.Sc. Forensic Science and Criminology 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.

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 .

**2 .Eligibility For Admission: :** A candidate for admission to M.Sc. Forensic Science and Criminology shall be required to have passed in any under graduate degree under any science discipline such as Mathematics, Physics, Chemistry, Botany, Zoology, Computer Science, Biotechnology, Genetic Engineering or Psychology or any other science discipline with minimum one science subject. Issued by the Government of Tamil Nadu or accepted by the Madurai Kamaraj University or any other Board or Universities.

Admission will be done only on merit basis taking into consideration of the aggregate marks obtained in major core subjects:

**Age :** Candidates applying for the above course should have maximum age limit for admission joining in M.Sc. Forensic Science and Criminology should be 25 Years, however 3 Year of relaxation will be given in the case of student who comes under SC/ST category.

**3. OBJECTIVES OF THE PROGRAMME :** Forensic Science and Criminology 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.

#### **4. OUTCOME OF THE PROGRAMME**

At the end of the programme the students will be able to:

Understand the knowledge of key principles of crime and forensic science, conceptual frameworks for forensic science and have understanding of relationships between the various forensic science stakeholders.

- Analyze problems and use appropriate scientific and professional tools to solve it.
- Execute experimental design, analyze the data and evaluate the weight and applicability of forensic evidence for investigative and court purposes.
- Acquire the art of logical and probabilistic thinking, evaluating hypotheses, analyzing, and presenting complex phenomenon.
- Write the technical presentation, report and present the evidence effectively in court.

**5. CORE SUBJECT PAPER:** All the core papers are mentioned inside the course structure.

**6. SUBJECT ELECTIVE PAPER:** All subject elective papers are mentioned inside the course structure.

**7. NON- MAJOR ELECTIVE PAPER :** Non Major elective paper as prescribed by the University.

**8. UNITIZATION:** Each Subject is segregated into five unites with each unit consisting of equal distribution of major concepts.

**9. PATTERN OF SEMESTER EXAM:** Examination will be conducted at the end of each semester. Each Semester has two patterns of examination namely Internal (25 marks) and external (75 marks).

**10. SCHEME FOR INTERNAL ASSESSMENT:** The Internal assessment will be as follows:

Test	= 10 Marks	(Average of the best two tests)
Assignment	= 5 Marks	Seminar/ Group Discussion =5Marks
Peer- team-Teaching	= 5 Marks	Total = 25 Marks

**11. EXTERNAL EXAM :** External Examination will be conducted as semester exams as per University norms with common question paper for all affiliated colleges.

**12. QUESTION PAPER PATTERN:** The exciting pattern of Question Paper will be as follows

**Time: 3 Hours**

**Maximum Marks: 75**

**Section A: (10\*1=10 Marks) Question No: 1 to 10 (Multiple Choice Pattern)**

1. Two question from each Unit
2. Four Choices in each questions
3. No "None of these : choice.

**Section B: (5\*7=35 Marks)**

1. Answer all questions either (a) or (b)
2. Answer not exceeding two pages
3. One question from each unit.

**Section C: (3\*10=30 Marks)**

Answer should not exceed Four Pages. Answer any Three out of Five (One Question from each Unit).

**13. Scheme of Evaluation:** Students shall be evaluated on the basis of internal tests, seminar, and assignment, peer-teaching and external examination. Question paper setters shall be requested to prepare scheme of valuation for all the papers.

**14. Passing Minimum :** Passing Minimum for the B.Sc. Course is 40% marks in internal and External Separately. Passing Minimum for the M.Sc. Course is 50 % marks in internal and External..

**15. Duration of the Programme:** This is a 2-year M.Sc. Forensic Science and Criminology Programme. Exit facility is available after Semester VI for students who wish to leave the program with a B.Sc. Forensic Science and Criminology Degree.

Students completing the M.Sc. degrees in Criminology and Forensic Science. Lateral entry into M.Sc. Programme is permitted. Any student who has completed B.Sc. Chemistry, Physics, Botany, Zoology, Anthropology, Bio-Chemistry, Bio-Physics, Mathematical Sciences, Bio-Tech, Genetics, Microbiology or B.Pharma, B.Tech, MBBS, BDS or life sciences with minimum 55% marks from a UGC recognized University. M.Sc. (Forensic Science and Criminology) Course involves 3 weeks attachment with a designated Forensic Science Laboratory (in/outside Tamilnadu ) during the forth Semester.

**16. TEACHING METHODOLOGY :**

To enhance the quality of students through creative and effective teaching the following teaching methodologies by classroom teaching methods, Practical training, Power Point Presentation classes, Guest lectures, Demonstrations and Internship for one month after each semester and study tour programmes.

**17. TEXT BOOKS :** The text books are mentioned below each individual paper.

**18. REFERENCEBOOKS :** The reference books are mentioned below each individual paper.

**19. RETOTALLING AND REVALUATION PROVISION :**

Revaluation and retotaling shall be pursued by submission of respective application forms duly filled and authorized by the head of the Institution as per University norms. The applications must reach the University within the stipulated time frame as set by University.

**20. TRANSITORY PROVISION**

The revision of syllabus shall be done once in FIVE years for better enhancement and updations.

**21. SUBJECT AND PAPER RELATED WEBSITE :**

The websites are mentioned below the reference books column for every subject.

**SCHEME OF EXAMINATIONS  
M.Sc. (Forensic Science and Criminology) CBCS (Semester)**

**FIRSTYEAR****SEMESTER I**

S. No	Title of the Paper	Hour	Credit	Internal	External	Total
1	Forensic Science and Criminology.	6	5	25	75	100
2	Medical Jurisprudence.	6	4	25	75	100
3	Instrumental Methods of Analysis – Physical, Chemical, Biology.	6	4	25	75	100
4	Forensic Physics and Ballistics.	6	5	40	60	100
5	Crime Scene Investigation – Outdoor, Indoor, Conveyance, others- Practical	6	5	40	60	100
	<b>Total</b>	30	23			500

## SEMESTER II

S. No	Title of the Paper	Hour	Credit	Internal	External	Total
1	Crime and Law	6	5	25	75	100
2.	Forensic Biology and Serology and DNA Profiling	6	5	25	75	100
3	Forensic Medicine and Pharmacology	6	5	25	75	100
4	Questioned Document and Fingerprint Examination	4	5	75	100	100
5	Questioned Document and Fingerprint Examination – Practical	6	5	40	60	100
	<b>Total</b>	28	25			500

## SEMESTER III

S.No	Title of the Paper	Hour	Credit	Internal	External	Total
1	Forensic Chemistry and Explosive and Forensic Chemistry Ballistics.	6	4	25	75	100
2.	Cyber and Advanced Digital Forensics.	6	4	25	75	100
3.	Forensic Toxicology and Narcotics	3	3	25	75	100
4.	Research Methodology and Statistics	3	4	25	25	50
5.	Forensic Anthropology and Odontology. and Forensic Photography (NME)	3	5	25	75	100
6.	Practical : Explosive and Forensic Toxicology. Cyber and Advanced Digital Forensics.	3	3	25	25	50
	<b>Total</b>	24	23			500

## SEMESTER IV DISSERTATION:

S.No	Title of the Paper	Exam Duration	Hour	Credit	Internal	External	Total
1	INTERNSHIP	3	6	8	25	75	100
2.	PROJECT REPORT	3	3	8	40	60	100
3.	VIVA-VOCE	12	9	5	40	60	100
	Total	18	17	21			300

## FIRST YEAR - SEMESTER-I - PART III CORE SUBJECTS

### Paper-I : Forensic Science and Criminology

**Unit-I : Forensic and Science:** Basic principles and its significance. History & development of forensic science. Nature and scope of forensic science. Organizational structure of Forensic Science Laboratories at central & State level. Ethics in Forensic science. Organizational setup of CFSL, FSL, GEQD, FPB, NICFS, CDTs, NCRB, NPA. Mobile Forensic Science Laboratory. Education of Forensic Science, Role of Media, Human Right & 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 & Function of Police Organization in the State & Centre, Police and Forensic Scientist Relationship with reference to Crime Investigation. International Perspective of Forensic Science.

**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 & 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:** 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.

**Unit V:** Criminal Law & 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.

### **Suggested Readings**

1. James w. Robinson; Atomic Spectroscopy, 2nd ed. Revised & Expanded, Marcel Dekkar, Inc. NY, (1996).
2. V.B. Patania; Spectroscopy, Campus Books International, (2004).
3. Jerry Workman, Jr, Art Springsteen; Applied Spectroscopy- A compact reference for practitioners, Academic Press (1997).
4. N. Subrahmanyam&Brij Lal; A text book of Optics, S. Chand & Co., (2004).
5. Gurdeep R. Chatwal & Sham k. Anand; Instrumental Methods of Chemical Analysis, Himalaya Pub. House (2004).
6. Hobert H. Willard, Lynne L. Merrett Jr, Jhon A Dean Frank A. Settle Jr; Instrumental Methods of Analysis, 7th ed. CBS Pub & Distributors (1986).
7. R.S. Khandpur; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co., New Delhi (2004).

### **PAPER-2 : Medical Jurisprudence**

**Unit–I : Concept of Medical Jurisprudence:** Brief knowledge about legal procedures in Courts, inquest, Criminal courts and their powers, Subpoena & oath of medical expert. Recording of Medical experts evidence in courts. Types of Medical evidence. Kinds of witness and rules for giving evidence.

**Unit–II : Personal Identity:** Definition and importance. Parameters contributing to personal identity- Race, Sex, Age, Complexion, features & Photographs, Anthropometry, Fingerprints, Footprints, Tattoo marks, Occupational marks, Handwriting, Clothes & Ornaments, Voice & Speech, DNA, Superimposition techniques for skull. Disputed paternity.

**Unit–III : Post-Mortem Examination:** Importance, post-mortem report format, external & internal examination in brief. Viscera & its preservation. Examination of decomposed and mutilated bodies. Precaution to be taken during post mortem examination. Exhumation. Cause of death.

**Unit–IV : Wounds:** Wounds & its types, Medico-legal aspects, post mortem & ante mortem wounds, General characteristics of injuries from burns, scalds, lightning, Electricity and radiation. Forensic importance of wounds.

**Unit–V : Deaths in its Medico-legal aspects:** Modes of Death (Coma, Syncope, Asphyxia), Sudden death. Sign of Death, cessation of vital functions, changes in the Eye & Skin, cooling of body, post-mortem lividity, and cadaveric changes in the muscles, putrefaction, adipocere& mummification. Estimation of time since Death.

### **PAPER –3 : Instrumental Methods of analysis – Physical, chemical, Biology.**

**Unit – I :** Basic Concept of Spectroscopy: General idea on spectroscopy, electromagnetic spectrum, various source of radiation their utility and limitation. Interaction of radiation with matter i.e., reflection, absorption, fluorescence etc. Detection of radiation i.e. photographic, photoelectric etc. Forensic application of spectroscopy. Sample preparation for chromatographic and spectroscopic evidence. Chromatographic methods. Fundamental

principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography.

**Unit II:** Electrophoresis – fundamental principles and forensic applications. Neutron activation analysis – fundamental principles and forensic applications. Fundamental principles. Different types of microscopes. Electron microscope. Comparison Microscope. Forensic applications of microscopy. Atomic spectra and Molecular spectra. Ultra violet visible and IR Spectrometry – Forensic Applications– Principles – Instrumentation – Techniques – Applications. Nuclear Magnetic Resonance Spectrometry – Principles, Instrumentation, Techniques Forensic Applications.

**UNIT III : Electrophoretic Techniques:** General principles, Classification of electrophoresis Factors affecting electrophoresis, Preparative, Horizontal, Vertical, two dimensional electrophoresis Brief idea of Low voltage electrophoresis, High voltage electrophoresis, Gel electrophoresis, Iso-electric focusing etc General idea and working of Capillary Electrophoresis Forensic Application of electrophoresis, electrochemical techniques: General principles Electron transport process, Polarography and variants.

**Unit IV: Mass Spectrometry (MS):** Principle and Instrumentation, Correlation of MS with molecular structure. A brief idea about the various forms of Mass Spectrometry Coupling MS with GC, LC, and CE etc. Application of MS in Forensic Science.

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:

1. Compound Microscope
2. Comparison Microscope
3. Fluorescence Microscope
4. Polarized Microscope
5. Stereomicroscope
6. Infra-red Microscope

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

**Unit V: Forensic photography :** Basic principles and applications of photography in forensic science, 3D photography, Photographic evidence, Infrared and ultraviolet photography, Digital photography, Videography, Crime scene and laboratory photography.

## Reference

1. John C. Lindon, George E. Tranter & John L. Holmes; Encyclopedia of Spectroscopy & Spectrometry, Academic Press (2000)
2. Dudley H, Williams & Ian Fleming; Spectroscopic Methods in Organic Chemistry, 4th ed. Tata McGraw-Hill Pub Co. New Delhi, (1994)



3. Colin N. Banwell & Elaine M. Mc. Cash; Fundamentals of Molecular Spectroscopy 4th ed. McGraw-Hill Pub Co. New Delhi, (1995)
4. R. Murugesan; Optics & Spectroscopy, S. Chand & co. (1998)
5. Jack L Koeing; Spectroscopy of Polymers, 2nd ed. Elsevier pub. Co. (1999)  
D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6<sup>th</sup> Edition, Saunders College Publishing, Fort Worth (1992).
6. W. Kemp, Organic Spectroscopy, 3<sup>rd</sup> Edition, Macmillan, Hampshire (1991). J.W. Robinson, Undergraduate Instrumental Analysis, 5<sup>th</sup> Edition, Marcel Dekker, Inc., New York (1995).

#### **PAPER-4 : Forensic Physics and Ballistics**

**Unit I :** Archimedes principle and law of floatation –Density and specific gravity-analytical balance – theory of weighing–equal arm mechanical balance–substitution mechanical balance–substitution mechanical balance- Electronic balance –Density determination for micro samples-forensic application. 1. Melting point –boiling point-determination-comparative and mixed boiling point determination –hot stage microscope.

**Unit II:** Refractive index- Definition –variation of Refractive index with wavelength-Dispersion-Abbey and pulfrisch Refractometer Theory and practice –backline method of determining refractive Index for micro samples. 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. Introduction of explosive.

**Unit III:** 2. Classification, Characteristics and firing mechanism of smooth bored firearms (M.L., B.L.) Rifled firearms (Pistol, Revolver, Rifles, Machine Guns), Classification, nomenclature and construction of country made fire arms, 3. Ammunition: Types, Cartridge Components (Cartridge case primer propellant, Bullets, Pellets and wads).

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

**Unit V:** 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.

#### **Suggested Reading:**

1. Forensic Science –Richard saferstein (Prentice Hall) 1978.
2. Police Photography – Harold Pountrey (Elsevier Publishing Company) 1974.
3. Activation Analysis –R.C Kochi (Academic Press)1950.
4. Physicss part-I and II- devidhalliday etal (Wiley Eastern)1960.
5. Fundamendal of optics –Jenkinsand white (Mc Graw Hill)1956.
6. Hand book of physics –E.U.Condon (Mc Graw Hill) 1956.
7. A treaise on heat –saha & Srinivasthava (Indian press Pvt.)1958.

## **Paper-V : Crime Scene Investigation: Practical**

1. Searching method in crime scene
2. Collection of evidence –with proper equipments and tools
3. Packing, Labeling and Sealing of evidences from crime scene.
4. Lifting shoe print scene of crime.
5. Lifting foot print scene of crime.
6. Analysis of various tire prints from scene of crime
7. To apply Sketching method indoor, outdoor and mobile scene of crime.
8. Photography of scene of crime using manual and digital camera.
9. Note Making scene of crime.
10. Reconstruction scene of crime.

## **SEMESTER II : PAPER 1: CRIME AND LAW**

**Unit 1:** 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, LokAyukts 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 & Judicial Organizations.

**Unit 2:** 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 & 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 3: Nature of Punishment :** Punishment : Meaning, aims, philosophy of punishment-Punishment in Ancient and Medieval India-Theories of Punishment and Types Punishment-Objectives of Punishment-Sentencing - principles, policies and procedures-Capital Punishments-Recent approaches to Punishment-Role of Central and State Governments in correctional administration.-Evolution of Correctional Philosophy-Correctional Manuals, rules etc.-Prisons Act, Prisoners Act, Transfer of Prisoners Act, Juvenile Justice Act.-Jail Manual Various Prison Reforms, Committees and Commissions.

**Unit 4: 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 5: Vulnerable groups and Victimology :** Laws related to vulnerable groups: DV act, POCSO act, POSH, SC/ST HR act & JJ act. 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 & abuse of power, 1985. Human Rights: Definition, Historical Development, U.N.Universal Declaration of Human Rights, 1948.

### Reference Books

1. Aloysius Irudayam and Jayashree P. Mangubhai (2004) Adivasis Speak Out, Books for change, Bangalore.
2. Bajpai, Asha (2004) Child Rights in India, Oxford University Press.
3. Human Rights Watch (1999) Broken People, New York.
4. National Campaign on Dalit Human Rights (2000) Dalit Human Rights Violation Vol. 1 Chennai.
5. Rajan, V.N. Victimology in India (1995).

## PAPER - 2

### FORENSIC BIOLOGY, SEROLOGY AND DNA PROFILING

**Unit 1: Forensic Biology :** Hair and fibers: Hair: Structure, Forensic examination of Hair including determination of origin race, sex, site, etc. Fibers: Type and Forensic aspects of fiber examination - fluorescent, optical properties, refractive index, birefringence, dye analysis etc and natural fiber.

Forensic Botany :Various types of wood, timber varieties, seeds and leaves - their identification and matching. Diatoms - Types morphology, methods of isolation from different tissue and forensic importance of planktons-especially diatom, forensic significance in drowning cases. Study and identification of pollen grains, Identification of starch grains, powder and stains of spices etc, Paper and Paper Pulp identification, Microscopic and biochemical examination of pulp material etc. Isolation, classification and identification of microbial organism.

**Unit 2 : Forensic Entomology:** General Entomology, importance of entomology, branches of entomology, Significance of terrestrial and aquatic insects in forensic investigations and their role in crime detection, insect's succession and its relationship to determine time since death. Impact of ecological factors on insect's developments. Role can be played by entomologist in estimating time of death. Organisms used in forensic entomology responsibilities of forensic entomologist.

**Unit 3: Wild Life Forensic:** Introduction and Importance of wild life, Protected and endangered species of Animals and Plants, Wild life species - Identification and examination of physical evidence by conventional and modern methods, Identification of Pug marks of various animals. Census of wild life population. Wild life/Environment Protection Act

**Unit 4: Basic Concepts of Genetics:** Mendel ion genetics, genotypes, phenotypes, mutation, multiple alleles. **Biochemical Markers of Individuality:** General Understanding, classification of markers, Biochemical basis of genetic variation. Expression of Gene and Gene Mapping. Analysis of protein by electrophoresis and related methods. Protein polymorphism and characterization by electrophoresis methods.

**Genomes** Introduction to Human genome, Genome Anatomies, Transcriptome and Proteomes, Mapping genome, Sequencing of genome. **Regulation of Genomes** Accessing the genome, Regulation of Genome activity. **Transposons and rearrangement of DNA** Transposition mechanisms, controlling elements, retroviruses and retrotransposons, Ty elements, rearrangement of DNA – yeast mating types, Ti plasmids Unit 4: Enzymes in laboratory applications Restriction enzymes, Phosphatases, DNA polymerases and DNA ligases

**Unit 5 : BLOOD:** Composition, Histology, Examination of blood and blood stains, Blood spatter patterns identification, Identification of menstrual and other stains by various methods.

**SEMEN:** Composition, St. of spermatozoa, forensic methods of detection and identification of semen and seminal stain examination.

**Serogenetic Markers;** 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 etc.

**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.

#### **Suggested Readings:**

1. E.J. Gardner, M. I. Simmons and D.P. Snustad; Principles of Genetics; John Wiley, New York, (1991).
2. H.G. Greenish & E. Collin; An anatomical Atlas of vegetable Powders; J&A Churchill, London, (1904).
3. Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice Hall, Englewood Cliff, New Jersey; (1982).
4. P. L. Williams and R. Warwick; Gray's anatomy; Churchill Livingston, London; (1980).
5. Biology Methods manual; Metropolitan Police Forensic Science Laboratory, London; (1978).

6. Herbert R. Mauersberger; Mathews Textile Fibres – their physical, Microscopic and chemical properties; John Wiley, New York; (1954).
8. R.P. Pandey, Plant Anatomy; S. Chand, new Delhi; (1998).
9. Kimball, John W; Biology; Arvind Publishing Co. New Delhi (1974).
10. Edwin, H. Mc Caney – Human Genetics, The Molecular Revolution, Jones & Bartlett Pub. London, (1993).
11. Albert's, B, Bray, D, Lewis, J, Roberts K & Watson, J.D; Molecular Biology of Cell, 2 nd ed. Garland Pub. New Yark (1989).
12. Lewis. B Gene IV, Oxford University Press, England (1980)
13. Clifford, B.J; The examination and typing of Bloodstains in the Crime Laboratory, US Court Printing Press (1971).
14. Morrison, Robert D; Environmental Forensics Principles and Applications, CRC Press, Boca Raton, New York, (2000).

### **PAPER: 3 - QUESTIONED DOCUMENTS, FINGERPRINTS AND OTHER IMPRESSIONS**

**Unit 1: Nature and scope of questioned document :** Definition of questioned document, Types of questioned documents, Instruments used to prepare documents, ink and its type, physical and chemical examination, paper and its type, manufacturing and examination of paper, collection, preservation and handling of questioned documents, photography of questioned document. **Document in General:** Importance, Classification& Preliminary Examination. Nature and Problems of Document Examination. Handling and Preservation of Documents. **Tools in questioned document;** Basic tools needed for Forensic Document Examination and their use. Ultraviolet, visible, infrared, fluorescence spectroscopy, Photomicrography, Microphotography, Visible spectral comparator, Electrostatic detection apparatus, Determining the age and relative age of documents.

**Unit 2: 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. Digital signature.

**Unit 3: Comparison of questioned document:** Merits and demerits of exemplar and non-exemplar samples during comparison of handwriting. Standards for comparison of handwritings. Comparison of paper, ink, printed documents, typed documents, Xerox documents.

Forged and Typed Documents: Alteration- Erasure, Addition, Obliteration and Sheet insertion. Secret writing & its decipherment. Charred documents and their decipherment. Indented writing. Typewriting- Class and individual characters and their comparison. Printed matter and their examination.

Disguised writing and anonymous letters: Definition, Characteristics and Identification of writer. Examination of seal impression and other mechanical impressions. determination of age of documents by Examination of Printed Matter, Types Script Writing, Signatures, Paper and Ink.

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 4: Finger Prints:** History of finger print, formation of ridges, finger print patterns, ridge characteristics, ridge count, ridge tracing etc. Classification of finger print- Ten digit Henry System of Classification, single digit, etc. Computerization of finger print and finger print bureau.

Chance Fingerprints-Types of chance prints, Composition of Sweat, Development of latent Fingerprints. Conventional method of development of Fingerprints. Digital imaging & Enhancement, Application of laser & other radiations to develop latent fingerprints. Photography of Fingerprints, Digital Transmission, Comparison of Fingerprints, Automated Fingerprint Identification System (AFIS).

**Unit 5: Examination of Finger Prints and Other Impressions:** Types of fingerprint, latent, visible prints, location of finger print, Photography of finger prints. Foot and footwear prints, gait pattern, casting of print on different surfaces and their comparison. Examination of tyre and skid mark on different surfaces and calculation of speed of vehicle. Forensic importance of lip print, bite mark and palm print.

#### **Suggested Readings:**

1. Rev. ED.; Ordway Hilton; Scientific Examination I Of Questioned Documents, Elsevier, New York; (1982).
2. Albert S. Osborn; Questioned Documents, Second Ed.; Universal Law Publishing, Delhi; (1998).
3. Albert S. Osborn; The Problem of Proof~ Secon Ed.; Universal Law Publishing, Delhi; (1998) 4. Charles C. Thomas, Typewriting Identification I.S.Q.D.; Billy Bates; Springfield, Illinois, USA, (1971).
4. Charles C. Thomas, I.S.Q.D. Identification System for Questioned Documents; Billy Prior Bates Springfield, Illinois, USA, (1971)
5. Wilson R. Harrison; Suspect Documents – Their Scientific Examination; Universal Law Publishing, Delhi. (1997).
6. Hard less, H.R. : Disputed Documents, handwriting and thumbs – print identification : profusely illustrated, Low Book Co., Allahabad, (1988)
7. David R. Ashbaugh; Quantitative and Qualitative Friction ridge analysis, CRS Press, (1999).
8. Mehta M. K. ; Identification of Thumb Impression & Cross Examination of Finger Prints, N. M. Tripathi (P) Ltd, Bombay (1989).
9. Henry C. Lee & R. E. Ganesslen, Advances in Finger Print Technology, ~RC Press, Boca Raton, London, (1991).

### **PAPER 4 : FORENSIC MEDICINE AND PHARMACOLOGY**

**Unit 1: Personal Identification:** Identification of Living Person and Medico-legal importance. • Identification of dead persons, skeletal remains and Medico legal importance.

**Injuries:** Meaning, Definition and Classifications) Nature and Medico Legal Importance of Thermal, Chemical and Injuries due to electricity, lightening and X-rays. b) Mechanical Injuries: i)Abrasion, ii)Contusion, iii) Punctured Wound, iv) Incised Wound v) Gun-Shot Wounds. vi) Head Injury Medico legal aspects of wounds: -medical and legal definition of wounds, types of mechanical and regional injuries, aging of wounds, difference between suicidal, homicidal and accidental wounds.

**Unit 2: Thanatology:** Meaning, Definition & Causes of Death- Natural & 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. Medico legal investigation of sexual offences, including examination of victims and suspects.

**Unit 3: 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.

**Unit 4: PHARMACOLOGY:** Types of Pharmacology drugs, Steroids, Forensic Pharmacological studies, Ingestion of drugs, absorption, distribution, metabolism, pathways of drug metabolism, drug metabolism and drug toxicity, excretion of drugs. Court Judgments and Analysis of recent cases relating to; Medico-legal experts and toxicological findings.

**Unit 5: Practical:** Post Mortem 3 cases, observation and findings in Record submission.

**Suggested Readings:**

1. C.K. Parikh (1990) – Medical Jurisprudence & Toxicology, CBS Publishers and Distributors, New Delhi-32.
2. Dr.Rao G. Nageshkumar (1993) – Clinical Forensic Medicine, House of Research Publication Aid, Manipal-19.
3. <http://forensicsciencecentral.co.uk/toxicology.shtml>
4. Krishnan's M.K.R. & Patnaik V.P. (Editor) (11th Ed 1999), Handbook of Forensic Medicine including Toxicology, Para Medical Publisher, Hyderabad - 095.
5. Laboratory Procedure Manual Forensic Toxicology(2005)-Directorate of Forensic Science Ministry of Home Affairs, Govt.of India
6. Mathiharan K. & Patnaik K. Amrit (Ed. 2009) - Modi's Medical Jurisprudence and Toxicology (23rd edition), Butterworths Wadhwa, Nagpur
7. Mukherjee J.B. (Vol.1 1981) – Forensic Medicine & Toxicology, Academy Publishers, Calcutta.
8. Rao Nageshkumar, G. (2009 & 2010) – Text book of Forensic Medicine and Toxicology, Jaypee Publishers, New Delhi.
9. Ratan Deepak & Zaidi Mohd. Hasan (2008) – Forensic Science in India and the World, Alia Law Agency, Alahabad-211 001.
10. Reddy Narayan K.S. (5th Edition 1981) – The Essentials of Forensic Medicine and Toxicology, Published K. Suguna Devi, Hyderabad.
11. Sharma B. R. (4th Ed. 2008) - Forensic Science in Criminal Investigation and Trial, Universal Publishers.
12. Walls H. J. (2nd Ed. 2008) – Forensic Science: An Introduction to Scientific Crime Detection, Universal Law Publishing Co. Pvt. Ltd. New Delhi-33.

## PAPER 6: PRACTICALS

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. Primary and secondary identification of blood/ semen sample.
18. Identification of species from the given hair sample.
19. Examination of given fiber by physical and chemical method.
20. Determine ABO and Rh factor of human blood in dried strains. Detection of salivary stains.

## SEMESTER III :

### PAPER 1: FORENSIC CHEMISTRY, EXPLOSIVES AND BALLISTICS

#### Unit 1:

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 2:** 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 3: 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

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.

**Unit 4: Explosives :** Classification of explosives, Low explosives and high explosives. Explosion process, blast waves, searching of scene of explosion. Post blast residue collection and analysis, blast injuries and detection of hidden explosives. Improvised explosive devices. 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.

**Unit 5: History and background of firearms:-** Their classification and characteristics, various component of small arms, smooth bore and class characteristics, purpose & types of rifling, trigger and firing mechanism, improvised / country-made / imitative firearm and their constructional features.

**Internal and External Ballistics:-** Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: Terminal Ballistics Effects of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target. **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, Arms Act.

### **Suggested Readings:**

1. Instrumental Method of Chemical Analysis by Chatwal & Anand, Himalya Publication.
2. Analytical Toxicology by S. N. Tiwari Govt. of India publications, New Delhi 1987
3. Advance in Chromatography by Brown P. R.
4. Introduction of Forensic Science in Crime Investigation by Dr. (Mrs.) R. Krishnamurthy
2. . 5. Forensics Analysis by Gas Chromatography by Howard
1. Forensic Application of Mass Spectroscopy by Yinon 1994.
3. Methods in Toxicology by Prakash M. et.al; Anmol Publication, New Delhi (1998)
4. Analytical Method in Human Toxicology by Curry
5. Advances in Forensic Science (Vol. 2) Instrumental Analysis by Lee and Gaensslem
6. Handbook of Instrumental Technique for Analytical Chemistry by Settle F. A.
7. Scientific Evidence in Criminal Cases by Moonesens A. A
8. Methods of Forensic Sciences by Lundquist and Curry
9. Hand book of drug and alcohol abuse by Holfmann, F. G
10. Analysis of Plant Poisons by Dr. M P Goutam
11. Indian Evidence Act.

12. Criminal Procedure code.
13. Indian Penal Code.
14. Bare Acts with short notes on the following : Narcotic Drugs & Psychotropic Substances Act,
15. Drugs and Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention Of Food Adulteration Act, Pr

## **PAPER 2 : CYBER AND ADVANCED DIGITAL FORENSICS**

**Unit 1:** 1. Meaning of Cyber Forensics, Nature and Characteristics of Cyber Crimes Role of “mens rea” and Criminal Liability in Cyber Crime. Criminal Investigation analysis and behaviour: Characteristics of computer criminal. 2. Definition of Cyber Crime, Types and Classifications of Cyber Crime. Types of Malware: Viruses, Worms, Trojan Horses, Blended Attacks, Tracking Cookies, Keystroke and Root kits. Prevention of Malware incidents, Spy ware detection and Intrusion Prevention using different tools (Router, Firewalls and Biometrics), Malware incident Response Process & Case Studies of Cyber Crime.

**Unit 2:** Online Frauds: Nature and Characteristics. Types of Internet Frauds: Phishing, Identity Theft, Cyber Stalking, Spam Mails, and Spoofing. Web hacking, website defacing, DoS, DDoS attacks 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.

1. Investigation of Cyber Crimes: Incident Response Methodology – Individual System and Networked system. Data collection: live system, stand alone system and networked system
2. 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 3:** Laws relating to Cyber Crime: Salient features of IT Act-2008, with emphasis on aspects relating to offences, Punishments, Investigative powers and regulations. 2. Amendments arising due to enactment of IT Act 2000 in IPC, Cr.P.C, I.E.A., Copyright Act. 3. Prevention of Cyber Crimes: Cyber Security, Global, National, Industrial & individual levels. Future Perspectives of Cyber crimes: Cyber Terrorism, Cyber Warfare and Hacktivism. Forensics auditing Forensics auditing – step-by-step, how-to process for securing, investigating, and auditing or assessing various IT environments. Introduction to Forensic Accounting: Introduction to Forensic Accounting and Fraud Examination; Principles of Forensic Accounting and Fraud Examination; Roles of the Forensic Accountant.

**Unit 4:** 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.

**Unit 5:** 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.

### **References and Books:**

1. Augustine T. Paul (2007) – Combating Cyber Crime, Crescent Publishing Corporation, New Delhi-02.
2. Augustine T. Paul (2007) – Cyber Crime and Legal Issues, Crescent Publishing Corporation, New Delhi-02
3. Augustine T. Paul (2007)-Intellectual Property crime, Crescent Publishing Corporation, New Delhi-02
4. Barkha & Mohan U.Rama – Cyber Law & Crimes IT Act 2000 and Computer Crime Analysis, Asia Law House, Hyderabad. 5. Bryan, Kellie, Dunnesen, Kristen & Jean Jayson (2009).

### **PAPER - 3 : FORENSIC TOXICOLOGY AND NARCOTICS**

**Unit 1: Forensic Toxicology:** Introduction, concept and Significance Poisons: Definition, Classification of poisons, Types of poisoning sign and symptoms of poisoning, mode of action, factors modifying the action of poisons, Toxicological exhibits in fatal and survival cases, their preservation Treatment in cases of poisoning, Analysis report.

**Unit 2: Extraction, Isolation and Clean-up procedures:** Non-volatile organic poison, Stas-otto, Dovbriey Nickolls (Ammonium Sulphate) method, acid digest and Valov (Tungstate) methods, Solid phase micro extraction techniques, Solvent extraction methods Volatile Poisons: Industrial solvent acid and basic Distillation Toxic Cations: Dry Ashing and Wet digestion process Toxic Anions: Dialysis method total alcoholic extract.

**Unit 3: Forensic Examination of Metallic Poisons:** Arsenic, Mercury, Lead, Bismuth, Copper, Aluminium, Iron, Barium, Zinc Analysis of Ethyl Alcohol in blood and urine, illicit liquor, Methanol, Acetone, Chloroform, Phenol Snake venoms and Poisons, Irrespirable gases

**Unit 4: General Study and Analysis:** Barbiturates, methaqualone, Hydromorphone, Methadone, Meprobamate, Mescaline, Amphetamines, LDS, Heroin, Cannabinoids, Phinothiazines Insecticides: Types, General methods for their analysis Alkaloids: Definition, classification, Isolation and General characterization.

**Unit 5:** Narcotic Drugs and Psychotropic Substances Act, Drugs and Cosmetics Acts.

### **PAPER - 4 : RESEARCH METHODOLOGY & STATISTICS**

**Unit 1:** Introduction to statistics and research process. Types and motivation of research. Scientific approach to enquiry in comparison to native, common sense approach. Definition, conceptual understanding of statistical measures, popular concepts and misuse of statistics. Role need and scope of research in Nutrition and Dietetics.

**Unit 2:** Steps in the Research Process identifying interest areas and prioritizing. Review of related literature and research. Hypothesis Concepts and theories. Research Design. Research questions, objectives and assumptions. Hypothesis- meaning, attributes of a sound hypothesis, Stating the hypothesis and types of hypothesis, Hypothesis testing- null hypothesis, sample distribution, level of significance, critical regions, Type-I and Type II errors. Variables- types of variables including discrete and continuous variables. Conceptual definitions and operational definitions.

**Unit 3:** Types of Research Basic and applied research, Qualitative and Quantitative research (brief review of differences). Historical research. Descriptive research methods – survey, case study, correlation study, content analysis, causal-comparative research, Analytic studies- pre-experimental, experimental research, quasi experimental research, Qualitative research, ethnography, Evaluative research- general characteristics, use of qualitative methods in enquiry.

**Unit 4:** Tools for Data Collection, Primary and secondary methods of data collection, Different types of questionnaires, rating scales, check lists, schedules, attitude scales, inventories, standardized tests, interviews, observation validity of tools. Procedure for preparation of the tool, administration of tools for data collection. Procedure for data collection specializations. Planning for data analysis-coding of responses. Construction of tools for data collection. Types of questions, Questionnaire, interview schedule, observation scales.

**Unit 5:** Sampling, Rationale, characteristics- meaning, concept of population and sample, and utility. Types of sampling. Probability sampling- simple random sample, systematic random sample, stratified random sampling etc.-random and non-random samples, random numbers and use Non-probability sampling-purposive samples, incidental samples, quota samples, snowball samples. General consideration in determination of sample size. Various statistical measurements for research data management and analysis.

### **1. Suggested Reading:**

1. Bell, J. (1997): *Doing Your Research Project: A Guide for First-time Researchers in Education and Social Science*, Viva Books, New Delhi.
2. Bulmer, M.C. (1984): *Sociological Research Methods: An Introduction*, Macmillan, Hong Kong.
3. Festinger, L. and Katz, D. (ed.) (1977): *Research Methods in the Behavioral Sciences*, Amerind Publishing, New Delhi.
4. Holloway, I. (1997): *Basic Concepts of Qualitative Research*, Blackwell Science, London.
5. Jain, G. (1998): *Research Methodology: Methods and Techniques*, Mangal Deep, Jaipur.
6. Kothari, C.R. (2000): *Research Methodology: Methods and Techniques*, Wishwa Prakashan, New Delhi.
7. Kumar, A. (1997): *Social Research Method (The Art of Scientific Investigation)*, Anmol Publication, New Delhi.
8. Kumar, A. (2002): *Research Methodology in Social Sciences*, Sarup and Sons, New Delhi.
9. Mc Burney, D.H. (2001): *Research Methodology*, Thomson-Wadsworth, Australia.

10. Gupta, S. (2001) "Research Methodology and Statistical Techniques", Deep and Deep, New Delhi.
11. Hooda, R.P. (2003) "Statistics for Business and Economics", 3rd ed., Macmillan India Ltd., New Delhi.

### **PAPER – 5 (NME)**

#### **FORENSIC ANTHROPOLOGY, ODONTOLOGY AND FORENSIC PHOTOGRAPHY**

**Unit 1: 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 2: Personal Identification Techniques** (Somatoscopy, Somatometry, Osteometry and Craniometry) & their Importance in Determination of Age and Sex. Portrait Parle/Bertillon system, Introduction and Importance of Photo fit/Identi Kit System for Facial Reconstruction. Cranio Facial Super Imposition Techniques (Photographic Super Imposition, Video-Superimposition, Roentgen graphic 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 3: 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 mark.

**Unit 4: Photography:** Basic principles and techniques of photography, cameras and lenses, exposing, developments and printing, Different kinds of developers and fixtures, modern developments in photography, linkage of cameras and film negatives, digital photography, digital water marking and digital imaging, photogrammetry, videography/ high speed videography, crime scene and laboratory photography.

**Unit 5: Practical and Record Submission:** Sex Determination from bones, Iris recognition, Morphing techniques.

#### **Suggested Reading:**

##### **Photography:**

1. Henry Horeustein, Colour Photography A Working Manual; Little Brow Company, Boston; (1995).
2. B.H.E. Jacobson, Sidney Ray GG Attridge, The Manual of Photograph ~ Focal Prss, London; (1998).
3. Jahne B; Digital Image Processing; Heidelberg Springer (1996).
4. Workinson, J; Art of Digital Video; Oxford Focal Press (1994).

## **PAPER 6: PRACTICALS**

- Separation and identification of volatile liquid by simple distillation.
- Identification of salts and metals by simple colour test and group analysis.
- Identification of different vegetable poison by colour test, chromatography etc.
- Identification of insecticides and pesticides by TLC/ colour test.
- Restoration of erased punched mark on metal piece by chemical treatment.
- Identification of explosives and gunshot residue by chemical test.

### **Cyber and Digital Forensic – Practical**

- Identify, seize and preserve digital evidence from crime scenes.
- Detect deletions, obliterations and modifications of files using encase software.
- Trace routes followed by e-mails and chats.
- Identify the IP address of the sender of e-mails.
- Identify encrypted files.
- Identify hidden files.
- Digital signatures for securing e-mail and online transactions.
- Acquire data from PCs/laptops/HDDs/USBs, pen drives, memory cards and SIM cards.
- Symmetric and asymmetric keys for protection of digital record.
- Carry out imaging of hard disks.
- Mobile forensic data recovery using Cellibrite touch Hardware tool.
- Chip of Forensic of Hard disk using chip of forensic kit.
- Data Recovery From hard disk using PC-3000 Software and hardware tool.

## **SEMESTER 4**

### **DISSERTATION ( INTERNSHIP, PROJECT REPORT AND VIVA-VOCE)**

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 faculty 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 four 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 - A: Specialization in Forensic DNA**
- **Option – B: Specialization in Forensic Toxicology**
- **Option - C: Specialization in Questioned document.**
- **Option - D: Specialization in Forensic Fingerprinting.**
- **Option - E: Specialization in Cyber and Digital Forensic.**

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