DEPARTMENT OF GENETICS, M.D. UNIVERSITY, ROHTAK

Syllabus of M.Sc. Forensic Science
Choice Based Credit System w.e.f. Academic Session 2016-17

Credit Matrix along with Marks for M.Sc. Forensic Science Course

Semester	Core Paper including practical (C)	Discipline Specific Elective (D)	Open Elective/ Interdisciplinary (O)	Foundation course (F)	Project work/ Field work/ Dissertation/ Group Seminar	Total Credits
I	28	-	-	-	-	28
II	20	04	03	02	-	29
III	16	08	03	-	-	27
IV	08	-	-	-	20	28
Total	**72**	**12**	**06**	**02**	**20**	**112**

Total credits required for M.Sc. Forensic Science (two year course) =112

INSTRUCTIONS FOR THE STUDENTS

Types of Courses

1. **Core Paper (C):** There are core papers in every semester. A core paper is a compulsory paper to be studied by a candidate as a core requirement to complete the requirements of a degree. These are offered by the respective departments, and based on papers that are unique to the programme and hence imperative for study to earn a degree in a given discipline/programme.
2. **Discipline Specific Elective (D)**: A paper/course which a candidate can choose from a pool of papers from the main discipline which supports the course. They are also mandatory as per course curriculum.
3. **Open Elective (O):** An elective paper chosen generally from an un–related discipline with an intention to seek exposure is called an Open Elective/Interdisciplinary. Choice may be from the poll of subjects/Departments of M.D. University, Rohtak.
4. **Foundation course (F):** This paper will be opted to enhance the proficiency/skill. It may be related to discipline of study or may be a generic proficiency enabler. The University shall provide to the students a pool of Foundation courses from various UDT.
5. **Project/Field Work/Dissertation/Group Seminars:** It is a special paper where a candidate carries out the application of knowledge in solving /studying /exploring a real life /difficult problem in a creative way. The project work/Field work/ dissertation/Group Seminars shall be discipline centric, and the candidate has to study it on his own with an advisory support by the concerned teacher.

SEMESTER-I

Paper Code	Nomenclature	Course structure credits (L:T:P)	Total Credits	Hrs. per weak	Marks		Total Marks
					Internal	External	
Core Paper (C)							
16FSC21C1	Elementary Forensic Science	4:0:0	4	4	20	80	100
16FSC21C2	Police and Crime Investigative Agencies	3:1:0	4	4	20	80	100
16FSC21C3	Fundamentals of Fingerprint Examination	4:0:0	4	4	20	80	100
16FSC21C4	Fundamentals of Questioned Document Examination	4:0:0	4	4	20	80	100
16FSC21C5	General Forensic Tools and Techniques	4:0:0	4	4	20	80	100
16FSC21CL1	Forensic Lab Course-I (Based on Fingerprint Examination)	0:0:4	4	8	-	100	100
16FSC21CL2	Forensic Lab Course-II (Based on Questioned Document Examination)	0:0:4	4	8	-	100	100
Total credits 28							

SEMESTER-II

Paper Code	Nomenclature	Course structure credits (L:T:P)	Credits	Hrs. per weak	Marks		Total Marks
					Internal	External	
Core Paper (C)							
16FSC22C1	Crime Scene Investigation	4:0:0	4	4	20	80	100
16FSC22C2	Fundamentals of Forensic Ballistics	4:0:0	4	4	20	80	100
16FSC22C3	Forensic Criminology and Law	3:1:0	4	4	20	80	100
16FSC22CL1	Forensic Lab Course-III (Based on CSI)	0:0:4	4	8	-	100	100
16FSC22CL2	Forensic Lab Course-IV (Based on Forensic Ballistics)	0:0:4	4	8	-	100	100
Discipline Specific Elective (D) (Opt any one)							
16FSC22DA1	Fundamentals of Forensic Psychology	3:1:0	4	4	20	80	100
16FSC22DA2	Forensic Quality Management						
16FSC22DA3	Fundamentals of Computer Forensics						
Open Elective/Interdisciplinary (O)							
	To be chosen from the University Pool		3				
Foundation course (F)							
	To be chosen from the University Pool		2				
Total credits 29							

SEMESTER –III Specialization-1: Forensic Chemical Sciences							
Paper Code	**Nomenclature**	**Course structure credits (L:T:P)**	**Credits**	**Hrs. per weak**	**Marks**		**Total Marks**
					Internal	**External**	
Core Paper (C)							
17FSC23CA1	Advanced Forensic Chemistry	4:0:0	4	4	20	80	100
17FSC23CA2	Advanced Forensic Toxicology and Pharmacology	4:0:0	4	4	20	80	100
17FSC23LA1	Forensic Lab Course –V (Based on Forensic Chemistry)	0:0:4	4	8	-	100	100
17FSC23LA2	Forensic Lab Course –VI (Based on Forensic Toxicology)	0:0:4	4	8	-	100	100
Specialization-2: Forensic Biological Sciences							
17FSC23CB1	Theoretical and Practical Aspects of Biological Evidences	4:0:0	4	4	20	80	100
17FSC23CB2	Forensic Genetics and Advanced DNA Forensics	4:0:0	4	4	20	80	100
17FSC23LB1	Forensic Lab Course –VII (Based on Forensic Biology)	0:0:4	4	8	-	100	100
17FSC23LB2	Forensic Lab Course –VIII (Based on DNA Forensics)	0:0:4	4	8	-	100	100
Specialization-3: Forensic Physical Sciences							
17FSC23CP1	Advanced Forensic Physics and Photography	4:0:0	4	4	20	80	100
17FSC23CP2	Advanced Forensic Ballistics	4:0:0	4	4	20	80	100
17FSC23LP1	Forensic Lab Course –IX (Based on Forensic Physics and Photography)	0:0:4	4	8	-	100	100
17FSC23LP2	Forensic Lab Course –X (Based on Forensic Ballistics)	0:0:4	4	8	-	100	100
Discipline Specific Elective (D) (Opt any two)							
17FSC23DA1	Instrumental Methods in Forensic Analysis	3:1:0	4	4	20	80	100
17FSC23DA2	Elements of Forensic Biology and Serology	3:1:0	4	4	20	80	100
17FSC23DA3	Elements of Forensic Chemistry and Toxicology	3:1:0	4	4	20	80	100
Open Elective (O)							
	To be chosen from the University Pool		**3**				
Total credits 27							

SEMESTER –IV Specialization-1: Forensic Chemical Sciences							
Paper Code	**Nomenclature**	**Course structure credits (L:T:P)**	**Credits**	**Hrs. per weak**	**Marks**		**Total Marks**
					Internal	**External**	
Core Paper I							
17FSC24CA1	Forensic Drugs Analysis	3:1:0	4	4	20	80	100
17FSC24CA2	Analytical Forensic Toxicology	4:0:0	4	4	20	80	100
17FSC24CA3	Project work/Field work/ Dissertation/Group Seminar	0:0:20	20	-	-	-	300
Specialization-2: Forensic Biological Sciences							
17FSC24CB1	Advanced Forensic Biology	3:1:0	4	4	20	80	100
17FSC24CB2	Forensic Physical Anthropology and Medicine	4:0:0	4	4	20	80	100
17FSC24CB3	Project work/Field work/ Dissertation/Group Seminar	0:0:20	20	-	-	-	300
Specialization-3: Forensic Physical Sciences							
17FSC24CP1	Advanced Fingerprints and Questioned Document Examination	3:1:0	4	4	20	80	100
17FSC24CP2	Advanced Computer and Cyber Forensics	4:0:0	4	4	20	80	100
17FSC24CP3	Project work/Field work/ Dissertation/Group Seminar	0:0:20	20	-	-	-	300
Total credits 28							

PROGRAM SPECIFIC OUTCOMES

M.Sc. Forensic Science programme is designed to meet the following program specific outcomes:

The students upon completion of M.Sc. Forensic Science Programme will be able to posses:

PSO-1: Practical and theoretical knowledge of various scientific fields and their applications to solve matters of law.

PSO-2: Understanding the analysis of forensic evidences pertaining chemical/biological, fingerprints, questioned documents, psychological and digital.

PSO-3: Practical ability to run different types of instrumental techniques under Chromatography, spectroscopy, Electrophoresis, Mass spectrometry, Microscopy, AAS and PCR etc. for analyzing evidences.

PSO-4: Ability to establish a private forensic laboratory for consultancy and private practice/expertise to form independent opinion on legal queries related to crime materials.

PSO-5: Understanding and preparation for higher education in Forensic science, and pursue research in relevant areas of forensic science and and respect the professional standards of ethics expected of Forensic scientists.

SEMESTER-I

Elementary Forensic Science

Core Paper	Paper Code: 16FSC21C1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to know about the basics and history of forensic science in India and worldwide.

CO-2: Students would be able to describe mandate, set-up of and report writing of Forensic Science in accordance with Indian justice system.

CO-3: Students would be able to explain the relationship between forensic science and police system.

CO-4: Students would know about recent trends like geo-forensics, biometric and bioterrorism in relation to Forensic Science

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Forensic Science:** Definition of Forensic Science, The Role of the Forensic Laboratory, History and Development of Forensic Science in India & Abroad, Pioneers in Forensic Science, Multidisciplinary nature, Forensic Technology solving crimes with advanced technology, Forensic intelligence and Interviews. **Forensic Evidences**: Concise of Forensic Physical, Biological, Chemical and Psychological evidences, Medico-Legal Cases. **Laws and Principles of Forensic Science:** Law of Exchange (Locard), Law of Individuality, Law of Comparison, Law of Progressive Changes and Law of Probability, Branches of Forensic Science.
Unit-II	**Administration and Organizational Setup:** DFSS, CFSL, GEQD, SFSL, RFSL, MFSL, FPB, NICFS, CDTS, NCRB, BPR&D, Qualifications and duties of Forensic Scientists **Academic centres of education and research:** Indian and Academy of Forensic Science, American Board of Forensic Odontology, Interpol and FBI, Australian Academy of Forensic Sciences. **Education and Employment systems of Forensic Science in India:** Teaching Courses and Research fields in Forensic Science, Scope and jobs in Forensic Science.
Unit-III	**Police and Forensic Science:** Relationship between police and forensic expert, Role of Police at the Crime scene, scientific help at crime scene, handling of various types of crime scenes by police, forensic teaching of police personals, forensic case documentation by Police, Technological Advance and Police. **Admissibility of Forensic Evidence in Court**: Admissibility of Expert Testimony and Evidence in Court, Frye and Daubert standards. **Forensic Report**: Forensic Expert, Forensic Report, Formats of Forensic Report, Court Testimony, Pre-Court Preparations & Court appearance, Examination in chief, Cross Examination and Re-examination, Ethics in Forensic Science.
Unit-IV	**Recent Trends in Forensic Science- Environmental Forensics**: Definition, Legal processes involving environmental forensic science. **Geo-forensics** Global Positioning System; Basic principles and applications. **Biometrics in Personal Identification**: Introduction, Concepts of Biometric Authentication, Role in person Identification, Techniques and Technologies (Finger Print Technology, Face Recognition, IRIS, Retina Geometry, Hand Geometry, Speaker Recognition,

	Signature Verification and other forensic related techniques). **Bioterrorism:** Definition, Concepts of Biosecurity and microbial forensics, Weapons of mass destruction (WMD), mass-casualty weapons (MCW), NBC and CBRNE, Dirty Bombs.

Suggested Readings:

1) Nanda, B.B. and Tewari, R.K. (2001) Forensic Science in India: A vision for the twenty first century Select Publisher, New Delhi.
2) James, S.H and Nordby, J.J. (2003) Forensic Science: An introduction to scientific and investigative techniques CRC Press,
3) Saferstein : Criminalistics (1976) Prentice Hall Inc., USA.
4) Deforest, Gansellen & Lee : Introduction to Criminalistics.
5) Sharma, B.R. (1974) Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.
6) Hess, A.K. and Weiner, I.B. (1999) Handbook of Forensic Psychology 2nd Ed. John wiley & sons.
7) Bruce A. Arrigo (2000) Introduction to Forensic Psychology Academic Press, London
8) J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press
9) Hand Book of Forensic Psychology – O' Donohue Levensky
10) Brain Experience – C.R.Mukundan
11) Criminal Profilling – B.Turvey
12) Investigative Forensic Hypnosis – J. Niehans
13) Art & Science of the Polygraph Techniques – J.A.Matte
14) Hand Book of Polygraph Testing – M.Kloinen
15) Detecting Lies & Deceit – A.Vrij
16) Virginia A. Lynch (2011) and Janet Barber Duval: Forensic Nursing Science.

SEMESTER-I

Police And Crime Investigative Agencies

Core Paper	Paper Code: 16FSC21C2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to explain functioning of Indian Police system at State and central level.

CO-2: They would be able to explain the association and importance of BPR&D, CBI, NCRB, NICFS, NPA, CID, MOB in solving crime.

CO-3: Students would be able to describe set-up of Police station & their role in crime management

CO-4: They would also know about the structure and functioning of various international investigative agencies in combating crime.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	Evolution of Police Administration, Indian Police Service, Nature, Rank of Police, Officers–Badges, Role & Functions of Police. National Investigative Agencies: National Investigative Agency, Research and Analysis Wing, Intelligence Bureau, Narcotic Control Bureau.
Unit-II	Central level Police organizations, Commissionerate System of Policing, Bureau of Police Research and Development (BPR&D), Central Bureau of Investigation (CBI), National Crime Records Bureau (NCRB), National Institute of forensic Science (NICFS), Sardar Vallabhbhai Patel National Police Academy (NPA).
Unit-III	State level Police Organization: Criminal Investigation Department (CID), Modus Operandi Bureau (MOB), District level police, Structure of an Indian Police Station.
Unit-IV	International Investigative Agencies: Federal Bureau of Investigation (FBI), Central Investigation Agency (CIA), MI-6, Inter-Services Intelligence (ISI) Mossad, Minister of State Security (MSS) , Federal Security Services of Russian Federation (FSB), Directorate General for External Security (DGSE), Australian Secret Intelligence Service (ASIS) and BND Germany.

Suggested readings:

1) Ghosh S.K. and Rustomji K.F. Encyclopedia of police in India.
2) Raghavan R.K. Indian police.
3) Shamim Allem. Women in Indian Police.
4) Rajinder prasher. Police Administration.

SEMESTER-I

Fundamentals of Fingerprint Examination

Core Paper	Paper Code: 16FSC21C3	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to utilize various terminologies, history and various classification system used in fingerprinting.

CO-2: Students would be able to identify and compare the fingerprints on the basis of Galton's details/ different ridge characteristics

CO-3: They would get familiarity with Automatic Fingerprint Identification System (AFIS)

CO-4: Students would describe various methods of developing latent fingerprints and essentials of report writing in Fingerprint

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Fingerprints in General:** Dactylography, Dermatoglyphics, and Dactyloscopy, basis for the science of fingerprints, Friction Ridge Skin, Morphogenesis of Friction Ridge Skin, Primary Dermal Ridge Development, Definition of fingerprint, History of Fingerprint Identification, Fingerprint as forensic Evidence, Visible Fingermarks, Latent Fingermarks,
Unit-II	**Classification of Fingerprints for Comparison purposes**: Pattern area, Core, Delta, Type lines, Poroscopy, edgeoscopy, ridge characteristics, Fingerprint Pattern Types: Essentials and its types of Loop, Arch, whorl, Composites, accidental patters etc, Ten Digit and Single Digit fingerprint classification.
Unit-III	**Methods of Taking Fingerprints**: From living and dead persons, preserving and lifting of fingerprints. **Comparison Protocols:** Class and individual characteristics (Galton's details), different ridge characteristics, Standards of proof, Automatic Fingerprint Identification System (AFIS), Poroscopy and Edgeoscopy.
Unit-IV	**Fingerprint Developing Methods:** Chemistry of latent fingerprint residue, factor contributing to latent fingerprints, Methods of Development of latent fingerprints using conventional methods– Powdering (Black and grey, fluorescent and magnetic), Fuming method, Vacuum Metal Deposition (VMD) Method, Chemical method, Reagent chemistry and formulations, Sequential Treatment and Enhancement., Photography of fingerprints, Digital Transmission. **Report Writing & Court Room Testimony**: Evidence and testimony in court, Information required by the Forensic expert, Components of Forensic Reports, Preparation of Report, Presenting findings in a Report format.

Suggested readings

1) Saferstein, R.(1990) Criminalistics, Prentice Hall, New York.
2) David R. Ashbaugh (1999) Quantitative and Qualitative Friction Ridge Analysis, CRC Press.
3) Roland Menzel (1999) Fingerprint Detection with Lasers, 2nd Ed., Marcel Dekker, Inc. USA.
4) James F. Cowger (1993) Friction Ridge skin, CRC Press London.
5) Mehta, M.K (1980) Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay.
6) Moenssens (1975) Finger Prints Techniques, Chitton Book Co. Philadelphia, NY.
7) Chatterjee S.K. (1981) Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata.

8) Cowger, James F (1993) Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY.
9) J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press.

SEMESTER-I

Fundamentals of Questioned Document Examination

Core Paper	Paper Code: 16FSC21C4	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: They would gain knowledge of different types of crime where questioned document examination

CO-2: They would be able to compare handwriting and signature specimens.

CO-3: Students would be able to explain authenticity of printed documents and currency notes.

CO-4: They would be able to perform Photography of documents and stand and deliver testimony/cross examination on questioned documents in the court of law.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Questioned Document**: Definition, Importance, Classification and Preliminary Examination of questioned documents. **Handwriting:** Definition, Scripts, Development, Graphology, Systems of Writing, Instruments and Appliances of handwriting expert. **Handwriting Characteristics:** General Characteristics, Individual Characteristics, Development of Individuality in Handwriting Comparison of Handwriting: Natural Variations, Fundamental Divergences.
Unit-II	**Forgeries:** Forgery and its types and characteristics, identification and examination of forgeries. **Decipherment of secret indented and charred documents**: Preservation of documents, Examination of seal and other mechanical impressions, examination of sequence of intersecting of strokes. Standards for Comparison and Disguise etc.
Unit-III	**Age of Document & Alterations:** Determination of Age of Document- Absolute/relative Age, Indented and Invisible Writings, Alterations in the document: erasures, additions, overwriting and obliterations. **Comparison of type written/printed matter**: Working of typewriter, Printing and Machine Defects, alterations in typed text, various type of typewriting devices- check writing machines, electronic. Typewriter and proportional spacing typewriter. Comparison of Printed matter: Various Printing Processes. **Currency Note examination:** Identifying features of fake and genuine Indian currency notes.
Unit-IV	**Instrumentation and Photography of Documents**: - Basic Principles & Techniques Visible and Florescence (UV and IR), Photomicrography & Microphotography, Stereo-zoom Microscopy, Video Spectral Comparator (VSC) and Electrostatic Detection Apparatus (ESDA). **Report Writing & Court Room Testimony**: Evidence and testimony in court, Information required by the Forensic expert, Components of Forensic Reports, Preparation of Report, Presenting findings in a Report format.

Suggested readings

1) Huber, A. R. and Headrick, A.M. (1999) Handwriting Identification: Facts and Fundamentals CRC LLC
2) Ellen, D (1997) The scientific examination of Documents, Methods and techniques. 2nd ed., Taylor & Francis Ltd.
3) Morris (2000) Forensic Handwriting Identification (fundamental concepts and Principles)
4) Harrison, W.R. (1966) Suspect Documents & their Scientific Examination, Sweet & Maxwell Ltd., London.
5) Hilton, O (1982) The Scientific Examination of Questioned Document, Elsevier North Holland Inc., New York.
6) Mehta, M. K. (1970) The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi,

Allahabad.
7) Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabad (Ed. A.K. Singla).
8) Osborn, A. S. (1929) Questioned Documents, Boyd Printing Co., Chicago.
9) Saferstein, R.(1990) Criminalistics, Prentice Hall, New York.

SEMESTER-I

General Forensic Tools and Techniques

Core Paper	Paper Code: 16FSC21C5	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to describe meaning and terminology of Instrumentation used in forensic analysis.

CO-2: They would be able to describe the mechanism behind conventional Colour spot tests.

CO-3: They would describe working and applications of instrumental techniques of forensic aid.

CO-4: They would be able use Light and Electron Microscope (SEM & TEM) and TLC in forensic science.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	Meaning and Terminology of Instrumentation: Definition, Need of Instrumentation in Forensic Science, Qualitative and quantitative methods of analysis, Destructive and Non-Destructive Methods, Separatorary techniques, Hyphenated techniques, Accuracy, Precision, Signal to noise ratio, Sensitivity and detection limit, sources of noise, Instrument calibration. **Scientific Calculations:** Scientific volume and weight measurements, Centrifugation, Extraction, Filtration, Distillation, Density, Specific Gravity, Specific Volume, Percentage, Ratio Strength, and other Expressions of Concentration.
Unit-II	Schematic analysis of Chemical, Biological and Physical samples, Preliminary and Confirmatory methods of analysis, Colour spot tests in Forensic Biological, Chemical and Physical analysis, Microcrystalline test. Centrifuge Techniques: Centrifugation Techniques, Basic principles of sedimentation, Various types of centrifuges, Density gradient centrifugation, Preparative centrifugation, Ultra-centrifuge-Refrigerated Centrifuges.
Unit-III	**Microscopy**: Theory and basic principles, setup and Forensic applications of Compound, Comparison, Fluorescence, Polarized, Stereo-zoom microscope. Introduction, Geometrical optics, Image formation, Magnification and Resolution, Lens aberrations, Distortion of image and curvature of field. **Electron Microscopy-** Theory and basic principles of Electron Microscopy, Structure and Forensic applications of Scanning Electron microscope (SEM), Transmission Electron Microscope (TEM).
Unit-IV	**Introductory Chromatography:** Definition, Chromatographic Techniques, History of Chromatography, Theoretical principles of Chromatography, Classification of Chromatographic Methods, Adsorption and Partition Chromatography. Thin Layer Chromatography: Basic Principle, Setup, visualization and Forensic applications etc..

Suggested readings:

1) Borrow (1980) Molecular Spectroscopy.
2) Willdard, H. H (1974) Instrumental Methods of Analysis.
3) Moonesens A.A. (1979) Scientific Evidence in Criminal Cases.
4) Lundquist & Curry (1963) Methods of Forensic Science.
5) Settle,F.A.(1997) Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.
6) E. Stahl (1969) Thin Layer Chromatography: A Laboratory Handbook.
7) Sue Jickells and Adam Negrusz (2008) Clarke's Analytical Forensic Toxicology.
8) Forensic Chemistry: Max M Houck (2015)

SEMESTER-I

Forensic Lab Course–I

(Based on Fingerprint Examination)

Practical	Paper Code: 16FSC21CL1	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students would be able to take and classify fingerprints.
CO-2: They would also be able to compare fingerprints.
CO-3: They would utilize different developing methods of latent/chance prints.
CO-4: They would be able to understand poroscopy.

1. To obtain Plain and rolled inked finger prints.
2. To identify the finger Print Patterns.
3. To perform Ridge tracing and Ridge counting.
4. To identify the Ridge characteristics (Minutia).
5. To compare the finger Prints.
6. To develop latent finger Prints with powdering methods.
7. To develop latent finger Prints with fuming methods.
8. To develop latent finger Prints with chemical methods.

SEMESTER-I

Forensic Lab Course–II

(Based on Questioned Document Examination)

Practical	Paper Code: 16FSC21CL2	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students would be in a position to identify and compare handwriting and signatures under question.
CO-2: They would easily detect written forgeries & disguise
CO-3: They could compare Typewritten scripts
CO-4: Currency note examination would also be made during course.

1. Identification of Handwriting Individual Characteristics.
2. Study of natural variations and fundamental divergences in handwriting.
3. Comparison of handwritings.
4. Detection of Simulated forgery.
5. Detection of traced forgery.
6. Study of Disguise in handwriting.
7. Comparison of Typewritten scripts
8. Currency note examination

SEMESTER-II

Crime Scene Investigation

Core Paper	Paper Code: 16FSC22C1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to reconstruct a scene of crime.

CO-2: They would be able to utilized Forensic Podiatry, Chieloscopy in personal identification of suspect.

CO-3: They would be able to describe Chain of custody in forensic science.

CO-4: They would be able to perform Crime scene photography.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Criminalistics:** Definition, Meaning of Recognition, collection, identification, individualization and interpretation of physical evidence. **Pursuit to crime scene**: Securing the scene, Documentation crime scene (including photography and sketching)
Unit-II	**Basic Principles & Stages Involved:** Data Collection, Conjecture, Hypothesis formulation, Testing & Theory formation; Pattern evidence; Writing a reconstruction report of cases of Special Importance pertaining to forensics. **Forensic Podiatry**: Foot prints and shoeprints, Importance, Gait pattern, Casting of footprints in different medium, electrostatic lifting of latent footprints, Taking of control samples and comparison of tool marks and evaluation. **Chieloscopy:** Significance, Nature, location, collection and evaluation. **Ear prints**: Significance, Nature, location, collection and evaluation.
Unit-III	**Crime Scene Reconstruction (CSR):** Nature & Importance of CSR. **Investigation of Road Accident crime scene**: Examination of scene, Victim and the vehicle, Collection of the evidence, **Tyre marks/prints and skid marks**: Significance**,** Nature, location, collection and evaluation. Forensic significance of Glass, Soil and Paint. **Interpretations of Bloodstain Pattern Analysis (BPA):** Biological and physical properties of human blood, Droplet Directionality from bloodstain patterns, Determination of Point of Convergence and Point of Origin, Impact spatter and mechanisms, Importance and Legal aspects of BPA. **Tool Marks examination**: Types of tool marks, Class characteristics and individual characteristics, Lifting of tool marks, Examination.
Unit-IV	**Chain of custody & Legal aspects of forensic science**: Difference between a civil case & a criminal case, Case acceptance, case opening, and case examination, production of evidence, Expert Witness. **Crime scene photography**: Crime scene and laboratory photography, Basic use of forensic photography, including selection and use of equipment, photographs as evidence, close-up work, Digital Photography of crime scene.

Suggested readings:

1) Kirk (2000) Vehicular Accident investigation and reconstruction.
2) H. James, Wouldiam G. Eckert (1999) Interpretation of Blood stain evidence at Crime Scene, 2nd edition, CRC Press.
3) Sharma, B.R. (1974) Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad.
4) Lundquest & Curry (1963) Forensic Science, Vol I to IV, Charles C. Thomas, Illinois, USA.
5) Saferstein : Forensic Science Handbook, Vol I, II & III, Prentice Hall Inc. USA.
6) Saferstein (1976) Criminalistics, Prentice Hall Inc. USA.
7) Kirk (1953) Criminal Investigation Interscience Publisher Inc. New York.
8) Sharma B. R. (1980) Footprints, Tracks and Trials. Central Law Agency. Allahabad.

SEMESTER-II

Fundamentals of Forensic Ballistics

Core Paper	Paper Code: 16FSC22C2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to describe different mechanisms of firearms.
CO-2: They would be able to compare cartridge cases and bullets.
CO-3: They would be able to estimate range of fire and use of GSR in catching the suspect.
CO-4: They may be able to present testimony in court of law on ballistics evidences.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit –I	**Forensic Ballistics:** Definition and scope, Types of evidences associated, History and mechanism of Muzzleloaders (Match lock, Wheel lock, Flint lock firearms), Briefs of Pinfire, Rimfire and Centrefire systems of firearms. **Different parameters of classification of firearms, Introduction to** Shotgun, Revolver, Pistol, Rifle and Country Made/ Improvised Firearms. Proof Marks of Weapons.
Unit –II	**Firearm Ammunition:** Ammunition Components of Shotgun and Rifled firearm cartridges, Headstamp Markings on Ammunition. **Internal Ballistics:** Definition, Shapes and manner of Propellant burning, Muzzle velocity and Factors affecting muzzle velocity.
Unit –III	**External Ballistics:** Definition- Bullet Trajectory and factors affecting bullet flight. **Wound Ballistics**: Definition of wound ballistics, Ballistic aspect of firearm injuries, significance of studying cavitations in body, Bullet Entry/Exit Hole Identification, Evaluation of Accident, Suicide, Homicide firearm injuries.
Unit IV	**Range of Firing determination**: Introduction and methods of estimation. **Gunshot Residue**: Introduction and methods of analysis. **Bullet and Cartridges matching:** Class and individual characteristics on bullet and cartridge case for comparing and matching with suspected firearm. Briefs of NIBIN and IBIS.

Suggested Readings:

1) Hatcher Jury & Weller, 1987 : Firearm Investigation Identification and Evidence, The University Book Agency, Allahabad.
2) Gunther & Gunther, 1935 : The Identification of Firearms, Wouldies, New York.
3) Jauhri, M. 1980 : Monograpnh on Forensic Ballistics, Govt. of India Publication, New Delhi.
4) Burrad, 1951 : The Identification of Firearms and Forensic Ballistics.
5) Sharma, B.R. : Firearms in Criminal Investigation and Trails, 1990.
6) Di Maio : Gunshot Wounds, 1987. 8. Kumar : Forensic Ballistics in Criminal Justice, 1987.
7) Yallop Explosion Investigation, 1980.
8) Edward Hueske: Firearms and Fingerprints
9) Brian J Heard:Handbook of Firearms and Ballistics, Examining and Interpreting Forensic Evidence, Second Edition

SEMESTER-II

Forensic Criminology and Law

Core Paper	Paper Code: 16FSC22C3	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to describe the concept of crime.

CO-2: They would be able to conduct Criminal Profiling.

CO-3: They would make use of various IPC sections & of Hierarchy of Courts in forensic provision.

CO-4: They can apply knowledge in solving crimes related to IT Act, NDPS Act, Wild Life Protection Act.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit –I	**Crime Scenario in India:** Concept and Definition of Crime, Introduction to crime, Sociological aspects of crime and criminals in society. **Types of crime and its causes:** Property crimes, public order crimes, violent crimes**,** cyber crimes, juvenile delinquency, Society-Criminal interaction and various types of crimes in India.
Unit-II	**Forensic Criminology**: Introduction of Forensic Criminology, Control and Prevention of Crime in context with Organization, Industrialization, Family set up, Psychology. **Procedures involved in detection of crime:** Latest evidence based research in detection and prevention of crime. **Criminal Profiling:** Definition, Need and Types, Forensic Scientific evidence, Crime and Psychopathology, Genetics and Crime, Serial murders, Modus Operandi.
Unit-III	**Indian Courts:** Constitution of Courts-Hierarchy of Courts and their Powers. Lok Adalats, Lok Ayukts and Juvenile Courts. **Constitution of India**-Preamble, Fundamental Rights Article 20, 21, 22. **Forensic Expert**: Definition and related Laws & Issues, Expert Witness (Cr.P.C. 291-93), **Indian Evidence Act** – Section 45
Unit-IV	**Indian Penal Codes: Offences against the person-Sections**:- 300, 302, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362, 375 and 377. **Offences against property**- Sections:-378, 383, 390, 391, 415, 420, 441, 463, 489A, 497, 499, 503 and 511. **Briefs of Information:** Technology IT Act, Narcotic Drugs & Psychotropic Substances Act, Dowry Prohibition Act, Arms Act, Wild Life Protection Act,

Suggested readings:

1) Constitution of India
2) Indian Evidence Act
3) Criminal Procedure code.
4) Indian Penal Code.
5) Barak, Gregg : Integrative Criminology.
6) Johnson : Crime, Correction and Society.
7) Riderman : The Manipulation of Human Behaviour.

SEMESTER-II

Forensic Lab Course–III
(Based On CSI)

Practical	Paper Code: 16FSC22CL1	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students can apply practical knowledge to compare Paints, Soils and Glass evidences.
CO-2: They could make out to process a Crime scene.
CO-3: They would be able to lift and compare impressions at SOC.
CO-4: They would be able to compare Tool Marks.

1. General comparison of Paints, Soils and Glass.
2. Miscellaneous evidences (Cloth, Bangles, fibres)
3. Evaluation of Crime scene.
4. Sole prints comparison and their lifting from the scene of crime.
5. Lifting of prints and impressions by caste and replicas.
6. Study of Lip prints and ear prints.
7. Tool Marks examination

SEMESTER-II

Forensic Lab Course–IV
(Based on Forensic Ballistics)

Practical	Paper Code: 16FSC22CL2	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: They would be able to identify different types of weapons.
CO-2: They would be able to identify different types of bullets and cartridge cases.
CO-3: They would be able to determine range of fire and bullet entry hole.
CO-4: They would be able to compare ballistics evidences.

1. Study of Muzzleloaders
2. Identification of modern firearms (Revolver, Pistol and Rifles)
3. Identification of bullets
4. Study of cartridge cases including Boxer and Berdan
5. Study of shotgun ammunition
6. Study of different types of propellants
7. Determination of range of fire
8. Matching bullets and cartridge cases
9. Chemical test for GSR
10. Determination of bullet entry and exit hole

SEMESTER-II

Fundaments of Forensic Psychology

Discipline Specific Elective	Paper Code: 16FSC22DA1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to explore their expertise in forensic psychology.
CO-2: They can make use of psychological assessment in criminal behavior.
CO-3: They would be able to describe functioning of Polygraph, BEOS and Narco test.
CO-4: They could make people aware of the legal aspects and ethics of forensic psychology.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Basics:** Forensic Psychology and the Law, Ethical Issues in Forensic Psychology, Civil and criminal case assessment, Assessing mental competency, Mental disorders and Forensic Psychology, Eye witness testimony, Criminal profiling- need and types, Forensic Scientific evidence, Crime and Psychopathology, Genetics and Crime, Serial murders, Modus Operandi.
Unit-II	**Psychological Assessment**: Psychological Assessment Tools, Detection of deception, Various methods for detection of deception, Interview, Non-verbal detection, statement assessment, Hypnosis, Psychological assessment, voice stress analyzer, Polygraph, thermal imaging, Brain Electrical Oscillation Signature Profiling, Functional Magnetic Resonance study, Current research in detection of deception/truth finding mechanisms
Unit-III	**Polygraph**: Historical aspects of Polygraph, Principles of polygraph, psycho physiological aspects, operational aspects, Question formulation techniques, Interviewing technique procedure, The Art-Polygraph, Legal and Ethical aspects, Human rights of individual.
Unit-IV	**Narco-Analysis:** Historical aspects, Principle and Theory, General Procedure –Legal and Ethical aspects, Human rights of individual. **Brain Electrical Oscillation Signature (BEOS) Profiling:** Principle and Theory, General Procedure –Legal and Ethical aspects, Human rights of individual.

Suggested readings:

1) Forensic Science in Criminal Investigation & Trials – B.R.Sharma
2) The Hand Book of Forensic Psychology – Weiner Hass
3) Hand Book of Forensic Psychology – O' Donohue Levensky
4) Brain Experience – C.R.Mukundan
5) Criminal Profilling – B.Turvey
6) Investigative Forensic Hypnosis – J. Niehans
7) Art & Science of the Polygraph Techniques – J.A.Matte
8) Hand Book of Polygraph Testing – M.Kloinen
9) Detecting Lies & Deceit – A.Vrij

SEMESTER-II

Forensic Quality Management

Discipline Specific Elective	Paper Code: 16FSC22DA2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to describe functioning of NABL, ILAC, APLAC, ASCLD, ISO-IEC, BIS.
CO-2: Students would be able to conduct internal audit in forensic science labs.
CO-3: Students would be able to describe procedure of external audit by NABL.
CO-4: They would make people aware of accreditation and its significance in testing labs.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Introduction to Quality management Systems:** Need of maintaining quality of Forensic laboratories**,** Definition of Accreditation, Benefits of Accreditation. **Organizations involved in setting guidelines and maintaining quality system:** National Accreditation Board for Testing and Calibration Laboratories (NABL), International Laboratory Accreditation Co-operation (ILAC), Asia Pacific Laboratory Accreditation Co-operation (APLAC). American Society of Crime Laboratory Directors (ASCLD), International Organization for Standardization (ISO), Bureau of Indian Standards (BIS).
Unit-II	**Forensic Quality Management System:** Definition of Quality, Quality Management System (based on People, Technical and Document), Quality Manual, Quality Manager, Total Quality, Quality Assurance, Quality Control, Quality Planning. **Quality Audit:** Internal Audits: Definition, Objectives, Organization of internal audits, Planning of audit, Implementation of internal audits, Follow up of corrective action, Records and reports of internal audits, Additional unscheduled audits.
Unit-III	**Management Requirements**: organizational, document control, subcontracting of tests and calibrations control of Non conforming testing / calibration work, corrective and preventive actions, Management Review. **Technical Requirements**: Test and calibration methods and their validation, measurements, standards and reference material, traceability, sampling, Proficiency Testing and Review Program.
Unit-IV	**Assessor Guide:** Assessor's role, Assessor assignment procedure, Procedure of assessment of new applicant laboratories, Pre-assessment visit, On-site assessment, Guide of assessors to formulate recommendations for NABL, Procedure for conducting closing meeting.

Suggested Readings:

1) J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press
2) NABL -, Guide for Internal audit and Management Review for Laboratories.
3) NABL-210, Assessor Guide Issue No.3, 1.5.2002.
4) DFSS: Manuals of Forensic Sciences.
5) Encyclopedia of Forensic Science: Elsevier

SEMESTER-II

Fundamentals of Computer Forensics

Discipline Specific Elective	Paper Code: 16FSC22DA3	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to define cyber crime.
CO-2: Students would be able describe functioning of Computer Software, Hardware and Internet.
CO-3: They would have knowledge of computer virus, worms, Trojan Horse, trap door.
CO-4: They would be able to make use of tools of retrieving digital data.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Basic of Computer and Internet**: Introduction, Computer generations, Software and Hardware. **Operating systems including**: DOS, Windows, NT/2000/XP, Linux. **Internet**: Basics setup and internetworking, Forensic utility of computer and internet.
Unit-II	**Computer Forensics**: Introduction, Nature of digital evidence, Retrieval and analysis of digital evidence, Sources of digital evidence, Computer security and its relationship to computer forensics. **Emergence of computer crime**: Classification of computer crimes, computer virus and types, computer worms, Trojan Horse, trap door, super zapping, logic bomb, salami logic, characteristics of computer crime and criminals.
Unit-III	**Investigation**: Investigating on various imaging methods. Lay down the image provided onto a hard disk and provide a disk map of the suspect drive. Extraction of all relevant information from a hard disk. **Cell phone/mobile forensics**: Introduction, Forensic toolkit, EnCase, Ilook Investigator. **Digital signature and cryptography**: signature in paper based society, Transfer of computer based documents, digital signature and authentication, digital signature generation and verification, certification of public keys, certification of authority.
Unit-IV	**Image Processing**: - Computer Scanners, Imaging Software (Photoshop, Pain etc.) Introduction and Process, Image Enhancement and restoration, The investigation of erased tapes and analysis of signals (Analog video image Processing), Compression, encryption methods. **Brief introduction to Cyber space and cyber Laws, IT Act.**

Suggested readings:

1) Eoghan Casey BS MA (2001) Handbook of Computer Crime Investigation: Forensic Tools and Technology
2) Marjie T. Britz (2003) Computer Forensics and Cyber Crime: An Introduction
3) Linda Volonino and Reynaldo Anzaldua (2008) Computer Forensics For Dummies
4) Eoghan Casey (2009)Handbook of Digital Forensics and Investigation
5) Warren G. Kruse II and Jay G. Heiser (2001) Computer Forensics: Incident Response Essentials
6) Robert C. Newman (2007) Computer Forensics: Evidence, Collection and Management
7) Michael A. Caloyannides (2001) Computer Forensics and Privacy (Artech House computer security series)
8) Steve Bunting (2007) The Official EnCE – EnCase Certified Examiner Study Guide.
9) Eoghan Casey BS MA (2001) Handbook of Computer Crime Investigation: Forensic Tools and Technology
10) Eoghan Casey (2009) Handbook of Digital Forensics and Investigation
11) Tewari, R.K., Sastry, P.K. and Ravikumar, K.V. (2003) Computer Crime & Computer Forensics select Publisher, New Delhi.
12) Mahajan T.S. and Singh, Didar (2003) : Computer Networking and HTML; Gurunanak Publication, Patiala.

SEMESTER-III

(Specialization -1: Forensic Chemical Sciences)

Advanced Forensic Chemistry

Core Paper	Paper Code: 17FSC23CA1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to reconstruct Arson.

CO-2: Students would be able to analyzed adulteration in petroleum products.

CO-3: They would have able to identify illicit and licit liquors.

CO-4: They would be able to perform Phenolphthalein in trap case

CO-5: They would be able to write forensic Report & present Court Room Testimony for chemical evidences.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit –I	Introduction to Forensic Chemistry, branches of and cases involved in Forensic chemistry, preliminary and confirmatory methods used in Forensic chemistry. **Analytical Chemistry**: Nature and scope of analytical chemistry in Forensic chemical analysis, Concepts of **S**tructure and function of drug molecules, Concept of Mole, Molecular Mass and Molecular Weight, Atomic Number and Atomic Mass, Classification of acids, bases and salts, pH value and pH scale, Buffer solutions, Oxidizing and reducing agents in organic chemistry, Functional group analysis, Schemes of identification of unknown solids, Volumetric/Titrimetric methods of analysis, Theory of indicators, Gravimetric methods of analysis, Process of precipitation, Saturated and supersaturated solution, Methods of sample preparation in organic and inorganic analytical chemistry. **Chemical separation Techniques:** Solvent extraction (Liquid-liquid extraction), Solid phase extraction, Solid phase microextraction (SPME). **Phenolphthalein in trap case**: Chemistry and Forensic examination of Phenolphthalein used in Bribe trap cases, and related legal issues. **Forensic significance of Cosmetics**: Introduction to cosmetics of forensic interest and their role in crime investigation, General Chemistry of Colorants, Dyes, Pigments & Polymers**. Industrial Products:** Physical and chemical examination of adulterated and non-adulterated oils and fats, Analysis of chemical fertilizers, consumer items such as gold, silver, tobacco, tea, sugar, salts. **Corrosive chemicals:** Hydrochloric acid, sulphuric acid, and nitric acid and alkalis' in crime exhibits of acid/alkali throwing cases.
Unit-II	**Fire & Arson**: Light and Flame, Chemistry of Fire, Combustion reaction, Fire Triangle, Fire Tetrahedron; Backdraft, Thermo-chemistry of Fire, Heat Capacity and Phase changes, Accelerants & types of accelerants, Combustible and Flammable liquids, Flash point, Fire point, Ignition point, Auto Ignition point, vapour density, vapour pressure, Fire extinguisher. **Arson:** Legal Definition, Arson motives, Degrees of Arson, Forensic and legal Concepts, Determining origin and cause; Fire patterns, Collection/Preservation of Arson Evidences, Flashover, Backdraught, Live or dead at time of arson; Documenting the fire or crime scene. **Scheme of analysis**: Extraction of samples from debris (Direct and solvent extraction methods, Head Space method, SPME, Distillation), Clean-up (Filtration & Acid stripping), Analysis (GC, GC-MS, FTIR & SEM etc.), Interpretation of GC-MS spectra. **Petroleum Products:** Introduction to Petroleum Products, Properties and Testing of Petroleum and Petroleum Products, Adulteration of petroleum products as per Prevention of Malpractices in Supply and Distribution, Analysis of common petroleum

	products including, Petrol, Kerosene, Diesel, Lubricating Oil, Furnace Oil and Grease as per BIS specifications. Analysis of Dyes used in petroleum products, Chemical fingerprinting of petroleum products
Unit-III	**Explosives:** Definition of Explosives, Definition as per Indian Explosive Acts. History of Explosives, Chemistry of explosives, Deflagration and Detonation phenomenon (Redox Chemistry, Kinetics-Molecular Theory of gases & Gas Laws), Characteristics of high and low explosives, Dust explosion, Gas/vapour explosion, BLEVE, Effect of blast wave on structures & human and Pyrotechnics. **Improvised Explosive Device**: Definition of IED, Components of IED, Explosives Initiation (Explosive Trains); Types (Molotov cocktail, Letter bomb, Pipe bomb, VBIED and CBRN), Detection of Hidden Explosives. **Bomb Scene**: Specific approach to scene of explosion, Reconstruction of sequence of events, Evaluation and assessment of scene of explosion, **Analysis of Explosive:** Pre-blast and Post blast residue collection, Systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques and interpretation of results.
Unit-IV	**Liquors (Alcoholic beverages):** Definition**,** classification of liquors based on origin (Indian Made Foreign Liquors, Country Made Liquors and Illicit Liquors), Fermented and Distilled methods (Pot Still and Continuous Still), Characteristics of Beer, wines and Whisky, Congeners in alcoholic beverages, Laws and penalties as per Excise/ Act. Laboratory methods of determination alcoholic strength, Forensic analysis of distilled and fermented liquors including illicit liquors. **Report Writing & Court Room Testimony**: Evidence and testimony in court, Information required by the Forensic expert, Components of Forensic Reports, Preparation of Report, Presenting findings in a Report format.

Suggested readings:

1) Modi's (1988) Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabd,.
2) Saferstein, R (1982) Forensic Science Hand Book, Vol I, II and III, Pretince Hall, NI.
3) Saferstein, R (2000) Criminalistics.
4) Curry (1986) Analytical Methods in Human Toxicology, Part II.
5) Curry, A.S. (1976) Poison Detection in Human Organs.
6) Mathew E. Johll (2009) Investigating Chemistry: A Forensic Science Perspective
7) Suzanne Bell (2009) Drugs, Poisons, and Chemistry
8) DFS Manuals of Forensic Chemistry and Narcotics.
9) A Naquest (1984) legal chemistry. a guide to the detection of poisons, examination of tea, stains, etc
10) DFS -Working Procedure Manual- Chemistry, Explosives
11) E. Stahl (1969) Thin Layer Chromatography: A Laboratory Handbook.
12) Jehuda Yinon; Forensic and Environmental Detection of Explosives
13) Saferstein (1976) Criminalistics.
14) Saferstien: Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA
15) Yinon Jitrin (1993)Modern Methods & Application in Analysis of Explosives, John Wiley & Sons ,England
16) J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press.

SEMESTER-III

(Specialization -1: Forensic Chemical Sciences)

Advanced Forensic Toxicology & Pharmacology

Core Paper	Paper Code: 17FSC23CA2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to discuss History and Pioneers of Forensic Toxicology, Elements of Forensic Toxicology, Role of the Forensic Toxicologist and Laws related.

CO-2: They would be able to define ADME of drugs of abuse.

CO-3: Students would be able to utilize applications of Veterinary Toxicology, Entomotoxicology, Environmental Toxicology and Ptomaine in Forensic context.

CO-4: They would be able to measure Toxicity using LD50 and ED50

CO-5: Students would be able to extract and analyze poison from biological material.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Forensic Toxicology**: Introduction, History and Pioneers (Paracelsus, Mary Blandy James Marsh and M. J. B. Orfila), International organization related to Forensic Toxicology, Different mode of Classification of Poisons, Areas of Forensic Toxicology, Elements of Forensic Toxicology, Applications, Scientific Principles, Instrumentation and equipments, Nature of cases, Role of the Forensic Toxicologist, Laws related to Forensic Toxicology.
Unit-II	**Forensic Veterinary Toxicology:** Definition, cases, common animal disease states affecting small animals and large animals, Legal and regulatory issues of veterinary pharmacy, Homicide and accidental animal poisoning. **Entomotoxicology:** Definition and Forensic utility. **Environmental Forensic Toxicology:** Introduction, principles and application, various pollutants, identification of biased environmental data, ground water characterization, soil, vapour survey, analytical methods. Forensic techniques in environmental litigation. **Ptomaine**: Introduction, interference caused in analysis of poison, especially in putrefied viscera, poisoning cases due to ptomaine.
Unit-III	**Forensic Pharmacology:** Introductory Toxicokinetics: Overall Drug Disposition, Absorption, Toxicokinetics and Bioavailability, First-Pass Metabolism, Distribution, Free and Bound Drugs Elimination. Biotransformation: Phase-I and Phase-II reactions. Detection of poison on the basis of their metabolic studies, Some Examples of Applied Biotransformation Knowledge of Codeine, Morphine, Amphetamine Benzodiazepines etc. **Clinical Toxicology:** Introduction and history of clinical toxicology, Toxidrome, Management of the poisoned or overdosed patient, Laboratory principles, Pharmacokinetics and Toxicokinetics overview, Administration, liberation, and absorption of toxicants, Prevention of absorption from the gastrointestinal tract, Distribution and Metabolism of Toxicants in the body, Elimination of toxicants, Enhancement of elimination of toxicants, Types of Antidotes in poisoning cases. **Therapeutic Drug Monitoring:** Introduction, Therapeutic and toxic concentrations of some forensic related substances, Criteria to assess the clinical value of drug monitoring, Methods of analysis. **Measuring Toxicity:** Qualitative Descriptions of Toxicity Exposure Limits Determination of LD50 and ED50, Units in Toxicology.
Unit-IV	The Role of the Laboratory in Diagnosis and Treatment of Poisoning, Current Practices Value and

	Limitations of Laboratory Testing, Laboratory Accuracy or Error Outcome Studies, The Structure of Clinical Toxicology Testing. **Methods of extraction:** Classical and Modern methods, Isolation and clean up procedures using conventional as well as modern techniques such as solid phase micro extraction technique. **Analysis of Poisons:** Inorganic poisons (cations and anions), Neutral poison (organic non volatile), **Method of analysis** of Basic drugs / poisons, Method of analysis of Acidic drugs / poisons, Method of analysis of metallic poisons and volatile poisons, Analysis of samples taken under Food Adulteration Act, Toxicological analysis of decomposed materials.

Suggested readings:

1) J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press.
2) Casarett & Doll Toxicology (2003) The Basic Science of poisons.
3) MaThew E. Johll (2009) Investigating Chemistry: A Forensic Science Perspective
4) JJ Fenton (2002) Toxicology A Case-Oriented Approach
5) S.N. Tiwari, Manual of Forensic Toxicology.

SEMESTER-III

(Specialization -1: Forensic Chemical Sciences)

Forensic Lab Course–V

(Based on Forensic Chemistry)

Practical	Paper Code: 17FSC23LA1	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students would be able to perform Phenolphthalein and analysis of adulteration in various domestic eatables

CO-2: They would be able to conduct Presumptive Drug Testing by using various methods.

CO-3: They would be exposed to examine arson scene of crime.

CO-4: They would be able to analysis of adulteration of Petroleum products.

CO-5: They would also be exposed to bomb scene.

1. Analysis of Phenolphthalein in trap cases.
2. Analysis of forensically important cosmetics
3. Analysis of Dyes, Pigments & Polymers
4. Forensic analysis of oils and fats
5. Analysis of chemical fertilizers, consumer items such as gold, silver, tobacco, tea, sugar, salts,
6. Analysis of Corrosive chemicals: Hydrochloric acid, sulphuric acid, and nitric acid and alkalis.
7. Chemical analysis of liquors.
8. Forensic Drug Testing
    - Presumptive Drug Testing by Color/spot test, Microcrystalline testing
    - Analysis of Drugs by Thin Layer Chromatography, High Pressure Liquid
    - Chromatography and Gas Chromatography-Mass Spectrometry
    - Quantitative drug analysis by UV-vis spectrophotometery
9. Melting Point determination of some substances of forensic interest.
10. Forensic investigation of arson scene of crime.
11. Forensic analysis of arson related evidences.
12. Characterization and analysis of adulteration of Petroleum products.
13. Bomb scene investigation
14. Systematic analytical approach to pre-blast and post-blast explosives

SEMESTER-III

(Specialization -1: Forensic Chemical Sciences)

Forensic Lab Course–VI

(Based on Forensic Toxicology)

Practical	Paper Code: 17FSC23LA2	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students would be able to perform various methods of extraction from bio material.

CO-2: They would be able to perform chemical and instrumental methods for analysis such poison.

CO-3: They would be able to conduct blood-alcohol conc.

CO-4: They would gain knowledge of toxic plants.

CO-5: They would be able to describe $LD_{50.}$

1. Extracting poisons from viscera/blood and urine samples.
2. TLC separation of pesticides/insecticides & Identification using chromomeric reagents
3. Lab testing of Aluminum Phosphide (Phosphine gas)
4. Identification of Gaseous Poisoning (Carbon Monoxide and HCN)
5. Detection of metallic poisons using Reinsch Test.
6. Extraction and analysis of different categories of poisons from viscera.
7. Estimation alcohol in Blood.
8. Microscopic Identification of plant poisons.
9. Analysis of viscera and food material for in case of food poisoning by chemical microscopic and instrumental techniques.
10. Qualitative Descriptions of Toxicity Exposure Limits Determination of LD50 and ED50, Units in Toxicology.

SEMESTER-III

(Specialization -2: Forensic Biological Sciences)

Theoretical and Practical Aspects of Biological Evidences

Core Paper	Paper Code: 17FSC23CB1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to Understand the importance of biological fluids (blood, semen, saliva and other body fluids) in crime investigations.

CO-2: They would be able to define biology and chemistry of the identification tests used for examination of different body fluids.

CO-3: Students would be able to understand the basic principles of the serological techniques used in Forensic biology for different body fluids.

CO-4: They would be able to understand the conventional and modern methods of individualization on the basis of different biological evidences.

CO-5: Students would be able to perform biological techniques.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Forensic Hair characterization**: Morphology and types, their importance, nature, location, collection, evaluation and tests for their identification: Species of origin, variation in different major population groups, somatic origin. Methods of Individualization: Blood grouping, enzyme typing and DNA typing.
Unit-II	**Forensic Characterization of Blood:** Chemistry and properties, Presumptive and Confirmatory tests, Individualization (Blood Grouping, Polymorphic enzyme typing). **Forensic Characterization of Semen:** Formation, Composition, Morphology of spermatozoa, forensic significance, Presumptive and Confirmatory tests (including Azoospermic semen stains). Individualization (Blood Grouping, seminal fluid isozymes typing, forensic significance, Collection and analysis of evidences in Rape cases.
Unit-III	**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-IV	**Serological Techniques:** Primary binding assays (ELISA**,** Immunochromatographic assays**),** Secondary binding assays(Precipitation based assays- Immunodiffusion and electrophoretic methods for species. Identification, Agglutination based assays-Direct agglutination assay, Passive agglutination assay)

Suggested readings:

1) Race, R.R, and Sanger, R. (1975) : Blood Groups in Man. Blackwell Scientific, Oxford.
2) Saferstein, R. (1982): Science Handbook, Vol. I, II, & III, Prentice Hall New Jersey.
3) Curry, A. S. (1965): Methods of Forensic Science, Vol IV, Interscience, New York.
4) Barris, H. and Hopkinson, D.A. (1976) : Handbook of Enzyme, Electrophoresis Eleavier, North, Holland, New York.
5) Robertson (1999) : Forensic examination of Hair. Francis & Taylor, USA.
6) Gilblet, E. (1969) : Markers in Human Blood, Davis, Pensylvania

7) Culliford, B.E. (1971) The Examination and Typing of Blood Stains, US Deptt. of Justice, Washingron
8) Dunsford, I and Bowley, C. (1967) : Blood Grouping Techniques, Oliver & Boyd, London
9) Boorman KE, Dodd BE, Lincoln PJ. (1988) Blood group serology, 6th ed. Edinburgh : Churchill Livingstone.
10) Basin Et al. A laboratory Manual for Human Blood analysis. Kamla Raj Enterprises.
11) Li R. (2008) Forensic Biology, Taylor & Francis Group LLC.

SEMESTER-III

(Specialization -2: Forensic Biological Sciences)

Forensic Genetics and Advanced DNA Forensics

Core Paper	Paper Code: 17FSC23CB2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to understand the basic concepts of human genetics.

CO-2: They would be able to understand the usefulness of genetic markers in forensic investigation along with the interpretation of a DNA profile.

CO-3: Students would be able to understand understand the need, progress, forensic significance and the legal importance of DNA profiling in various scenarios in India and abroad.

CO-4: They would be able to understand the potential Benefits of DNA Data banking

CO-5: Students would be able to Use DNA statistics for calculations in different types of cases encountered in Forensic Science.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	Human Genetics, Heredity, Alleles, Mutations and Population Genetics, The concept of Genetics polymorphism, Hardy-Weinberg Law.
Unit-II	DNA Profiling: Introduction, History of DNA Typing, molecular biology of DNA, variations, polymorphism, DNA Extraction-Organic and Inorganic extraction, Comparison of Extraction methods, Commercial kits DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR, Mitochondrial DNA, Ancient DNA typing, Evaluation of results.
Unit-III	DNA Statistics: frequency estimate calculations, interpretations, allele frequency determination, Paternity/Maternity index, Sibling index, Probability of match. Human Genome Project: Introduction, History, Goals, Benefits, Social, Ethical and Legal Issues DNA Forensic Databases, Ethical, Legal, and Social Issues Associated with DNA Databanking, Potential. Benefits of DNA Databanking 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, veter inary, 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. New and future technologies: DNA chips, SNPs and limitations of DNA profiling.

Suggested readings:

1) Saferstein, R. (1982) Science Handbook, Vol. I, II, & III, Prentice Hall New Jersey.
2) Kirby : DNA Fingerprinting Technology.
3) DNA structure and functions by Richard R. Sinden; Academic Press, Inc. 1994.
4) DNA Profiling and DNA fingerprinting (1999) Edited by Jorg T. Epplen and Thomas Lubjuhn; Birkhauser Verlag, Switzerland.
5) Forensic DNA Profiling Protocols (1998) Patrick J. Lincoln and Jim Thomson; Humana Press, Inc.
6) DNA and other Polymorphism in Forensic Science (1990) Henry C. Lee and R.E. Gaensslen; Year book nMedical Publishers, Inc.
7. Keith In man and Norah Rudin (1997) An Introduction to Forensic DNA Analysis, CRC Press; Ny.
7) Koblinsky et al. (2005) DNA -Forensic and Legal Implications.
8) John M. Butler (2005) Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers Academic Press.

SEMESTER-III

(Specialization -2: Forensic Biological Sciences)

Forensic Lab Course–VII
(Based on Forensic Biology)

Practical	Paper Code: 17FSC23LB1	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students would be able to perform forensic hair analysis.
CO-2: They would be able to determine species of origin from blood.
CO-3: They would be able to conduct blood identification and blood grouping.
CO-4: They would be able to conduct saliva test.
CO-5: They would be able to conduct Diatom test.

1. To prepare slides of scale patterns of human hair.
2. To examine human hair for cortex and medulla.
3. To examine Barr bodies from hair root.
4. Examination of hair of different domestic animals as cat, dog, cow, horse and goat.
5. To determine species of origin from blood.
6. To determine blood group from fresh blood and blood stains.
7. To identify blood stains.
8. To identify semen stains.
9. To identify saliva stains.
10. To determine titre of antisera.
11. To perform precipitin test for species of origin determination.
12. To perform Immunodiffusion test for species of origin..
13. Comparative analysis of Diatoms.

SEMESTER-III

(Specialization -2: Forensic Biological Sciences)

Forensic Lab Course–VII
(Based on DNA Forensics)

Practical	Paper Code: 17FSC23LB2	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students would be able to perform Electrophoretic techniques.

CO-2: They would be able to extract DNA from blood.

CO-3: They would be able to extract DNA from other biological fluids.

CO-4: They would be able to quantify DNA.

CO-5: They would be able to assess DNA databasing.

1. To prepare gel plates for electrophoresis.
2. Organic extraction of DNA from blood.
3. Extraction of DNA from other body fluids.
4. Quantification of DNA
5. PCR for DNA samples
6. Accessing of DNA databases.

SEMESTER-III

(Specialization -3: Forensic Physical Sciences)

Advanced Forensic Physics and Photography

Core Paper	Paper Code: 17FSC23CP1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to analyze Fiber, Glass, Soil, Paints and Tool Marks, strings/ropes, Wires/cables, Seals, Counterfeit coins and Gem Stones by using various forensic technique.

CO-2: Students would also be able to decipher Obliterated Numbers in Metal Surfaces.

CO-3: They would run SPID for Voice/Tape analysis.

CO-4: Students would be able to know the functioning of Camera for forensic photography.

CO-5: Students would be able to write forensic report on analysis of physical evidences .

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Introduction to Forensic Physics**: Nature, collection, preservation & forwarding of physical evidence for scientific examinations. **Forensic Engineering:** What is forensic engineering; Fire investigation; Industrial accidents; Traffic accident reconstruction; Transportation disaster investigation; Civil engineering investigation; Investigation report. **Building Materials**- Types of cement and their composition, Determination of adulterants, Analysis of Bitumen and road material, Analysis of cement mortar and cement concrete and stones. Forensic examination of electrical appliances/installations. **Road Accidents**- Examination of scene, Filaments examination, Examination of skid marks. **Physics of Bloodstain Pattern Analysis (**BPA): Introduction, Terminologies and classification, Biological and physical properties of human blood, Droplet Directionality from bloodstain patterns, Determination of Point of Convergence and Point of Origin. Impact spatter and mechanisms. Importance and Legal aspects of BPA.
Unit-II	**Glass-**Types of glass and their composition, Glass fracture analysis, Laboratory exercises include refractive index measurements using immersion methods and classical chemical and physical methods of analysis. **Soil**- Formation and types of soil, Composition and color of soil, Forensic examination of soil, Interpretation of soil evidence. **Paints**- Types of paint and their composition, Forensic examination of paints, Interpretation of paint evidence. **Tool Marks**- Types of tool marks, Class characteristics and individual characteristics, Lifting of tool marks, Examination. **Resuscitation of Obliterated Numbers in Metal Surfaces**- Theoretical and practical aspects of resuscitation. **Fiber analysis:** Forensic significance, Classification, Textile Fibers, Yarns, Fabric construction, Fabric characteristics, Microscopy characteristic, Birefringence, Fluorescence Microscopy, Colors in textile, Color Assessment, Chemical properties, **Miscellaneous Clue Materials**- Examination of strings/ropes, Wires/cables, Seals, Counterfeit coins, **Gem Stones:** Analysis of crystalline substances.
Unit-III	**Voice/Tape Authentication:** Introduction to human Voice, Nature of voice and production of speech, perception of voice and speech, speech signal processing & pattern recognition basic factor of sound in speech acoustic characteristics of speech signal, **Voice as Evidence:** Collection of evidence, Quality of evidence, type of evidence, speaker variability and simulation, Transmission and channel distortion, admissibility. Fourier analysis, frequency & time domain representation

	of speech signal, analogue to digital signal and conversion, fast Fourier transform, quantization, digitization and speech enhancement, analysis of audio & video signal for authenticity, Introduction to the technique of pattern recognition and comparison. Speaker recognition and types of speaker recognition, procedures and methods, feature extraction, Future comparison. Speaker recognition by Listening (SRL), speaker recognition by visual comparison of spectrograms (SRS), Automatic speaker recognition (ASR), Interpretation of results. Recent Development of Computerized Speech Laboratory, Legal Aspects. Speaker profiling, Intelligibility Enhancement of audio recording, Transcription and analysis of disputed utterances, Authenticity and integrity examination of audio recordings.
Unit-IV	**Forensic Photography: Basics:** Definition of photography, basic concepts of videography/high speed videography, Introduction to photographic instruments, Basic principles and techniques of Black & White and color photography. **Camera**: Cameras and its working, attachments of camera, types of camera lenses Image sensors, spectral sensitivity of photographic materials, reproduction of colors- photographic processing, Exposing, Camera exposure determination, Working of Camera, F-Number, Depth of field, ISO, Developing and Printing, Modern Developments in Photography: Digital photography and advanced Crime scene and Laboratory photography. **Photoshop-development-** digital images processing and manipulation-Determination of authenticity and genuineness- forensic application. **Format of Report writing in Forensic Physical Sciences.**

Suggested Readings:

1. Forensic Examination of Fibres, Second Edition - Kindle Edition - Kindle eBook (Apr. 16, 2007) by Ichael Grieve
2. Noon (2000) : Forensic Engineering Investigation.
3. Sharma, B.R. : Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.
4. Nickolas : Scientific Criminal Investigation.
5. Forensic Digital Imaging and Photography – (2001) by Herbert L. Blitzer and Jack Jacobia
6. Advanced Crime Scene Photography (2010) by Christopher D Duncan
7. Kirk (2000) Vehicular Accident investigation and reconstruction.
8. J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press
9. H. James, Wouldiam G. Eckert; (1999) Interpretation of Blood stain evidence at crime scene stuart Second edition, CRC Press.
10. Sharma, B.R. (1974) Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad.
11. Lundquest & Curry : Forensic Science, Vol I to IV, 1963, Charls C. Thomas, Illinosis, USA.
12. Saferstein (1976) Forensic Science Handbook, Vol I, II & III, Prentice Hall Inc. USA.
13. Saferstein (2000) Criminalistics, Prentice Hall Inc. USA

SEMESTER-III

(Specialization -2: Forensic Physical Sciences)

Advanced Forensic Ballistics

Core Paper	Paper Code: 17FSC23CP2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to understand the working of different firearms and composition of ammunition and bullet trajectory.

CO-2: They would be able to explain Terminal Ballistics (entry and exit bullet holes).

CO-3: Students would be able to determine direction and Range of fire

CO-4: They would be able to match spent bullet and cartridge with the suspected gun

CO-5: They would be able to use comparison microscope.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Firearms:** Definition, Breech Loader and Muzzle loader (Match lock, Wheel lock, Snaphaunce, Flint lock, Percussion), Smooth bore (Shotgun) and Rifled firearms, (Revolver, Pistol and Rifles), Briefs of Indian Arms Act, Country Made/Improvised Firearms, Illegal firearms: AK-47, SKS and M16/AR15 Assault Rifles 47, SKS and M16/AR15 Assault Rifles, Proof Marks of weapons. **Concepts of Ammunition**: A Brief History of Ammunition, Types of ammunition- classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, velocity and pressure characteristics under different conditions, various types of bullet and compositional aspects, latest trends in their manufacturing and design projectile, Headstamp Markings.
Unit-II	**Core concepts of Internal Ballistics**: Definition, Ignition of the propellant, Shapes of Propellants, Manner of the propellant burning, Piobert's law, Pressure space curve, Shot Start Pressure, All Burnt Point, Velocity, Le Du's formula, Muzzle velocity, various factors affecting the internal ballistics: lock time, barrel time, erosion, corrosion and gas cutting, equation of motion of projectile, Density of loading, Heat problems, Vibration & jump, Measurement of strength of firearm, projectile velocity determination, theory of recoil, methods for measurement of recoil. **Core concepts of External Ballistics:** Bullet Drop in the flight, Use of sight to compensate for bullet drop, Influence of Earth on Trajectory, Angle of Fall, Ballistic Coefficient and Air resistance-base drag, Sectional Density, Brief introduction to Terminal velocity, Maximum effective range, Drift, Yaw, Precession, Nutation, Terminal velocity, Ballistics tables, measurements of trajectory parameters, Escape velocity & Ricochet.
Unit-III	**Core concepts of Terminal Ballistics:** Definition, Effect of projectile on hitting the target: function of Bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate targets, function of bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, Brief introduction to Cavitations (Temporary and Permanent), Ricochet and its effects, stopping power **Wound Ballistics (Firearm injuries):** Ballistic aspect of firearm injuries, Mechanism of firearm injuries (Lacerations and Shockwaves etc.), Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, penetrative in gel block and other targets, Bullet Entry/Exit Hole

	Identification, Evaluation of Accident, Suicide, murder and self defense firearm injuries, explosive wounds, evaluation of injuries caused due to shot-gun, rifle, handguns and country made firearms, methods of measurements of wound ballistics parameters, post-mortem and anti-mortem firearm injuries. **Determination of Range of Fire**- burning, scorching, blackening, tattooing and metal fouling shots dispersion and GSR distribution, time offering different method employed, and their limitations, Bullet recovery, time of firing. **Gunshot Residues/ Powder Residues:** Composition of GSR depending upon propellants & primer mixtures, GSR Distribution**,** Mechanism of formation of GSR, Location, source and collection of GSR, Analysis of GSR: spot test, chemical test, identification of shooter and instrumental techniques involved of GSR Analysis, Practical problems related with GSR detections.
Unit-IV	**Principles and practice of identification of origin**: ammunition and their components, different types of marks produced during firing process on cartridge- 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, techniques for obtaining test material from various types of weapons and their linkage with fired ammunition, class and individual characteristics. **Test firing**, Procedure for test fire, Purpose for test firing, Recovery methodology, Specifications of Firing gallery, working of automatic firing rest, Safety & Preventive measures. Characterization of bullet proof jacket. **Instrumental techniques used for ballistic evidence analysis:** Boroscope, Comparison Microscope, Stereo microscope, traveling microscope, Neutron Activation analysis, Flameless AAS, Scanning Electron microscope, EDXRF. Introduction to automated system of trajectory computation **(Ballistic Data Acquisition system)**: Operating system & its concepts, Universal Receiver, ICM, Target Frame. Automated management of ballistics data **(**NIBIN and IBIS), History of establishment, Brass Trax, Bullet Trax & Match Point, Limitation & Advantages, Applications. **Introduction to Forensic Ballistics Report Writing etc.**

Suggested Readings:

1) Hatcher Jury & Weller (1987) Firearm Investigation Identification and Evidence, The University Book Agency, Allahabad.
2) Jauhri, M. (1980) Monograpnh on Forensic Ballistics, Govt. of India Publication, New Delhi.
3) Sharma, B.R. (1990) Firearms in Criminal Investigation and Trails.
4) Dimado (1987) Gunshot Wounds.
5) Kumar (1987) Forensic Ballistics in Criminal Justice.
6) Brian J. (2008) Handbook of Firearm and Ballistics Examination and Interpretation Forensic Evidence.
7) James Smyth Wallace (2008) Chemical Analysis of Firearms, Ammunition, and Gunshot Residue.

SEMESTER-III

(Specialization -3: Forensic Physical Sciences)

Forensic Lab Course–IX

(Based on Forensic Physics and Photography)

Practical	Paper Code: 17FSC23LP1	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students would be able to perform density gradient of forensic evidences.

CO-2: They would be able to compare paints, Soils, cloths, bangles and glass.

CO-3: They would be able to explain blood stain pattern

CO-4: They would be able to compare voice specimens

CO-5: They would be able to perform crime scene Photography

1. Determination of density, by density gradient tube techniques.
2. Comparison of paints, Soils and glass.
3. Miscellaneous (Cloth and Bangles)
4. Bloodstain pattern analysis
5. Voice examination
6. Methods of Photography

SEMESTER-III

(Specialization -3: Forensic Physical Sciences)

Forensic Lab Course–X
(Based on Forensic Ballistics)

Practical	Paper Code: 17FSC23LP2	Credits: 4	Max. Marks: 100	Time: 6 Hours

Course Outcomes

CO-1: Students would be able to identify and compare ballistics evidences.

CO-2: They would be able to identify country made firearms

CO-3: They would be able to explain the mechanism of common firearms.

CO-4: They would be able to compare GSR.

CO-5: They would be able to deterime range of fire.

1. Identification of firearms, cartridges and bullets
2. Study of caliber and rifling characteristics
3. To study the working mechanism of firearms
4. Determination of shot number from size and weight of shots.
5. Physical examination of propellant of ammunition
6. Study of choking in shotgun
7. Study of constructional features of improvised firearms
8. To study proof mark of firearm
9. Study of constructional features of cartridge
10. To study proof mark of cartridge
11. GSR testing; Bullet entry characteristics in tissue and clothing; Blood spatter interpretation at shooting scenes
12. Determination of range of fire
13. Matching bullets and cartridge cases by comparison microscope.
14. Theory and practice of shooting reconstruction; Review of firearms and ammunition as related to shooting reconstruction
15. Preparation of report of the examination.

SEMESTER-III

Instrumental Methods in Forensic Analysis

Discipline Specific Elective	Paper Code: 17FSC23DA1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able run chromatographic techniques like TLC and GC-MS
CO-2: They would be able run UV-vis and FTIR spectrophotometer
CO-3: They would be familiar to Physical methods of analysis like AAS, XRD etc.
CO-4: Students would be able to sampling protocols for analysis.
CO-5: They would be able to explain merits and demerits of all such methods.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Spectroscopic analysis:** Definition and Fundamentals of Spectroscopy, Light and Energy, Electromagnetic Radiations, Wavelength and Frequency, Spectroscopy Techniques, Absorption of radiations, Basics of Fluorescence, Phosphorescence and Chemiluminescence spectrometry, Spectrophotometers. **Ultraviolet and Visible-visible (UV-vis) Molecular Spectroscopy:** Introduction, Review of UV-Visible spectroscopy-Fundamental laws of spectrophotometry, Deviation from Beer's Law, Instrumentation and techniques, Analytical Protocols, Forensic applications. **Infrared Spectroscopy:** Introduction, Review of IR spectroscopy, Dispersive and Non-dispersive IR spectrophotometers, Fourier Transform Infrared Spectroscopy, Instrumentation and Techniques, Analytical Protocols, Interpretation of IR spectra and Forensic applications. **Nuclear Magnetic Resonance (NMR):** Basic Principle, Properties of Nuclei, Width of Absorption Lines, Chemical shifts, Spin-spin coupling, Instrumentation, Analytical Protocols and Forensic applications.
Unit-II	**Electrophoresis:** Theory and General Principles, Various factors affecting electrophoresis, Low and High Voltage electrophoresis, Horizontal and Vertical Electrophoresis. Electrophoresis for DNA, RNA and Proteins. **Electrophoresis techniques** – Immuno-electrophoresis, Sodium dodecyl sulphate (SDS) polyacrylamide gel electrophoresis, Iso-electric focusing (IEF), Capillary Electrophoresis (CE) -Theory and basic principles, Instrumentation, Forensic applications. DNA Profiling Techniques: PCR, RFLP etc. **Immunoassays**: Antigens and antibodies, Basic principles of immunoassay, Enzyme immunoassays, Radioimmunoassay and Fluorescence immunoassay, Application of Immunoassay in Forensic biological science.
Unit-III	**Chromatographic:** Introduction, Review of basic principles and Classification of chromatographic techniques, Normal and Reverse Phase chromatography. **HPTLC**: Principle, Theory and Instrumentation, visualization, Qualitative and Quantitative concepts and Forensic applications. **Gas Chromatography (GC):** Principles, Theory, Instrumentations, injection, Columns, Detectors, Sample preparation, interpretation of spectra, Forensic applications, Pyrolysis GC and Forensic applications. **High Performance Liquid Chromatography (HPLC):** Principle, Theory, Instrumentation, Column, Detectors, Sample preparation, interpretation of spectra, Forensic applications, Liquid Chromatography- Mass Spectrometry (LC-MS), Forensic applications. **Ion Chromatography:** Basic Principle, Instrumentation and Forensic applications. **Analytical**

	Protocols: Sample preparation and interpretation of spectra, Forensic applications of MS with special reference to hyphenated techniques.
Unit-IV	**Mass Spectrometry:** Basic Principle and Theory, Instrumentations. Techniques: Resolution, Resolving power and Mass Accuracy, Vacuum systems, Ionization types (CI-MS, EI-MS, ECNI, FI, APCI), Mass analyzers (Transmission Quadrupole, Quadrupole Ion trap, Time of Flight & Double Focusing), Scanning modes (SIM and SCAN), Tandem Mass Spectrometry and MALDI-TOF. **Stable Isotope Ratio Mass Spectrometry:** Introduction, Basics of mass spectrometry, Gas source (Stable isotope), Static gas (noble gas), Solid source (Radiogenic isotope) Mass spectrometry, Multiple Collector Inductively Coupled Plasma Mass Spectrometry (MC-ICP-MS) – Moving wire Isotope Ratio Mass Spectrometry), Accelerator Mass Spectrometry, Geological, food, biochemical, pharmaceutical and forensic applications **Ion Mobility Spectrometry:** History, Ion mobility, Instrumentation, Ionization, Analyzers Drift gas detector, Ion traps, Hyphenated ion mobility spectrometry (GC-IMS,IMS-MS, LC- IMS, LCIMS-MS) and their Applications. **Analytical Protocols:** Sample preparation and interpretation of spectra, Forensic applications. **Neutron Activation Analysis:** Principles, Theory, Instrumentation-Various Neutron Sources, Detection and Measurement of Gamma-Rays for Qualitative And Quantitative Analysis. **Atomic Absorption Spectrometry:** Introduction, Basic principles, Theory, Instrumentation and Techniques, FAAS and GFAAS, Interference in AAS-Background correction methods, Forensic applications. **Atomic Emission Spectroscopy:** Introduction, Basic principles, Theory, Instrumentation and Techniques and forensic applications. **Electrochemical and Electrothermal Techniques:** Coulometry, Polarography and Thermogravimetry: Introduction, Principles, Theory, Instrumentation, techniques and Forensic applications, along with Differential Scanning Calorimetry, Potentiometry, Ion-selective electrodes. **Pyrolysis gas Chromatography:** Basic Principle, theory, instrumentation and Forensic applications. **Introduction and experimentation related to of X-rays, X-ray Diffraction (XRD):** Basic Principle, Theory, Instrumentation and Forensic applications. X-Ray Fluorescence (XRF) Basic Principle, Theory, Instrumentation and Forensic applications.

Suggested readings

1) James R et al. (2005) Undergraduate Instrumental Analysis
2) Borrow (1980) Molecular Spectroscopy.
3) Wildard, H. H., et al (1974) Instrumental Methods of Analysis.
4) Moonesens A.A. et al (1973) Scientific Evidence in Criminal Cases.
5) Lee & Gaensslen : Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
6) Settle, F.A. (1997) Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.
7) Sue Jickells and Adam Negrusz (2008) Clarke's Analytical Forensic Toxicology.

SEMESTER-III

Elements of Forensic Biology and Serology

Discipline Specific Elective	Paper Code: 17FSC23DA2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Gain an in-depth understanding of biological evidences along with their forensic significance.

CO-2: Comprehend the role of forensic botany, entomology and microbiology in investigation of death when usual methods of determining time, place and manner of death are not possible.

CO-3: Understand the significance of wildlife and the crucial role they can play in providing justice to wildlife.

CO-4: Appreciate the use of Forensic anthropology for determining age and sex of human skeletons found in mass graves as a result of natural and man-made calamities.

CO-5: Students would be able to explain applications of Forensic Entomology and Microbial Forensics.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Forensic Biology:** Introduction, sub-disciplines, Important Cases involving Forensic Biology. **Forensic Serology**: Introduction, basic concepts- antigens, antibodies (Polyclonal and monoclonal), Affinity, avidity, Antigen-antibody binding reactions- primary and secondary. Introduction to Tools and techniques involving analysis of Biology and serology
Unit-II	**Blood:** Composition and functions, Human Blood groups: General Principles, theory of their inheritance, Blood group determination from fresh blood, titer, rauleaux formation and Bombay blood group. Forensic Characterization of Bloodstains, Stain Patterns of Blood. **Semen:** Composition, functions and morphology of spermatozoa, Forensic significance, location, collection, evaluation. **Body fluids:** Forensic significance of other body fluids as Saliva, Sweat and fecal matters, their collection and identification. **Hair:** Introduction, types, location, collection evaluation and forensic significance of Hair.
Unit-III	**Botanical evidences:** Introduction, types, location, collection evaluation and forensic significance of Diatoms, Wood, Pollen grains. **Wild Life Forensics:** Introduction, importance, protected and endangered species of Animals and Plants. Identification of wild life materials such as skin, bones, nails, horn, teeth, flowers and plants, by conventional and modern methods, Identification of Pug marks of various animals. **Forensic Physical Anthropology & Odontology**: Definition and significance in forensic science. Importance of bones and teeth in forensic investigation.
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. **Microbial Forensics** : Types and identification of Bacteria and Viruses in Forensic Science, Microbial profiles as identification tools, use of microorganisms in bioterrorism, Anthrax, transmission of HIV as a criminal act, role of microbes in food poisoning

Suggested readings:

1) Robertson, J. (1996): Forensic Examination of Hair. Taylor and Francis, USA.
2) Boorman, K. E: Blood Group Serology, Churchill, and Lincolin, P. J. (1988)

3) Race, R. R. and Sangar, R. (1975): Blood Groups in Man. Blackwell Scientific, Oxford.
4) Saferstein, R. (1982): Science Handbook, Vol. I, II and III, Prentice Hall, New Jersey.
5) Gilblet, E. (1969): Marker 's in Human Blood, Davis, Pennsylvania.
6) Culliford, B. E. (1971), The examination and Typing of Blood Stains, US Deptt. of Justice, Washington.
7) Chowdhuri, S. (1971): Forensic Biology, B P R & D, Govt. of India.
8) Dunsford, I. and Bowley, C. (1967): Blood Grouping Techniques, Oliver & Boyd, London.
9) Eckert, W. G. & James, S.H. (1989): Interpretation of Blood Stain, Evidence, Elsevaier, New York
10) Advanced Forensic Biology and Serology

SEMESTER-III

Elements of Forensic Chemistry and Toxicology

Discipline Specific Elective	Paper Code: 17FSC23DA3	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would get practical exposure of Drugs of abuse, petroleum products, liquors and explosives.

CO-1: Students would be able to apply various forensic methods of extraction of poison from human body.

CO-3: Students would be able to use Color tests, Thin-Layer Chromatography, and spectrophotometry in forensic chemical analysis.

CO-4: Students would be able to know about the Drugs of Abuse, Club drugs and to differentiate Toxicants, Toxins and Poisons.

CO-5: They would be able to understand types and Trends of Poisoning in animals and Human in India.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**General Forensic Chemistry:** Definition, Important cases associated with Forensic chemistry, Types of cases which require chemical analysis, Presumptive and confirmatory testing of chemical evidences. **Scientific Instrumentation and Equipments involving analysis of chemical evidences**: Early Analytical Techniques: Wet Chemistry, Chemistry of Color, Thin-Layer Chromatography Development of Instrumental Techniques Microscopy, Hyphenated Instruments: Separation and Detection, Spectrophotometry.
Unit-II	**Drugs of Abuse:** Introduction and classification of Drugs of Abuse (Narcotics, Stimulants, Depressant and hallucinogens), Status of Drug abused in India, Introduction to Club drugs and Drug abuse in Sports, Drugs as Evidence. Introduction and brief analysis of Phenolphthalein in Trap case, Petroleum adulteration. Illicit liquors and Arson and Explosives.
Unit-III	**Forensic Toxicology**: Definition, Areas of Forensic Toxicology, Elements of Forensic Toxicology Nature of cases, Role of the Forensic Toxicologists, Laws related to Forensic Toxicology. **Poisons:** Definition of Poison, Toxin and Toxicant, Ideal Poison, Classification of poisons based on their origin and Chemical nature, mode of action.
Unit-IV	**Types and Trends of Poisoning:** Animals and Human poisoning in India with special reference to Suicidal, Homicidal and accidental poisons, Major vesicants used as chemical-warfare agents. Factors affecting the poisoning, methods of administration. Extraction methods of some important poisons and their forensic identification.

Suggested readings:

1) Modi's (1988) Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabd,.
2) Saferstein, R (1982) Forensic Science Hand Book, Vol I, II and III, Pretince Hall, NI.
3) Saferstein, R (2000) Criminalistics.
4) Curry (1986) Analytical Methods in Human Toxicology, Part II.
5) Curry, A.S. (1976) Poison Detection in Human Organs.
6) Mathew E. Johll (2009) Investigating Chemistry: A Forensic Science Perspective
7) Suzanne Bell (2009) Drugs, Poisons, and Chemistry
8) DFS Manuals of Forensic Chemistry and Narcotics.

SEMESTER-IV

(Specialization -1: Forensic Chemical Sciences)

Forensic Drug Analysis

Core Paper	Paper Code: 17FSC24CA1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to identify any type of drug of abuse by using different methods.
CO-2: Students would know about the working of clandestine laboratories and chemistry of designer drugs.
CO-3: Students would be able to form opinion in cases by using rules and regulations given in NDPS act.
CO-4: Students would understand Drug abused in Sports and their analysis.
CO-5: Students would be able to run instruments like UV-vis,. TLC, IR/FTIR, NMR, GC-MS & HPLC/LC-MS.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Drug:** Definition of Drug, Drug Use & Misuse, Drug Chemistry, Drug Dependence and chemistry of Addiction, Drug Receptors and Brain Chemistry. **Drugs of Abuse:** Definition, Classification based on Form and Origin, Use, Effects and Schedules, Structure of NDPS Act and the definitions of each drug classification, Drugs as Evidence, Profiling Examples of Illegal Drugs, United Nations International Drug Control Programme.
Unit-II	**Chemistry and Analysis of Drugs of Abuse**: Origin, Pharmacology, Methods of preparation, Storage, Diluents and Adulterants, Sample Handling, Optimization of Experimental Conditions, Presumptive/Screening and Confirmatory Methods: Color/spot test, Microscopic examination, Microcrystalline tests, Thin-Layer Chromatography, Sample Preparation before TLC Specimen, Extraction Evaluation of TLC for Drug Screening, Immunoassay Methods, UV Spectrophotometry, IR/FTIR Spectrophotometry, NMR, GC-MS & HPLC/LC-MS, Legal Implications and Data Interpretation of Opium and Opioids analgesics, Stimulants (Cocaine, Amphetamine & other amphetamine derivatives), Depressants (Barbiturates and Benzodiazepines), Hallucinogens (Cannabis, LSD, Psilocybine and Mescaline), OTC, Inhalant and Volatile Substances, Drugs in sexual assault
Unit-III	**Clandestine laboratory:** Meaning and Definition of Clandestine, Clandestine Laboratory, Related Problems, Factors Contributing to Clandestine Drug Labs, Harms Caused by Clandestine Drug Labs, **Equipment Needs:** Reflux, Distillation, Hydrogenation, Bucket Chemistry, Extractions, Chemical Needs, Cooking Methods Commonly Used in Clandestine Drug Labs, Extraction Process, Conversion Process, Synthesis Process, Tableting. **Designer drugs**: Definition, Analogs of Fentanyl and Meperidine (both synthetic opioids), Phencyclidine (PCP), Amphetamines and methamphetamines (which have hallucinogenic and stimulant properties). **Laboratory Analysis**: The Chemist, Extractions: Physical Extraction, Dry Wash/Extraction, Liquid/Liquid Extractions, Analysis: Chemical Color Tests, Microscopic Techniques, Infrared Spectroscopy, Thin-Layer Chromatography, Ultraviolet Spectroscopy, Gas Chromatography. Format of NDPS Report Writing & Court Room Testimony.
Unit-IV	**Drug Abuse in Sports**: Introduction, International Olympic Committee (IOC), World Anti-Doping Agency (WADA), classification of commonly prohibited substances and Performance enhancing Drugs, Steroids, Stack and Pyramid methods, Dope test and Blood Doping, Sampling techniques, analytical approaches.

Suggested Readings:

1. Clarke's Analysis of Drugs and Poisons, (Formerly Isolation & Identification of Drugs) 3rd Ed. 2 Vol. Set.
2. Clark, E.G.C. : Isolation and identification of Drugs, VI and Vol. II, 1966, 1975-1986.
3. Modi, Text Book of Medical Jurisprudence Forensic Medicines and Toxicology (1999) CBS Pub. New Delhi
4. Saferstien (1982) Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
5. DFS -Working Procedure Manual- Narcotics
6. E. Stahl (1969) Thin Layer Chromatography: A Laboratory Handbook.
7. Saferstein (1976) Criminalistics.

SEMESTER-IV

(Specialization -1: Forensic Chemical Sciences)

Analytical Forensic Toxicology

Core Paper	Paper Code: 17FSC24CA2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to explain the the methodologies used for the analysis of post-mortem samples for the identification of suspected presence of poisons.

CO-2: Students get familiarity with the role of Alternative specimens like Hair analysis, Drugs in oral fluid, Detection of drugs in sweat etc. in toxicological analysis.

CO-3: Students would be able to appreciate the functioning of Kozeka-Hine and GC for the detection of alcohol in blood.

CO-4: Students would also be able to explain legalities of drunk driving.

CO-5: Students would be able to appreciate the functioning of animal poisons, gaseous poisons, Food poisons and their role in medico-legal cases.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Samples required in Toxicological analysis:** Selection of Post-mortem samples and reference to particular class of poison, Classes of samples (Biological and Non-biological), Methods of sample collection (Living and Dead person), Classification of matrices, choice of preservatives, containers and storage conditions. **Alternative specimens:** Hair analysis, Drugs in oral fluid, Detection of drugs in sweat etc. Analysis of Exhumed and decomposed bodies.
Unit-II	**Alcohol Intoxication & analysis**: Related cases, Properties and types of Alcohols, Pharmacology, Toxic properties and effects of alcohol. Chemical tests for alcohol in blood and urine including Breath Alcohol Screening devices, Method of analysis of some alcoholic beverages in biological materials by chemical methods (Kozelka- Hine) and instrumental methods (GC), Legal context to drinking and driving. Format of Report Writing & Court Room Testimony: Information required by the Forensic toxicologist, Presenting findings in a Report format.
Unit-III	**Animal Poisons:** Insects and animal toxins and their examination, Composition of Snake venoms, Sites and mode of action, Effect on the body as a whole, and tests for identifications. **Plant poisons**: Classification and characteristics, method of extraction and stripping of plant poisons in matrices and analysis by chemical and instrumental techniques.
Unit-IV	**Gaseous Poisoning:** Carbon Monoxide, Hydrogen Cyanide and Phosphine gase, significance, signs and symptoms, methods of diagnosis, tests for identification. **Food Poisoning:** What is food poisoning, Food poisoning due to chemical and bacterial, Sign and symptoms of food poisoning, collection and preservation of evidence material, extraction and isolation, from food material, Biological material, detection and identification by colour test and Instrumental techniques.

Suggested books:

1. DFS Manual of Forensic Toxicology
2. A C Moffat Clarke's Analysis of Drugs and Poisons, (Formerly Isolation & Identification of Drugs) 3rd Ed. 2 Vol. Set.
3. Casarett & Doll Toxicology (2003) The Basic Science of poisons.
4. Clark, E.G.C. : Isolation and identification of Drugs, VI and Vol. II, 1966, 1975-1986.
5. Curry A.S (1986) Analytical Methods in Human Toxicology, Part II, CRC Press Ohio
6. Curry, A.S. (1976) Poison Detection in Human Organs.
7. Michael J. Deverlanko et al (1995) Hand Book of Toxicology CRC Press.
8. Morgan B.J.T (1996) Statistics in Toxicology, Clarendon Press, Oxford.
9. Modi, Text Book of Medical Jurisprudence Forensic Medicines and Toxicology (1999) CBS Pub. New Delhi
10. Saferstien (1982) Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.

SEMESTER-IV

(Specialization -1: Forensic Chemical Sciences)

Project work/Field work/ Dissertation/Group Seminar

Core Paper	Paper Code: 17FSC24CA3	Credits: 20	Max. Marks: 300

Course Outcomes

CO-1: Students would be able to obtain practical knowledge in the field of Chemical (Chemistry & Toxicology) by conducting experimentation and field work in departmental laboratories or other recognized institutes where hand on practice and lab facilities would be available.

CO-2: It would strengthen their practical skills and bring additions to their academics by publishing the findings of their work.

CO-3: It will add to their confidence for conducting Ph. D. research work in Forensic Chemical sciences.

Instructions

It is a special paper where a candidate carries out the application of knowledge in solving /studying /exploring a real life /difficult problem in a creative way. The project work/Field work/ dissertation/Group Seminars shall be discipline centric, and the candidate has to study it on his own with an advisory support by the concerned teacher.

SEMESTER-IV

(Specialization -2: Forensic Biological Sciences)

Advanced Forensic Biology

Core Paper	Paper Code: 17FSC24CB1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: The forensic significance of botanical evidence to pinpoint a place of crime, clandestine graves and probable time of crime.

CO-2: The difference between ante and post-mortem drowning along with the bearing the diatoms have in the investigation of probable place and time of drowning.

CO-3: The methods used to arrive at post-mortem interval, manner of death and sometimes the cause of death by using entomological evidence.

CO-4: Understand the significance of wildlife and the crucial role they can play in providing justice to wildlife.

CO-5: They would be able to differentiation between a natural outbreak of certain diseases and the deliberate attack in the form of bioterrorism.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Botanical evidences:** Introduction, types, location, collection evaluation and forensic significance. **Wood**: Type of wood and their identification and comparison. **Pollens**: Structure, function, methods of identification and comparison.
Unit-II	**Forensic Diatomology:** Nature, location, Structure and life cycle of diatoms, methods of identification and comparison, Diatom Monitoring and D-Mapping of water bodies, Extraction from water samples, Slide preparation and identifying features. Diatom Test: Ante-mortem and Post-mortem drowning, Diatom as a forensic evidence, Forensic significance of Diatom Test, Fate of Diatom inside the body, Extraction methods of diatoms from body, Criterion of Concordance, Validity of Diatom test and its Limitations.
Unit-III	**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, Insect Applications to Medico-legal Entomology, Human Decomposition and Insect Succession, Factors that Influence Decomposition and Succession, Case Studies Involving Insect Succession.
Unit-IV	**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. **Forensic Microbiology:** Definition, Types and identification of Bacteria and Viruses in Forensic Science, Microbial profiles as identification tools, use of microorganisms in bioterrorism, Anthrax, transmission of HIV as a criminal act, role of microbes in food poisoning**.**

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uggested Readings

1) Jason H. Byrd and James L. Castner (2001) Forensic entomology, CRC Press LLC.
2) Forensic Science Hand book by Richard saferstein Vol (II); Prentice Hall, Publications.
3) Robertson (1999) : Forensic examination of Hair. Francis & Taylor, USA.
4) Safersstein, R. (1982) Science Handbook; Vol. III, Prentice Hall, New Jersey.
5) Curry, A. S. (1965) Methods of Forensic Science, Vol. IV, Interscience, New Youk.
6) Chowdhuri, S. (1971) : Forensic Biology, B P R & D Govt. of India.
7) Forensic Diatomology by M.S. Pollanen Encyclopedia of Forensic Science, Wiley (2010)

SEMESTER-IV

(Specialization -2: Forensic Biological Sciences)

Forensic Physical Anthropology and Medicine

Core Paper	Paper Code: 17FSC24CB2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to identify human bones and their forensic significance in determining Age, Sex, Race and Stature of deceased.

CO-2: Students would make use of Portrait Parle/Bertillon system, Somatoscopy and Somatometry, Forensic Facial Reconstruction in elucidating the personal identification of humans.

CO-3: Students would appreciate the practicability of Forensic Odontology

CO-4: They would be able to compare Bites marks in solving crime cases.

CO-5: Students would form opinion on Time Since Death, Injuries, Sexual Offences, Asphyxial deaths, Infanticide, Forensic Pathology.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Forensic Physical Anthropology:** Definition and Scope within the medical-legal context of personal identification of human remains as in cases of homicides or mass disasters, Brief introduction to Forensic Archeology and Anthropometry. **Human skeletal system:** Nature and formation of bones, introduction to Human skeleton, Classification of human bones. Determination of Age and sex from human bones. Determination of Race and estimation of stature from skeletal remains. **Personal Identification:** Portrait Parle/Bertillon system, Somatoscopy and Somatometry.
Unit-II	**Forensic Facial Reconstruction:** Two Dimensional and 3 Dimensional Methods, Importance of tissue depth to reconstruct various facial features. **Forensic Odontology:** Development and scope, role in mass disaster and anthropology, 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-III	**Forensic Medicine**: Definition of Forensic Medicine and Medical Jurisprudence, Dying declaration, Death: Definition, types; somatic, cellular and brain-death, Sudden natural and unnatural deaths. **Identification**: Definition, Identification of unknown person, dead bodies and remains of a person by age, sex, stature, dental examination, scars, moles, tattoos, dactylography, DNA typing and personal belonging including photographs. **Medicolegal Death Investigation:** Aspects of death scene analysis by a medical examiner, including autopsy procedures, unidentified remains, child death investigations and mass disaster investigations. **Determination of Time Since Death:** Immediate changes, Livor, Rigor and Algor mortis, cadaveric spasm, cold stiffening and heat stiffening. Putrefaction, mummification, adipocere and maceration Postmortem artifacts.
Unit-IV	**Injuries**: Wounds, Bruises Abrasions, Lacerations, Incised wounds, Stab wounds, Bone damage, Burns and scalds, ante-mortem and post-mortem injuries, aging of injuries, artificial injuries.

	Sexual Offences: Medico-legal investigation of Sexual offences, including examination of victim and suspect. **Asphyxial deaths**: Definition, causes, types, post-mortem appearances and medico-legal significance of hanging, strangulation, suffocation and drowning. **Infanticide**: Definition and related issues. **Forensic Pathology:** Terminology and scientific techniques used in medico-legal investigations, sudden or unexpected deaths, homicides, suicides, accidental deaths, and trauma.

Suggested readings:

1) Forensic Dentisty (1999) Paul G. Stimson, Curtis A. Mertz; CRC Press, LLC.
2) Craniofacial Identification in forensic Medicine, edited by John. G Clement and David. L. Ranso; Oxiford University, Press; 1998.
3) Beals, R.L. and Hozier, H. (1985): An Introduction to Anthropology, Macmillan, New Delhi.
4) Krogman, W.M. And Iscan, M. (1987): Human Skeleton in Forensic Medicine, Charles & Thomas, U.S.A.
5) Gray's Anatomy (1987): Churchill Livingston, Edinburgh.
6) Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
7) Taylor (2000) : Forensic Art and Illustrations CRC Press.
8) Singh, I.P. and Bhasin M. K. (1968): Anthropometery, Kamla-Raj Publications, Delhi.
9) Beals, R.L. and Hoizer, H. (1985): An introduction to Anthropology, Macmillan, New Delhi.
10) Alan Gunn (2009) Essential Forensic Biology, 2nd Edition
11) Text book of Forensic Medicine by Krishan Vij; B.I. Churchill Livingstone Pvt. Ltd. 2001.
12) Craniofacial Identification in forensic Medicine, edited by John. G Clement and David. L. Ranso; Oxiford University, Press; 1998.
13) Forensic Taphonomy, edited by Wouldiam D. Haglernd, Marculla H. Sorg; CRC Press, LLC, 1997.
14) Glaister (Ed)-Rentoul & Smith (1973) : Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.
15) Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
16) Glaister Anatomy (Ed)—Rentoul & Smith (1973): Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.

SEMESTER-IV

(Specialization -2: Forensic Biological Sciences)

Project work/Field work/ Dissertation/Group Seminar

Core Paper	Paper Code: 17FSC24CB3	Credits: 20	Max. Marks: 300

Course Outcomes

CO-1: Students would be able to obtain practical knowledge in the field of biological and DNA forensics by conducting experimentation and field work in departmental laboratories or other recognized institutes where hand on practice and lab facilities would be available.

CO-2: It would strengthen their practical skills and bring additions to their academics by publishing the findings of their work.

CO-3: It will add to their confidence for conducting Ph. D. research work in Forensic biology, serology & DNA.

Instructions

It is a special paper where a candidate carries out the application of knowledge in solving /studying /exploring a real life /difficult problem in a creative way. The project work/Field work/ dissertation/Group Seminars shall be discipline centric, and the candidate has to study it on his own with an advisory support by the concerned teacher.

SEMESTER-IV

(Specialization -3: Forensic Physical Sciences)

Advanced Fingerprints and Questioned Document Examination

Core Paper	Paper Code: 17FSC24CP1	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Students would be able to development of latent fingerprints by using various techniques viz. Absorption, Luminescence, Diffused Reflection, Ultraviolet Imaging, Multimetal Deposition (MMD) etc.

CO-2: They would be able to detect fingerprints on various types of surfaces.

CO-3: They would be able to explain working and applications of AFIS.

CO-4: They would be able top compare handwriting and signatures, disguise and forgeries.

CO-5: They would be able to explain Forensic stylistics and determine source of paper and ink samples.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Fingerprint Detection Techniques**: **Optical Detection Techniques-** Absorption, Luminescence, Diffused Reflection, Ultraviolet Imaging. **Detection Techniques for Porous Surfaces:** Ninhydrin, Ninhydrin Analogs, Diazafluorenone (DFO), Physical Developer, Multimetal Deposition (MMD), Recommended Detection Sequence. **Detection Techniques for Nonporous Surfaces:** Fingerprint Powders, Small-Particle Reagent, Cyanoacrylate Fuming, Vacuum Metal Deposition (VMD). **Miscellaneous Techniques for Latent Fingermark Detection**: Iodine/Benzoflavone, imethylaminocinnamaldehyde (DMAC), Osmium Tetroxide (OsO) and Ruthenium Tetroxide (RTX), Silver Nitrate. **Fingermark Detection on Semiporous Surfaces**: Fingermark Detection on Human Skin, Powdering, Transfer Techniques, Physico-Chemical Methods. **Fingermark Detection on Adhesive Surfaces:** Gentian Violet, Sticky-Side Powder, Cyanoacrylate Fuming. Fingermark Detection on Firearms and Cartridge Cases, Enhancement of Fingermarks in Blood, Optical Techniques, Protein Stains, Diaminobenzidine (DAB), Miscellaneous Techniques. **AFIS**: Introduction, Importance, Structure and Techniques, Search possibilities, Livescan, worldwide Status and Networking.
Unit-II	**Handwriting: The Purposes and complexities in Examination:** Comparison of Handwriting, Consideration of Similarities, The Possibility of Chance Match, The Possibility of Simulation, Subjectivity, Identification, Qualified Conclusions, Limited Populations, Consideration of Differences, Consistent Differences, Other Reasons for Differences, Similarities with Differences, Disguise, Simulation, Identification of the Writer of Simulations, Inconclusive Examinations, Complexities of Handwriting Comparisons, Inconsistent Known Writings, Multiple Suspects, Reproduced Writing, Unfamiliar Scripts, Statements, Expressing Conclusions, Qualified Conclusions, Scales of Conclusions, Clarity of Expression, Quality Assurance, Variety of Forms in Handwriting.
Unit-III	**Handwriting:** Accidental Variation of Handwriting, Writing Instruments, Writing Position, Health of Writer, Guided Hand Signatures, Drugs and Alcohol, Impairment of Vision, Deliberate Variation of Handwriting, Disguised Writings, Difficulties of Disguising Writing, Disguised Signatures, Simulated Writings, Freehand Simulation, Slowly Made Simulations, Simulations of Poorly Made Signatures, Rapidly Made Simulations, Traced Signatures, Introduction of Features

	of the Copier. **Digital signature/writings and examination.** **Forensic stylistics**- Forensic linguistics, e-documents, digital signatures Opinion- Reporting to the court juxtaposed charts - evidence in the court- cross examination, Related Case Studies.
Unit-IV	**Examination of Paper:** Types of Paper, Manufacture of Paper, Paper gsm, Testing of Paper, Nondestructive Tests, Destructive Tests, Comparison of Paper, Mechanical Fits, Watermarks, Dating of Paper, Envelopes, Writing Materials, Pencils, Inks, Liquid Inks, Ball-Point Inks, Fiber-Tipped, Roller Ball, and Gel Pens. **Examination of Inks**: Visual Examination, Examination of Color, Absorption Spectra and the Examination of Inks, Ultraviolet and Infrared Radiation, Detection of Infrared Radiation, Infrared Absorption, Ultraviolet Fluorescence, Infrared Luminescence, Comparison of Inks Using Infrared Luminescence, Erasures, Obliterations, Other Luminescence Effects, Destructive Techniques, Chromatography, Thin-Layer Chromatography, High-Performance Liquid Chromatography, Chemical Tests, Other Components of Ink, Further Techniques, Relative Aging of Ball-Point Inks, Dating of Inks.

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 techniques. 2nd ed., Taylor & Francis Ltd.
3. Morris (2000) Forensic Handwriting Identification (fundamental concepts and Principals)
4. Harrison, W.R. : Suspect Documents & their Scientific Examination, 1966, Sweet & Maxwell Ltd., London.
5. Hilton, O (1982) The Scientific Examination of Questioned Document, Elsaevier North Holland Inc., New York.
6. Mehta, M. K. : The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi, Allahabad. 1970.
7. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
8. Osborn, A. S. (1929) Questioned Documents, Boyd Printing Co., Chicago.
9. Kelly,J.S and Lindblom, B.S (2006) Scientific Examination of Questioned Documents, Taylor & Francis, New York.
10. Brunelle, R.L. and Reed, R.W (1984) Forensic
11. Examination of Ink and Paper, Charles C Thomas Publisher, U.S.A.

SEMESTER-IV

(Specialization -3: Forensic Physical Sciences)

Advanced Computer and Cyber Forensics

Core Paper	Paper Code: 17FSC24CP2	Credits: 4	Max. Marks: 80	Time: 3 Hours

Course Outcomes

CO-1: Run forensic tools like En-cae, SIMMI and FTK for retrieval of digital data from laptops, PCs and other storage devices etc.

CO-2: They would also be able to answer the legal questions on computer/cyber crime.

CO-3: They would explain Forensic Accounting, cyberspace, cryptography, encryption and their breakdown.

CO-4: They would be familiar with offences and penalties under Information Technology Act, 2000.

CO-5: They would be able to compile reports & testify in the Court.

Instructions

There will be a total of nine questions. Question No. 1 will be compulsory and shall contain eight to ten short answer type questions without any internal choice and it shall cover the entire syllabus. The remaining eight questions will include two questions from each unit. The students will be required to attempt one question from each of the four units. The students will attempt five questions in all.

Unit-I	**Digital Evidence:** increasing awareness of digital evidence, challenging aspects of digital evidence, challenging aspects of cyber trail, forensic science and digital evidence, computer image verification and authentication, digital image watermarking and its application in forensic science, Various techniques for digital watermarking, Logical structures of the Microsoft operating system FAT file system, DOS and Windows boot process, How to recover deleted files, The significance and determination of the creation date and time. **Digital signature and cryptography**: signature in paper based society, Transfer of computer based documents, digital signature and authentication, digital signature generation and verification, certification of public keys, certification of authority. **Passwords and encryption techniques**: Importance of keeping a log, Explanation of passwords keys and hashes.**Security using Cryptography**: introduction, types of Cryptography, different types of ciphers like caeser cipher, mono alphabetic cipher, poly alphabetic cipher etc. Diffie- Hellman key exchange, and key management protocols. Steganography: Introduction, History, Steganography types: Image steganography, video steganography, audio steganography, text steganography. Various methods for hiding the message into images. Use of steganography in Biometrics, parameters affecting steganography, steganalysis.
Unit-II	**Seizure of computers**: Preparations to be made before seizure, Actions at the scene, Treatment of exhibits, bitstream (exact copies) of the original media, Establishing a case in computer forensics, Computer forensic analysis within the forensic tradition, **Investigation**: Investigating on various imaging methods. Lay down the image provided onto a hard disk and provide a disk map of the suspect drive. Extraction of all relevant information from a hard disk. Instruction on the acquisition, collection and seizure of magnetic media. How to best acquire, collect or seize the various operating systems. Legal and privacy issues, Forensic examination procedures, Preparing and verifying forensically sterile storage media. **Various Image Enhancement Techniques**: Image Enhancement in the Spatial Domain (Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Smoothing and sharpening filters) Image Enhancement in the Frequency Domain (Frequency domain filters: Smoothing and Sharpening filters Homomorphic filtering).

Unit-III	**Computer Forensics in Forensic Accounting:** Auditing and fraud detection, Detecting fraud—the auditor and technology, Defining fraudulent activity, What is fraud, Internal fraud versus external fraud, Understanding fraudulent behavior, Technology and fraud detection, Data mining and fraud detection, Digit analysis and fraud detection, Fraud detection tools, Fraud detection techniques, Fraud detection through statistical analysis, Fraud detection through pattern and relationship analysis, Dealing with vagueness in fraud detection, signatures in fraud detection, Visual analysis techniques, Time-line analysis and Clustering. **Current Practice**: Introduction, Electronic evidence, Secure boot, write blockers and forensic platforms, Disk file organization, Disk and file imaging and analysis, File deletion, media sanitization, Mobile telephones, PDAs, Discovery of electronic evidence, Forensic tools, EnCase. ILook Investigator, CFIT, Emerging procedures and standards, Seizure and analysis of electronic evidence, National and international standards, Computer crime legislation and computer forensics, Council of Europe convention on cybercrime and other international activities, Carnivore and RIPA Antiterrorism legislation, Networks and intrusion forensics. Documenting And Reporting, Evaluation And Interpretation Of Results, Reporting Conclusions, Case Records, Quality Control Checks, Technical Review, Proficiency Testing/Inter-laboratory Comparison.
Unit-IV	**Cyberspace**: Concept of Cyberspace, Emergence of Cyberspace, Nature & Meaning of Cyberspace, Attributes of Cyberspace, Classification of Cyberspace, Legal Framework for Cyberspace. **Research Directions and Future Developments**: Introduction, Forensic data mining, finding useful patterns in evidence, Text categorization, Authorship attribution: identifying e-mail authors,Association rule mining, application to investigative profiling, Evidence extraction, link analysis, and link discovery, Evidence extraction and link analysis, Link discovery Stegoforensic analysis Image mining, Cryptography and cryptanalysis, The future society and technology. **Cyber crimes and related offences and penalties:** Introduction to Cybercrimes, Classification of cybercrimes, Distinction between cyber crime and conventional crimes, Reasons for commission of cyber crime, Kinds of cyber crimes – cyber stalking; cyber pornography; forgery and fraud; crime related to IPRs; Cyber terrorism; Spamming, Phishing, Privacy and National Security in Cyberspace, Cyber Defamation and hate speech, computer vandalism etc. Relevant provisions under Information Technology Act, 2000, Indian Penal Code, 1860. Jurisdictional challenges in cyberspace, Investigation challenges in cyberspace, Emerging trends in Information Technology Act, 2000, Need to regulate internet, country specific cyber laws, Legal recognition of electronic records and digital signature, measures to adapt electronic governance, inadequacy in IT act. **Report Writing & Court Room Testimony**.

Suggested Readings:-

1) Nathan Clarke (2010) Computer Forensics
2) Eoghan Casey BS MA (2001) Handbook of Computer Crime Investigation: Forensic Tools and Technology
3) Marjie T. Britz (2003) Computer Forensics and Cyber Crime: An Introduction
4) Linda Volonino and Reynaldo Anzaldua (2008) Computer Forensics For Dummies
5) Eoghan Casey (2009)Handbook of Digital Forensics and Investigation
6) Warren G. Kruse II and Jay G. Heiser (2001) Computer Forensics: Incident Response Essentials
7) Robert C. Newman (2007) Computer Forensics: Evidence, Collection and Management
8) Michael A. Caloyannides (2001) Computer Forensics and Privacy (Artech House computer security series)
9) Eoghan Casey BS MA (2001) Handbook of Computer Crime Investigation: Forensic Tools and Technology
10) The Indian IT Act 2000.

11) Steve Bunting (2007) The Official EnCE - EnCase Certified Examiner Study Guide.
12) Robert C. Newman (2007) Computer Forensics: Evidence, Collection and Management
13) Eoghan Casey BS MA (2001) Handbook of Computer Crime Investigation: Forensic Tools and Technology
14) Eoghan Casey (2009) Handbook of Digital Forensics and Investigation
15) Tewari, R.K., Sastry, P.K. and Ravikumar, K.V. (2003) Computer Crime & Computer Forensics select Publisher, New Delhi.
16) Mahajan T.S. and Singh, Didar (2003) : Computer Networking and HTML; Gurunanak Publication, Patiala.

SEMESTER-IV

(Specialization -3: Forensic Physical Sciences)

Project work/Field work/ Dissertation/Group Seminar

Core Paper	Paper Code: 17FSC24CP3	Credits: 20	Max. Marks: 300

Course Outcomes

CO-1: Students would be able to obtain practical knowledge in forensic physical specialization by conducting experimentation and field work in departmental laboratories or other recognized institutes where hand on practice and lab facilities would be available.

CO-2: It would strengthen their practical skills and bring additions to their academics by publishing the findings of their work.

CO-3: It will add to their confidence for conducting Ph. D. research work in Forensic Physical science.

Instructions

It is a special paper where a candidate carries out the application of knowledge in solving /studying /exploring a real life /difficult problem in a creative way. The project work/Field work/ dissertation/Group Seminars shall be discipline centric, and the candidate has to study it on his own with an advisory support by the concerned teacher.