National Forensic Sciences University

An Institution of National Importance
(Ministry of Home Affairs, Government of India)
Gujarat Campus
Sector – 9, Gandhinagar, Gujarat – 382007

School of Forensic Science

M. Sc. Forensic Science with specializations

(Syllabus, Teaching & Evaluation Schemes)

(W.E.F. Academic Year 2023 -24)

Teaching Scheme

Semester - I							
Sr. No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**	**TCH**
1	FSMS SI-1	Introduction to Forensics, Psychology, Law and Statistics	4	1	0	5	5
2	FSMS SI-2	Instrumental Techniques	4	0	0	4	4
3	FSMS SI-3	Crime Scene Management and Forensic Evidences	4	0	0	4	4
4	FSMS SI-4	Fingerprints and Questioned Documents	4	0	0	4	4
5	FSMS SI-5	Forensic Biology and Anthropology	4	0	0	4	4
6	FSMS SI-LC1	Laboratory Course– I	0	0	2	2	4
7	FSMS SI-LC2	Laboratory Course– II	0	0	2	2	4
Total Credits & Credit Hours						**25**	**29**

Semester – II							
Sr. No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**	**TCH**
1	FSMS SII-1	Quality Management, Narcotic Drugs, Explosives and Forensic Chemistry	4	0	0	4	4
2	FSMS SII-2	Forensic Serology and DNA Profiling	4	0	0	4	4
3	FSMS SII-3	Forensic Medicine and Toxicology	4	0	0	4	4
4	FSMS SII-4	Forensic Ballistics	4	0	0	4	4
5	FSMS SII-5	Basic Concepts of Digital Forensics	4	0	0	4	4
6	FSMS SII-LC1	Laboratory Course – I	0	0	2	2	4
7	FSMS SII-LC2	Laboratory Course- II	0	0	3	3	6
Total Credits & Credit Hours						**25**	**30**

Semester - III

Specialization – 1 (Forensic Chemistry and Toxicology)

Sr. No.	Subject Code	Subject Name	L	T	P	C	TCH
1	FSMS SP-I P1	Forensic pharmacology and Pharmaceutical drug analysis	4	0	0	4	4
2	FSMS SP-I P2	Advanced Forensic Toxicology	4	0	0	4	4
3	FSMS SP-I P3	Modern and Applied Analytical Forensic Chemistry	4	0	0	4	4
4	FSMS EL	Elective	3	0	0	3	3
5	FSMS SP-I LC	Laboratory Course	0	0	6	6	12
Total Credits & Credit Hours						**21**	**27**

Specialization – 2 (Forensic Biotechnology)

Sr. No.	Subject Code	Subject Name	L	T	P	C	TCH
1	FSMS SP-II P1	Forensic Genomics and Biocomputing	4	0	0	4	4
2	FSMS SP-II P2	Molecular Biology and r-DNA Technology	4	0	0	4	4
3	FSMS SP-II P3	Immunological techniques and Forensic Proteomics	4	0	0	4	4
4	FSMS EL	Elective	3	0	0	3	3
5	FSMS SP-II LC	Laboratory Course	0	0	6	6	12
Total Credits & Credit Hours						**21**	**27**

Specialization – 3 (Forensic Physics and Ballistics)

Sr. No.	Subject Code	Subject Name	L	T	P	C	TCH
1	FSMS SP-III P1	Advance in Physical Techniques	4	0	0	4	4
2	FSMS SP-III P2	Advances in Forensic Ballistics & Armour Materials	4	0	0	4	4
3	FSMS SP-III P3	Audio Recognition and Video Analysis	4	0	0	4	4
4	FSMS EL	Elective	3	0	0	3	3
5	FSMS SP-III LC	Laboratory Course	0	0	6	6	12
Total Credits & Credit Hours						**21**	**27**

Specialization – 4 (Fingerprints and Questioned Documents)							
Sr. No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**	**TCH**
1	FSMS SP-IV P1	FSMS SP-IV P1: Modern Trends in Fingerprint Sciences	4	0	0	4	4
2	FSMS SP-IV P2	FSMS SP-IV P2: Questioned Documents and Forensic Accounting	4	0	0	4	4
3	FSMS SP-IV P3	FSMS SP-IV P3: Forensic Photography & Biometrics	4	0	0	4	4
4	FSMS EL	Elective	3	0	0	3	3
5	FSMS SP-IV LC	Laboratory Course	0	0	6	6	12
Total Credits & Credit Hours						**21**	**27**

Specialization – 5 (Cyber Forensics)							
Sr. No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**	**TCH**
1	FSMS SP-V P1	FSMS SP-V P1: Cyber Law, Risk and Compliance	4	0	0	4	4
2	FSMS SP-V P2	FSMS SP-V P2: Incident Response and Digital Forensics	4	0	0	4	4
3	FSMS SP-V P3	FSMS SP-V P3: Vulnerability Assessment and Penetration Testing	4	0	0	4	4
4	FSMS EL	Elective	3	0	0	3	3
5	FSMS SP-V LC	Laboratory Course	0	0	6	6	12
Total Credits & Credit Hours						**21**	**27**

Specialization – 6 (Crime Scene Management)							
Sr. No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**	**TCH**
1	FSMS SP-VI P1	FSMS SP-VI P1: Basics of Crime, Evidence and Law	4	0	0	4	4
2	FSMS SP-VI P2	FSMS SP-VI P2: Concepts of Crime Scene Management	4	0	0	4	4
3	FSMS SP-VI P3	FSMS SP-VI P3: Advance techniques in Crime Scene Management	4	0	0	4	4
4	FSMS EL	Elective	3	0	0	3	3
5	FSMS SP-VI LC	Laboratory Course	0	0	6	6	12
Total Credits & Credit Hours						**21**	**27**

Semester - IV							
Sr. No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**	**TCH**
1	FSMS SIV	Dissertation/Major Project	0	0	0	25	0
Total Credits & Credit Hours						**25**	0

Total Credits: 96
L: Lecture **T:** Tutorial **P:** Practical
1 C = 1 Hour of Lecture / Tutorial & 1 C = 2 Hours of Laboratory / Project

LIST OF ELECTIVES

Elective 1: Forensic Engineering

Elective 2: Scientific Protocols of Fire Investigation

Elective 3: CCTV Forensics

Elective 4: Anti-Dope Forensics

Elective 5: Nano-Biotechnology

Elective 6: Cryptography & Steganography

Elective 7: Research Methodology

Elective 8: Disaster Victim Management

Elective 9: Machine Learning for Data Science

Elective 10: Forensic Journalism

SYLLABUS

Semester – I

FSMS SI-1: INTRODUCTION TO FORENSIC SCIENCE, PSYCHOLOGY, LAW AND STATISTICS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
Th	Tu	Pr	C	TCH	TA-1 & TA-2		MSE						Total
					Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	1	0	5	5	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn basic principles of Forensic science
2. To help students learn basic laws pertaining to the Criminal Justice System.
3. To study the basic concept of report writing.
4. To study the concepts of Psychology

UNIT-I Teaching Hours: 15 Hours

Forensic science Definition and Scope of Forensic Science, History and development of Forensic science, Need and Principle**,** Police and, Forensic science laboratories / institutions in India, Organizational Structure of a Forensic Science Laboratory/Institution, Services provided by other institutions, Functions and responsibility of Forensic scientist Ethics in forensic science

Forensic Photography: Definition of photography, Cameras and its working, types of camera lenses, crime scene and laboratory photography, UV and IR photography, Photomicrography and macro photography. Digital photography, digital imaging, photogrammetry, basic concepts of videography/high speed videography

UNIT-II Teaching Hours: 15 Hours

Law: Sections of Indian Evidence Act: 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 159, Sections of Criminal Procedure code:53, 53A, 54, 291, 292, 293.311A

Sections of Indian Penal Code: Offences against person: 299, 300, 302, 304B, 306, 319, 320, 326, 339, 340, 351, 359, 362, 375, 377. Offences against property: section 378, 383, 390, 405,

415, 441, 463, 471, 499, 503, and 511. Indian constitution article 20, 21

Criminal Justice System: Structure of Police, Police and Forensic Scientist relationship with reference to Crime Investigation, Modus Operandi and its role in Crime Record, maintenance of crime records, Prosecution and Judicial Organizations. Courts in India, Jurisdiction of courts in criminal cases and FIR.

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

Court testimony: Admissibility of expert testimony, pre court preparation and court appearance, examination in chief, cross-examination and re- examination.

UNIT-III **Teaching Hours: 15 Hours**

Crime: Definition, types of crimes, causes of crime, Theories and prevention of crime, characteristics of criminals.

Psychology and investigative techniques: Polygraph (Lie-detection), Narco analysis, Brain mapping, Forensic psychiatry – human behavior and relationship between human behavior and legal proceeding in both civil and criminal cases

UNIT-IV **Teaching Hours: 15 Hours**

Laboratory management System: Laboratory information management system, Chain of custody of samples covered by LAN system, Security system, validation and safety equipment.

Forensic statistics: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test

Reference Books:

1. Saferstein: Criminalistics : An Introduction To Forensic Science, Prentice Hall Inc. USA
2. G. G. G. Aitken and D. A. Stoney; The use of statistics in Forensic Science, Ellis Harwood Limited, England
3. James, S.H. And Nordby, J. J.; Forensic Science; An Introduction To Scientific And Investigative Techniques, CRC Press USA
4. O' Hara & Osterberg: An Introduction to Criminalistics.
5. Forest; Forensic Science: An Introduction.

6. Lee, Henry; Advances in Forensic Science.
7. Sharma JD: Vidhivigyan Avem Vish Vigya.
8. Sharma JD: Apradh Ka Vaigyanik Anveshan.
9. Sharma BR: Forensic Science in Criminal Investigation And Trials.
10. Mordby, J Deed Reckoning – The Art Of Forensic Science Detection, CRC Press LLC, Boca Raton FL, CRC Press
11. Ram Ahuja: Criminology, Rewal Publ. Jabalpur
12. Indian Penal Code
13. Indian Evidence Act.

FSMS SI-2: INSTRUMENTAL TECHNIQUES

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn theory and basics of instrumentation.
2. To help students learn Spectroscopic and chromatographic techniques.
3. To study the concepts of microscopy.
4. To study the concepts of centrifugation techniques.

UNIT-I Teaching Hours: 15 Hours

Basics of Instrumentation: Electromagnetic radiations and their properties General properties of electromagnetic radiations: Wave and Quantum mechanics Interaction of EMR with matter Photoelectric effect, De Broglie-Bohr Theory and derivation of equation, Heisenberg uncertainty principle, Plank's Quantum theory Davisson and Germer Experiment, Electronic spectra and molecular structure.

UNIT-II Teaching Hours: 15 Hours

Spectroscopic Techniques: Absorption, Emission and Transmission Spectroscopy, Ultraviolet and visible spectroscopy: Instrumentation and Applications. Infrared Spectroscopy: Molecular vibration, Theory of IR absorption, IR Basics of Mass Spectroscopy Introduction to Chromatography: Theory of separation techniques, Types of chromatography and their Forensic Applications, Thin layer chromatography, High Performance Liquid Chromatography, Gas Chromatography

UNIT-III Teaching Hours: 15 Hours

Chromatography and Hyphenated Techniques: Introduction to Chromatography: Theory of separation techniques, Types of chromatography and their Forensic Applications, Thin

layer chromatography, High Performance Liquid Chromatography, Gas Chromatography, GC-MS, GC-HS, LC-MS, LC-MS/MS

UNIT-IV **Teaching Hours: 15 Hours**

General Principles of Biological/Biochemical Analysis: pH and Buffers, Physiological solution**,** Centrifugation Techniques: Basic principle of centrifugation and sedimentation, various types of centrifuges, Density Gradient Centrifugation, Preparative Centrifugation, analysis of sub-cellular fractions, Ultra centrifuge- Refrigerated Centrifuges.

Microscopy: Basic principles of microscopy, Simple and Compound microscope, Study of different types of microscopes: Comparison microscope, Phase contrast microscope, Stereoscopic microscope, Polarizing microscope, Fluorescence microscopy, IR microscopy, Scanning electron microscope (SEM).

Reference Books:

1. D.A.Skoog, F.J.Holler and T.A.Neman, Harcourt Principles of Instrumental Analysis college publishers, Singapore
2. G.D.Christian and J.E.O'Reilly, Instrumental Analysis, Allyn and Bacon, Inc., Boston.
3. F.W.Fifield and D.Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London.
4. R.P.Bauman, Absorption Spectroscopy, John Wiely, New York.
5. M.Donhrow, Instrumental Methods in Analytical Chemistry; Their Principles and practice Vol.2, optical method, Pitaman, New York.
6. G.G.Guilbanlt, Practical Fluorenscence: Theory, Methods and Practice, Marcel Dekker, New York.
7. S.Udenfriend, Fluorescence Assay in Biology and Medicine, Academic Press, New York.
8. W.J.Price, Spectrochemical Analysis by Atomic Absorption, Hyden, London.
9. R.S.Alger, Electron Paramagnetic Resonance: Techniques and Applications, Interscience, New York.
10. Analytical Chemistry by Open Learning, John Wiley & Sons, New York.
11. J.C.Giddings, Dynamics of Chromatography, Marcel Dekker, New York.
12. R.C.Grob, Modern Techniques of Gas Chromatography, Marcel Dekker, New York.
13. J.A.Dean, Chemical Separation Methods, Ban Nostrand Reinhold Co., New York.

14. R.E.Smith, Ion Chromatography Applications, C.R.C. Press, Inc., Boca Raton.
15. R.E.Smith, Supercritical Fluid Technology, C.R.C. Press, Inc., Boca Raton.
16. G.Zweig and J.R.Whitaker, Paper Chromatography and Electrophoresis, Academic Press, New York.
17. Safferstein: Forensic Science Handbook Vol. I, II, III.
18. Lee Henry: An Introduction to Forensic Science
19. Egon Stahl: Thin Layer Chromatography

FSMS SI-3: CRIME SCENE MANAGEMENT AND FORENSIC EVIDENCES

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. The Significance in crime scene management and forensic physics.
2. The methods of securing, searching and documenting crime scenes.
3. The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.
4. The legal importance of chain of custody.
5. Significance and examination of different physical evidence found in different types of crime scene

UNIT-I **Teaching Hours: 15 Hours**

Crime scene management: Introduction to the crime scene, Types of crime scene, Evaluation and processing of crime scene, Securing the scene of crime, Documenting the crime scene (Note making, Sketching, Photography ,videography of crime scene), role of the first arriving officer at the crime scene.

Searching techniques of Crime scene, Processing of physical evidence-discovering, recognizing and examination of physical evidences

Collection, Safety measures for evidence collection

Preservation, Packaging, sealing, labeling and forwarding of physical evidence, Maintaining the chain of custody, Probative value of physical evidence, Reconstruction of scene of crime. Introduction to physical evidences, Types of physical evidences, Classification and Role of physical evidences in Criminal Investigations & Trails

Advances in crime scene management:

- Tele forensic Technology for crime scene investigation
- Information, Manpower, and logistics management of crime scene
- Mobile kits and equipment's, their utility on crime scene
- Digital Imaging of Crime Scene, 3-D scanning technique
- Case studies & report writing of crime scene visits
- National and International scenario of crime scene management

UNIT – II **Teaching Hours: 15 Hours**

Glass: Introduction to glass, Types of glass and their compositions, Forensic examination of glass fractures under different conditions, determination of direction of impact: hackle marks, backward fragmentation, Physical measurements of glass, color and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis, and interpretation of glass evidence, Case Studies.

Paints: Introduction, Composition, Manufacture of Paint, types of paint, Forensic Examination of Paints and Coatings: Collection and Preservation of paint samples, macroscopic and microscopic techniques for the characterization of Paint Fragments, Physical , Chemical & Instrumental analysis of paint, , interpretation of Paint Evidence, Case Studies

Soil: Soil and its composition, Classification of soil, Collection and preservation of soil as a evidence, analysis of soil samples: Physical, chemical and instrumental, interpretation of soil evidence, Case Studies

Lip print: Introduction to Cheiloscopy and history of lip prints, Classification of lip prints, Collection, Development , Identification and Comparison of lip prints

Ear Prints: Introduction to the history of ear prints, Morphology of the ear, Procedure of taking standards from the suspects, Identification and comparison of ear prints

UNIT – III **Teaching Hours: 15 Hours**

Tool mark Evidences: Introduction to tool marks, Types of tool marks, Class characteristics and individual characteristics of tool marks, Collection and Preservation of tool marks, Forensic examination of tool marks, Case Studies

Bite marks: Objectives and forensic importance of bitemark examination, the typical bitemarks morphology, types of bite marks, Evidence collection from victims and suspects,

Photography, lifting, preservation of bite marks, casting of bitemarks, Identification and comparison of bite marks, Case Studies

Tyre Impressions: Introduction to tire impressions, Collection and Preservation of the tire impression evidence, Forensic Significance of skid marks, Forensic Examination for identification and comparison, Case Studies

Footprints & Shoe impression examination: Introduction to footprints & Shoe impression , locating impressions at the scene of crime, Evidence collection: Collection, Lifting/Casting and Preservation of foot/footwear impressions, importance of Gait pattern, Forensic Identification and Methods of comparison, Case Studies

UNIT – IV **Teaching Hours: 15 Hours**

Fiber analysis: Forensic significance, Classification, Textile Fibers, Yarns, Fabric construction, Fabric characteristics, Microscopy characteristic, Birefringence, Fluorescence Microscopy, Colors in textile, Color Assessment, Chemical properties, Physical, chemical and instrumental methods of examination of string/ropes, wires/cables, seals, counterfeit coins, physical matches of broken objects.

Gemology: Examination of Gems, Diamonds and Precious and Semi-Precious Stones to Identify their Authenticity and Quality, Physical Methods, Optical Methods, Fluorescence Techniques, Spectroscopic Techniques, X-Ray Diffraction Studies.

Restoration of erased/obliterated marks: Principle of restoration of erased marks, Techniques involved for alteration of individual markings, Restoration of erased and obliterated marks on various surfaces, Photography and Forensic assessment of methods for restoration of obliterated marks, case studies

Reference Books:

1. C.E. O 'Hara al1d .J.W. Osterburg; An Introduction to Criminalistics: Indiana University Press, Blomington.
2. Dahiya M S, Crime scene management: a scientific approach; Shanti SarvarPrakashan
3. R. Saferstein; Forensic Science Handbook, Vols. I, II; (Ed); Prentice Hall, Eaglewood Cliffs,NJ;
4. F.W. Sears, M.W Zemansky, and H. D. Young; University Physics, Sixth Ed.,Narosa;
5. Dennis Shaw; Physics in the Prevention and Detection of Crime, Contem Phys. Vol7;

6. Philip Rose; Forensic Speaker Identification; Taylor and Francis Forensic Science Series, London
7. Bengold & Nelson Moryson- Speech and Audio signal processing; John Wiley & Sons, USA, Nickolls, L.C; Scientific Investigation of Crime, Butler West, London
8. Raymond C Murray & John C.F Tedrew; Forensic Geology; Prentice Hall, NewJersey
9. Working Procedure Manual: Physics BPR&DPublication
10. B. Caddy; Forensic Examination of glass and paints analysis and interpretation ISBN 0784 05749
11. Philip Rose; Forensic Speaker Identification; Taylor & Francis Forensic Science series,London
12. Bengold& Nelson Morgan; Speech and Audio Signal Processing; John Wiley and Sons,USA
13. Jenkins and White; Fundamentals of Optics; McGraw Hill; Fourth Ed, (I) James, S.H. And Nordby, J. J.; Forensic Science; An Introduction to Scientific And Investigative Techniques, CRC PressUSA
14. Ray D. Kent and Charles Read; Acoustic analysis of speech
15. Phil Rose & James R Robertson; Forensic speaker identification

FSMS SI-4: FINGERPRINTS AND QUESTIONED DOCUMENTS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
Th	Tu	Pr	C	TCH	Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn about basic concepts of fingerprint science
2. To help students learn about basics of forensic document examination

UNIT-I Teaching Hours: 15 Hours

Introduction to Fingerprint science: Definition, History, development, Scope of Fingerprint science, Composition of sweat, Introduction to chanced prints: their search, development and collection procedure, Maintaining the fingerprint slips: rolled and plain prints. Identification of fingerprints: pattern analysis, ridge characteristics, comparison of fingerprints. Ridge tracing, Ridge counting, Photography of fingerprint exhibits

UNIT-II Teaching Hours: 15 Hours

Introduction to document examination: Definition, scope, nature and problems, care, handling and packaging of document evidence. Collection of writing standards: specimen and admitted. Forgeries and its types, Principles of handwriting examination, authorship identification, detection of alterations/tampering in documents, Photography of document exhibits.

UNIT-III Teaching Hours: 15 Hours

Fingerprint classification techniques: Single digit, 10-digit classification, Henry classification system, numerical value, symbol, primary classification, secondary classification, sub-secondary classification and final classification, NCIC classification, AFIS classification. Introduction to FACTS and AFIS.

UNIT-IV **Teaching Hours: 15 Hours**

Document Examination: Physical matching of Documents, Examination of alterations, erasers, overwriting, addition and obliterations.Examination of secret writings and charred documents, Examination of typewriting, photocopies and computer printouts. Examination of counterfeit currency notes, passport, credit card, visa, seal and other mechanical impressions. Instrumental techniques used for document examinations.

Reference Books:

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRCPress
2. E. Roland Menzel; Fingerprint Detection, with Lasers, Second edition; Marcel, Dekker,Inc. USA.
3. James F. Cowger; Friction Ridge skin CRC PressLondon.
4. Mehta, M.K: Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi (P) Ltd,Bombay
5. Moenssens: Finger Prints Techniques, Chitton Book Co. Philadelphia, NewYork.
6. Chatterjee S.K., Speculation in Finger print identification, Jantralekha, Printing Works,Kolkata.
7. Cowger, James F: Friction ridge skin: Comparison and Identification of Fingerprints; CRCPress, Boca Raton, NewYork.
8. Cook Nancy: Classifying fingerprints -Innovative learning publication MentoPark
9. Cossidy, M. J. Footwear Identification, Royal Canadian Mounted Police, Ontario,Canada.
10. J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II andIII, Acad.Press
11. Hillison, S; Dental Anthropology, Cambridge Univ. Press,UK.
12. Albert S. Osborn; Questioned Documents, Second Ed.; Universal Law Publishing, Delhi
13. Koppenhaver, K. (2010). Forensic Document Examination: Principles and Practice (1st Ed.).
14. Hilton, O. (1993). Scientific examination of questioned documents (1st ed.). Boca Raton:CRC Press.
15. Harrison, W. (1958). Suspect documents.
16. Kelly, J., & Lindblom, B. (2006). Scientific examination of questioned documents. Boca Raton, FL: CRC/Taylor & Francis.

17. Ellen, D. (2006). Scientific examination of documents. Boca Raton, FL: Taylor & Francis.
18. Huber, R., & Headrick, A. (1999). Handwriting identification (1st ed.). Boca Raton: CRC Press.

FSMS SI 5: FORENSIC BIOLOGY AND ANTHROPOLOGY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
Th	Tu	Pr	C	TCH	TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	Total
					Marks	Hrs	Marks	Hrs					
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn basic techniques for identification and collection of biological evidence.
2. To help students learn about the basics of classical genetic principles.
3. To help prospective students learn about the basics of anthropology.
4. To help prospective students learn about the basics of disaster victim identification.

UNIT-I Teaching Hours: 15 Hours

Fundamentals of Forensic Biology and Biological Evidences: Scope of forensic biology**,** Different domains of forensic biology, Types of biological evidences**,** Importance of biological evidences in forensic investigation**,** Procedure for Collection, Preservation, Packing, Sealing and Forwarding of biological samples.

Hair examination: Morphological, anatomical and Microscopic examination of hair. Characteristics of hair to determine the species origin, race and sex.

Diatoms Examination : Introduction to Diatoms, Types and Structure of Diatoms, Importance and examination of Diatoms in Forensic Science.

UNIT-II Teaching Hours: 15 Hours

Introduction to Classical genetics: Organization of genome, Structure and Functions of Nucleic acids; Griffith's experiments, Introduction to Mendelian inheritance and its extensions, Pedigree analysis, Sex-linked inheritance, Linkage and crossing-over, Cytoplasmic inheritance and maternal effects, Cytogenetics; karyotyping, chromosomal abnormalities.

UNIT-III **Teaching Hours: 15 Hours**

Wildlife Forensics : Definition and advances in wildlife forensics; Threats to the natural resources and wild species inhabiting globally; Importance of Wildlife Conservation; Classification of Species as per IUCN Red Data Book; CITES; Wildlife (Protection) Act, 1972 of India and other related acts; Different Methods of Poaching; Conventional methods of species identification; Morphological identification and examination of wildlife parts and products; Application of DNA technologies used in Wildlife Forensics.

Forensic Entomology : Basic elements of Entomology, Importance of insects in forensic investigations, life cycles of insects to determine time since death, Applications of Forensic Entomology.

Forensic Palynology : Introduction to Forensic Palynology, Examination of Pollen grains and Spores.

UNIT-IV **Teaching Hours: 15 Hours**

Forensic Anthropology : Introduction to forensic anthropology, Forensic Anthropometry, Osteometry, Identification of individuals (living), Identity of missing person by superimposition techniques, Facial reconstruction method, Advanced Imaging Techniques and Musculo-Skeletal Reconstruction, Portrait parley.

Forensic Odontology- Human Dentition; Structure and types of Teeth; Definition and dental formula; Identification of individuals from teeth; Ages of eruption and other individual characteristics; Determination of age, sex and race from teeth - Role of teeth in mass disaster – Forensic significance in individual identification.

Disaster Victim Identification : Examination and identification of dead bodies in mass disasters; mutilated bodies; fragmentary skeletal remains and bones; Determination of age, sex, race and species origin from bones and assessment of stature; Identification of burnt bones, skeletal remains in accidents, crimes and mass disaster.

Reference Books:

1. Criminalistics: An Introduction to Forensic Science (2014) Saferstein, Pearson Prentice Hall Inc. USA, ISBN-13: 978-0133458824
2. James, S.H. And Nordby, J. J.; Forensic Science; An Introduction to Scientific and

Investigative Techniques, CRC Press USA

3. Laboratory Procedure Manual - Forensic Biology (2005), Directorate of Forensic Science, MHA, New Delhi
4. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528
5. Forensic Science: An Introduction to Scientific and Investigative Techniques – Stuart H. James, Jon J. Nord by, CRC Press, ISBN:08493274

FSMS SI-LC1: LABORATORY COURSE-I

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
0	0	2	2	4	-	-	50	03:00	-	-	100	06:00	150

P2: Instrumental Techniques

1. Measurement and adjustment of pH.
2. Preparation of buffers and standard solutions.
3. Separation of mixture using centrifugation.
4. Calibration of Micropipettes.
5. Morphological examination of samples and microstructures using microscope
6. To prepare TLC plate and identify natural dyes
7. To identify the compound UV-VIS spectrophotometer
8. To understand the concepts and working GC, GC-MS and HPLC
9. Microscopic examination of forensic evidences
10. To understand basic concepts of column chromatography and to separate mixture of samples

P3: Crime Scene Management and Forensic Evidences

1. Density gradient analysis of soil and glass samples.
2. Restoration of erased identification marks.
3. Physical matching of Cloth piece and/or rope piece and /or garments or broken pieces of different objects.
4. Physical and microscopic studies of affected electric wires, panel boards due to electrical overload and short-circuit.
5. Physical examination of paint samples by microscopic method
6. Comparison of tool marks.

7. Sketching and photography of crime scenes.
8. Collection and packing of physical clues at the scene of crime.
9. Reconstruction and evaluation of scene of crime
10. Physical and microscopic studies of gems and fibers.

FSMS SI-LC2: LABORATORY COURSE-II

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
0	0	2	2	4	-	-	50	03:00	-	-	100	06:00	150

P4: Fingerprint & Questioned Documents

1. Identification of Handwriting-general characteristics, fundamental divergences and individual characteristics.
2. Examination and Identification of Signature Forgeries
3. To study the natural variations in handwriting written in different circumstances.
4. Examination of additions, alterations, and obliterations in the documents.
5. Examination of mechanical and chemical use of erasers on the documents
6. Examination of indented handwriting.
7. Examination of sequence of intersecting strokes
8. To take plain and rolled fingerprints and to identify the patterns.
9. To perform ridge tracing and ridge counting.
10. To identify ridge characteristics.
11. To compare the fingerprints.
12. To develop latent fingerprints with powders, fuming and chemical methods.

P5: Forensic Biology & Anthropology

1. Protocol of handling different biological sample and maintaining their chain of custody
2. Karyotyping, different banding patterns of chromosome.
3. Examination of Diatoms and Pollen grains
4. Examination of hair characteristics for identification of species.

5. Examination of skeletal remains- Long bones- Femur, Humerus,
6. Identification of individuals by long bones and stature estimation
7. Determination of sex and age from Skull with mandible
8. Determination of sex from pelvis and sacrum.
9. Identification of individuals by dental examination
10. Anthropometry.- Identification of individuals (in living)

Semester – II

FSMS SII-1: QUALITY MANAGEMENT, NARCOTIC DRUGS, EXPLOSIVES & FORENSIC CHEMISTRY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
Th	Tu	Pr	C	TCH	TA-1 & TA-2		MSE						Total
					Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn the basics of forensic chemistry.
2. To help students learn about quality management.
3. To study and understand Narcotics and psychotropic substances.
4. To learn about explosives, arson and petroleum products.

UNIT-I — Teaching Hours: 15 Hours

Forensic chemistry: Introduction to forensic chemistry, Types of cases/exhibits received for analysis, Overview of forensic chemical analysis

Quality management: Introduction to Quality, Quality Assurance, Quality control, TQM, Definition of Accreditation, History and development of ISO, Importance of accreditation in Forensic science laboratories, Process of accreditation,Quality system,International Laboratory Accreditation Co-operation (ILAC), AsiaPacific Laboratory Accreditation Co-operation (APLAC). American Society of Crime Laboratory Directors (ASCLD), Traceability and Validation of new methods, measurement of uncertainty, Equipment maintenance and calibration , Proficiency testing, internal audit/External audit,MRM, Training and conferences

UNIT-II — Teaching Hours: 15 Hours

Narcotic Drugs & Psychotropic Substances: Introduction to NDPS drugs, Controlled Substances, Classification of controlled substances, Precursor chemicals, Narcotic raids and clandestine drug laboratories investigation, Mandatory provisions of NDPS Act, 1985. Drug addiction (Physical & Psychological), Drug dependence and Drug Tolerance. Designer Drugs,

Doping Drugs, Analysis of Drug of abuse by colour test and other instrumental techniques,.Case studies.

UNIT-III **Teaching Hours: 15 Hours**

Explosives Chemistry: Introduction, Classification and chemistry of explosives; Post blast investigation. Systematic examination of explosive and explosion residues (organic and inorganic) by colour test and other instrumental techniques..Case studies.

Introduction to Fires & Arson Investigation: Introduction to Thermodynamics and Chemistry of Fire , Investigation of Fire and Arson, Forensic Analysis of Fire Debris by Instrumental methods, Case studies.

UNIT-IV **Teaching Hours: 15 Hours**

Forensic Analysis of Petroleum Products: Introduction to Petroleum Products and Analysis of Petrol, Kerosene and Diesel as per BIS Specifications. Case Studies

Alcoholic Beverages: Forensic Analysis of alcoholic beverages, country made liquor, illicit liquor and medicinal preparations containing alcohol as constituents. Case studies.

Bribe Trap Case: Examination of Chemicals (Phenolphthalein) used in Bribe trap cases. Case studies.

Food Adulteration: Introduction to food adulteration and general color tests to detect common food adulterants

Reference Books:

1. J ASiegel, P.J Saukko (2000) Encyclopaedia 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. Maudham Bassett et al.; Voget's Textbook of Quantitative Chemical Analysis, 6th Ed. Longman Essex.
6. Brean S. Furniss Etal; A.I.Vogel Textbook of Practical Organic Chemistry, Addison Wesley Longman, Edinburg.
7. D A Skoog, D.M. West, F.J. Holler; Analytical Chemistry – An Introduction, 7th Ed. Saunders College Pub, Philadelphia, USA.

8. Boudreau JE, Etal; Arson & Arson Investigation, Survey & Assessment National Institutes of Law Enforcement, U.S. Deptt. Of Justice, U.S. Govt Printing Press.
9. Dettean J D; Kirk's Fire Investigation, 5th Ed. Prentice Hall, Eaglewood Cliffs, N. J.
10. YinonJitrin; Modern Methods & Application in Analysis of Explosives, John Wiley & Sons, England.
11. Working Procedure Manual – Chemistry, Explosives and Narcotics, BPR&D Pub.
12. C.A. Watson; Official and Standardized Methods of Analysis, Royal Society of Chemistry, UK.
13. Feigl; Spot Test in Inorganic Analysis, Elsevier Pub. New Delhi.
14. Feigl; Spot Test in Organic Analysis, Elsevier Pub. New Delhi.
15. Silverman; Organic Chemistry of Drug Design & Drug Action, Elsevier Pub. New Delhi.
16. Abraham Burger; Medicinal Chemistry & Drug Discovery, 6 Vol Set, 6th Ed John Wiley & Sons, NY.
17. NDPS Act, 1985.

FSMS SII-2: FORENSIC SEROLOGY AND DNA PROFILING

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning objectives:

1. To help students in examination of blood and other biological fluids.
2. To help students learn basics methods used for microbial sterilization
3. To study the basic concept of DNA profiling and their analysis.

UNIT-I **Teaching Hours: 15 Hours**

Basic Serology: Blood and its composition, Hemoglobin and its variants, Blood Typing/Grouping - 'ABO'system and its significance in forensic investigation., Other blood group antigens - 'Rh sub types', MN, I, P, Kell, Duffy, Kidd, Lewis, Lutheran and Bombay blood group, Identification of other biological fluids like Saliva, Urine, Semen and Vaginal secretion, and their forensic significance.

UNIT-II **Teaching Hours: 15 Hours**

Biochemistry and Cell Biology: Chemistry of Carbohydrates -Definition, classification and their importance in forensic investigation.Chemistry of Lipids -Definition, classification and their importance in forensic investigation.Types and properties of amino acids, structure of proteins and their importance in forensic investigation.Introduction of plant and animal cells. Different eukaryotic cellular organelles,·Plasma membrane, Transport across membrane Endoplasmic Reticulum, Golgi complex, Mitochondria, Chloroplast and Lysosomes. Organization of Nucleus and nuclear transport.,Cell division-Mitosis and Meiosis; Barr bodies and their importance in forensic investigation

UNIT-III **Teaching Hours: 15 Hours**

DNA extraction, quantification and separation: Techniques and equipment for DNA extraction and purification, Different methods of DNA quantitation, DNA separation and detection techniques, Polymerase Chain Reaction (PCR),

UNIT-IV **Teaching Hours: 15 Hours**

Introduction to Forensic DNA analysis: History of DNA fingerprinting, DNA polymorphism, Genes and DNA markers in forensic DNA analysis, Introduction to mitochondrial DNA and its forensic importance, Important case studies of DNA fingerprinting.

Reference Books:

1. The examination and Typing of Blood Stains in the crime laboratory-BJ Culliford, U.S.Dept. of Justice, Washington D. C.
2. Blood Group Serology - Boorman KE, Dodd BE and LOncoln PJ, Chuchill LivingstoneInc. New York.
3. Laboratory Procedure Manual - Forensic Serology (2005), Directorate of Forensic Science, MHA, New Delhi
4. Lehninger Principles of Biochemistry 6th Edition (2012) – Nelson and Cox, W.H. Freeman, ISBN: 978-142923414
5. Molecular Biology of the Cell, 6th Edition (2014) – Bruce Alberts, et al., Garland Science, ISBN: 978-0815341055
6. Laboratory Procedure Manual - DNA Profiling (2005), Directorate of Forensic Science,MHA, New Delhi.
7. Molecular Biology of the Cell, 6th Edition (2014) - Bruce Alberts, et al., Garland Science, ISBN: 978-0815341055
8. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528
9. Forensic Science: An Introduction to Scientific and Investigative Techniques - StuartH. James, Jon J. Nord by, CRC Press, ISBN:0849327474
10. Genes XI (2012) - Benjamin Lewin, Jones & Bartlett Learning, ISBN: 978-1449659851

11. Kuby Immunology6th Edition-Kindt, Goldsby and Osborne, W.H. Freeman and Co. ISBN: 978-0716767640
12. Lehninger Principles of Biochemistry 6th Edition (2012) - Nelson and Cox, W.H. Freeman, ISBN: 978-1429234146
13. Microbiology 5th Edition - Pelczar et. al., McGraw-Hill Inc., ISBN: 978-0074623206
14. Prescott's Microbiology 9th Edition (2013) - Joanne Willey, Linda Sherwood, Christopher J. Woolverton, McGraw-Hill Education, ISBN: 978-0073402406
15. An Introduction to Forensic Genetics 2nd Edition (2010) - William Goodwin, Adrian Linacre and Sibte Hadi, Wiley-Blackwell, ISBN: 978-0470710197

FSMS SII-3: FORENSIC MEDICINE AND TOXICOLOGY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. Prospective students will learn about basic concepts of Death and postmortem changes.
2. Prospective students will develop the skill of identification of various deaths due to asphyxia, burns, sexual voilence etc.
3. To help students learn basic principles of toxicology.
4. To learn the concepts of toxicological examination.

UNIT-I — Teaching Hours: 15 Hours

Forensic medicine/Medico legal investigation Objectives of medico legal investigation, Inquest and types of Inquest, Thanatology, Death and its causes, types of death, Signs of death, Postmortem changes, Mode and Manner of death, Custodial Death, Determination of cause of death, Autopsy, Post-mortem examination of dead body, Estimation of time since death, Postmortem biochemistry of the body fluids, Modern techniques used for the estimation of time since death, exhumation.

UNIT-II — Teaching Hours: 15 Hours

Asphyxial deaths: Classification of asphyxia deaths, Hanging, Strangulation, evidence collection and analysis, establishing manner of deaths Suffocation, Drowning and traumatic asphyxia, medico legal importance of diatoms, medico legal importance, manner of deaths.

General and medico legal aspects of injuries/traumatology: Injuries, types of injuries,Mechanical Injuries: Abrasions, Bruises, Lacerations, Incised wounds, Stab wounds, Firearm injuries, Electrical and Thermal Injuries, Regional Injuries and traffic injuries; self inflicted injuries and examination. **Crimes against women**- Introduction to sexual offences

Natural and unnatural sexual offences, perversions Domestic violence and abuses at work place against women child abuses and abuses of old people, Abortion & Infant Deaths.

UNIT-III **Teaching Hours: 15 Hours**

Forensic Toxicology: Basics of Forensic Toxicology, History Scope and Significance, Crime scene involving poisons, medico legal aspects of poisoning, Laws related to poisons, nodal agencies and stakeholders, Poisons and classification of poisons, mode of action, types of poisoning, factors affecting poisoning, nature of forensic toxicological examinations, Roles and Responsibilities of forensic toxicologists, drug paraphernalia, poisoning management, Format of autopsy report and laboratory report, expert witness testimony.

Collection and Preservation Biological and non-biological samples, National and International guidelines of toxicological sample collection and preservation.

UNIT-IV **Teaching Hours: 15 Hours**

Extraction and Examination of Poisons : Extraction of poisons from biological and non-biological samples, Methods of Extraction, Liquid-Liquid extraction, extraction methods for acidic, basic and neutral poisons, extraction of volatile and non-volatile poisons, extraction of plant poisons, common methods of poison detection (Volatile, non-volatile, metallic, plant poisons, insect and snake bites), chemical tests and Instrumental methods (Chromatographic & Spectroscopic)

Reference books:

1. Modi JS: Medical Jurisprudence and Toxicology
2. Taylor: Medical Jurisprudence
3. Anil Aggrawal: Text book of Medical Jurisprudence and Toxicology
4. R.K. Sharma: Consice text book of forensic medicine & Toxicology
5. Keith Simpson & Bernard Knight: Forensic Medicine
6. C.M.V. Cox Medical Jurisprudence and Toxicology
7. K.S. N. Reddy: Text book of Forensic Medicine & Toxicology
8. Apurba Nandi: Text book of Forensic Medicine
9. V.V. Pillay: Text book of Forensic medicine and toxicology
10. Modi JS: Medical Jurisprudence and Toxicology

11. Taylor: Medical Jurisprudence
12. Parikh CK: Medical Jurisprudence and Toxicology
13. Keith Simpsen& Bernard Knight: Forensic Medicine
14. Poison, CJ, DJ Gee, B. Knight: Forensic MedicineReddy: Forensic Medicine
15. Laboratory Procedure Manual- Forensic Toxicology, DFS, MHA, New Delhi
16. Essentials of Toxicology- Ellenhorn

FSMS SII-4: FORENSIC BALLISTICS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. The classification of firearms and their firing mechanisms.
2. The methods of identifying firearms.
3. The characteristics of ammunition.
4. The importance of firearm evidence.
5. The nature of firearm injuries.
6. The methods for characterization of gunshot residue.

UNIT-I Teaching Hours: 15 Hours

Introduction to Forensic Ballistics, Basics concept of forensic ballistic, its definition, History and development of Forensic Ballistics, Introduction to Internal, External and Terminal ballistics, Role of Forensic Ballistics Expert.

Introduction to firearms: Parts of firearms and its function, Firearm safety, Assembly and disassembly of firearm, Firearms characteristics & classification of firearms on different basis, History and background of firearms,Functional assembly & Operating principle of firearms, Bore and caliber, choke, rifling – class characteristics of rifled bore, purpose of rifling, types of rifling, methods to produce rifling, Characteristics & Working mechanism of Standard: Rifled firearms, Small arms, Shot guns & Non-standard: Improvised, Country made, Imitative firearms, identification of origin.

UNIT-II Teaching Hours: 15 Hours

Introduction to Ammunition: Definition of Ammunitions, Ammunition & its constructional parts, Introduction to Shotgun ammunition and Rifle Ammunition,

Classifications of Ammunition on basis of constructional features, Functional assembly of different types of ammunition & their types, Safety aspects for handling firearms and ammunition, cartridge-firing mechanism. Bullet and its types, Case studies related to firearm cases.

Indian Firearm Act: Introduction to Act, Basic concepts of chapters describe in Act, Prohibited & Non-Prohibited Firearms calibres.

UNIT-III **Teaching Hours: 15 Hours**

Types of ballistics & their aspects, Internal ballistics: General elementary & other principle problems: Heat problems, Pressure, Recoil, Vibration & Jump, Barrel Fouling.

External ballistics: Trajectory formation & its computation, Vacuum Trajectories & its measurement, Influence of earth trajectory, Effect of air resistance on trajectories, Parameters involved in exterior ballistics.

Terminal/Wound ballistics: Effect of projectile on target based on: nature of target, bullet shape, striking velocity, striking angle and nature of target, intermediate targets, range, etc., Basic concepts of wound ballistics & phenomenon involved: threshold velocity for penetration of skin / flesh / bones, Nature of wound of entry & exit wound, Characterization & evaluation of injuries depending upon Range, Velocity, Projectile Types, Firearm types, etc.

UNIT-IV **Teaching Hours: 15 Hours**

Identification of firearms, ammunition and their components: Principles, Processing of Firearm Exhibits involved, Class characteristics & Individual characteristics (Identifiable marks) produced during firing process on cartridge cases & projectilesand their linkage with firearms.

Analysis of GSR –Composition of GSR, Location & Collection, Mechanism of formation, Chemical & Instrumental techniques involved in analysis, Shooter Identification Technique.

Determination of range of fire & its related phenomena, Techniques involved in ballistic studies, Stereo and comparison microscopy, BDAS, IBIS

Reference Books:

1. J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1,2,& 3; Springfield, Illinois;

2. Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, PA
3. Vincent Di Maio, Gunshot Wounds; Crc Press, Washington,Dc;
4. Brain J. Heard;, Hand Book Of Firearms And Ballistics; John Willey,England;
5. TA, Warlow; Firearms, The Law And Forensic Ballistics; Taylor And Francis,Landon;
6. Karl G. Sellier et al ; Wound Ballistics And The Scientific Background; Elsevier,London
7. M. Johari, Identification Of Firearms, Ammunition And Firearms Injuries; BPR&D, New Delhi;
8. L V. Hogg; The Cartridges Guide - A Small Arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, PA
9. Gary J. Ordog, Management Of Gunshot Wounds, Elsevier, NewYork
10. Working Procedures Manual: Ballistics, BPR&DPub.

FSMS SII-5: BASIC CONCEPTS OF DIGITAL FORENSICS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To know the background of internal communication of computer.
2. To familiarize students with the standard models for the layered approach OSI and TCP/IP to communication between machines in a network and the protocols of the various layer.
3. To make students understand about how multimedia evidences are collected and analyzed for forensic investigation.
4. To learn about the legal admissibility of multimedia evidences

UNIT-I Teaching Hours: 15 Hours

Number Systems and logical operations: Binary, Octal, Decimal and Hexadecimal, Conversion and Operations on Binary Number Systems, Representing Information in Hexadecimal and Binary, Logical operations on binary number system.

Computer Architecture: Components of computer, Input Devices, Central Processing Unit, Primary and secondary Storage Devices, Output Devices.

Secondary Storage Devices: Understanding Disk, Volume and Partition, HDD and SSD Structures.

UNIT-II Teaching Hours: 15 Hours

Basics of Operating Systems: Role of Operating System, Boot Process, Introduction to Process and Memory Management**.** Windows OS Architecture **-** FAT and NTFS File Systems.

Computer Network: Basic concepts of Computer Network, Open System Interconnection (OSI) and TCP/IP reference model, Protocols and functionalities of each layer, types of connections, networking devices

UNIT-III **Teaching Hours: 15 Hours**

Audio Forensics- Introduction to voice identification/speaker recognition, Speech Enhancement, Speaker profiling: Segregation of Speech samples, auditory analysis/listener's approach, spectrographic approach or voiceprint analysis, automatic speaker recognition technique. Audio Authentication.

UNIT-IV **Teaching Hours: 15 Hours**

Video/Image Forensics- Video processing and enhancement, Video authentication, Metadata analysis, hash value generation.video analysis: frame extraction, frame by frame analysis, shot by shot analysis. Technical aspects of the video, collection, handling and preservation of video files, Introduction to CCTV Forensics.

Reference Books: -

1. Practical Guide to Computer Forensics Investigations, A (Pearson IT Cybersecurity Curriculum (ITCC)) 1st Edition by Darren R. Hayes
2. Learn Computer Forensics: A beginner's guide to searching, analysing, and securing digital evidence 1st Edition by William Oettinger
3. Investigating Windows Systems 1st Edition by Harlan Carvey.
4. Computer Systems_ Digital Design, Fundamentals of Computer Architecture and Assembly Language
5. Carle, B., & Jensen, R. C. (2018). Understanding Video Management Systems.
6. Wolper, V. E. (2020). Photograph Restoration and Enhancement: Using Adobe Photoshop CC 2021 Version (3rd ed.). Mercury Learning & Information
7. Forensic Speaker Identification by Phil Rose & James RRobertson
8. The Acoustic Analysis of Speech by Ray D Kent & CharlesRead
9. Damjanovski, V. (2005). CCTV: Networking and Digital Technology (2nd ed.). Butterworth-Heinemann.

FSMS S2-LC1: LABORATORY COURSE - I

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
0	0	2	2	4	-	-	50	03:00	-	-	100	06:00	150

P1: Quality Management, Narcotic Drugs, Explosives and Forensic Chemistry

1. Identification of Narcotic drugs by colour test and TLC.
2. Detection of low explosives by chemical/colour test
3. Detection of high explosives by color test and TLC.
4. Examinations of petroleum products as per BIS specifications.
5. Identification of alcoholic beverages as per BIS specifications.
6. Analysis of phenolphthalein in bribe trap cases.
7. Identification of psychotropic substances by color tests and TLC
8. Identification of narcotic drugs by UV spectrophotometry
9. Detection of common adulterants by color test in milk, oil and food
10. Analysis of fire/arson by GC-MS
11. Identification of dyes in petroleum by TLC

P2: Forensic Serology and DNA Profiling

1. Physical, biochemical and spectrophotometric examination of blood stains.
2. Blood group typing of biological fluid stains by mixed agglutination techniques.
3. Biochemical and microscopic examination of Saliva, Semen stain and Urine
4. Determination of protein concentrations in various biological samples
5. Microscopic examination of mitotic and meiotic cell division
6. Staining and visualization of Barr Bodies.
7. Extraction and quantification of DNA from blood sample.
8. Extraction of DNA using FTA card.

FSMS S2-LC2: LABORATORY COURSE- II

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 &TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
0	0	3	3	6	-	-	50	03:00	-	-	100	06:00	150

P3: Forensic Medicine and Toxicology

1. Postmortem examination in various Asphyxial deaths.
2. Postmortem examination of various homicidal/ accidental injuries
3. Extraction of heavy metals using wet digestion and dry digestion
4. Extraction of acidic, basic and neutral poisons by liquid-liquid extraction
5. Extraction of pesticides by QuEChERS method
6. Advanced extraction procedures using SPE and SPME.
7. Extraction of volatile and non-volatile poisons
8. Analysis of heavy metals using colour tests(reinsch test).
9. TLC of acidic and basic drug
10. Identification of plant poisons by color test, TLC and spectroscopic method

P4: Forensic Ballistics

1. Characteristics of Firearms-Caliber, Choke, Trigger pull, and Proof marks.
2. Examination and comparison of fired bullet with reference to caliber, rifling characteristics, and identification of firearm
3. Examination and comparison of fired cartridge case with reference to caliber, firing pin, breech face, chamber indentations, extraction, and ejector marks by comparison microscope
4. Determination of shot numbers from size and weight of shots
5. Identification of propellants
6. Chemical tests for powder residue and barrel wash
7. Instrumental examination of Gunshot Residues.

8. Study on Deformed bullets
9. Determination of velocity using BDAS
10. Determination of angle and direction of fire on different surfaces

P5: Basic concepts of Digital Forensics

1. Explore and list the steps required to type in an Indian language using UNICODE.
2. Encode the word 'COMPUTER' using ASCII and convert the encode value into binary values.
3. To study about types of IP addresses.
4. To study about ports and protocols of networks.
5. To study about the DNS information.
6. Recording, editing, processing, and conversion of audio files.
7. Speech acquisition and Spectrographic analysis of Voice.
8. Detection of tampering in audio & video files.
9. Audio restoration and speech enhancement.
10. Analysis and enhancement of video/image/CTV Footages

Semester – III

Specialization – I (Forensic Chemistry and Toxicology)

FSMS SIII SP- I P1: FORENSIC PHARMACOLOGY AND PHARMACEUTICAL DRUG ANALYSIS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn the basics of pharmacology.
2. To help students learn concepts of forensic pharmacology.
3. To study and understand the action of various drugs.
4. To study pharmaceutical drugs analysis.

UNIT-I — Teaching Hours: 15 Hours

Basic Principles of Forensic Pharmacy: Introduction to Pharmacology and Forensic Pharmacy, Branches of Pharmacology, Scope of Forensic Pharmacy, Pharmacopoeias IP, USP, EP, pharmacognosy, pharmacovigilance, Nature and Source of drug, forms of drugs,classification of drugs, Prodrug and soft drug concept, Drug synthesis,Route of administration of Drugs, Factor affecting the effects of Drug,Ferguson's principle, Adverse drug reactions and drug induced side effects.

UNIT-II — Teaching Hours: 15 Hours

Concepts of Pharmacology: Pharmacokinetics,Bioavailability, Bioequivalence and Bioaccumulation, Efficacy and potency,Dose response relationship, Pharmacodynamics,Phase–I and Phase–II mechanism, Drug **Therapeutic** Index, Drug Receptor concept, types of receptors and mechanism of action, Pharmacokinetic drug interactions, various biological barriers,Agonism, Antagonism, Addition, Synergism,Potentiation, drug addiction and drug dependence, drug tolerance,drug hypersensitivity.

UNIT-III **Teaching Hours: 15 Hours**

Pharmacology of Different classes of controlled drugs: Pharmacology of neurotransmitters like GABA, Glutamate, Glycine, Serotonin, Dopamine, aliphatic alcohol, General Anaesthetics, Antidepressants, Sedatives, Hypnotics, antihypertensive drugs, Antidepressant, Stimulants, & hallucinogens and antipsychotics, Case Studies

UNIT-IV **Teaching Hours: 15 Hours**

Methods of Analysis of of Prohibited Drugs: Detection of prohibited drugs (anabolic steroids, peptide hormones, growth factors and mimetics, beta agonist, metabolic modulators, diuretics and masking agents and beta blockers by different techniques)

Reference Books:

1. Klaassen, C. D.,:Casarett and Doull's Toxicology: The Basic Science of Poisons, 5th ed,McGraw-Hill, 1995.
2. Moffat, A.C. :Osselton, D. M. Widdop, B. : Clarke's Analysis of Drugs and Poisons inPharmaceuticals, body fluids and postmortem material, 3rd ed., PharmaceuticalPress2004.
3. Bogusz, M. J.,: Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed.,Elsevier Science ,2000.
4. Siegel, J.A., Saukko, P. J., Knupfer, G.,:Encyclopedia of Forensic Sciences (Vol3),Academic Press, 2000.
5. Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt/ChurchillLivingstone, 2000.
6. Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed.,NiraliPrakashan, 1990.
7. Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2nd ed.,1999.
8. Wiseman, H and Henry J.: Management Of Poisoning, A Handbook for Healthcareworkers, 1st ed., A.I.T.B.S, 2002
9. Hardman, J. G. and Limbird, L. E.,: Goodman and Gilman's The Pharmacological basis ofTherapeutics, 9th ed., McGraw-Hill, 1996
10. Stolmen, A.; Progress in Chemical Toxicology: Academic Press, New York (1963)

11. Modi, Jaisingh, P.; Textbook of Medical Jurisprudence& Toxicology, M.M. TripathiPublication (2001)
12. Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001
13. Curry, A. S: Poison Detection in Human Organ

FSMS SIII SP-I P2: ADVANCED FORENSIC TOXICOLOGY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn basic principles of toxicology.
2. To help students learn about xenobiotics and toxic effects.
3. To study and understand concepts of mechanism of toxicity.

UNIT-I Teaching Hours: 15 Hours

Concepts of Toxicology :Branches of toxicology, Toxicants and Types of Toxicants, Dose and related terms used in toxicology, Sources of poisoning, duration and frequency of exposure, modals of toxicity testing, Laws and Regulations in toxicological testing, Regulatory bodies national and International, Risk and Hazard characterization, Global Harmonization System (GHS), Good Laboratory Practice (GLP).

UNIT-II Teaching Hours: 15 Hours

Principles of Toxicology : Dose-effects and dose-response relationship, types of toxicity, Factors affecting toxicity – species and strain, age, sex, nutritional status,hormones, environmental factors, circadian rhythms, Enzyme Induction and Inhibition, molecular mechanism of toxicity, role of electrophiles and nucleophiles in toxicity, translocation of toxicants, toxicokinetics and toxicodynamics processes, detoxification of xenobiotics, biotransformation of xenobiotics, bioaccumulation of xenobiotics, antidotal therapy.

UNIT-III **Teaching Hours: 15 Hours**

Toxic effects of Xenobiotics Toxic effects of drugs, mechanism of drug toxicity,Toxic effects of pesticides, mechanism of pesticide toxicity, toxicity, Toxic effects of heavy metals, mechanism of heavy metal toxicity, Toxic effects of Alcohol and solvents, mechanism of poisonous liquor, Toxic effects of plant poisons, Toxic effects of insects and animal poison, toxicity symptoms and treatment of xenobiotics.

UNIT-IV **Teaching Hours: 15 Hours**

Post-mortem toxicology, Methods of poison detection, chemical tests, Instrumental methods for toxicological examination, Toxicological analysis of decomposed material and body remains, metabolomics and biomarkers , challenges in forensic toxicological examination

Reference books:

1. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
2. Gupta, P.K.. Fundamentals of Toxicology: Essential Concepts and Applications. India, Elsevier Science, 2016.
3. Casarett& Doll Toxicology: The Basic Science of poisons.
4. Clark, E.G.C.: Isolation and identification of Drugs, 1966
5. Curry, A.S.: Poison Detection in Human Organs, 1976
6. Curry, A.S.: Advances in Forensic Chemical Toxicology, 1972
7. Holfmann, F.G.: Handbook of Drug and Alcohol Abuse.
8. Turner: Drugs & Poisons.
9. Samford : Poisons Their Isolation Identification
10. Stoleman: Progress in Chemical Toxicology.
11. Sunshine, I: Guidelines for Analytical Toxicology Programme, Vol-I, CRC press, 1950.
12. Sunshine, I: Handbook of Analytical Toxicology, press, 1969.
13. Mule, S. J. et al. : Immunoassays for Drugs subjects to ab, CRC Press, 1974
14. Connors, K.: A text book of Pharmaceuticals analysis, Interscince, New York, 1975

FSMS SIII SP-I P3: MODERN AND APPLIED ANALYTICAL FORENSIC CHEMISTRY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn advanced aspects of forensic drug chemistry.
2. To help students learn the concepts of petro forensics and international guidelines about fire forensics.
3. To study and understand various chromatographic and spectroscopic techniques.

UNIT-I Teaching Hours: 15 Hours

Advanced Forensic Drug Chemistry: Drug Trafficking, Forensic examination of drugs/Narcotics - Cannabis, Phenethylamines (Amphetamine, Methamphetamine), Hydroxyl derivative (Ephedrine), Ketone Derivative (Cathinone), Methoxy Derivative (Mescaline), Tertiary Amines (Cocaine and Opiates), Tryptamines(Psilocin and Psilocybin), Anabolic Steroids, Miscellaneous Controlled Substances(Barbiturates, Benzodiazepines, GHB, Ketamine and LSD).

UNIT-II Teaching Hours: 15 Hours

Presumptive/Screening and Confirmatory Methods: Colour/spot test,microscopic examination, Microcrystalline tests, Thin-Layer Chromatography, Sample Preparation before TLC Specimen, Extraction Evaluation of TLC for Drug Screening, Immunoassay Methods other instrumental techniques (HPLC, GC, GC-MS) involved in analysis. Determination of origin of narcotic drug by IRMS , Elemental Profiling by ICP-MS-MS Format of NDPS Report Writing & CourtRoom Testimony. Case studies.

UNIT-III **Teaching Hours: 15 Hours**

Petro Forensics: Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Physical Properties of Petroleum Products Analytical Techniques: Quantitative and Qualitative Steps in Analysis of Petroleum, Analysis of traces of petroleum products in forensic exhibits. Case studies.

Fire Chemistry: Scientific Investigation of Fire, NFPA 921 and NFPA 1033, Separation and analytical techniques of ignitable liquid residues, Interpretation of Data Obtained from Fire Debris, Quality Assurance in Fire debris Analysis, Report Writing and Court Testimony.Case studies.

UNIT-IV **Teaching Hours: 15 Hours**

Explosives Chemistry: Introduction and assessment of explosives, Oxygen balance, Explosive Power Index, Heat and Temperature of Explosion, Pressure of explosion, Mechanism of Ignition and hot spot formation. Thermal decomposition, physical and chemical aspects of combustion, Deflagration and Detonation, Analysis of low and high explosives by different instrumental techniques, Quality control, Proficiency Testing, Interpretation and Significance of Results. Case studies

Chemical Warfare Agents: Classification, physical and biochemical properties, toxic effects detection by Biosensors and various instrumental techniques

Reference Books:

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.
8. Klaassen, C. D.:Casarett and Doull's Toxicology: The Basic Science of Poisons, 5th ed,McGraw-Hill, 1995.

9. Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons inPharmaceuticals, body fluids and post-mortem material, 3rd ed., Pharmaceutical Press2004.
10. Bogusz, M. J., Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed.,Elsevier Science, 2000.
11. Siegel, J.A., Saukko, P. J., Knupfer, G.: Encyclopaedia of Forensic Sciences (Vol. 3),Academic Press, 2000.
12. Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt/ChurchillLivingstone, 2000.
13. Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed., NiraliPrakashan, 1990.
14. Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2nd ed.,1999.
15. Wiseman, H and Henry J.: Management Of Poisoning, A Handbook for Healthcare workers,1st ed., A.I.T.B.S, 2002.
16. Hardman, J. G. and Limbird, L. E.: Goodman and Gilman's The Pharmacological basis ofTherapeutics, 9th edn., McGraw-Hill, 1996.
17. Laboratory procedure Manual, Forensic Toxicology: DFS, 2005.
18. Sunshine, I; Methods for Analytical Toxicology, CRC Press USA (1975).
19. Cravey, R.H; Baselt, R.C.: Introduction to Forensic Toxicology, Biochemical Publications,Davis, C.A. (1981).
20. Stolmen, A.; Progress in Chemical Toxicology: Academic Press, New York (1963).
21. Modi, Jaisingh, P.; Textbook of Medical Jurisprudence& Toxicology, M.M. TripathiPublication (2001).
22. Eckert; An Introduction to Forensic Science, CRC Press.
23. Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001.
24. Curry, A. S: Poison Detection in Human Organ.
25. James, S. H. and Nordby, J. J.: Forensic Science: An Introduction to Scientific andInvestigative Techniques, 2003.
26. Saferstein, R: Criminalistics - An Introduction to Forensic Science, Prentice Hall, 1995.
27. Sarkar, S: Fuels and Combustion, Orient Longman, 1990.
28. Verma, R. M: Analytical Chemistry – Theory and Practice, CBS Pub., 1994.

29. Svehla, G. Ed.: Vogel's Qualitative Inorganic Analysis, Longman, 1998.
30. Bassett: Vogel's Text Book of Quantitative Inorganic Analysis, Longman, 1978.
31. Vogel, A. I: Text Book of Practical Organic Chemistry including Qualitative OrganicAnalysis, ELBS, 1971.
32. Skoog, D. A., West, D. M. and Holler, F. J: Analytical Chemistry: An Introduction,Saunders College, 1994.
33. Siegel, J. A, Saukko, P. J. and Knupfer, G. C: Encyclopaedia of Forensic Sciences, AcademicPress, 2000.
34. Townsends, A. (Ed): Encyclopaedia of Analytical Science, Academic Press, 2005.
35. Beveridge, A: Forensic Investigation of Explosives, Taylor & Francis, 2000.
36. Yallop, H. J: Explosion Investigation, Forensic Science Society & Scottish Academic Press,1980.
37. Narayanan, T. V: Modern Techniques of Bomb Detection and Disposal, R. A. SecuritySystem, 1995.
38. Yinon, J. and Zitrin, S: The Analysis of Explosives, Oxford: Pergamon, 1981.
39. An Introduction to Physics and chemistry of Petroleum.
40. Kinghorn: Introduction to Petrochemicals Sukumar Maiti.
41. D.W.Waples: Geochemistry in Petroleum Exploration.
42. A.L.Waddams: Petroleum Geochemistry and Geology Chemicals from Petroleum.
43. Day&Underwood:Analytical Chemistry.

FSMS SIII SP-I LC: LABORATORY COURSE

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
0	0	6	6	12	-	-	50	03:00	-	-	100	06:00	150

P1: Pharmacology and Pharmaceutical Drug Analysis

1. Preparation of standard and working solutions.
2. Plotting of calibration curve and quantification using UV-VisSpectroscopy
3. LLE & DLLME based extraction of drugs
4. FTIR based detection of various drug classes
5. Analysis of drugs and metabolites by LC-MS
6. Determining Limit of Detection & Limit of Quantitation of drug by UV-VIS
7. Multicomponent Quantitative estimation of drug by UV-VIS
8. Detection of anabolic agents in supplements by GCMS
9. Concept & Parts identification of GC, GCMS, HPLC

P2: Concepts of Toxicology

1. Extraction and identification of organochlorine pesticides from biological matrices by TLC and GC-MS
2. Extraction and identification of organophosphorous pesticides from biological matrices by TLC and GC-MS
3. Extraction and identification of carbamates and pyretheroids from biological matrices by TLC and GC-MS
4. Identification of common plant poisons Oleander, Dhatura, Calotropis and Ricin etc by various analytical methods
5. Extraction of heavy metals by conventional methods and analysis by color tests.
6. Extraction and Analysis of heavy metals by microwave extraction and ICP-MS.

7. Analysis of alcohol and derivatives by head-space gas chromatography (HS-GC).
8. Analysis of non-volatile poisons by HPLC
9. Identification of non-volatile poisons by UV and TLC
10. Calculation of uncertainty measurement in blood alcohol by GC

P3: Modern and Applied Analytical Forensic Chemistry

1. Microcrystalline tests for Narcotic drugs.
2. Separation of Psychotropic substance by TLC.
3. Separation of Cannabis TLC, UV, FTIR
4. Separation of Opium by TLC, UV, FTIR
5. Analysis of high explosives by TLC, UV, FTIR
6. Qualitative Analysis of fire residues by GC-HS and GC-MS.
7. Analysis of NDPS drugs and explosives by instrumental techniques.
8. Detection of drug classes by imaging system like Raman
9. Detection of Low explosives by Ion Chromatrography
10. Organic composition profiling of drug class by CHNS/O

Specialization – II (Forensic Biotechnology)

FSMS SIII SP-II P1: FORENSIC GENOMICS AND BIOCOMPUTING

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
Th	Tu	Pr	C	TCH	Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students get acquainted with the latest modalities in Forensic Genomics.
2. To help students learn the basics of STR profiling.
3. To study the application of population and conservation genetics in relation to forensic investigation.

UNIT-I **Teaching Hours: 15 Hours**

Advanced topics in STR Profiling: STR Profiling, Types of errors, Result interpretation and Report Writing, DNA Mixtures – Current status of tools and guidelines, Paternity/maternity indices, sibship indices, Advanced Y-STR and X-STR analysis and its significance in establishing paternal relationships. Non-human DNA analysis, Mitochondrial DNA analysis for human

UNIT-II **Teaching Hours: 15 Hours**

Forensic Genomics: Identity, Phenotypic and ancestry informative markers**,** Quality assurance and quality control in DNA forensics**,** Molecular autopsy and tissue identification by DNA and RNA**,** Post mortem redistribution**,** Various guidelines for DNA forensics work flow

UNIT-III **Teaching Hours: 15 Hours**

Basics of Biocomputing: Biological Data: The form of biological information, Databases – Format and Annotation: Conventions for database indexing and specification of search terms, common sequence file formats, annotated sequence databases - primary sequence databases, organism specific databases, Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, Submission of (new and revised) data, data submission tools, Sequence Similarity Searches: Local v/s global, Distance metrics. FASTA, BLAST and other variants of BLAST, Multiple Sequence Alignment and Whole genome analysis

UNIT-IV **Teaching Hours: 15 Hours**

Biocomputing in Forensic investigation: Genealogy and its applications in forensic genetics, Database management tools in DNA Forensics: CODIS and DNAxs, Other Databases and Online-Tools: NCBI, STRBase, STRidER, PhyloTreemt, SNPforID Browser, popSTR browser, ALFRED, scientific literature

Reference Books:

1. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528
2. Advanced Topics in Forensic DNA Typing: Methodology (2011, 2014), John M. Butler, Academic Press, ISBN: 978-0123745132
3. Forensic DNA Profiling - A Practical Guide to Assigning Likelihood Ratios, 1st ed. (2020) - Jo-Anne Bright and Michael D. Coble, CRC Press, ISBN: 9780367029029
4. Forensic Practitioner's Guide to The Interpretation of Complex DNA Profiles, 1st ed. (2020) - Peter Gill et. al., Academic Press, ISBN: 978-0-12-820562-4
5. An Introduction to Forensic Genetics, 2ndEdition (2010) - William Goodwin, Adrian Linacre and Sibte Hadi, Wiley-Blackwell, ISBN: 978-0470710197
6. Forensic Genetics in the Governance of Crime, 1st ed. (2019) - Helena Machado and Rafaela Granja, Palgrave Macmillan, ISBN 978-981-15-2429-5
7. High-Throughput Next Generation Sequencing – Methods and applications, 1st ed. (2011), Young Min Kwon and Steven C. Ricke, Humana Press, ISBN: 9781617790881
8. Next Generation DNA Led Technologies, 1st ed. (2016), Sharada Avadhanam et. al., Springer, ISBN: 978-981-287-669-0
9. Next Generation Sequencing – Methods and Protocols, 1st ed. (2018) - Steven R. Head et. al., Humana Press, ISBN: 978-1-4939-7514-3
10. Introduction to Genomics, 1st ed. (2020) - Akalin, Chapman and Hall/CRC, ISBN: 9780429084317-1.
11. Handbook of Statistical Genomics, 1st ed. (2019) - D.J. Balding, I. Moltke and J. Marioni, Wiley, ISBN: 9781119487845.
12. Genomes:4, 4th ed. (2017) - T.A. Brown, Garland Science, ISBN: 9780815345084
13. Bioinformatics for dummies®, J.-M. Claverie, C. Notredame n.d.

14. S. Dua, P. Chowriappa, Introduction to Bioinformatics, in: Data Min. Bioinforma., CRC Press, 2012: pp. 3–40. https://doi.org/10.1201/b13091-1.
15. W.D.R. Hodgman T. Charlie, French Andrew, Bio Instant Notes Bioinformatics, 2010.
16. W. Miller, An Introduction to Bioinformatics Algorithms, J. Am. Stat. Assoc. 101 (2006) 855–855. https://doi.org/10.1198/jasa.2006.s110.
17. P. Romero, Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, 2004. https://doi.org/10.1093/bib/5.4.393-a.
18. F.H. Stephenson, Calculations for Molecular Biology and Biotechnology, Elsevier, 2003. https://doi.org/10.1016/B978-0-12-665751-7.X5041-0.
19. T. Warnow, Bioinformatics and Phylogenetics: Seminal Contributions of Bernard Moret, 2019. https://doi.org/10.1007/978-3-030-10837-3.
20. Supratim Choudhuri, Michael Kotewicz, Bioinformatics for beginners: genes, genomes, molecular evolution, databases and analytical tools, 2014, 1st ed., Academic Press, ISBN 13:9780124104716

FSMS SIII SP-II P2: MOLECULAR BIOLOGY AND R-DNA TECHNOLOGY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn the basics of molecular biology and r-DNA Technology
2. To help students get acquainted with basic molecular biology techniques and rDNA Technology
3. To study the application of molecular biology and r-DNA Technology in relation to forensic investigation

UNIT-I Teaching Hours: 15 Hours

Central Dogma: Organization of genome in prokaryotes and eukaryotes, Chemical structure of DNA and RNA, DNA replication: Enzymes and accessory proteins, Mechanism of DNA replication in prokaryotes and eukaryotes. Transcription: RNA polymerases, features of prokaryotic and eukaryotic transcription, transport of RNA within eukaryotic cells. Translation: Structure and role of t-RNA in protein synthesis, ribosome structure, genetic code and their properties; translation (initiation, elongation and termination and post translational modifications).

UNIT-II Teaching Hours: 15 Hours

Population and Conservation Genetics : Basic Concepts in Population Genetics**,** Hardy-Weinberg Principle and Linkage disequilibrium**,** Causes of evolution- admixture, selection, mutation, drift**.** Genetic Diversity and variations; Haplotype analysis**,** Various tools for phylogenetic analysis

UNIT-III **Teaching Hours: 15 Hours**

Molecular Biology Techniques : Sanger Sequencing**,** Next Generation Sequencing techniques, DNA modifying enzymes, genomic and cDNA libraries,, Biosafety guidelines and containment strategies.

UNIT-IV **Teaching Hours: 15 Hours**

rDNA Technology: General introduction and concept of recombinant DNA technology.Vectors: Types of vectors and choice of vectors- Plasmids, cosmids, Lambda phagevectors, shuttle vectors, BACs and YACs**,** Choice of hosts,Expression systems in Eukaryotic cells, Yeast, Bacteria, Insect cell lines, Genescreening; methods for transferring recombinant DNA to host cells(transformation and transfection)

Reference Books:

1. Laboratory Procedure Manual - Forensic Serology (2005), Directorate of Forensic Science, MHA, New Delhi.
2. Laboratory Procedure Manual – DNA Profiling (2005), Directorate of Forensic Science, MHA, New Delhi.
3. Molecular Biology of the Cell, 6th Edition (2014) – Bruce Alberts, et al., Garland Science, ISBN: 978-0815341055
4. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR
5. Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528
6. Forensic Science: An Introduction to Scientific and Investigative Techniques – Stuart
7. H. James, Jon J. Nord by, CRC Press, ISBN:0849327474
8. Genes XI (2012) – Benjamin Lewin, Jones & Bartlett Learning, ISBN: 978-1449659851
9. A Primer of Conservation Genetics. 2004. Richard Frankham, Jonathan D. Ballou, David A. Briscoe. Cambridge University Press. http://www.cambridge.org/9780521831109
10. An Introduction to Population Genetics Theory and Applications. Rasmus Nielsen, Montgomery Slatkin. Publisher: Sinauer Associates, Year of Publication-2013.
11. Population Genomics :Concepts, Approaches and Applications. Edited by Om P. Rajora. Publisher : Springer International Publishing. DOI: 10.1007/978-3-030-04589-0. Year of Publication : 2019.

12. Conservation and the genetics of populations / Fred W. Allendorf, Gordon Luikart, Sally N. Aitken; with illustrations by Agostinho Antunes. – 2nd ed. ISBN 978-0-470-67146-7. Year of Publication : 2013. Publisher: John Wiley & Sons, Ltd

13. Population genetics by Matthew B. Hamilton. 2009. ISBN 978-1-4051-3277-0. Publisher: John Wiley & Sons, Ltd

14. Advanced Topics in Forensic DNA Typing: Interpretation (2014), John M. Butler, Academic Press, ISBN: 9780124052130

FSMS SIII SP-II P3: IMMUNOLOGICAL TECHNIQUES AND FORENSIC PROTEOMICS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To help students learn the basics concept of immunology
2. To help students get acquainted with basic immunological techniques
3. To help students in developing the understanding of various strategies of proteomics

UNIT-I Teaching Hours: 15 Hours

Overview of immunology: Phylogeny of immune system, Innate and acquired immunity, clonal nature of immune response**,** Cells and Organs of the immune system: Hematopoiesis and differentiation, B – Lymphocytes, T- Lymphocytes, Macrophages, Dendritic cells, Natural Killer cells, Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells**,** Organization and structure of lymphoid organs; Structure and properties of Antigen and Antibodies; Types of Antibodies.

UNIT-II Teaching Hours: 15 Hours

Hypersensitivity and auto-immune diseases: Hypersensitivity and its types (Type I,II,III and IV); mechanism and molecular events in mast cell degranulation by IgE, Pharmacologically active mediators of Type I reactions, mechanisms behind type II, III and IV hypersensitivity reactions

Auto-immune diseases: Organ specific and systemic auto-immune disorders, different examples of auto-immune disorders

UNIT-III **Teaching Hours: 15 Hours**

Immunological techniques: Antigen-Antibodies Interaction; Different techniques to study antigen- antibody interactions: Immunodiffusion, Radioimmunoassay, Immunoelectrophoresis, ELISA, Immunohistochemistry, Flow cytometry, development of dot blot, development of monoclonal antibodies and polyclonal antibodies, hybridoma technology

Vaccines: Overview of Vaccine Development, Concept of vaccines, types of vaccine, whole organism vaccines, recombinant vaccines, DNA vaccines, synthetic peptides and multivalent sub-unit vaccines, different strategies of vaccine development.

UNIT-IV **Teaching Hours: 15 Hours**

Techniques in Proteomics

Extraction of protein from various body fluids, Biochemical changes in body fluids and proteins, Native PAGE, SDS-PAGE, Circular Dichroism, Iso electric focusing, Western Blotting, Mass Spectroscopy.Protein sequencing by mass spectrometry, Protein sequencing; Strategies for protein identification; Protein chips and functional proteomics; Protein-protein interaction; Protein-ligand interaction, Clinical and biomedical application of proteomics; Proteome database; Protein biomarkers and their application in forensic investigation. Applications of forensic proteomics using human samples like blood, hair, bone, saliva, fingerprint, and urine. Case studies in Forensic Proteomics

Reference Books:

1. J. Owen, J. Punt, S. Stranford, (2012) Kuby Immunology (8th Edition), WH Freeman and Company, USA.
2. D. Male, J. Brostoff, D. Roth, I. Roitt, (2012) Immunology (8th Edition), Saunders, Elsevier, USA.
3. K. Murphy (2011) Janeway's Immunobiology (8th Edition), Garland Science, USA.
4. A. Abbas, A. Lichtman, S. Pillai, (2014) Cellular and Molecular Immunology (8th Edition), Saunders, Elsevier, USA

FSMS SIII SP-II LC: LABORATORY COURSE

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
0	0	6	6	12	-	-	50	03:00	-	-	100	06:00	150

P1: Forensic Genomics and Biocomputing

1. Different mathematical calculations for data analysis using Microsoft Excel.
2. DNA extraction from various forensic samples
3. Polymerase chain reaction
4. STR Profiling and report writing using simulated evidences
5. Sequence comparison using BLAST
6. Construction of a Phylogenetic tree from nucleotide and protein sequences

P2: Molecular Biology and r-DNA Technology

1. Isolation of Plasmid from bacteria
2. Restriction digestion of DNA
3. Agarose gel electrophoresis
4. Preparation of the competent cells for transformation
5. Selection of the transformed cells

P3: Immunological Techniques and Forensic Proteomics

1. Extraction of proteins from various biological samples.
2. Protein estimation by different techniques.
3. SDS-PAGE for protein analysis
4. Immunodiffusion

5. ELISA
6. Western Blotting
7. Development of dot blot
8. Analysis of protein structure using RASMOL

Specialization – III (Forensic Physics and Ballistics)

FSMS SIII SP-III P1: ADVANCES IN PHYSICAL TECHNIQUES

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. The importance of spectroscopy and thermal techniques in processing crime scene evidence.
2. The utility of nanoscience technology in identifying chemical and biological evidences.
3. The significance of microscopy in visualizing trace evidence and comparing it with control samples.
4. The usefulness of lasers and its Application in forensic investigation.

UNIT-I Teaching Hours: 15 Hours

Nuclear Process: General introduction of radioactivity, fission, fusion, Type of radioactive decays, basic concepts of half-life including dating concepts, effects of radiation on biological substances. Introduction to principles, working and instrumentation and application for analysis of physical evidences: Nuclear Magnetic Resonance Spectroscopy (NMR), Theory of NMR, NMR spectrophotometers, data interpretation and applications

Atomic Process: General introduction of electromagnetic spectrum, atomic and nuclear structure, band gap, energy levels, photoluminescence, absorption, transmission. Introduction to principles, working and instrumentation and application for analysis of physical evidence: Atomic Absorption Spectroscopy, Energy dispersive x-rays, Raman spectroscopy along with their data interpretation and applications.

Lasers: Characteristics of laser light, Spontaneous emission, Stimulated emission, Stimulated absorption, Population inversion and light amplification, Application in forensic investigation

UNIT – II **Teaching Hours: 15 Hours**

Molecular Process: General introduction of molecular vibration, bond length Valence electrons, ionic bond, covalent bond, bond parameters, polar character of covalent bond, s, p and d orbitals and shapes of some simple molecules, Hydrogen bond.

Introduction to principles, working and instrumentation and application for analysis of physical evidences: FT-IR spectroscopy, FT-IR: transmission mode along with their data interpretation and applications.

Thermal Analysis: Principle theory and applications of Thermo gravimetric analysis, differential thermal analysis and differential scanning calorimetry.

Nanoscience: Basics of nanoscience, synthesis process, effects of shape, size on chemical and physical properties, introduction of forensic Nanotechnology, Utilization of nanotechnology in analysis of physical evidences, and their applications.

UNIT – III **Teaching Hours: 15 Hours**

Crystal Analysis: X-rays: Production; continuous and characteristic X-rays and their spectra; principle of diffraction analysis, data interpretation and application.

Introduction to Microscopy: Introduction to principles, working and application: Optical microscope: Compound microscope, stereo microscope, comparison microscope, phase contrast microscope, fluorescence microscope. Electron microscope: Introduction to principles, working, sample preparation, data interpretation and application: Scanning electron microscope, transmission electron microscope. Probe microscope: Introduction to principles, working, sample preparation, data interpretation and application: Atomic force microscope, Scanning Tunneling Microscope.

UNIT – IV **Teaching Hours: 15 Hours**

Introduction to Forensic Engineering and Various Types of Failures

Introduction to forensic engineering, ISI/Code of Building Construction, Structural failures: Structural Failures basics of failures analysis in case of bridge/flyover, structural material composition analysis leading to failures, testing of prototype for commercialization, an investigation view of multi components failures due to any one module manufacturing defects, etc., static loads, dynamic loads, causes of structural collapse, Reporting the results of Forensic Engineering Investigation, Role of the Legal System

Cement: Types of cement and their composition, determination of adulterants by physical, chemical and instrumental methods, examination of brick, analysis of Bitumen & road

materials, analysis of cement mortar and cement concrete & stones, forensic examination of electrical appliances installations.

Legal aspects of failures detection and sampling collection after an incident – Channelization of legal procedures for arriving at investigation, some novel concept of modern technology for forensic analysis

Reference Books:

1. B. Caddy; Forensic Examination of Glass and Paints Analysis and Interpretation ISBN 0784 05749 (2001)
2. David A. Crown; The Forensic Examination of Paints and Pigments, Taylor & Francis, NY (2001)
3. J.Walls; Forensic Science-An Introduction to Scientific Crime Detection 2nd Ed.,Universal, 1st Indian Reprint(2002).
4. Richard Saferstein; Criminalistics-An Introduction to Forensic Science 5th Ed., Prentice Hall(1995).
5. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Kooupfer; Encyclopedia of Forensic Science, Academic Press(2000).
6. E.R.Mengel; Forensic Physics in 2002 year book, McGraw hill Encyclopedia of Science & Technology.
7. R.W. Moncrieff; Man-Made Fibres 6th Ed.,NewnesButterworths(1975)
8. J.E.Booth; Principles of Textile Testing-An Introduction to Physical Methods of testing textile Fibres, Yarns and Fabrics. 3rd Ed., CBS Pub. &Distributors(1996).
9. Katharine Paddock Hess; Textile Fibres and their use, 6thEd.,Oxford& IBH Pub.,Co. (1974)
10. A.B. Wildman; The Microscopy of Animal Textile Fibers. Wool Industries Research Association(1954).
11. Elliot B. Grover and D.S. Hamby; Handbook of Textile testing and Quality Control, Wiley Eastern Pvt. Ltd.(1969)
12. Dorothy Catling and John Grayson; Identification of vegetable Fibers, Chapman and Hall (1982)

13. John H.Skinkle; Textile Testing- Physical, Chemical and Microscopial, 2nd Ed.,Revised and Enlarged, D.B. Taraporevala Sons and Co. (1972).
14. J. Gordon Cook; Handbook of Textile Fibers, Vol-I, Natural Fibres,5th Ed., Merrow(1993)
15. B.P. Saville; Physical Testing of Textiles, The Textile Institute CRC Press and wood head Pub., (2000)
16. AATCC Technical Manual of American Association of Textile Chemists and Colorists, Vol-75 (2000), American Association of Textile Chemists and Colorists,USA
17. W.E. Morton and J.W. S. Hearle; Physical Properties of Textile Fibers, 3rd Ed., The textile Institute, 1993 (Re printed1997)

FSMS SIII SP-III P2: ADVANCES IN FORENSIC BALLISTICS & ARMOUR MATERIALS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. The classification of firearms and their identification firearms.
2. The importance of firearm evidence.
3. The significance of Armour structure and their fabrications
4. The utility of IBIS and BDAS in firearm evidence investigations

UNIT – I Teaching Hours: 15 Hours

Examination of Firearm exhibits: Review of firearms & its types, ammunitions & its types along with examination. Recent Development in Firearms.

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 – II Teaching Hours: 15 Hours

Wound Ballistics: Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, penetrative in gel block and other targets, nature of wounds with various ranges and velocities with various types of projectiles, evaluation of injuries caused due to shot-gun, rifle, handguns and country made firearms and its ante-mortem & post-mortem examination, determination of range of fire.

Core concepts of Forensic Ballistics: Effects of Internal ballistics,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, Influence of range, Cavitations- Temporary and permanent cavities, Ricochet and its effects, stopping power.

UNIT – III **Teaching Hours: 15 Hours**

Armour Structure: Basis concepts of armour structure, types of armour, materials: Stress and Strain, Elasticity, Strength, Hardness and dynamic, Penetration Mechanics, Reactive Armour Systems, Human Vulnerability.

Types of armour: Metallic Armour Materials and Structures, Ceramic Armour, Woven Fabrics and Composite Laminates for Armour Applications, Blast and Ballistic Testing Techniques.

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

Introduction to Ballistic Resistance of Body Armor NIJ Standard: NIJ Body Armor Classification, Sample Requirements and Laboratory Configuration, Flexible Armor Conditioning Protocol, Hard Armor Conditioning Protocol, Ballistic Test Methods.

UNIT– IV **Teaching Hours: 15 Hours**

Instrumental techniques used for ballistic evidence analysis: Borescope, Comparison Microscope, Stereo microscope, traveling microscope, 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 **(Integrated Ballistics Identification system)**: History of establishment, Brass Trax, Bullet Trax & Match Point, Limitation & Advantages, Application- comparison of bullets and cartridges- database creation and significance in forensic ballistic investigations. Management and reconstruction of cases involving firearm; Report writing and court findings

Reference Books

1. J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1,2,& 3; Springfield, Illinois;

2. Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, PA
3. Vincent Di Maio, Gunshot Wounds; Crc Press, Washington,Dc;
4. Brain J. Heard;, Hand Book Of Firearms And Ballistics; John Willey,England;
5. TA, Warlow; Firearms, The Law And Forensic Ballistics; Taylor And Francis,Landon;
6. Karl G. Sellier et al ; Wound Ballistics And The Scientific Background; Elsevier,London
7. M. Johari, Identification Of Firearms, Ammunition And Firearms Injuries; BPR&D, New Delhi;

FSMS SIII SP-III P3: AUDIO RECOGNITION AND VIDEO ANALYSIS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. Give a detailed insight about audio, video and image forensics
2. To make students understand about how multimedia evidences are collection and analyzed for forensic investigation
3. To learn about the legal admissibility of multimedia evidences

UNIT-I Teaching Hours: 15 Hours

Introduction to voice identification/speaker recognition and its forensic importance, History of voice analysis, Voice production theory, uniqueness in person's voice, interspeaker and intraspeaker variations, text-dependent and text-independent speaker recognition, Discriminating tests: closed test, Open test, collection of standards for comparison

Handling of audio recording evidences & its physical examination, marking of speakers, Procedure for preparation of working copies

UNIT-II Teaching Hours: 15 Hours

Speaker profiling: Segregation of Speech samples, auditory analysis/listener's approach, spectrographic approach or voiceprint analysis, automatic speaker recognition technique.

Enhancement and normalization techniques, establishing the authenticity and integrity of audio recordings, Speech signal processing, Fourier analysis, frequency & time domain representation of speech signal, analogue to digital conversion, Principle and working if various instruments: hardware, software used for audio analysis, report writing, related case studies, admissibility of audio evidences in court proceedings

UNIT-III **Teaching Hours: 15 Hours**

Forensic video examination: definition, scope and significance in crime investigation, technical aspects of the video, collection, handling and preservation of video files, video analysis: frame extraction, frame by frame analysis, shot by shot analysis. Video processing and enhancement, Video authentication, Metadata analysis, hash value generation. Biometric Analysis for personal identification, facial biometrics, related case studies.

UNIT-IV **Teaching Hours: 15 Hours**

CCTV Forensics: introduction to CCTV Forensics, Acquisition of CCTV footages from the scene of crime, Handling and preservation of CCTV footages, hash value generation, extracting the data from DVR/NVR, maintaining chain of custody. Authentication and enhancement of CCTV footages, extraction of frames, Forensic tools for Enhancement and authentication of CCTV footages, legal admissibility of CCTV evidence, related cases studies.

Reference books:

1. Hill, T. (2020). CCTV Handbook: Buying, Installing, Configuring, & Troubleshooting: A User's Guide to CCTV Security. Independently published.
2. Damjanovski, V. (2005). CCTV: Networking and Digital Technology (2nd ed.). Butterworth-Heinemann.
3. Kroener, I. (2014). CCTV: A Technology under the Radar? (1st ed.). Routledge.
4. G. (2020, March 18). Types of CCTV Cameras – The Complete Guide. BusinessWatch. https://www.businesswatchgroup.co.uk/types-of-cctv-cameras-the-complete-guide
5. Paul, D., & Puvvala, C. (2020). Video Analytics Using Deep Learning. Apress.
6. Ph.D., P. P. M. (2021). The 2022 Report on Video Analytics, Intelligence, Surveillance, Reconnaissance and Object Recognition Technologies: World Market Segmentation by City. ICON Group International, Inc.
7. Carle, B., & Jensen, R. C. (2018). Understanding Video Management Systems.
8. Wolper, V. E. (2020). Photograph Restoration and Enhancement: Using Adobe Photoshop CC 2021 Version (3rd ed.). Mercury Learning & Information
9. Forensic Speaker Identification by Phil Rose & James RRobertson
10. Forensic Voice Identification by HarryHollien
11. The Acoustic Analysis of Speech by Ray D Kent & CharlesRead

FSMS SIII SP-III LC: LABORATORY COURSE

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
Th	Tu	Pr	C	TCH	Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
0	0	6	6	12	-	-	50	03:00	-	-	100	06:00	150

P1: Advances in Physical Techniques

1. Examinations of physical evidence by EDXRF technique
2. Examination and analysis of various physical evidences by Comparison and Stereomicroscope
3. Examination of physical evidences by AFM.
4. Examinations of physical evidence by SEM technique
5. Synthesis, characterization and Utilization of nanomaterials for various forensic applications (silver, gold, tungsten etc)
6. Examination of various physical evidences by Nanotechnology
7. Examination of various physical evidence by ICP technique
8. Examination of Structural materials.
9. Examination of cement
10. Examinations of physical evidence using FTIR and Raman Spectroscopy.

P2: Concepts of Conventional and Modern Ballistics

1. Instrumental Examination & Analysis of GSR
2. Barrel Wash Examination
3. Instrumental techniques used for identification of origin
4. Measurement of Rifling by traveling microscope
5. Test Firing System
6. Ballistic data Acquisition system
7. Integrated ballistics identification system.

8. Testing ballistic material in line with different standards.
9. Automated Ballistic Identification System
10. Reconstruction of Deformed bullets using different techniques.

P3: Audio Recognition and Video Analysis

1. Recording, editing, processing, and conversion of audio files.
2. Segregation of audio files.
3. Word collection from audio files.
4. Spectrographic analysis of Voice.
5. Detection of tampering in audio files.
6. Audio restoration and speech enhancement.
7. Analysis and enhancement of video/image/CTV Footages
8. Detection of tampering in video files.
9. Detection of tampering in image files.
10. Extraction of frame from video/CCTV footages.

Specialization – IV (Fingerprints & Questioned Documents)

FSMS SIII SP-IV P1: MODERN TRENDS IN FINGERPRINT SCIENCES

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To make the prospective students understand the basics of fingerprint sciences pertaining to identification.
2. To develop the students skill in fingerprint identification system irrespective of the space and place on which the fingerprint are present.
3. To develop the students with skill of using modern techniques in identification of individuals based of fingerprint sciences.

UNIT-I Teaching Hours: 15 Hours

Introduction and re capsulation to fingerprint science- Functions of Fingerprints bureau Fundamental principles of fingerprint science- Anatomy of skin, Biological significance of skin- Composition of sweat, secretary glands eccrine glands apocrine glands Sebaceous glands chemical composition- Age of donor- various age groups Composition of latent print residues **Chemical developmental methods**: Iodine fuming, cyanoacrylate esters acceleration procedures- Post treatment procedures Fluorescent and other chemical alternatives- Ninhydrin analogues. Silver nitrate reagent Special surfaces and situations : bloody prints, tape and sticky surfaces and skin Postmortem fingerprinting techniques

UNIT-II Teaching Hours: 15 Hours

Automated fingerprint Identification and imaging systems: Introduction, emerging application System architecture, sensing, finger print representation Minutiae feature extraction, orientation, estimation, segmentation, Ridge detection, finger print matching enhancement

Latent print enhancement by Laser and other alternate light sources: Using photo luminescent nanoparticles Basics of time gated fingerprint detection-Basics of phase resolved imaging Fingerprint treatments: lanthanide based procedures-Photo luminescent fluorescence and phosphorescence- Use of Nano particles: cadmium, Zinc, Silver salts

UNIT-III **Teaching Hours: 15 Hours**

Silver physical development of latent prints: Silver physical development process of latent prints Formation of silver physical developer particles and preparation Water and acid pretreatment Multi metal deposition process Colloidal gold solution , modified physical developer enhancement techniques Digital imaging methods, optic methods, X ray , SEM methods Chemical methods: bleaching , intensification

Introduction to Molecular fingerprinting- importance of the molecules detected from the fingerprint residues- factors influencing them- identification characteristics with the molecular concentration

UNIT-IV **Teaching Hours: 15 Hours**

Importance of Ridgeology and Poroscopy- for individual identification- Application of the pores dimensions and ridge dimensions in the identification- scope of establishing the identification – characteristics and traits

Application of Edgeoscopy- personal identification using fingerprints, Other biometric methods of identification iris scan, retinal scan. Cheiloscopy, palato prints, ear prints etc. in forensic and other sciences.

An introduction to UID aadhaar and its significance Scope of research on DNA from fingerprint residues

Reference Books:

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press (1999)
2. E. Roland Menzel; Fingerprint Detection with Lasers, 2nd Ed., Marcel Dekker, Inc. USA (1999)
3. James F. Cowger; Friction Ridge skin, CRC Press London, (1993)
4. Mehta, M.K; Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay (1980)

5. Moenssens; Finger Prints Techniques, Chitton Book Co. Philadelphia, NY (1975)
6. Chatterjee S.K.; Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata (1981)
7. Cowger, James F; Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY (1993)
8. Cook Nancy; Classifying Finger Prints, Innovative learning pub. Mento Park (1995)
9. Cossidy M.J; Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada (1980)
10. J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press (2000)
11. Smith B.C, Holland MM, Sweel DL & Dizinno. A; DNA & Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA (1995)
12. Hillison, S; Dental Anthropology, Cambridge Univ. Press, UK (1996)
13. Kasprzak J; Possibilities of Cheiloscopy in Forensic Science (1980)
14. Iannarelli, A V; Ear Identification, Forensic Identification series, Paramount (1989).
15. Henry C. Lee & R. E. Ganesslen; Advances in Finger Print Technology, CRC Press, London (1991).
16. Saxena, B.L.; Law and techniques relating to identification of handwriting, disputed documents, finger prints, foots and detection of forgeries, Central Law Agency, Allahabad (1990)
17. Hardless, H.R; Disputed documents examination and fingerprints Identification (with Illustrations, Sketches, Diagrams, Photos etc), Law Book Co. Allahabad (1995)
18. Menzel, E Roland; Fingerprint detection with lasers, Marcel Dekker, NY (1999)
19. Jain L C; Intelligent Biometric Techniques in Fingerprint and face recognition, CRC Press Ohio (1999)
20. Bridges B C; Criminal Investigation, Practical fingerprinting, Thumb Impressions, Hand writing expert testimony opinion Evidence, University Book Agency, Allahabd (2000)
21. Maltoni, Davide; Handbook of fingerprint recognition, Springer Verlag, NY (2003)
22. Ratha Nalini; Automatic Fingerprint recognition system, Springer Pub., NY (2004)

FSMS SIII SP-IV P2: QUESTIONED DOCUMENT & FORENSIC ACCOUNTING

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. Give a detailed insight about Forensic document examination
2. To make students understand basics of forensic accounting
3. To learn about the legal admissibility of document evidences

UNIT-I Teaching Hours: 15 Hours

Types of documents-genuine, contested, questioned and forged documents, Care and Handling of Document Exhibits, Forgeries & its types, detection of forgeries in handwriting, signatures and related case studies, Basics of handwriting identification, individuality of handwriting, natural variations, determination of authorship of writer, collection of exemplars, basic tools needed for forensic documents examination and their significance.

UNIT-II Teaching Hours: 15 Hours

Disguised writing and anonymous letters, Examination of alterations in documents, Decipherment of secret writing, Indented writings and charred writings. Examination of seal and other mechanical impressions, Built up documents, determination of sequence of strokes, physical matching of documents

Examination of Photostat (Xerox) copies, carbon copies, fax message, typewritings, printed matter: letterpress printing, intaglio printing, offset printing, screen printing & its related concepts, printing of security documents, examination of security features: Indian currency notes, passports/visa, credit/debit cards etc, Related Case Studies.

UNIT-III **Teaching Hours: 15 Hours**

Estimating the age of document and writings, types of computer printers and their working, Examination of Computer printouts, Forensic linguistics and stylistics, its importance in writer identification Examination of e-documents and digital signatures, Opinion- Reporting to the court juxtaposed charts - evidence in the court- cross examination, Related Case Studies

UNIT-IV **Teaching Hours: 15 Hours**

Introduction to Forensic accounting, fraud triangle and other theories of fraud, Fraudster profiling, Fraud deterrence, Money laundering and its types, Laws related to money laundering, understanding business information & financial reporting system accounting & auditing standards & procedures, evidence gathering & investigative techniques, litigation processes, Examination of financial documents. Whistleblowers and acts for their protection, Concepts of Red flags, related case studies

Reference Books:

1. Albert S. Osborn; Questioned Documents, Second Ed.; Universal Law Publishing, Delhi
2. Koppenhaver, K. (2010). Forensic Document Examination: Principles and Practice (1st Ed.).
3. Hilton, O. (1993). Scientific examination of questioned documents (1st ed.). Boca Raton:CRC Press.
4. Harrison, W. (1958). Suspect documents.
5. Kelly, J., & Lindblom, B. (2006). Scientific examination of questioned documents. Boca Raton, FL: CRC/Taylor & Francis.
6. Ellen, D. (2006). Scientific examination of documents. Boca Raton, FL: Taylor & Francis.
7. Huber, R., & Headrick, A. (1999). Handwriting identification (1st ed.). Boca Raton: CRC Press.
8. Zimbelman, M., Albrecht, C., Albrecht, W., & Albrecht, C. (2012). Forensic accounting. South-Western

FSMS SIII SP-IV P3: FORENSIC PHOTOGRAPHY & BIOMETRICS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. Establish understanding of optics, light and camera functions
2. Establish understanding and skills in camera operation, image composition and proper focus and exposure.
3. Establish understanding and skills in crime scene, vehicle, subject and evidence photography during investigative situations.
4. To understand the general principles and types of biometric systems.
5. To recognize personal privacy and security implications of biometrics based identification technology.
6. To understand the technologies of physiological and behavioral biometrics
7. To identify issues in the realistic evaluation of biometrics based systems.

UNIT-I Teaching Hours: 15 Hours

Introduction to Photography, History of photography & Cameras, Types of Camera and lenses, photographic instruments: light sources, optical filters, fundamentals of light and vision, Spectral sensitivity of photographic materials, Camera exposure determination. Basic principles and techniques of Black & White and color photography, Concepts of colored photography, Linkage of cameras and film negatives

UNIT-II Teaching Hours: 15 Hours

Modern developments in photography: digital photography, Image sensors, software for digital photography, Image File formats, photo shop-development- digital images processing and manipulation- forensic application. Crime scene photography, photomicrography, macro photography, Reprovit unit, photography of fingerprints and documents, IR and UV

photography, Introduction to photogrammetry and its applications in Forensic Science, crime scene videography / high speed videography, Court representation and admissibility of photographs in the judicial system.

UNIT-III **Teaching Hours: 15 Hours**

Introduction to Biometrics, Types of Biometrics, Biometric applications, Traits of Physiological Biometrics: Facial recognition, Hand geometry, Fingerprints, Iris scan & Retinal Scan, Thermogram.

UNIT-IV **Teaching Hours: 15 Hours**

Traits of Behavioural Biometrics: Gait Pattern, Keystroke Analysis, Signature Analysis, Voice pattern Analysis, Heartbeat Analysis, Recent Advances in Biometrics for Security Prospects. Biometric Data base management – Surveillance, Physical Security, management & maintenance, Biometric privacy, Biometric standards and application, Multimodal biometrics, performance testing and reporting.

Reference Books:

1. Henry Horenstein; "Black and White Photography: A Basic Manual", Little, Brown and Company., 2004
2. Henry Horenstein; "Color Photography: A Basic Manual", Little, Brown and Company., 1995
3. Ang Tom; "The Complete Photographer", Dorling Kindersley Ltd., 2010.
4. Gernsheim Helmut; "A concise history of Photography", 3rdEd., Dover Publications, 1986.
5. Freeman Michael; "The Complete Guide to Digital Photography", 4thEd., Lark Books, 1945.
6. Farrell Ian; "Complete Guide to Digital Photography", Quercus Publications, 2017.
7. Edge Martin; "The Underwater Photographer", Focal Press, 2010.
8. Bergner Joachim, E. Gelbke, W. Mehliss; "Practical Photomicrography", Focal Press, 1966.
9. White Laurie; "Advance Infrared Photography", Amherst Media, 1995.
10. Feininger Andreas; "The Complete Photographer", Prentice Hall, 1965
11. Champod, C. (2017). *Handbook of Biometrics for Forensic Science*. Springer International Publish.

12. Jain, A. K., & Ross, A. A. (2011). *Introduction to biometrics* (1st ed.). Springer.

13. Vacca, J. R. (2007). *Biometric Technologies and Verification Systems*. Elsevier - Butterworth Heinemann.

14. Fairhurst, M. (2014). *Age factors in biometric processing*. The institution of engineering and technology.

15. Boulgouris, N. V., Plataniotis, K. N., Micheli-Tzanakou, E., & Boulgouris, N. V. (2010). *Biometrics: Theory, methods, and applications*. IEEE Press.

16. Tsutsui, S. (2021). *Intelligent biometric techniques in fingerprint and face recognition*. Routledge.

17. Yang, J., & Xie, S. (2012). *New trends and developments in Biometrics*. InTech.

FSMS SIII SP-IV LC: LABORATORY COURSE

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
Th	Tu	Pr	C	TCH	Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
0	0	6	6	12	-	-	50	03:00	-	-	100	06:00	150

P1: Modern Trends in Fingerprint

1. Analysis of fingerprints with microscopic techniques for the ridge dimensions with the complete identification profiling.
2. Comparison of males and females fingerprints with the specific reference to the ridge dimensions.
3. Development of latent fingerprints using Physical Method.
4. Development of latent fingerprints using Iodine Fuming.
5. Development of latent fingerprints using Ninhydrin.
6. Development of latent fingerprints using Silver Nitrate.
7. Development of latent fingerprints using Nanoparticles.
8. Understanding AFIS method of fingerprints analysis.
9. Cheiloscopy
10. Importance of molecular fingerprints with special reference to fingerprint residues using instrumental methods.

P2: Questioned Documents & Forensic Accounting

1. Examination of additions, alterations, and obliterations in the documents.
2. Examination of indented handwriting.
3. Examination of sequence of intersecting strokes
4. Examination of currency notes
5. Examination of Passport
6. Examination of Stamps

7. Examination of Rubber Stamp Impressions
8. Examination of ink by TLC
9. Examination of ink by GCMS
10. Examination of ink by LCMS

P3: Forensic Photography & Biometrics

1. Identification of parts of Camera
2. Study the Depth of Field using photography
3. Evidences photography
4. Crime scene photography-long shot, medium and close ups
5. Photomicrography & Macro-photography
6. Hand Geometry
7. Facial Recognition System
8. Facial Geometry
9. Gait Pattern Analysis
10. To understand and correlate ridges of the palm as a biometric trait

Specialization – V (Cyber Forensics)

FSMS SIII SP-V P1: CYBER LAW, RISK AND COMPLIANCE

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To Learn Security Audit and Compliance
2. To Understand the Process of Security Audit
3. To Understand the industry standard practice for auditing
4. To Understand the Risk and Continuity Planning
5. To Understand the Legal Aspects

UNIT-I Teaching Hours: 15 Hours

What is IT security assessment? What is an IT security audit? What is compliance? How does an audit differ from an assessment? Why are governance and compliance important? What if an organization does not comply with compliance Laws? What is the scope of an IT Compliance audit?, Defining the scope for audit, Identifying critical requirements for audit, assessing IT security, Understanding Audit Plan, Audit Process, Types of IT Audits, Computer Assisted Audit Techniques, CAATs for Sampling, CAATs for Application Reviews, CAATs for Auditing Application Controls

UNIT-II Teaching Hours: 15 Hours

Identifying the minimum Acceptable Level of Risk and Appropriate Security Baseline Definitions, Seven Domains of a Typical IT infrastructure, Writing the IT Infrastructure Audit Report, Compliance within User Domain: Compliance law requirements and business drivers, Items commonly found in the user domain, Compliance within the workstation domain: Compliance law requirements and business drivers, devices and components commonly found

in the workstation domain, Maximizing C-I-A, Compliance within LAN Domain: Compliance law requirements and business drivers, devices and components commonly found in the LAN domain, Compliance within WAN Domain: Devices and Components Commonly Found in the Domain, Penetration Testing and Validating Configurations, Compliance within Remote Access and Application Domain: Devices and Components Commonly Found in the Domain, Application Server Vulnerability Management, Application Patch Management

UNIT-III **Teaching Hours: 15 Hours**

Introduction to Risk Analysis, Risk Identification, Risk Assessment, Risk Response and Mitigation, Risk Reporting, Introduction to Business Continuity Planning (BCP), Overview of BCP Life Cycle, Need for BCP, Identifying and Selecting Business Continuity Strategies

UNIT-IV **Teaching Hours: 15 Hours**

Introduction to Disaster Recovery (DR) planning, Identification of potential disaster status, DR Strategies, Plans for Business Resumption, Category to Cyber-crime, Cyber Law, IT Act 2000 and its amendments, International Cyber Laws, Cyber Ethics, Child Sexual Abuse Material related to cyber domain, various acts related to social media, privacy and security on cyber domain, Auditing Standards and Frameworks: ISO/IEC 27001/2, COBIT, SOC Compliance, HIPAA, Case Studies.

Reference Books: -

1. Auditing IT Infrastructures for Compliance By Martin M. Weiss, Michael G.Solomon, Jones & Bartlet Learning, 2015
2. The IT Regulatory and Standards Compliance Handbook by Craig S. Wright, Syngress, 2015
3. Information Technology Control and Audit 5th Edition by Angel R. Otero, 2019
4. (Internal Audit and IT Audit Series) The Complete Guide to Cyber Security Risks and Controls by Anne Kohnke, Dan Shoemaker, Ken Sigler, 2016
5. PCI DSS An Integrated Data Security Standard Guide- APress By Jim Seaman, 2020
6. AICPA - Guide_ SOC 2 Reporting on an Examination of Controls at a Service Organization Relevant to Security, Availability, Processing Integrity, Confidentiality, or Privacy-Wiley, 2018

7. Bob Hayes, Kathleen Kotwica, "Business Continuity 2nd Edition", Elsevier Pub.2013.
8. Governance, risk, and compliance by Microsoft, 2019
9. IT Act 2000 and 2008 bare acts documents
10. Cyber Law in India, Satish Chandra (2017)

FSMS SP-V P2: INCIDENT RESPONSE AND DIGITAL FORENSICS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To understand concept of Incident Response Management
2. To learn various Incident Response Management Techniques
3. To understand fundamental of Digital Forensics
4. To learn various Digital Forensics Techniques

UNIT-I Teaching Hours: 15 Hours

Cyber Incident Statistics, Computer Security Incident, Information Warfare, Key Concepts of Information Security, Types of Computer Security Incidents, Examples of Computer Security Incidents, How to Identify an Incident, Need for Incident Response, Goals and Purpose of Incident Response, Signs of an Incident, Incident Categories, Incident Prioritization, Use of Disaster Recovery Technologies, Impact of Virtualization on Incident Response and Handling, Estimating Cost of an Incident, Incident Reporting, Incident Reporting Organizations, Vulnerability Resources, Incident Management, Incident Response Team Roles, Incident Response Team Responsibilities, Dependencies

UNIT-II Teaching Hours: 15 Hours

Incident Handling Process, Real-time log capture and analysis, Botnet identification and counteraction, Enterprise Solutions for Incident Response and Recovery, Timeline Analysis, Malware Handling: Safety; Documentation; Distribution, Report Writing: Reporting Standards; Report Style and formatting; Report Content, Quality Assurance, When to perform a live response, selecting a live response tool, what to collect, collection best practices, live

data collection on Microsoft windows systems, Live data collection on Unix-based systems, understanding network monitoring, Types of network monitoring, setting up a network monitoring system, network data analysis, collect logs generated from network events, Analysis methodology: Define Objectives; Where the data is stored? Outline an approach; select methods; evaluate results, investigating applications: What is application data; where is application data stored; general investigation methods; web browsers; email clients; instant message clients, Analysis of application data

UNIT-III **Teaching Hours: 15 Hours**

Digital Forensics: Definition, Process, Locard's Principle of Exchange, Branches of Digital Forensics, Handling Digital Crime Scene, Important documents and Electronic Evidence, Introduction to Evidence Acquisition: Identification, Acquisition, Labelling and Packaging, Transportation, Chain-of-Custody, Importance of Document and Preservation, Acquisition Process; Write-Blockers, Imaging Techniques, Evidence Integrity, Standard Operating Procedures for Acquisitions and Preservation of Evidences, Introduction to Data Recovery and Carving: Importance of Data Recovery in Forensic Investigation, Carving Methods, Difference between Data Recovery and Carving,

UNIT-IV **Teaching Hours: 15 Hours**

File System Analysis: Understanding and Analysing FAT and NTFS File Systems, Recreating FAT and NTFS Partitions, Analysing Unallocated Partitions, Registry Analysis: Understanding Windows Registry, Analyzing Windows Registry, Finding Important Artefacts Related to user Activities, User/Application Configurations and Preferences; Attached Devices, Shared Locations, Recently Accessed Documents, Programs and Locations; Installed Applications and Others from Windows Registry, Event and Log Analysis: Introduction to Windows Events, Understanding Windows Events (Evt and Evtx Files). Analysing Logs of Third-Party Applications

Reference Books: -

1. Computer Incident Response and Forensics Team Management: Conducting a Successful Incident Response by Leighton Johnson
2. Incident Handling and Response: A Holistic approach for an efficient security incident management by Jithin Aby Alex

3. Blue Team Handbook: Incident Response Edition by Don Murdoch
4. The Computer Incident Response Planning Handbook: Executable Plans for Protecting Information at Risk by N. K. McCarthy
5. Critical Incident Management: A Complete Response Guide, Second Edition by John McNall, Thomas T. Gillespie, Vincent F. Faggiano
6. Applied Incident Response by Steve Anson
7. Security Operations Center – SIEM Use Cases and Cyber Threat Intelligence by Arun E Thomas
8. Incident Response & Computer Forensics by Jason T. Luttgens, Kevin Mandia and Matthew Pepe
9. Incident Management for Operations by Chris Hawley, Rob Schnepp and Ron Vidal
10. Digital Forensics and Incident Response: Incident Response Techniques and Procedures to Respond to Modern Cyber Threats, 2nd Edition by Gerard Johansen

FSMS SP-V P3: VULNERABILITY ASSESSMENT & PENETRATION TESTING

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
Th	Tu	Pr	C	TCH	Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To find the vulnerabilities and learn various vulnerability assessment techniques.
2. Learn various aspects of web application security.
3. Exploitation of potential web vulnerability.
4. Learn industry standard techniques to exploit advanced vulnerability.

UNIT-I **Teaching Hours: 15 Hours**

Introduction to Computer Network and Vulnerability Assessments: Introduction of OSI and TCP/IP model, layers and its functionality, Introduction to Vulnerability Assessment, Life cycle of Vulnerability Assessment, Vulnerability Scanners, Manual Testing, Vulnerability testing using OpenVAS, Netcat, Introduction to Unknown Vulnerability Assessment.

UNIT-II **Teaching Hours: 15 Hours**

Foot Printing and Scanning Foot printing: Mapping a Network: Why Map a (Remote) Network, Ping Sweeping: Fping, Nmap Ping Scan, OS Fingerprinting: Fingerprinting with Nmap Port Scanning : Under the Hood of a Port Scanner: TCP Three Way Handshake, Scanning with Nmap : Nmap Scan Types, TCP Connect Scan with Nmap , TCP SYN Scan with Nmap , Version Detection with Nmap , Specifying the Targets : By DNS Name , With an IP Addresses List , By Using CIDR Notation , By Using Wildcards , Specifying Ranges , Octets Lists , Combining the Previous Methods , Choosing the Ports to Scan , Nmap Examples, Port Scanning, Service Detection, Vulnerabilities Database Lookup

UNIT-III **Teaching Hours: 15 Hours**

Web Application Pen Testing: Brute-force, Dictionary-based Enumeration. Cross Site Scripting ,XSS Actors, Vulnerable Web Applications, Users, Attackers, Finding an XSS, Reflected XSS Attacks, Reflected XSS Filters, Persistent XSS Attacks, Persistent XSS Attack Examples, Cookie Stealing via XSS,DOM XSS SQL Injections: SQL Statements, SELECT Example, UNION Example, SQL Queries Inside Web Applications, Vulnerable Dynamic Queries, Finding SQL Injections, Example - Finding SQL Injections, From Detection to Exploitation, Boolean Based SQL Injections, Exploiting a Boolean Based SQL Injection, Scripting Boolean Based SQL Injections, UNION Based SQL Injections, Exploiting UNION SQL Injections, SQL Injection (Blind), SQL Map with all options.

UNIT-IV **Teaching Hours: 15 Hours**

Password Attacks - Brute Force Attacks: A Brute Force Algorithm, Brute Force Weaknesses, Dictionary Attacks, Performing a Dictionary Attack, Weaknesses of Dictionary Attacks, Mangling Words, John the Ripper, Unshadow, Brute Force with John the Ripper, Dictionary Attacks with John the Ripper, Installing Password Dictionaries, Rainbow Tables, Rainbow Tables Limitations, Ophcrack, **Burp Suite** : Intercepting Proxies, Intercepting Proxy Example, Proxy Server Example, Burp Proxy, Burp Proxy Configuration, Burp Repeater, Command Execution, Cross Site Request Forgery, File Inclusion, File Upload, Insecure Captcha.

Reference Books: -

1. Computer Networks, Fifth Edition, Andrew S. Tanenbaum, David J. Watherall, Prentice Hall.
2. Web Application Security, A Beginner's Guide by Bryan Sullivan, Vincent Liu, McGraw Hill Education Publication (2011).
3. Hands-On Bug Hunting for Penetration Testers A Practical Guide to Help Ethical Hackers Discover Web Application Security Flaws By Joseph Marshall, Packt Publication (2018).
4. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws by Dafydd Stuttard, Marcus Pinto, 2nd Edition, Wiley Publication (2007).
5. The Penetration Tester's Guide to Web Applications By Serge Borso, Artech House Publication (2019).
6. Web Application Security Exploitation and Countermeasures for Modern Web

Applications by By Andrew Hoffman,O'Reilly Media Publication (2020)

7. Developing Web Applications By Ralph Moseley, M.T. Savaliya, Wiley Publication.

FSMS SIII SP-V LC: LABORATORY COURSE

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
Th	Tu	Pr	C	TCH	Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
0	0	6	6	12	-	-	50	03:00	-	-	100	06:00	150

P1: Cyber Law, Risk and Compliance

1. To study about Sys-Internals.
2. To study about Windows Logs based on scenarios.
3. To study about filter logs based on scenarios.
4. To study and implement any SIEM (Security Information & Event Management) tool.
5. To study real-time visibility across an organization's information security systems using any SIEM tool.
6. To study Event log management that consolidates data from numerous sources using any SIEM tool.
7. To perform acquisition of any drive (HDD, SSD, USB) using FTKImager.
8. To perform primary level analysis using HxDEditor.
9. Manipulating Data by Using HxD.
10. To perform detailed analysis of Forensic Image using Forensic Toolkit.

P2: Incident Response and Digital Forensics

1. To perform Brute Force attack.
2. To perform SQL Injection attack on the Lab Environment.
3. To perform File Upload attacks on the Lab Environment.
4. To perform Social Engineering attacks using SET.
5. To study capturing network packets using Wireshark (Fundamentals).
6. To analyze the packets provided in the lab using wireshark.

7. Using Sysinternals tools for Network Tracking and Process Monitoring, monitor Hard disk and virtual memory.
8. Recovering and Inspecting deleted files using any tool.
9. To study and analyse web browsing history.
10. To study cache and cookies analysis.

P3: Vulnerability Assessment and Penetration Testing

1. TCP scanning using NMAP
2. Port scanning using NMAP
3. TCP / UDP connectivity using Netcat
4. How to install OpenVAS in Linux System ?
5. Network vulnerability using OpenVAS
6. How to install DVWA in Linux System / Windows ?
7. Web application testing using DVWA
8. Manual SQL injection using DVWA
9. XSS using DVWA
10. Automated SQL injection with SqlMap

Specialization – VI (Crime Scene Management)

FSMS SIII SP-VI P1: BASICS OF CRIME, EVIDENCE AND LAW

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. The importance of crime.
2. The causes of criminal behaviour.
3. The significance of evidence in crime.
4. The working of the forensic establishments in India and abroad.
5. The elements of criminal justice system

UNIT-I Teaching Hours: 15 Hours

Basis of Crime: Introduction to Crime, Essentials of a crime (Actusreus & Mens Rea), Causes and consequences of crime, Theories of Crimes. Crimes against Property and Person. Traditional Crimes, Modern Crimes, Cyber assisted Crimes. Terrorism and Insurgency, Crime and Politics. Media, Technology and Crime. Transnational Crimes. Basic Concepts of Victimology. Juvenile delinquency. Social change and crime.

UNIT-II Teaching Hours: 15 Hours

Crime & Criminal behaviour: Definition of Crime; Various types of crime: White Collar Crimes Economic Crimes, Organized crimes, Environmental Crimes, Cyber Crimes, Terrorism, Victimless Crimes, Hate Crimes, Honour Crimes; Criminal behaviour-cause and theories; Modus Operandi; Criminal profiling; Corpus Delicti.

UNIT-III **Teaching Hours: 15 Hours**

Law: Law, types of Law, Important Provisions of Code of Criminal Procedure- FIR, Complaint, Sec. 291, 292, 293, Framing of Charges, Bailable and Non-Bailable offence, cognizable and non-cognizable offence, summons, warrant, Investigation, inquiry and trial. Important Provisions of Indian Evidence Act, 1872- Section 32, 45, 46, 47, 57, 58, 60, 65, 65B, 73, 135, 136, 137, 159. Important Provisions of Indian Penal Code, 1860- Definitions, General Exceptions, Relevant provisions. IPC 302, 304, 306, 307, 309, 375, 376, 377, 498 and Cr PC 174. Medico Legal Aspects – PM report, Dying Declaration & Expert Testimony.

UNIT-IV **Teaching Hours: 15 Hours**

Evidence: Definition of Evidence, Classification of crime scene evidence – Physical and trace evidence, Collection, labelling, sealing of evidence, Hazardous evidence, Preservation of evidence, Chain of Custody, Sample Warden.

Organizations: Police Academies, National investigation agency, Police & Detective Training Schools, Government of Questioned Documents Examiners, Fingerprint Bureaus, National Crime Records Bureau, National Investigation Agency, Central Bureau Of Investigation,

Crime and Criminal Tracking Network & Systems, Research and Analysis Wing, INTERPOLE, Bureau of Police Research & Development, and other agencies involved in the criminal investigations, agencies referred for the additional information and requisite examinations

References and Suggested Readings:

1. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
2. D.E. Zulawski and D.E. Wicklander, Practical Aspects of Interview and Interrogation, CRC Press, Boca Raton (2002).
3. 3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
4. J.L. Jackson and E. Barkley, Offender Profiling: Theory, Research and Practice, Wiley, Chichester (1997).

5. R. Gupta, Sexual Harassment at Workplace, LexisNexis, Gurgaon (2014).
6. Criminology , Victimology and Penology by N.V. Paranjape, Central Law Publications 2014

FSMS SIII SP-VI P2: CONCEPTS OF CRIME SCENE MANAGEMENT

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs					
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. The importance of Crime Scene Management.
2. The significance of report writing in any investigation.
3. The usefulness of reconstruction in any criminal investigation.
4. Study of different medicolegal aspects in various criminal cases.

UNIT-I Teaching Hours: 15 Hours

Forensic Science: Definitions and concepts in forensic science. Scope of forensic science. Need of forensic science, Basic, Principles & Significance, History & Development of Forensic Science, Organizational structure of Forensic Science, Frye case and Daubert standard, labs in Central & State, Hierarchical set up of Central Forensic Science Laboratories, State Forensic Science Laboratories, Branches of Forensic science, Police structure, Organization set up of police structure.

UNIT-II Teaching Hours: 15 Hours

Crime Scene Management: Defining the Scene of crime, Managing a crime scene & its hierarchy, Role of First Responding Officers, Securing the Crime scene, Emergency & First Aid, Dos and Don'ts in Crime Scene, Documenting initial crime scene information.

Processing of Crime scene: Documentation/ Note taking of crime scene, crime scene Photography, Sketch drawing of scene of crime, Search Patterns of a crime scene, use of video and CCTV, Chain of custody.

Reconstruction of crime scene: Introduction to Crime Scene Reconstruction, Nature of Reconstruction, Basic Principles of Reconstruction, Stages in Reconstruction, Types of Reconstruction, Pattern Evidence in Reconstruction (Bloodstain Pattern Analysis for Reconstruction, Glass Fracture Patterns, Fire Bum Patterns, Tire and Skid Mark Pattems), Writing A Reconstruction Report.

UNIT-III **Teaching Hours: 15 Hours**

Report writing: General aspects of report, Processing of the repost, Panchnama, Report Writing. Case studies & report writing of crime scene visits.

Court testimony- admissibility of experts' testimony, pre court preparation and court appearance, examination in chief, cross examination and re-examination. Ethics in forensic science.

Preventive Forensics: Types of Situational Crime Prevention, A problem oriented policies, concepts of crime prevention, forensic intelligence: surveillance, CCTV, Introduction to big data, types of big data, analysis and forensic implication of big data.

UNIT-IV **Teaching Hours: 15 Hours**

Understanding medicolegal aspects of victim and deceased at the scene of Crime: Time of death, various types of injuries and wounds. Antemortem hanging, Postmortem hanging, Antemortem drowning, Postmortem drowning, Antemortem burning, postmortem burning. Visit to the medico legal institute for understanding autopsy and various samples drawn during the time of autopsy examination like Visra, V.S slide, V.S. swab, Blood and Urine samples. Ballistics: Classification of fire arm, Range of fire, Line of fire and Wound ballistics.

References and Suggested Readings:

1. M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001).

2. T.J. Gardener and T.M. Anderson, Criminal Evidence, 4th Ed., Wadsworth, Belmont (2001).
3. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
5. D.E. Zulawski and D.E. Wicklander, Practical Aspects of Interview and Interrogation, CRC Press, Boca Raton (2002).
6. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
7. J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1,2,& 3; Springfield, Illinois;
8. Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, P A
9. Vincent Di Maio, Gunshot Wounds; Crc Press, Washington, Dc;
10. Brain J. Heard;, Hand Book Of Firearms And Ballistics; John Willey, England;
11. TA, Warlow; Firearms, The Law And Forensic Ballistics; Taylor And Francis, Landon;

FSMS SIII SP-VI P3: ADVANCE TECHNIQUES IN CRIME SCENE MANAGEMENT

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
4	0	0	4	4	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. The importance of Crime Detection Devices in processing crime scene evidence.
2. The utility of Lasers and Photography in identifying crime scene evidence.
3. The significance of kits for in field investigation.
4. The usefulness of photography and videography for recording the crime scenes.

UNIT-I Teaching Hours: 15 Hours

Crime Detection Devices: UV, IR, X-Rays, their nature and applications, Detective Dyes, Neutron Radiography, Speed Detection Devices, Tools: Basic Kits, Investigator's Kit, Tools used in Mobile laboratory.

UNIT-II Teaching Hours: 15 Hours

Lasers: Characteristics of laser light, Spontaneous emission, Stimulated emission, Stimulated absorption, Population inversion and light amplification, Essential components of the laser, Holography: Formation of a hologram, Reconstruction of the hologram, Requirements, Application in forensic investigation

Forensic psychology and investigation techniques: Forensic psychiatry (insanity), criminal profiling, Polygraph (Lie detector), Narco analysis, Brain fingerprinting, forensic hypnosis, Voice stress analysis and speaker profiling.

UNIT-III **Teaching Hours: 15 Hours**

Photography: Digital photography, software for digital photography, file formats - jpg, gif, bmp, tiff, raw etc., digital watermarking, digital imaging, photogrammetry, radiography, photomicrography, microphotography, Scope of photography in various disciplines of forensic science-finger prints, foot prints, physics, chemistry, biology, ballistics, computer forensics etc. CCTV image enhancement, processing of digital images and its manipulation. Case studies. Laws relating to digital evidence and its admissibility.

UNIT-IV **Teaching Hours: 15 Hours**

Crime Scene Kits: General introduction to the types of crime scene kits, their applicability and utility on crime scene, general introduction of mobile forensics van, crime scene reporting and report writing.

Digital Imaging: Digital Imaging of Crime Scene, 3-D scanning technique, Tele forensic Technology for crime scene investigation, Technology innovation in crime scene management, Case studies & report writing of crime scene visits, 3D simulation of crime scene, Automatic evidence marker.

References and Suggested Readings:

1. J.Walls; Forensic Science-An Introduction to Scientific Crime Detection 2nd Ed.,Universal, 1st Indian Reprint (2002).
2. Richard Saferstein; Criminalistics-An Introduction to Forensic Science 5th Ed., Prentice Hall (1995).
3. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Kooupfer; Encyclopedia of Forensic Science, Academic Press (2000).

4. .R.Mengel; Forensic Physics in 2002 year book, McGraw hill Encyclopedia of Science & Technology.

5. Jenkins and White; Fundamentals of Optics; Mc Graw Hill; Fourth Ed, (I) James, S.H. And Nordby, J. J.; Forensic Science; An Introduction to Scientific And Investigative Techniques, CRC Press USA.

6. Forensic Photography: A Practitioner's Guide By Nick Marsh, 2014.

7. Fundamentals of Forensic Photography: Practical Techniques for Evidence Documentation on Location and in the Laboratory By John Sidoriak, 2017.

8. The Handbook of Forensic Psychology, 4th Edition By Irving B. Weiner (Editor), Randy K. Otto (Editor).

FSMS SIII SP-VI LC: LABORATORY COURSE

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
0	0	6	6	12	-	-	50	03:00	-	-	100	06:00	150

P2: Concepts of Crime Scene Management

1. Collection of physical evidences at the scene of crime
2. Packaging of physical evidences at the scene of crime
3. Moot court
4. Crime Scene Management at the scene of crime
5. Sketching of scene of crime
6. Reconstruction and evaluation of scene of crime
7. Searching Methods on crime scene
8. Forensic Ballistics: Cartridge examination, Bullet examination
9. Case studies and Report Writing

P3: Advance techniques in Crime Scene Management

1. Introduction to different kits used for crime scene investigation.
2. Use of 3D scanner at the crime scene.
3. Examination of physical evidences under Stereomicroscopic.
4. Examination of physical evidences under Comparison Microscope.
5. Examination of physical evidences under Tool Scan Imaging System.
6. Photography of physical evidences at different distances.
7. Examination of physical evidences using Spectroscopic techniques.
8. Examination of physical evidences using chromatographic techniques.
9. Forensic psychology investigation techniques: Lie detector

Semester – IV

(Dissertation)

FSMS SIV: DISSERTATION/MAJOR PROJECT

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
0	0	0	25	0	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Electives

FSMS EL-I : FORENSIC ENGINEERING

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To make students learn about the importance of forensic engineering and scientific investigation.
2. To make students learn about the importance of structural parameters

UNIT-I **Teaching Hours: 15 Hours**

Introduction to forensic engineering and scientific investigation. Investigation and observation of collapsed structures and causes of failure Examination of structural parameters (beam, column, slab, foundation, ties, reinforcements and reinforcement cover etc.), with reference to building code of construction applicable at the time of construction of structures and I.S standards

UNIT-II **Teaching Hours: 15 Hours**

Examination of the approved design and comparison of the design and structural parameters Examination of the basic materials like cement, sand, brick, grit, steel, quality of water, cube rest and curetting etc. Sampling of the materials with relevant information required for the investigation (column, beam, slab, mortar, bricks, reinforcement steel, soil and basic materials used in the construction,

UNIT-III **Teaching Hours: 15 Hours**

Fire and explosion investigation: Chemistry and behaviour of fire Classification of fires Origin and cause of fire Motor vehicle fire- investigation Explosion investigation Reconstruction and report writing Collection and preservation of fire and explosion evidence. Case studies

Motor vehicle accident Introduction Primary causes of accidents. Analytical tools used to evaluate accidents Converting scene data into event sequence Measurement of speed of the vehicle Reconstruction of the scene Collection and preservation of the evidences

Reference books:

1. Dahiya. M.S. (2009): Crime scene management –A scientific approach
2. Kirk (2000): Vehicular accident Investigation and reconstruction
3. Noon (2000): Forensic Engineeering Investigation
4. Carper (2000): Forensic Engineering
5. James, Nordby (2005): Forensic Science an introduction to scientific investigative techniques

FSMS EL-II : SCIENTIFIC PROTOCOLS FOR FIRE INVESTIGATION

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To make students learn about the importance of forensic and scientific investigation in fire and arson investigation cases.
2. To make students learn about the analysis of ignitable residues and evaluation of ignition sources.

UNIT-I Teaching Hours: 15 Hours

Fire and science: Introduction, arguments, national fire protection association 921(NFPA) Fire and arson, motives and pathology of arson Scientific approach to fire investigation, modern fire analysis

Chemistry and Physics of combustion Fire and energy, basic chemistry, chemistry and behavior of fire State of matter and behavior of gases, liquids and solids, stereo chemistry and Flammable limits.

Fire dynamics- Introduction, ignition, spontaneous and chemical ignition Flames and flam abilities, compartmental fire (house fire) Development of fire pattern, fire modelling

UNIT-II Teaching Hours: 15 Hours

Fire and Arson Investigation Introduction, need and presumption of accidental causes, planning of investigation, survey and documentation, Determination of origin and cause of fire, Reconstruction, inventory, avoiding spoliation Mythology of arson investigation (sources of error in fire and arson investigation) Eliminating accidental cause, investigating fatal fire and vehicular fire Origin determination, hypothesis development and testing of hypothesis.

Evidence collection, preservation. Reporting procedures and conclusion Professional practice of fire investigation

UNIT-III **Teaching Hours: 15 Hours**

Analysis of ignitable residues and evaluation of ignition sources Introduction, Evolution of separation and analytical techniques and standard methods Isolation of the residue, Analysis of ILR (ignitable liquid residue)

Criteria for identification -Identification of gasoline, distillates and other classifiable products Improving sensitivity and estimation of the degree of evaporation Reporting procedures, quality assurance and conclusion Evaluation of ignition sources Introduction- Joint examination of physical evidence appliances and electrical components Testing of ignition scenario, spontaneous ignition tests, Conclusion

References :

1. Scientific protocols for fire investigation John J. Lentini CRC press
2. Practical fire and arson investigation David R. Redsicker, John J.O ' Connor CRC press
3. Crime scene management – a scientific approach; M. S. Dahiya

FSMS EL- III: CCTV FORENSICS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To make students learn about the importance of CCTV camera in crime detection and prevention
2. To make students learn about components of CCTV camera
3. To learn about the techniques of effective surveillance to safeguard our public and private spaces

UNIT-I **Teaching Hours: 15 Hours**

Introduction to CCTV camera: definition, its types: Dome shaped, Bullet Cameras, C-Mount Cameras, PTZ Pan Tilt & Zoom Cameras, Day/Night Cameras, Infrared/night vision Cameras, Network Cameras, Wireless Cameras, High Definition (HD) Cameras, Discreet cameras, Fish eye Cameras, varifocal Cameras, Drone cameras, components of CCTV camera: analog camera, IP based camera, monitoring station, cables, DVR, NVR, storage mechanism, Image sensors: CCD and CMOS sensors.

UNIT-II **Teaching Hours: 15 Hours**

Introduction to Video Management System, its components, working mechanism, Benefits of Utilizing a VMS, CCTV topology, design, network, integration, bandwidth.Acquisition of CCTV footages from the scene of crime, Handling and preservation of CCTV footages, hash value generation, extracting the data from DVR/NVR, maintaining chain of custody. Authentication and enhancement of CCTV footages, extraction of frames, Forensic tools for Enhancement and authentication of CCTV footages, legal admissibility of CCTV evidence, related cases studies

UNIT-III **Teaching Hours: 15 Hours**

Introduction to video analytics: Smart video content analysis, uses of video analytics, video synopsis, automatic license plate recognition, crowd detection, face recognition, indoor people tracking, object detection, motion detection, vertical motion detection, left and removed item detection, outdoor people and vehicle tracking, ptz auto-tracking, behavior tracking, loitering detection,traffic monitoring, future of video analytics. Concept of active CCTV surveillance and monitoring techniques

Reference books:

1. Hill, T. (2020). CCTV Handbook: Buying, Installing, Configuring, & Troubleshooting: A User's Guide to CCTV Security. Independently published.
2. Damjanovski, V. (2005). CCTV: Networking and Digital Technology (2nd ed.). Butterworth-Heinemann.
3. Kroener, I. (2014). CCTV: A Technology under the Radar? (1st ed.). Routledge.
4. G. (2020, March 18). Types of CCTV Cameras – The Complete Guide. BusinessWatch. https://www.businesswatchgroup.co.uk/types-of-cctv-cameras-the-complete-guide/
5. Paul, D., & Puvvala, C. (2020). Video Analytics Using Deep Learning. Apress.
6. Ph.D., P. P. M. (2021). The 2022 Report on Video Analytics, Intelligence, Surveillance, Reconnaissance and Object Recognition Technologies: World Market Segmentation by City. ICON Group International, Inc.
7. Carle, B., & Jensen, R. C. (2018). Understanding Video Management Systems.
8. Wolper, V. E. (2020). Photograph Restoration and Enhancement: Using Adobe Photoshop CC 2021 Version (3rd ed.). Mercury Learning & Information.

FSMS EL-IV: ANTI-DOPE FORENSICS

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
Th	Tu	Pr	C	TCH	TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	Total
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives:

1. Basic concepts of Dope drugs and drugs of abuse
2. Forensic and legal awareness
3. Testing methods of dope drugs from biological fluid
4. Understanding of pharmacovigilance

UNIT-I **Teaching Hours: 15 Hours**

Introduction to Anti-Dope Forensics & Drugs of Abuse in Sports: Doping & Sports Forensics; Problem of Doping in Sports; Types of Sports under anti-doping norms; Introduction to Dope Drugs; New medicines and medical technologies; Stimulants, Anabolic Steroids, Energy Boosters, Contraband Drugs, Growth Hormones, Diuretics, Synthetic Oxygen Carriers, Blood Doping, Insulin, Gene Doping; Therapeutic drug use exemptions.

UNIT-II **Teaching Hours: 15 Hours**

Pharmacovigilance and Legal aspects: Pharmacodynamics and Pharmacokinetics of Dope drugs; Protecting the health of the athlete and maintaining clean sport; Healthcare providers at major sporting events; National & International Laws governing doping in sports; Anti-Doping Agencies NADA & WADA; Need of Doping Education & Awareness among athletes.

UNIT-III **Teaching Hours: 15 Hours**

Testing & Analysis: Dope testing in Humans & Animals; Guidelines for dope testing; Role of Body Fluids in Analysis of Dope drugs (Blood, Urine, Saliva & Sweat); International Standards for Dope testing Laboratories and Accreditation, Effective Testing Programs. Case Studies.

Reference Books:

1. W. Goodwin, A. Linacre, H. Sibte, An Introduction to Forensic Genetics, John Wiley & Sons, England, 2007, pp. 17-25.
2. World Anti-Doping Agency (WADA), The World Anti-Doping Code, Montreal, 2009 (accessed April 2011) http://www.wada-ama.org.
3. At-a-Glance - About Anti-Doping." World Anti-Doping Agency. N.p., 04 July 2014. Web. 18 Apr. 2016.
4. At-a-Glance - The Doping Control Process." World Anti-Doping Agency. N.p., 04 July 2014. Web. 18 Apr. 2016.
5. Reardon, Claudia L., and Creado, Shane. "Drug Abuse in Athletes." Substance Abuse and Rehabilitation (2014): 95-105. Web. 29 Feb. 2016.
6. 2016 Prohibited List." World Anti-Doping Agency. N.p., 29 Sept. 2015. Web. 18 Apr. 2016.
7. Moston, S., &Engelberg, T. (2016). Detecting Doping in Sport (1st ed.). Routledge. https://doi.org/10.4324/9781315718514.

FSMS EL-V: NANO-BIOTECHNOLOGY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives:

1. To understand the basics of nanobiotechnology.
2. To learn techniques used for characterization of nanomaterials .
3. To understand the application of nanoparticles as molecular imaging probes.
4. To understand the application of nanomaterials in forensic and life science.

UNIT-I **Teaching Hours: 15 Hours**

Introduction, history and development in nanotechnology, Physical synthesis of nanoparticles, Biological production of nanoparticles: fungi, bacteria, yeast and actinomycetes, Properties and characteristic of nanomaterials.

UNIT-II **Teaching Hours: 15 Hours**

Tool for the characterization of nanomaterial: Optical microscopy, Electron microscopy (TEM and SEM), scanning probe microscopy, atomic force microscopy, fluorescence microscopy. DNA based nanostructure, DNA-protein nanostructure, Carbon nanotubes, Nano rods and fullerenes

UNIT-III **Teaching Hours: 15 Hours**

Application of nanoparticles as molecular imaging probes (Quantumdots), Application of nanoparticles as therapeutic drug carriers, gene delivery and diagnostics. Application of nanomaterials in forensic and life science., Nanoparticles as a tool for cleaning environment: Remediation of heavy metal, Nanoparticles as sensors.

Reference books:

1. Bionanotechnology - Lessons from nature - David S. Goodshell, Wiley-Liss, ISBN: 978- 047141719-4
2. Nanobiotechnology: Concepts, Applications and Perspectives - Christof M. Niemeyer and Chad A. Mirkin, Wiley, ISBN:978-3527306589
3. Nanoscale Materials in chemistry, 2nd edition - Kenneth J. Klabunde and RyanM. Richards, John Wiley and Sons Inc., ISBN:978-0470222706

FSMS EL-VI: MODERN CRYPTOGRAPHY AND STEGANOGRAPHY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives:

1. To Learn Cryptographic Keys and Algorithms
2. To Understand the Process of Cryptography
3. To Understand Cryptanalysis and Steganalysis
4. To Understand the Information Theory

UNIT-I Teaching Hours: 15 Hours

Introduction: Basic Terminology, Protocols, Communication using Symmetric Cryptography, Introduction to One-way Functions, Public-Key Cryptography, Introduction to Digital Signatures, Random and Pseudo Random Sequence Generators. Introduction to Basic, Intermediate, Advanced and Esoteric Protocols.

UNIT-II Teaching Hours: 15 Hours

Cryptographic Keys and Algorithms Introduction**, Key Length:** Symmetric Key, Public-Key. **Key Management:** Generating, Transferring, Verifying, Using, Updating, Storing, Destroying, Lifetime, Backup, Compromised Keys. **Algorithms:** Types, Modes and Use & Awareness among athletes.

Cryptographic Algorithms Mathematical Background: Introduction to Information Theory, Number Theory, Factoring, Prime Number Generation. **DES:** Background, Description, Security, Cryptanalysis, Variants. **One-Way Hash Functions:** MD, SHA, Other one-way functions. **Public-Key Algorithms:** RSA, DSA, and others.

UNIT-III **Teaching Hours: 15 Hours**

Cryptanalysis and Steganalisys: Introduction to Cryptanalysis and Steganalysis, Introduction to tools used technologies used in Cryptanalysis, Introduction to tools used technologies used in Steganalysis, Different Attacks and their outcome.

Reference Books

1. Applied Cryptography by BruceSchneier Cryptology Unlocked by ReinhardWobst
2. Break the Code: Cryptography for Beginners by BudJohnson
3. Modern Cryptography: Applied Mathematics for Encryption and Information Security by Chuck Easttom
4. Cryptography Engineering: Design Principles and Practical Applications by Niels Ferguson, Bruce Schneier and TadayoshiKohno
5. Introduction to Modern Cryptography by Jonathan Katz and YehudaLindell
6. Modern Cryptography: Theory and Practice by WenboMao
7. Steganography in Digital Media: Principles, Algorithms, and Applications by JessicaFridrich
8. Investigator's Guide to Steganography by GregoryKipper
9. Hiding in Plain Sight: Steganography and the Art of Covert Communication by EricCole
10. Data Hiding: Exposing Concealed Data in Multimedia, Operating Systems, Mobile Devices and Network Protocols by Michael T. Raggo and ChetHosmer
11. Noiseless Steganography: The Key to Covert Communications by AbdelrahmanDesoky
12. Digital Watermarking and Steganography by Ingemar Cox, Matthew Miller, Jeffrey Bloom,Jessica Fridrich and TonKalker
13. Steganalysis by means of Artificial Neural Networks: Steganography detection in JPEG files by means of Artifical Neural Networks using Huffman coding by Jiri Holoska and ZuzanaKominkovaOplatkova

FSMS EL-VII: RESEARCH METHODOLOGY

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives:

1. To understand the basics of Research methodology
2. To understand basic statistics
3. To understand Ethical issues and Intellectual copyrights.

UNIT-I **Teaching Hours: 15 Hours**

Types of Research and Research Design: Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis. Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs

UNIT-II **Teaching Hours: 15 Hours**

Data Collection, analysis and Interpretation of Findings: Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

UNIT-III **Teaching Hours: 15 Hours**

Reporting, Presentation and Publication: Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation,

Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research. Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

Reference Books:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12. Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.

FSMS EL-VIII : DISASTER VICTIM MANAGEMENT

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	Total
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To provide students basic conceptual understanding about disasters and Disaster management
2. To make students learn about the importance of the key aspect of Disaster victim identification
3. To Enhance the skill of the students investigative procedure in mass fatality

UNIT-I Teaching Hours: 15 Hours

Disaster and Disaster Management: Introduction, Types of disaster, Classification of Disasters, national and International Impact of Disasters; Causes, Effects and Practical examples for all disasters.

Disaster Management Techniques: Risk and Vulnerability Analysis, Its concept and Reduction, Early and Advance Warming Systems, Understanding climate risk, Mapping of risk assessment, Decision making for risk reduction, Problems in risk assessment, Geographical Information System (GIS).

Disaster preparedness and Response: Overview and Understanding of Disaster Preparedness, Early Warnings and Safety Measures of Disaster, Resource Management-Financial, Medical, equipment, communication, Human, transportation, Food and essential commodity, Directing and controlling functions, Role of Government, International and NGO Bodies

UNIT-II **Teaching Hours: 15 Hours**

Fundamentals of DVI: Principle and Guideline of DVI, Different expertise and equipment's, Composition of Investigation team (DVI team), Health and personnel safety.

Scene Processing and Recovery: Process of DVI operation on site and Mortuary, Handling and preservation of Human and non-human remains, Documentation, Body labelling, Disaster photography/videography and their kits, Different types of coordination centre.

Investigative Process: Establishing Identifiers, Biological Profiling of Primary and Secondary Identifiers (Fingerprint, Teeth and DNA), Advance Techniques (Radiology, Scanners, 3D printers), Different AM data collection and documentation, Different type of PM examination and Documentation, Digital data maintenance software,Reconciliation and Repatriation

UNIT-III **Teaching Hours: 15 Hours**

Humanitarian Approach: Concept and Nature of ethics; Role and purpose of ethics; ethical norms and principles; International Humanitarian Law; Disaster Policy: The International Decade for Natural Disaster Reduction, Disaster Policy (National Policy on Disaster Management), Disaster Management Act 2005. National Disaster Management Plan, Role of Media and its importance, role of Fire Services, Para-military, Armed forces, presently challenging aspect of disaster management in India.

References:

1. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
2. Staggs, S. (2005). Crime scene and evidence photographer's guide. Staggs Pub.
3. Global perspective on disaster victim identification series, CRC Press (Latest Edition)

FSMS EL-IX : MACHINE LEARNING FOR DATA SCIENCE

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
					Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE						
Th	Tu	Pr	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs	
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To introduce students to the basic concepts of Data Science and Machine Learning.
2. To have a thorough understanding of the Supervised and Unsupervised learning techniques
3. To learn about preparing, evaluating and improving the ML model.
4. To understand architecture of Artificial Neural Network.

UNIT-I **Teaching Hours: 15 Hours**

Data Science: Overview of data science, need for data science, components of data science, Data analysis, Data Science lifecycle

Introduction to Machine Learning : Overview of human learning, How do machine learn?, learning problem, types of Machine Learning : Supervised learning, unsupervised learning, reinforcement learning, Applications of Machine Learning, Issues in Machine Learning, Tools in Machine Learning

Preparing to model : Basic types of data in Machine learning, Exploring structure of data, data quality and remediation, Data Preprocessing

Modeling and Evaluation : Selecting a model, training a model, model representation evaluating performance of model

UNIT-II **Teaching Hours: 15 Hours**

Basics of Feature Engineering: Feature and Feature Engineering, Feature transformation: Construction and extraction, Feature subset selection

Supervised Learning – classification and regression : Classification model, classification learning steps, Classification algorithms : k-Nearest Neighbour, Decision tree, Random forest,

Support Vector Machine; Regression model, Regression algorithm : Simple linear regression, Multiple linear regression, logistic linear regression

UNIT-III **Teaching Hours: 15 Hours**

Unsupervised Learning : Supervised vs. Unsupervised Learning, Applications, Clustering, Association rules

Artificial Neural Network : Overview of biological and artificial neuron, Types of activation functions, Architecture of neural network, learning process in ANN, back-propagation algorithm, deep learning

Reference books:

1. Saikat Datt, Subramanian Chandramouli, Amit Kumar Das, “Machine Learning”, Pearson
2. Andreas C. Muller and Sarah Guido, “Introduction to Machine Learning with Python: A Guide for Data Scientists”, O'Reilly Media
3. Ethem Alpaydin, "Introduction to Machine Learning, third edition”, The MIT Press.

FSMS EL-X : FORENSIC JOURNALISM

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
					Theory						Practical		
Th	Tu	Pr	C	TCH	Internal Exams				University Exams		University Exams (LPW)		Total
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	50	01:30	50	01:30	100	03:00	-	-	200

*Note: TA-2 will be in the form of assignments or workshops.

Learning Objectives

1. To provide students basic conceptual understanding about mass communication with fundamental theories and models of communication. It enhances the capacity to react to incidents and developments in the larger interests of the society.
2. To develop the skill to write for all kinds of media with emphasis laid on professional training in information gathering, processing and delivering including specialized reporting like Investigation.
3. To understand the nature of new media journalism and how it can be put to good use for mutual benefit of the media house and the society; To develop an understanding of guard the nation from cyber-attack and strengthen national security by awaring the public at large

UNIT-I Teaching Hours: 15 Hours

Introduction to Journalism: Scope and Definition of Journalism; Role and Responsibilities of Mass Media; Types of Communication Models; Types of Mass Communication Theories; Public Opinion and Democracy; The media scene: The characteristics of the Indian Press; The present state of Print Media, Electronic media, Cyber Media; A brief look into the Government media organizations.

UNIT-II Teaching Hours: 15 Hours

Reporting and Editing: Defining news: news value, elements of news; Structure of news: five W's (Who, What, When, Why, Where) and one H (How); Selection of information, writing introduction/lead, body, different types of introduction/lead, organizing the news story; Understanding beats and their categories (Political, Health, Crime, Art and Culture); City reporting, Crime reporting: sources and related laws, Legal reporting; Investigative Reporting:

Analysis of documents, Database of public records, Research into social and legal issues; Other Specialized reporting: Defense, Science & Technology etc.

UNIT-III **Teaching Hours: 15 Hours**

New Media Studies: Revolutionary change in communication; rise of new media in contemporary era; New media as a tool for social change, freedom of expression vs. privacy, largest ungoverned space on earth; National Security and New Media, Guard the nation from Cyber Attack, Hacking, Fraud; Strengthen National Integration, Case Study : 'Digital Strike' etc.; Citizen Journalism: Concept, Case studies, Mobile Journalism; Types of Fake News: Parody, False connection, Misleading Content, False Content, Impostor Content, Manipulated Content, Fabricated Content; Detecting Fake News and Web portals: Targeted, Propaganda, Organized, Sensitization, Opinionated; Drone Journalism.

Reference Books:

1. Fiske, John., Introduction to Communication Studies, Methew, London 1982.
2. Schramm, Wilbur, The process and Effects of Mass Communication, 1971.
3. Mitchell V Charnley (K Holt, Reinnhart and Winston), Reporting
4. Lewis James, The Active Reporter, Vikas
5. The Active News room (International Press Institute) Noah Wardrip-Fruin and Nick Montfort (eds),
6. The New Media Reader, The MIT Press, Cambridge, 2003.
7. Christopher Callhan, A Journalist Guide to the Internet: The Net as a Reporting Tool, Pearson/Allyn and Bacon, 2007.
8. Jagdish Chakraborty, Cyber Media Journalism: Emerging Technologies, Authors Press, New Delhi, 2005.