



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Programme: B.Sc. Honours in Forensic Science (Major)

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Introduction to Classical Biology	3+2	4
		2	Introduction to Applied Biology	3+2	4
	II	3	Forensic Science and Criminology	3	3
			Forensic Science and Criminology Practical Course	2	1
		4	Forensic Document Examination	3	3
			Forensic Document Examination Practical Course	2	1
II	III	5	Crime Scene Management	3	3
			Crime Scene Management Practical Course	2	1
		6	Fingerprint Science and Impressions	3	3
			Fingerprint Science and Impressions Practical Course	2	1
		7	Forensic Psychology	3	3
			Forensic Psychology Practical Course	2	1
	8	Forensic Ballistics	3	3	
		Forensic Ballistics Practical Course	2	1	
	IV	9	Forensic Biology and DNA Fingerprinting	3	3
			Forensic Biology and DNA Fingerprinting Practical Course	2	1
		10	Forensic Chemistry	3	3
			Forensic Chemistry Practical Course	2	1
		11	Forensic Toxicology	3	3
	Forensic Toxicology Practical Course		2	1	
III	V	12	Forensic Physics	3	3
			Forensic Physics Practical Course	2	1
		13	Instrumentation	3	3
			Instrumentation Practical Course	2	1
		14	Forensic Quality Management System (OR) Narcotic Drugs and Psychotropic Substances	3	3
			Forensic Quality Management System (OR) Narcotic Drugs and Psychotropic Substances Practical Course	2	1
	15	Forensic Medicine and Anthropology (OR)	3	3	

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits	
			Forensic Laws			
			Forensic Medicine and Anthropology (OR) Forensic Laws Practical Course	2	1	
	VI	Semester	Internship/Apprenticeship with 12 Credits			
IV	VII	16	Forensic Odontology	3	3	
			Forensic Odontology Practical Course	2	1	
		17	Forensic Nanotechnology	3	3	
			Forensic Nanotechnology Practical Course	2	1	
		18	Forensic Engineering	3	3	
			Forensic Engineering Practical Course	2	1	
		SEC				
		19	Forensic Photography and Videography	3	3	
			Forensic Photography and Videography Practical Course	2	1	
		20	Forensic Entrepreneurship	3	3	
	Forensic Entrepreneurship Practical Course		2	1		
	VIII	21	Forensic Biometrics	3	3	
			Forensic Biometrics Practical Course	2	1	
		22	Microbial Forensics	3	3	
			Microbial Forensics Practical Course	2	1	
		23	Wildlife Forensics	3	3	
			Wildlife Forensics Practical Course	2	1	
		SEC				
		24	Forensic Journalism	3	3	
			Forensic Journalism Practical Course	2	1	
25		Security Document Analysis	3	3		
	Security Document Analysis Practical Course	2	1			

SEMESTER-I

COURSE 1: INTRODUCTION TO CLASSICAL BIOLOGY

Theory

Credits: 4

5 hrs/week

Learning objectives

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Unit 1: Introduction to systematics, taxonomy and ecology.

- 1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
- 1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
- 1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.
- 1.4. Pollution and climate change.

Unit 2: Essentials of Botany.

- 2.1. The classification of plant kingdom.
- 2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
- 2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
- 2.4. Mushroom cultivation, floriculture and landscaping.

Unit 3: Essentials of Zoology

- 3.1. The classification of Kingdom Animalia and Chordata.
- 3.2. Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders
- 3.3. Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
- 3.4. Economic Zoology – Sericulture, Apiculture, Aquaculture

Unit 4: Cell biology, Genetics and Evolution

- 4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.

4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.

4.3. Central Dogma of Molecular Biology.

4.4. Origin of life

Unit 5: Essentials of chemistry

5.1. Definition and scope of chemistry, applications of chemistry in daily life.

5.2. Branches of chemistry

5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.

5.4. Green chemistry

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.

2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.

3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.

4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.

5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.

6. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.

9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

ACTIVITIES:

1. Make a display chart of life cycle of nonflowering plants.

2. Make a display chart of life cycle of flowering plants.

3. Study of stomata

4. Activity to prove that chlorophyll is essential for photosynthesis

5. Study of pollen grains.

6. Observation of pollen germination.

7. Ikebana.

8. Differentiate between edible and poisonous mushrooms.

9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.

10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell

11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

SEMESTER-I

COURSE 2: INTRODUCTION TO APPLIED BIOLOGY

Theory

Credits: 4

5 hrs/week

Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

Learning Outcomes

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit 1: Essentials of Microbiology and Immunology

- 1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
- 1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.
- 1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
- 1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

Unit 2: Essentials of Biochemistry

- 2.1. Biomolecules I – Carbohydrates, Lipids.
- 2.2. Biomolecules II – Amino acids & Proteins.
- 2.3. Biomolecules III – Nucleic acids -DNA and RNA.
- 2.4. Basics of Metabolism – Anabolism and catabolism.

Unit 3: Essentials of Biotechnology

- 3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.
- 3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.
- 3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.
- 3.4. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

Unit 4: Analytical Tools and techniques in biology – Applications

- 4.1. Applications in forensics – PCR and DNA fingerprinting
- 4.2. Immunological techniques – Immunoblotting and ELISA.
- 4.3. Monoclonal antibodies – Applications in diagnosis and therapy.
- 4.4. Eugenics and Gene therapy

Unit 5: Biostatistics and Bioinformatics

- 5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.
- 5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.
- 5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI,EBI, Gen Bank; Protein 3D structures, Sequence alignment
- 5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.
8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.
10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

ACTIVITIES

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene'

7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

[**NOTE:** In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty. In other colleges, the above topics shall be dealt by Botany and Zoology faculty]

SEMESTER-II

COURSE 3: FORENSIC SCIENCE AND CRIMINOLOGY

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and history of forensic science and criminology.

Learning outcomes: After studying this course the students will know-

- The significance of Forensic Sciences to the Criminal Justice System.
- The working conditions of Forensic Science Laboratory.
- The importance of criminology and penology for crime detection.
- The working of Indian courts and role of criminal justice system in crime detection.

Unit 1: Basics and Historical Development of Forensic Science

Introduction, Definition, need, signification and scope of Forensic Science. Principles of Forensic Science. Domains in Forensic Science: Forensic Biology, Forensic Medicine, Forensic Toxicology, Forensic Osteology and Odontology, Forensic Physics, Forensic Photography, Ballistics, Fingerprint, Questioned Documents, Forensic Psychology, Forensic Anthropology, Wild life Forensic, DNA profiling, Computer Forensic etc.

Specific contribution of scientists in the field of Forensic Science. Development of Forensic Science in India. National and international scenario of teaching and research institution in Forensic Science. Functions of: Forensic Scientist, Police officers, Prosecution, Judicial Officers and Medico legal expert etc. Problem of proof in Forensic Science, corpus dilecti, modus operandi.

Unit 2: Forensic Science Laboratory and National and International perspective of Forensic Science

Structure and function of State and regional Forensic Science Laboratory, Central Forensic Science Laboratory and facility provided, Mobile Forensic Science Laboratory. Directorate of Forensic Science Service. Police and Forensic scientist relationship, role of FSL in criminal investigation, relationship between forensic expert and judiciary officer, Importance of FSL, National and International scenario of FSL, facilities provided in forensic science laboratory. Ethical issues in FSL.

National perspective of forensic science: Central and Divisional Fingerprint Bureaus, National Crime Records Bureau, Police & Detective Training Schools, Bureau of Police Research & Development, Police Academies, Police dogs.

International perspectives of forensic science: INTERPOL, FBI, CIA, CSI, Ameripol, Europol, Frontex etc.

Unit 3: Policing System and Criminal Justice System in India

Policing style and principles, police power of investigation, filling of criminal charges, community policing a heterogenous society. Introduction to penology, Broad concepts of criminal justice system, Correctional measures and rehabilitation of offenders, Human rights and criminal Justice system in India.

Criminal Justice System in India- Introduction, Administration of Civil and Criminal Laws. Introduction to constitution of India- Fundamental Rights, Indian Penal Code (IPC), Criminal

Procedure Code (Cr. PC), Indian Evidence Act (IEA), IT Act-2000, Wild Life Protection Act-1972, POCSO Act, etc. Indian Courts- Introduction, Hierarchy of courts- Powers of courts, types of courts, Lok Ayukta & Lok Adalat, etc. Role and responsibilities of Public Prosecution – Defence Council -Admissibility of Expert Testimony.

Unit 4: Crime & Criminology

Crime: Definition of crime, history and development, Victimology, criminological perspective, characteristics of crime, classification of crimes, present scenario of crime in India. Criminal and Criminology: Definition of criminology & criminal, classification of criminals, growth of criminology in India, conservative criminology, liberal criminology, radial criminology.

Criminal behaviour: Introduction of criminal behaviour, Theories of criminal behaviour, Ethical issues in forensic science: Definition of ethics, professional standards for practice of Criminalistics, sanction against expert for unethical conduct.

Unit 5: Criminal Psychology

Introduction, Definition & Scope. Mc. Naughten Rule, Insanity in IPC, Sensation and Perception. Gestalt principle of perceptual process. Personality – definition, traits and approaches. Freuds psycho-analytical theory. Personality disorders, delusional disorder, anti-social personality. Psychological Motives and its impact on behaviour. Mental disorder and Mental deficiency as factor in the causation of Crime. Psychological methods of control and rehabilitation of offenders – Psychotherapy and counselling – Victims, Witnesses and Suspects. Polygraphy, Narco Analysis & BEOS in the Criminal Justice System.

Suggested Readings:

1. Henry Lee's Crime Scene Handbook: Henry C Lee
2. Crime Scene Processing and Laboratory Work Book: Patric Jones
3. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed.: Stuart H. James
4. Criminalistics: An Introduction to Forensic Science, 9th edition.: Richard Saferstein
5. Criminal Profiling: An Introduction to a Behavioral Evidence Analysis, 3rd edition.: Brent E. Turvey
6. Forensic Science in Criminal Investigation and Trial, 4th edition.: B.R. Sharma
7. Handbook of Forensic Psychology: Dr. Veer raghavan crime scene, sketching of crime scene, searching, collection, preservation, packing of physical evidence, documentation of crime scene, forwarding or dispatch of exhibit in to the laboratory, chain of custody, collection of standard/reference samples.
8. Crime Scene Management with Special Emphasis on National Level Crime Cases: Dr. Rukmani Krishnamurthy under publishing
9. Richard Saferstein: Forensic science from the crime scene to the crime lab.
10. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
11. Criminology – Ram Ahuja

Suggested Co-Curricular Activities:

- Visit to FSL and Allied institutions.

- Quiz and seminars on Forensic Science.
- Jurisdiction & Powers of various courts in India.
- Debate on Criminology & its importance
- Case studies and assignments on criminal psychology.

SEMESTER-II

COURSE 3: FORENSIC SCIENCE AND CRIMINOLOGY

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. To study the Do's and Don'ts in the Forensic Science Laboratory.
2. To prepare a poster on various domains of forensic science.
3. To prepare a poster on the contribution of various scientists in forensic science.
4. To prepare a poster on the forensic teaching and research institutes in India.
5. To prepare a case study of famous criminal and civil cases in India.
6. To prepare a poster on the hierarchy and functions of working professionals in Central Forensic Science Laboratory.
7. To study the different forensic science kits available in the Forensic Science Laboratory.
8. To understand the roles of forensic experts of various divisions of the Forensic Science Laboratory. (Role Play)
9. To study the types, causes and rate of crimes in India.
10. To prepare a poster on functions and hierarchy of the Policing System and Criminal Justice System in India.

SEMESTER-II

COURSE 4: FORENSIC DOCUMENT EXAMINATION

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of forensic document examination.

Learning Outcomes of Course: After studying this course the students will know-

- Introduction to Document
- Introduction to Handwriting and Signature
- Introduction to Forgery
- Introduction to Security Documents

Unit I: Basics of Document, Handwriting & Signature Examination

Definition, Types of documents, Essentials to produce document, scope of forensic document examination, document expert, Handling of Documents.

Principles of handwriting, Comparison of handwriting. Development of individuality in handwriting. Natural variations and Factors affecting handwriting, Class and individual characteristics. Standards for comparison of handwriting. Signature Examination.

Unit II: Detection and Decipherment of Forgeries

Definition, Types of forgery, Handwriting & Signature forgeries, Alterations in documents, including erasures, additions, deletions, over-writings and obliterations.

Unit III: Examination of Questioned Documents

Preliminary examination of document. Examination of Printed documents, Type written documents & Xeroxed documents. Examination of Indented writings, Invisible writings & Charred documents. Examination of anonymous letters.

Unit IV: Examination of Security Documents

Definition, Types of security documents, Examination of counterfeit Indian currency notes, passports, plastic cards and stamp papers.

Unit V: Tools and techniques used in document examinations

Tools and techniques needed for forensic documents examination – Stereomicroscope, Projectina Nirvis, Video Spectral Comparator, Electrostatic Detection Apparatus, TLC and Paper chromatography.

Suggested Readings

1. O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (1982).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, Foundation Press, New York (1995).

3. R.N. Morris, Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2000).
4. E. David, The Scientific Examination of Documents – Methods and Techniques, 2nd Edition, Taylor & Francis, Hants (1997).

Suggested Co-Curricular Activities:

- Visit to Forensic Document Examination Laboratory
- Poster making – Signature Examination
- Seminar on Handwriting Forgery
- Collection of standard samples for examination
- Hands on training on Security Document Examination
- Workshop on Forensic Document Examination

SEMESTER-II

COURSE 4: FORENSIC DOCUMENT EXAMINATION

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. To opine whether given signature samples are written by the same author or not.
2. To extract the handwriting features including class and individual from the given handwriting samples.
3. To opine whether given handwriting samples are written by the same author or not.
4. To identify and examine the exhibits for secret writing.
5. To extract and identify the security features in the Indian Currency Notes.
6. To extract and identify the security features in the debit card and credit card.
7. To extract and identify the security features in the Indian passport.
8. To extract and identify the security features in the stamp papers.
9. To identify and compare the given typewritten document.
10. To identify and compare the given photocopied document.

SEMESTER-III

COURSE 5: CRIME SCENE MANAGEMENT

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of crime scene management.

Learning outcomes: After studying this course the students will know-

- The importance of protection of crime scene.
- The significance of photography and videography at scene of crime.
- The importance of physical evidences.
- The Integrity of chain of custody.
- The role of crime scene reconstruction in crime investigation.

Unit 1: Crime Scene Management

Types of crime scenes- Macroscopic, Microscopic, Indoor and Outdoor. Set up involved in CSM- Components of Crime Scene Management- Information management, manpower management, technology management & logistics management, Role of crime scene managers and FRO, Duties of various officers at crime scene, educational background & hierarchy of forensic expert. Crime scene security, contamination control, documentation protocols and maintaining health & safety procedures.

Unit 2: Crime Scene Evidence

Introduction to evidence, Importance of evidence, Classification of crime scene evidence, Locard's principle of exchange, Handling of evidences, Precautions, Evidence collection methodologies and materials, Collection, preservation, labelling, sealing and forwarding of evidences, Chain of custody.

Unit 3: Crime Scene Investigation

Steps of CSI- Self-protection, Medical Assessment, Secure the crime scene, Search for evidence, Crime Scene Documentation (Note taking, Photography, Sketching and Videography), Role of first responding officer, Coordination between police personnel and forensic scientists at crime scenes. The evaluation of 5Ws -who? what? when? where? why? and 1H -how?

Unit 4: Crime Scene Reconstruction

Defining crime scene reconstruction, nature & importance of crime scene reconstruction, basic principles of physical evidence and crime scene reconstruction, stages of crime scene reconstruction, types of crime scene reconstruction- (Specific Type of Incident/Crime Reconstruction, Specific Events Reconstruction, Degree of Involvement Reconstruction and Specific Type of Physical Evidence Reconstruction), Crime Scene Staging, Sequence of events recording, Documentation required for Crime scene reconstruction, Computerized Reconstruction (Faro).

Unit 5: Report Writing

Introduction, Expert report, General guidelines, Importance of report, Nature of report, Types of report, Report format, Length of report, Common reporting mistakes, Tips to Keep in Mind When Writing an Expert Report, Do's and Don'ts while preparing forensic report, Legal challenges, Legal considerations of report: Sec 45 of IEA, Sec 293 of Cr.P.C.

Suggested Reading:

1. Henry Lee's Crime Scene Handbook: Henry C Lee
2. Forensic Biology: Shrikant H. Lade
3. Crime Scene Processing and Laboratory Work Book: Patric Jones
4. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed.: Stuart H. James
5. Criminalistics: An Introduction to Forensic Science, 9th edition.: Richard Saferstein
6. Computer Crime and Computer Forensic: Dr. R.K. Tiwari
7. Criminal Profiling: An Introduction to a Behavioral Evidence Analysis, 3rd edition.: Brent E. Turvey
8. Forensic Science in Criminal Investigation and Trial, 4th edition.: B.R. Sharma
9. Handbook of Forensic Psychology: Dr. Veer raghavan crime scene, sketching of crime scene, searching, collection, preservation, packing of physical evidence, documentation of crime scene, forwarding or dispatch of exhibit in to the laboratory, chain of custody, collection of standard/reference samples.
10. Crime Scene Management with Special Emphasis on National Level Crime Cases: Dr. Rukmani Krishnamurthy under publishing
11. Text Book of Medical Jurisprudence, Forensic Medicine and Toxicology: Parikh C.K.
12. The Identification of Firearms and Forensic ballistics: Barrard and Gerald
13. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
14. Richard Saferstein: Forensic science from the crime scene to the crime lab.
15. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
16. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

Suggested Co-Curricular Activities:

- Flow chart Preparation-Crime scene investigation
- Poster making –Photographic skills
- Seminar on crime scene management
- Collection of samples-for museum
- Simulation of various crime scenes
- Workshop on crime scene sketching techniques

SEMESTER-III

COURSE 5: CRIME SCENE MANAGEMENT

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. To study the seven principles of forensic science with examples.
2. To study the different evidence collection methods with examples.
3. To study the different evidence collection materials with examples.
4. To search, collect and preserve the physical evidence recovered from the crime scene.
5. To record the crime scene by photography and videography methods of crime scene documentation.
6. To record the crime scene by Note making and Sketching methods of crime scene documentation.
7. To study the reconstruction of blood spatter patterns.
8. To study the reconstruction of glass fracture evidence.
9. To simulate the scene of crime and perform its investigation.
10. To prepare a forensic report on crime scene investigation.

SEMESTER-III

COURSE 6: FINGERPRINT SCIENCE AND IMPRESSIONS

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of fingerprint science and impressions.

Learning Outcomes of Course: After studying this Course the students will know-

- Introduction to Fingerprint
- Introduction to Handling of Fingerprint
- Introduction to Detection and Development of Fingerprint
- Introduction to Other Impression Evidence

Unit I: History of fingerprint science & Basics of fingerprint

History and development of fingerprint in India and abroad, morphology and anatomy of dermal skin, Embryology of fingerprint- morphology of volar pad and configurational areas, development of volar pad, formation of friction ridges, Sweat glands- eccrine, sebaceous and apocrine, Definition of fingerprint, Theory and principles of fingerprint, Forensic significance of fingerprint. Case studies.

Unit II: Fingerprint classification systems

Basic classification of fingerprint- arch, loop, whorl and composite, Rules for placing core and delta, counting and tracing of ridges, ridge density, Classification of identification of fingerprint- different system of classifications (Ivon, Vucetich, Purkinje, Francis Galton, Henry 10-digit, Henry FBI extension and Battley single digit classification) and their modification till date and their utilities.

Unit III: Taking and collection of fingerprints

Types of fingerprint- rolled, plain, chance, latent, patent and plastic, Collection of latent, patent and plastic fingerprint: methods, procedure, precautions, limitations, preservation and preservation and lifting of fingerprint, Taking of fingerprint: Taking fingerprints of living person- purpose, requirements, procedures, precaution, limitation and collection, Taking finger prints of dead bodies- purpose, requirements, procedures, precaution, limitation and collection(techniques of recording fingerprints of dead bodies of different stages, viz, immediately after death and after rigor mortis, decomposed and charred bodies).

Unit IV: Detection Development and Comparison of fingerprints

Detection of fingerprint using Light sources, Development of fingerprint: Physical methods and chemical methods- silver nitrate, Ninhydrin and its analogues, physical developer etc., fuming methods- iodine fuming, cyanoacrylate fuming, soot method, hydrogen fluoride fuming and metal deposition method.

Comparison of fingerprint: class and individual characteristics (minutia's), fundamentals of comparison- print to print, trace to record, trace to print, trace to trace, documentation of fingerprint, AFIS (Automated Fingerprint Identification System).

Unit V: Impression Evidence

Lip prints & Ear Prints: Introduction, Collection, preservation, Examination & their significance.
Palm Prints & Foot print impressions: Introduction, Collection, preservation, Examination & their significance.

Suggested Readings

1. J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983).
2. D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton (2000).
3. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).
4. Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

Co-Curricular Activities:

- Visit to Forensic Fingerprint Science Laboratory
- Poster making – Fingerprint Examination
- Seminar on Fingerprint and Other Impressions Examination
- Collection of standard samples for examination
- Hands on training on Impression Evidence Examination
- Workshop on Fingerprint Examination

SEMESTER-III

COURSE 6: FINGERPRINT SCIENCE AND IMPRESSIONS

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. To record plain and rolled fingerprints and identify different types of fingerprint patterns in a given fingerprint.
2. To locate and identify type line, core and delta in a given fingerprint.
3. To carry out ridge tracing, ridge counting and ridge density of fingerprints.
4. To locate, identify, develop and preserve the fingerprint impression by using physical methods of fingerprint detection.
5. To locate, identify, develop and preserve the fingerprint impression by using chemical methods of fingerprint detection.
6. To extract the fingerprint minutiae from a given fingerprint sample.
7. To compare and opine whether two given fingerprints are same or not.
8. To carry out ten-digit classification of fingerprints.
9. To carry out the forensic analysis of given lip print impression.
10. To carry out the forensic analysis of given foot print impression.

SEMESTER-III

COURSE 7: FORENSIC PSYCHOLOGY

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of Forensic Psychology.

Learning Outcomes:

- Description of different interviewing techniques
- The science of lying
- Psychophysiological aspect of speech and deception
- Polygraphy technique of lie detection
- Brain signature profiling
- Law related to mental health and psychology
- Different interrogation techniques
- Deception Detection Techniques.
- Legal aspects of Psychology.

Unit I: Basics and History of Psychology

Introduction, Historical Perspective Psychology and Modern Psychology-, Definition, significance and scope of Psychology. Principles & Ethics of Psychology. Branches of Psychology.

Role of Psychologists: Assessment, Evaluation of Eyewitness Testimony, Errors/Problems in Eyewitness Testimony, Solutions for Increasing Eyewitness Accuracy., psychology of evidence, psychology in courtroom with special ref. to 84 IPC

Unit II: Crime & Delinquency

Psychology of crime & Delinquency, Juvenile Delinquency: Definition, Concept.

The Developmental perspectives in delinquent behaviour- Developmental theory, Coercion Developmental Model.

Risk Factors of Juvenile Delinquency- Biological Factors- Temperament, Genetic influence, Hormones and aggression, Substance abuse. Individual Factors- intelligence, language development, Self-regulation skills & Executive functions. Family Factors- Family pattern, Rejection in family, Family Conflicts, Family Relationships, Emotional Deprivation. Social Factors- Peer Group, Cultural Values, Media. Juvenile Psychopathy, Prevention and Control of Juvenile Delinquency.

Unit III: - Investigative Psychology

Criminal Psychological Profiling- Nature, Definition. Ethical Guidelines for Criminal profiler. Psychological Investigative Tools- Mental Status Examination, Psychological Testing: Polygraph Testing, Narco Analysis, Forensic Hypnosis, Brain Electrical Oscillation. Signature Profiling – Introduction, Theory, Procedure, Interpretation of results & Limitations, Ethical issues. Psychological Autopsy- Manner of Death Defined, Types of Psychological Autopsies. Modus Operandi- Nature, Elements of Modus Operandi, Modus Operandi Risk- Low MO risk and High MO risk.

Unit IV: Stress, Criminal Psychology & Police Psychology

Stress- Definition, Nature, Models of Stress- Response based model, Stimulus based model, Transactional/Interactive model. Consequences of Stress- Physiological, Psychological, Behavioral. Stress and Burnout, Coping with the stress, Stress Management.

Criminal Psychology – Serial Murderers, psychology of Terrorism

Police psychology- Nature, Psychological testing & selection of police officer: aptitude test, intelligence test, personality test. Stress and Policing, Types of police stress, Fitness for duty evaluation, Police suicide.

Unit V: - Perspective of Criminal Behavior and Legal Proceedings

Psychological Approaches- Emotional Deprivation, Psychological Motives of Crime, Frustration, Attitudes, Peer Influence. Psychological Disorders, Social Perspective- Differential Association theory, Labeling theory, Critical theory, Control theory.

Application of Forensic Psychology in Civil & Criminal Proceedings- Assessment of Domestic Issues in Childhood and Adolescent, Assessment of Civil Competency, Competency to stand trial, Criminal responsibility and insanity defense, Risk assessment, Evaluation of Eyewitness testimony, Personal Injury Evaluation, Evaluation of Trauma Caused by Sexual Harassment or Rape.

Suggested Readings:

1. Sandra K. Ciccarelli, Psychology
2. David V. Canter, Forensic Psychology for Dummies
3. Ellis, Havelock, The criminal
4. Stanton E. Samenow, Inside the Criminal Mind
5. Dennis Howitt, The Psychology of Criminal Conduct: Theory, Research and Practice
6. Ronald Roesch, Patricia A Zapf, Stephen D. Hart, Forensic Psychology and Law
7. Kevin S Douglas, Randy K.otto, Patricia Zapf, Handbook of Violence Risk Assessment
8. Helen Gavin, Criminological and Forensic Psychology
9. Handbook of Forensic Psychology Prof. (Dr) Vimala Veeraraghavan
10. Criminology Prof. (Dr) Vimala Veeraraghavan
11. Organized Crime Dr Minakshi Sinha
12. 'Handbook of Forensic Psychology, Prof Dr. Vimala Veeraraghwan, Edition 1st, 2009, Selective and Scientific Books Publications, New Delhi.
13. 'Introduction to Forensic Psychology-Research and Application', Curt R. Bartol, Anne M.Bartol, Editon 2nd, 2008,Sage Publication.
14. Psychology, (2006) Ciccarelli, S. K. & Meyer G. E. New Delhi; Perason Education
15. Criminology and Penology', Mittal S., Saxena S. K., [2012], Commonwealth Publishers Pvt. Ltd., New Delhi.

SEMESTER-III

COURSE 7: FORENSIC PSYCHOLOGY

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. To review a crime case involving serial murders. Comment on the psychological traits of the accused.
2. To cite a crime case involving a juvenile and argue for and against lowering the age for categorizing an individual as juvenile.
3. To study a criminal case in which hypnosis was used as a means to detect deception.
4. NEO-PI
5. Minnesota Multiphasic Personality Inventory-2/A (MMPI-2/A)
6. Rorschach Test
7. Bhatia's Battery for Intelligence
8. Thematic Apperception Test
9. Word Association Test
10. Polygraphy / Psychological evaluation test

Suggested Co-Curricular Activities

- Visit to police stations to know the procedure of interrogation
- Visit to Polygraphy unit at Forensic Science Laboratory
- Visit to mental hospitals and juvenile courts

SEMESTER-III

COURSE 8: FORENSIC BALLISTICS

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Ballistics.

Learning Outcomes: After studying this Course the students will know-

- Introduction to Firearms
- Introduction to Ammunition
- Introduction to Internal Ballistics
- Introduction to External Ballistics

Unit I: Firearms and Ammunition

Firearms: History and development of firearms. Classification of firearms. Weapon types and their operation. Firing mechanisms of different firearms.

Ammunition: Types of ammunition. Constructional features and characteristics of different types of cartridges and bullets. Primers and priming compounds. Projectiles. Head stamp markings on ammunitions. Different types of marks produced during firing process on cartridge – firing pin marks, breech face marks, chamber marks, extractor and ejector marks.

Unit II: Internal ballistics

Definition, ignition of propellants, shape and size of propellants, manner of burning, and various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting.

Unit III: External Ballistics

Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistic data.

Unit IV: Terminal & Wound 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. Ricochet and its effects, stopping power.

Unit V: Examination of Firearm Evidence

Matching of bullets and cartridge cases in regular firearms. Identification of bullets, pellets and wads fired from improvised, country made firearms. Automated method of bullet and cartridge case comparison. Determination of range of fire and time of fire.

Mechanisms of formation of gunshot residues. Methods of analysis of gunshot residues from shooting hands and targets, with special reference to clothing.

Suggested Readings:

1. B.J. Heard, Handbook of Firearms and Ballistics, Wiley and Sons, Chichester (1997).
2. W.F. Rowe, Firearms identification, Forensic Science Handbook, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).
3. A.J. Schwoeble and D.L. Exline, Current Methods in Forensic Gunshot Residue Analysis, CRC Press, Boca Raton (2000).
4. E. Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).

SEMESTER-III

COURSE 8: FORENSIC BALLISTICS

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. To describe, with the aid of diagrams, the firing mechanisms of Pistol.
2. To describe, with the aid of diagrams, the firing mechanisms of Revolver.
3. To describe, with the aid of diagrams, the firing mechanisms of Air Gun.
4. To describe, with the aid of diagrams, the firing mechanisms of AK-47 Rifle.
5. To describe, with the aid of diagrams, the assembling and disassembling of different types of firearms.
6. To describe, with the aid of diagrams, the internal structure of different types of bullets.
7. To describe, with the aid of diagrams, the difference between Pin fire, Rimfire and Centrefire ammunition.
8. To carry out the comparison of fired bullets.
9. To carry out the comparison of fired cartridge cases.
10. To differentiate, with the aid of diagrams, contact wounds, close range wound and distant wounds.

Suggested co-curricular activities

- Visits to Bell of Arms Unit
- Visit to Forensic Ballistics Lab

SEMESTER-IV

COURSE 9: FORENSIC BIOLOGY AND DNA FINGERPRINTING

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of Forensic Biology and DNA Fingerprinting.

Learning Outcomes: After studying this course the students will know-

- The various techniques used for examination of biological evidences.
- Applications of entomology in death investigation
- Importance of Wildlife Forensics in Wildlife Protection and Conservation
- Forensic examination of bodily fluids of human body
- DNA fingerprinting technology in crime investigation.
- Laws related to DNA technology in India and other countries.

Unit I: Cell Biology and Human Physiology

The Cell Theory, Structure of Prokaryotic & Eukaryotic cells (Plant & Animal), Structural organization and functions of plasma membrane and cell wall. Cell-organelles and cytoskeletal elements (Microtubules, microfilaments and intermediate filaments); Biomolecules – Proteins (Amino acids, Enzymes), Nucleic acids, Carbohydrates, Lipids; Minerals & Vitamins.

Immunity: Definition, Types: Innate - physical & chemical barriers, Acquired, Active, Passive. Immunogens & Antigens - Definition, types of antigens, factors influencing antigenicity; Antibody - Definition, structures, types, properties and functions of immunoglobulin. Antigen - Antibody Reactions –Agglutination & Precipitation.

Human Physiology: Introduction to Nervous system, Respiratory system, Circulatory system, Endocrine system, Excretory system & Digestive system

Unit II: Biological Evidences

Biological Evidence – Nature, Importance and Identification of Blood, Semen, Vaginal fluids, Saliva, Urine, Feces, Sweat, Skin, Nails, Tissues, Tooth, Bones, Uterine fluids, Vomit, Vitreous humor, CSF, Colostrum.

Diatoms – Structure, Identification Tests & Importance. Hair – Structure & growth - Differences between human & animal hair. Fibre - Classification of fibres- Identification and comparison of fibres by Physical & Chemical methods - Forensic Significance.

Blood and its function, Composition of blood, Formation of Blood cells, Types of Blood cells and blood groups, (ABO systems & Rh factor).

Unit III: Forensic Entomology

Forensic Entomology - Introduction, History, Advances in Forensic Entomology, Forensic Importance of Insects, Arthropod Biology and Entomology, Crime Scene Investigation, Collection of evidence at the Crime Scene, Estimating the time since death, The use of insects in death investigations, Expert Witness, Report Writing.

Unit IV: Genetics

Basics of Genetics - Mendelian principles, Sex determination and Sex-linked Inheritance
Prokaryotic & Eukaryotic Genetic material: Discovery, Experiments, Composition and
Structure of DNA & RNA, Organization of DNA in Chromosomes, DNA replication,
Genetic code, Proteins synthesis, Introduction to recombinant DNA technology - its
Forensic applications.

DNA isolation, Extraction methods – Phenol Chloroform, Chelation, Differential &
Silica based. DNA Quantification – Slot blot Assay, FID Assay & PCR Amplification.

Unit V: DNA Fingerprinting

DNA Separation techniques – Supporting matrices, Gel & Capillary Electrophoresis.
Advances in DNA testing: VNTR, STR, STR multiplex, STR Polymorphism, SNPs,
mtDNA, Y - chromosome analysis; DNA profiling and applications. Rapid DNA Testing.
DNA Database & Databank – CODIS. Human Genome Project. Admissibility of DNA
evidence in court of law. The DNA Legislation-India, USA, UK. The DNA Profiling
Regulation bill. Application of DNA Fingerprinting in Wildlife Forensics.

Suggested Readings:

1. Forensic Biology – Richard Li
2. Forensic DNA collection at Death Scenes - Rhonda Williams & Roger Kahn
3. Forensic DNA Analysis: Current Practices and Emerging Technologies – Jaiprakash G. Shewale.
4. Forensic DNA Evidence Interpretation - Jhon S. Buckley on, Jo-Anne Bright, Duncan Taylor.
5. Forensic Biology - Dr. (Mrs) Rukmani Krishnamurthy, Sharikant H.Lade, Dr. Trupti Khedkar
6. Encyclopedia of Forensic Science Vol I, II & III, - Siegel.J.A , Sukoo.R.J and Knufer
7. Forensic Science in Criminal Investigation in trials – B.R.Sharma
8. Interdisciplinary Approach to Forensic science – Dr. Praveen Kumar Janjua, Dr. G.Sunil Babu , Dr.Navjot Kaur Kanmai
9. Forensic Science in Criminal Investigation – Dr. (Mrs) Rukmani Krishnamurthy
10. Criminalistics – An Introduction to Forensic science 5th edition –Saferstein
11. Statistical Methods in Human Population Genetics, ISI,1988 – Malhotra.K.C
12. An Introduction to Software tools for Biological Applications -Jambeck, P &Gibas.C
13. Bioinformatics Basics: Applications in Biological Sciences and Medicine - Rashidi, HH &Bueler.

Suggested Co-Curricular Activities:

- Seminars on wild life forensics
- Preparation of Model DNA
- Assignments on cell structure & cell organelles

SEMESTER-IV

COURSE 9: FORENSIC BIOLOGY AND DNA FINGERPRINTING

Practical

Credits: 3

3 hrs/week

List of Experiments:

1. Serological Test – ABO Blood grouping
2. Identification tests for bodily fluids.
3. Antigen - Antibody reactions – Agglutination and Precipitation
4. Identification of Diatoms
5. Identification of Pollen grains
6. Morphological Examination of Human Hair, Animal hair & Fiber
7. Isolation & Extraction of DNA from Blood
8. Gel electrophoresis of DNA
9. Gel electrophoresis of Protein.
10. Identification of Diatoms

SEMESTER-IV

COURSE 10: FORENSIC CHEMISTRY

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of Forensic Chemistry.

Learning Outcomes: After studying this course the students will know-

- The roles of chemistry and Ballistics in Forensic Science.
- The classification and characteristics of NDPS.
- The analysis of drugs and its importance in detecting the culprit.
- The introduction to explosives and petroleum products.

Unit I: Basics of Forensic Chemistry

Forensic Chemistry: Introduction & Significance, Qualitative analysis of precious metals –Gold, Silver & Platinum, Agrochemicals, Industrial chemicals. Chemical Etching techniques. Bribe Trapping by Phenolphthalein.

Chemistry of fire – Fire triangle. Definition of Arson & Incendiary Fire. Motive of Arson – Indicators of arsons in SoC. Collection for Evidence. Chemical analysis of Arson residues & Charred debris. Relevant IPC sections – 285,435, 436 & IEA 113B.

Unit II: Beverages

Beverages: Classification & Composition of Alcoholic & Non-Alcoholic beverages. Collection of samples for identification of alcohols – Blood, Urine, Vitreous fluid, Brain, Liver etc. Tests and Evaluation - Blood alcohol content (BAC), Urine Alcohol Content (UAC), Breath Analysis. Clinical Features, Diagnosis and Treatment for Chronic and Acute effects of Alcohol. Relevance of Central Excise Act -1944 on Beverages. Motor Vehicles Act - 1988 (Penalties for Drunk n Drive).

UNIT III: Explosives

Explosives - Definition of Explosives, Definition as per Indian Explosive Acts. History of Explosives, Chemistry of explosives, Deflagration and Detonation phenomenon (Redox Chemistry, Kinetics -Molecular Theory of gases & Gas Laws), Characteristics of high and low explosives, Dust explosion, Gas/vapour explosion, Effect of blast wave on structures & human and Pyrotechnics.

Analysis of Explosive: Pre-blast and Post blast residue collection, Systematic examination of explosives

and explosion residues in the laboratory using chemical and instrumental techniques and interpretation of results.

Unit IV: Improvised Explosive Devices and Bomb Scene Investigation

Improvised Explosive Devices - Definition of IED, Components of IED, Explosives Initiation (Explosive Trains); Types (Molotov cocktail, Letter bomb, Pipe bomb, VBIED and CBRN), Detection of Hidden Explosives.

Bomb Scene Investigation - Specific approach to scene of bombing, Investigation of

bombing scene, Reconstruction of sequence of events, Evaluation and assessment of scene of explosion.

UNIT V: Petroleum and Petroleum Products

Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Analysis of petroleum products. Analysis of traces of petroleum products in forensic exhibits. Comparison of petroleum products. Adulteration of petroleum products.

Suggested Readings:

1. Analytical chemistry: An Introduction – Skoog, D.A. West. D.M, Holler
2. Fuels and Combustion – Sarkar – Orient longmann 1990
3. Modern Techniques of Bomb Detection and Disposal & Security – Narayanan, T.V.
4. The Analysis of Explosives, - Yinon, J. and Zitrin – Oxford
5. Kirks Fire Investigation – Dettean, J.D – Prentice Hall 2002
6. Bureau of Indian standards: Specifications and Methods of Analysis for Alcoholic Beverages
7. Bureau of Indian standards: Specifications and Methods of Analysis for Petroleum Products
8. Explosive act with Amendments
9. Explosive Substances act with Amendments
10. Working Procedure Manual: Chemistry, Explosives & Narcotics, BPRd 2000
11. Forensic Science in Criminal Investigation in trials – B.R. Sharma
12. Forensic Biology - Dr. (Mrs) Rukmani Krishnamurthy, Sharikant H. Lade, Dr. Trupti Khedkar
13. Interdisciplinary Approach to Forensic science – Dr. Praveen Kumar Janjua, Dr. G. Sunil Babu, Dr. Navjot Kaur Kanmai
14. Encyclopedia of Forensic Science Vol I, II & III, - Siegel. J.A, Sukoo. R.J and Knufer
15. Forensic Science in Criminal Investigation – Dr. (Mrs) Rukmani Krishnamurthy
16. Criminalistics – An Introduction to Forensic science 5th edition – Saferstein
17. Analytical chemistry: An Introduction – Skoog, D.A. West. D.M, Holle

Suggested Co-Curricular Activities:

- Seminars on explosives
- Assignments on screening of drugs
- Quiz on various 'NDPS Act'.
- Examination of various petroleum products.
- Visit to Forensic Chemistry Lab.

SEMESTER-IV

COURSE 10: FORENSIC CHEMISTRY

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Analysis of alcohol as per BIS specifications
2. Detection of Methanol, Chloral Hydrate, Diazepam & Alprazolam in Alcoholic Liquors
3. Density/ Specific gravity Determination of petroleum products by Hydrometer
4. Filter Course test for detecting adulteration of petrol
5. Phenolphthalein test for Bribe Trap cases
6. Preliminary examination of Explosives (tests for nitrite, nitrate, thiocyanate, chlorate, Thiosulphate, Perchlorate, Sulphite, Phosphate etc.)
7. To prepare a case report on a case involving arson.
8. To prepare a case report on bomb scene management.
9. To carry out analysis of low explosive materials.
10. Analysis of Alcoholic and Non-alcoholic Beverages.

SEMESTER-IV

COURSE 11: FORENSIC TOXICOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Toxicology.

Learning Outcomes:

1. Able to describe the major effects on the rate of absorption of alcohol from the stomach into the bloodstream
2. Students will be able to classify various poisons depending on their toxicity
3. Will be able to answer different techniques to detect poisons in viscera sample
4. Post-mortem appearances of poisons in the body
5. Antidotes for lethal poisons

Unit I: Introduction

History & Development. Definitions – Toxins, Drug, Toxicodynamics, Toxicokinetics, Dose, Lethal Dose, LD50, Tolerance, Role of Forensic Toxicologist in Criminal Justice System. Poisons Act 1919
National Poisons Information Centre (NPIC).

Unit II: Poisons

Definition, Forms of Poison – Physical, Chemical & Mechanical state. Classification – Corrosives/caustics – Strong acids & Alkalis, Irritants – Organic (Plant & Animal) Inorganic (Metallic & Non-metallic). Neurotoxic Poisons – Cerebral & Spinal. Cardiovascular Poisons. Asphyxiants. Pesticides.

Unit III: Toxicokinetics

Routes of Administration of poisons - Inhalation, Ingestion, Injection, Topical etc. Mode of Action, Clinical features, Elimination of poisons - Urinary excretion, Fecal excretion, and other routes of elimination. Definition of Antidote– Types of antidotes.

Unit IV: Post Mortem Toxicology

Types of samples. Collection of visceral samples, other body fluids - Blood, Saliva, Urine, and Stomach washes etc. their Preservation. Toxicological analysis of visceral samples.

Unit V: Toxicology of Alcohol

Alcohol testing for intoxication. Alcohol in Circulatory system. i.e., Mode of Action. Analysis of alcohol samples. Analytical Toxicology – Isolation and Purification, Screening tests, Methods of identification, Quantitative estimation of individual poisons.

Suggested Readings:

1. Analytical Methods in Forensic Toxicology Dr S N Tiwari
2. Practical Book for Forensic Chemistry and Toxicology Dr Ashok Jaiswal
3. Forensic Toxicology Dr S P Singh
4. Handbook of Environmental Chemical Toxicology Dr B Singh
5. Practical Manual of Food Chemistry and Nutrition Dr Neetu Singh
6. Environmental Administration in India Dr Namita Gupta
7. Environmental Studies Systems & Solutions Dr Archana Mishra
8. Biochemistry U. satyanarayan
9. Practical crime scene analysis and reconstruction Ross m gardner , tom bevel
10. Concise book of forensic medicine and toxicology R.K Sharma
11. Bloodstain pattern analysis Tom bevel
12. Introduction to spectroscopy Pavia
13. Techniques of crime scene investigation Barry A.J fisher
14. Principles of forensic toxicology Nicholas lappas
15. Review of forensic medicine and toxicology Gautam biswas

SEMESTER-IV

COURSE 11: FORENSIC TOXICOLOGY

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Perform the colour test for the given acidic drug/poison.
2. Perform the TLC for the given acidic drug/poison.
3. Perform the UV-Visible analysis of drug/poison.
4. Perform the FT-IR analysis of drug/poison.
5. Perform the colour test for the given basic drug/poison.
6. Perform the TLC for the given basic drug/poison.
7. Perform the colour test for the given plant poison.
8. Perform the TLC for the given plant poison.
9. Identify the given metallic poison.
10. Analysis of the given neutral poison.

Suggested Co-Curricular Activities:

- Visits to Forensic Science Laboratories for detection of different lethal poisons
- Visits to botanical gardens containing poisonous plants
- Simulation of animal poisoning and their treatment technique

SEMESTER-V

COURSE 12: FORENSIC PHYSICS

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Physics

Learning Objectives: After studying this paper the students learn about

- Types of glass and their composition.
- Photographic examination of tool marks.
- Able to determine direction of force on a piece of glass
- Able to describe the common methods for the analysis of soil
- Different types of tools involved in criminal activity
- What other types of polymer-based evidences are analyzed?
- How paint evidence is encountered, collected and preserved

Unit I: Soil, Cement and Concrete

Types and composition of soil, sample preparation, molecular particle size distribution, turbidity test, pH measurements, microscopic examination, density gradient analysis, ignition-loss test, elemental analysis, interpretation of soil evidence. Cement bromoform test, fineness test, ignition-loss test. Identification of adulterated cement. Mortar and concrete analysis.

Unit II: Paint

Types of paint and their composition, macroscopic and microscopic analysis of paint pigments, pigment distribution, micro-chemical analysis- solubility test, pyrolysis gas chromatography, IR spectroscopy and X-ray diffraction, elemental analysis, interpretation of paint evidence.

Unit III: Fiber

Types of fiber, forensic aspects of fiber examination- fluorescence, optical properties, refractive index, birefringence, dye analysis. IR-micro spectroscopy, Py-MS. Difference between natural and man-made fibers.

Unit IV: Glass

Types of glass and their composition-soda-lime, boro-silicate, safety glass, laminated, light sensitive, tempered/ toughened, wire glass, coloured glass. Forensic examinations of glass fractures- rib marks, hackle marks, cone fracture, wavy, backward fragmentation, concentric and radial fractures. Refractive index, density gradient, becke-line, specific gravity examination.

Unit V: Toolmarks

Types of toolmarks- compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks. Restoration of erased/ obliterated marks- Method of making-cast,

punch, engrave, method of restoration- etching (etchings for different metals), magnetic, electrolytic etc.

Suggested Readings:

1. Physical Evidence in Criminal Investigation and Trials Dr B P Maithil
2. Forensic Evidence Real Cash Study Dr H K Pratihari
3. Introduction to Forensic Science in Crime Investigation Dr Rukmani Krishnamurty
4. Caddy, B; Forensic Examination of Glass and Paint Analysis and Interpretation, CRC Press, New York, 2001.
5. Shaw, D; Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17,1976.
6. Saferstein, R; Forensic Science Handbook. Vol. I,II, (Ed.), Prentice Hall, New Jersey, 1988.
7. Working Procedure Manual; Physics BPR&D Publication, 2000.
8. Sharma, B.R; Forensic Science in Criminal Investigation and Trials (3rd Ed.), Universal Law Publishing Co., New Delhi, 2001.
9. Working Procedure Manual- Physics, BPR&D Publication. 2000
10. Hess, K.P; Textile Fibers and their Use, 6th Edn, Oxford and IBH Publishing Co., 1974.
11. Trace Evidence By Max M. Houck.
12. Laboratory Procedural manual, Physics Section, DFSL, Mumbai.
13. Forensic science in criminal investigation and trail by B R Sharma
14. Forensic Science in Criminal Investigation & Court Evidence V N Sehgal

SEMESTER-V

COURSE 12: FORENSIC PHYSICS

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Microscopic examination of soil.
2. Particle size distribution of soil sample.
3. Density gradient method for soil.
4. Density gradient method for glass.
5. Microscopic examination of Paint.
6. Examination of glass fracture.
7. Determination of sequence of strokes on glass.
8. Examination and matching of paint chips.
9. Examination and Comparison of tool marks.
10. Restoration of erased/obliterated punch marks.

Suggested co-curricular activities:

- Visit to Glass Industry
- Visit to Fiber Industry
- Visit to Paint Industry
- Visit to Vehicle Manufacturing Industry

SEMESTER-V

COURSE 13: INSTRUMENTATION

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of instrumentation.

Learning Outcomes:

- The students will be able to understand about the principle and working of optical and electronic microscopes used for characterization of micro evidences.
- Students will be able to gain knowledge about the concept of different chromatographic techniques which are used to separate chemical compounds.
- Students will be aware about the basics of spectroscopy, sources of radiation, their utility and limitations.
- Student will able to recognize the best suited techniques to be employed for examination of evidence.

Unit I: Microscopy

Microscopy: Principles and techniques: Light Microscope, Phase contrast, Fluorescence, stereomicroscope, polarizing, comparison and Electron Microscope (Scanning, Transmission), Forensic applications.

Unit II: Chromatography

Chromatography: Basic principles. Thin Layer Chromatography - Theory and Instrumentation, HPLC - Principle and Instrumentation application, HPTLC, densitometer, applications.

Gas chromatography: Principle and Instrumentation, types of GC (GLC, and GSC) and column types, Detectors for GC -TCD, FID, ECD, NPD etc., Pyrolysis GC, GC-MS; applications.

Unit III: Spectroscopy I

Spectroscopy: Spectrum of EMR, Interaction of EMR with matter, Source of radiations wavelength selector, Optical detector UV-Visible, IR and Raman spectroscopy Principle of single and double beam spectrophotometer, Instrumentation of IR, UV, spectroscopy qualitative and quantitative analysis of spectroscopy and their Forensic applications.

Unit IV: Spectroscopy II

Mass Spectroscopy: Principle, instrumentation, ion sources, types mass analyser-quadrupole time of flight, double focusing, tandem mass spectroscopy, detectors for mass spectroscopy their applications. NMR Spectroscopy, Neutron Activation Analysis: Principle, techniques and Forensic application. X-rays spectroscopy: Principles of X ray diffraction and X ray florescence technique, their forensic applications.

Unit V: Centrifugation and Electrophoresis

Basic fundamentals of molecular separation methodologies and parts of centrifuge – Bench top centrifugation, micro centrifugation, Low speed centrifugation, Ultra centrifugation, Gas centrifugation.

Fundamentals of electrophoresis – Agarose gel electrophoresis, Poly acrylamide Gel electrophoresis.

Suggested Readings:

1. Instrumental Methods Forensic Science Analysis 2022 Dr A K Jaiswal
2. Forensic Science UGC Net / JRF MCQ's Dr Anusinghla
3. Past 10 Years Question Bank with Answers UGC Net / JRF Khushal Singh
4. Question Answers Criminology & Forensic Science UGC Net/ JRF V N Sehgal
5. Forensic Science UGC Net / JRF MCQ s Anil Kumar Sigh
6. Barbara Wheeler and Lori J. Wilson. Practical Forensic Microscopy: A Laboratory Manual, Wiley
7. Lee and Caensstem. Advances in Forensic Science, Vol. 2. Instrumental Analysis.
8. B. K. Sharma. Instrumental Methods of Chemical Analysis, Goel Publishing House, 26th Edition (2007).
9. D. A. Skoog, D. M. West, F. James Holler and S. R. Crouch, Fundamentals of Analytical Chemistry, 8th Edition, Thomson, 2004.
10. G. Chatwal and S. Anand, Instrumental Methods of Chemical Analysis, 7 Edition Himalaya Publishing House.
11. Hobart H. Willard, Instrumental Methods of Analysis (Chemistry) Wadsworth Publishing Company.

SEMESTER-V

COURSE 13: INSTRUMENTATION

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. To determine the concentration of a coloured compound by calorimetry analysis.
2. To carry out thin layer chromatography of ink samples.
3. To carry out separation of organic compounds by paper chromatography.
4. To identify drug samples using UV-Visible spectroscopy.
5. To perform Agarose Gel Electrophoresis by using any forensic sample
6. To Separate the Molecules by using Ultra centrifugation
7. To identify the unknown petroleum product by GC-MS.
8. To separate the unknown compound by HP-TLC.
9. To determine the chlorophyll by using UV-Visible spectroscopy.
10. To determine the caffeine and benzoic acid in soft drinks by using FT-IR.

Suggested Co-Curricular Activities:

1. Visit to IICT, NIN, CDFD, CCMB
2. Visit to Forensic Science Lab.

SEMESTER-V

COURSE 14: FORENSIC QUALITY MANAGEMENT SYSTEM

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of Forensic Medicine and Anthropology.

Learning Outcomes: After studying this course the students will know-

- What is Quality assurance?
- Why it is necessary in forensic field?
- Need of quality in forensic field

Unit 1: Quality Management System: Definition of Quality, Quality Management System (based on People, Technical and Document), Quality Manual, Quality Manager, Total Quality, Quality Assurance, Quality Control, Quality Planning. Introduction, Scope of quality of Forensic Laboratories; Significance of quality assurance in Forensic Science; Accreditation: Definition and Benefits.

Unit 2: Organizations in Quality Management Systems: Organizations involved in setting guidelines and maintaining quality system: National Accreditation Board for Testing and Calibration Laboratories (NABL), International Laboratory Accreditation Co-operation (ILAC), Asia Pacific Laboratory Accreditation Co-operation (APLAC). American Society of Crime Laboratory Directors (ASCLD), International Organization for Standardization (ISO), Bureau of Indian Standards (BIS).

Unit 3: Organizational Requirements: Management Requirements- Organizational, Document control, subcontracting of tests and calibrations, control of non-conforming tests / calibration work, corrective and preventive actions, Management Review. Technical Requirements- Test and calibration methods and their validation, measurements, standards and material, traceability, sampling, Proficiency Testing and Review Program.

Unit 4: Quality Audit: Definition, Objectives and types (Internal and External): Organization, Planning, Implementation, Corrective action, Records and reports, Additional unscheduled audits.

Unit 5: Assessor Guide: Assessor's role, Assessor assignment procedure, Procedure of assessment of new applicant laboratories, Pre-assessment visit, On-site assessment, Guide of assessors to formulate recommendations for NABL, Procedure for conducting closing meeting.

Suggested Readings:

- Sean Doyle, Quality Management in Forensic Science.
- Khar R.K., Vyas S.P., Ahmad F.J., Jain G.K., Lachman/Lieberman's The Theory and Practice of
- Industrial Pharmacy, CBS Publishers and Distributors Pvt. Ltd., New Delhi.
- Willig S.H., Tuckerman M.M., Hitchings IV W.S., Good Manufacturing Practices for

- Pharmaceuticals: A Plan for Total Quality Control, Bhalani Publishing House, Mumbai.
- Lachman L., Lieberman H. A., Schwartz J.B., Tablets, Vol. I-III, CBS Publishers and Distributors, New Delhi.
- Block J.H., Roche E., Soine, T. and Wilson, C., Inorganic, Medicinal and Pharmaceutical Chemistry, Lea and Febiger.

SEMESTER-V

COURSE 14: FORENSIC QUALITY MANAGEMENT SYSTEM

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Case study on FSL management.
2. Report on NABL Accreditation.
3. Report on ISO Certification.
4. FSL Audit.

Co-curricular Activities:

Mock Inspection of Forensic Labs

SEMESTER-V

COURSE 14: NARCOTIC DRUGS AND PSYCHOTROPIC SUBSTANCES

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Narcotic Drugs and Psychotropic Substances

Learning Outcomes:

1. To differentiate between various classes of illicit drugs
2. The concept of analytical techniques for analysis of drugs
3. The laws related to narcotic drugs
4. Classification of NDPS and their effect on human body
5. Trend cases of NDPS in India

Unit I: Narcotics

Introduction, Legal Definitions, Classification- Sedatives, Stimulants, Hallucinogens, Synthetic Narcotics, Designer Drugs.

Unit II: Drugs and crimes

Nonviolent crimes, violent crimes, drug problems in India-cannabis and poppy cultivation – illegal possession – Smuggling – Transportation – Drug Profiling – Clandestine laboratories – Drug abuse in sports – Preliminary tests for Narcotic Drugs and Psychotropic Substances (NDPS).

Unit III: Sedatives

Opium and opium derivatives- Morphine- Administration, Physiological Effects, Addiction, Identification - Heroin- Abuse, Physiological Effects and Identification - Barbiturates- Nature, Administration and Identification.

Unit IV: Stimulants

Cocaine, Amphetamine, Benzodiazepines and their Use, Abuse, Physiological, Psychological, Effects, Addiction, and Identification. Hallucinogens: Cannabis, Quinazolones- Administration, Effects, Addiction and Identification- LSD (Lysergic Acid Diethylamide), Psylocybin, Mescaline and MDMA: Administration, Effects, Addiction and Identification.

Unit V: NDPS Act 1985

Drug law enforcements in India- Narcotic control bureau, Central Bureau of Narcotics, Narcotics Control and Intelligence Bureau– Prevention of Drug trafficking - Penalties for NDPS related offenses – NDPS Amendments 2014 – United Nations Drugs Conventions.

Suggested Readings:

1. Pharmacological classification of drugs K. D Tripathi

2. Essentials of medical pharmacology K. D Tripathi
3. Chromatographic analysis of pharmaceuticals John a adamovics
4. Pharmaceutical analysis David G watson
5. Pharmaceutical chemical analysis: methods for identification and
limit test Olepederson
6. Drug testing in alternate biological specimens Amanda j. jenkins

SEMESTER-V

COURSE 14: NARCOTIC DRUGS AND PSYCHOTROPIC SUBSTANCES

Practical

Credits: 1

2 hrs/week

List of Experiments:

Detection of following Narcotic Drugs & Psychotropic Substances by spot/colour test.

- a. Opiates
- b. Barbiturates
- c. Benzodiazepines
- d. Amphetamines and Cannabis

Suggested Co-curricular activities:

- Visit to Narcotics Control Bureau
- Visits to Rehabilitation Centers

SEMESTER-V

COURSE 15: FORENSIC MEDICINE AND ANTHROPOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Medicine and Anthropology.

Learning Outcomes:

1. Able to define the postmortem interval and explain how short- and long-term PMIs are estimated
2. Able to define and describe the medico legal autopsy and explain when a coroner or medical examiner must perform an autopsy
3. Define and distinguish between the cause of death and the manner of death
4. Able to describe the development and structure of bones
5. The various anthropological tests that can be done on skulls to help identify them
6. Able to describe how bones are individualized.

Unit I: Introduction to Forensic Medicine

Pathology, Medical Jurisprudence. Medical Law and Ethics. Introduction, History & Development of Forensic Anthropology & Archaeology, Forensic Odontology & Forensic Taphonomy. Role of Anthropologist.

Unit II: Introduction to Human Anatomy

Axial Skeleton- Skull, Sutures of skull, Cranial bones, Facial bones, Sternum, thoracic bones, vertebral column, Appendicular Skeleton- Bones of Upper limbs, Lower limbs, Pelvic Girdle etc. Determination of sex & age from skull, mandible, pelvis, Femur, scapula etc.

Unit III: Medico-legal Autopsy

Death and its Causes- External examination of deceased body – Internal Examination- Determination of time since death and cause of death- Injuries - classification- Medico-legal aspects of injuries- Postmortem changes. Exhumation process and its importance.

Unit IV: Sexual Offences

Rape- unnatural sexual offences- sexual perversions- Abortion- Infanticide- foeticides- impotence and sterility- virginity, Thermal deaths- electrocution- starvation Asphyxia- Drowning deaths.

UNIT V: Forensic Odontology

Basic principles, Applications in crime investigations- Bite Mark Analysis, Age estimation etc., Development of teeth- Dentition, Architecture of teeth, growth of teeth- Milk, Permanent. Dentition Library, Forensic Odontology limitations

Suggested Readings:

1. Forensic Medicine and Toxicology S N Tiwari
2. A Handbook of Forensic Anthropology by Meenal Dhall, Renu Tyagi, Prof. Anup Kumar Kapoor
3. Handbook for Forensic Odontology Dr Vikram Ahuja
4. Anthropology and Forensic Science the Current Dynamism Prof. Anup Kumar Kapoor
5. Practical Manual on Human Physiology by Prof. Sunita Mishra
6. Nutrition Health and Life Style Management by Pro Sunita Mishra
7. Forensic Science in India, A Vision for the Twenty first Century by B B Nanda
8. Forensic Biology Dr Rukmani Krishnamurty.
9. Forensic Serology & Blood Examination Dr Archana Tripathi
10. An Introduction to Forensic Hair Examination Shubhra Goutam
11. Women Victimization Dr Deepti
12. Forensic Science for Criminal Justices System Dr Anu Singhla
13. An Interdisciplinary Approach to Forensic Science Dr P K Janjua
14. Women Nutrition and Health Dr Neetu Sing
15. Perceived Status of Women in India Prof. Vimala Veerarghavan
16. Introduction to Forensic Anthropology, Steven N. Byers, Pearson/Allyn and Bacon, 2011.
17. Forensic Anthropology Laboratory Manual, Steven N. Byers, Pearson Education, USA, 2011.
18. Forensic Anthropology: Current Methods and Practice, Angi M. Christensen, Nicholas V. Passalacqua and Eric J. Bartelink, Academic Press, USA, 2014.

SEMESTER-V

COURSE 15: FORENSIC MEDICINE AND ANTHROPOLOGY

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Autopsy
 - i) External Examination of Deceased body
 - ii) Internal Examination of Deceased body
 - iii) Post-mortem Changes
2. Collection and Preservation of Visceral Samples.
3. Identification and differentiation of Human Bones (Male & Female)
 - iv) Skull
 - v) Pelvis
 - vi) Upper limbs
 - vii) Lower limbs

Suggested co-curricular activities:

- Visits for post-mortem autopsy
- Visits to clinical laboratories for testing procedures
- Handling and studying human skeleton

SEMESTER-V

COURSE 15: FORENSIC LAWS

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Laws

Learning Outcomes:

- To learn about the Forensic Law and legal system
- Laws pertaining to the admissibility of Electronic Evidence.
- Legal system in India
- Various sections

Unit I: Law to Combat Crime & Constitution of India

Classification – civil, criminal cases. Essential elements of criminal law. Constitution and hierarchy of criminal courts. Criminal Procedure Code. Bailable and Non-bailable offences. Cognizable and non-cognizable offences. Compoundable and Non-compoundable offence. Constitution of India: Preamble, Fundamental Rights, Directive Principles of State Policy. – Articles 14, 15, 20, 21, 22, 51A.

Unit II: Indian Penal Code

Indian Penal Code pertaining to offences against persons – Sections 121A, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362. Sections 375 & 377 and their amendments. Indian Penal Code pertaining to offences against property Sections – 378, 383, 390, 391, 405, 415, 420, 441, 463, 489A, 497, 499, 503, 511.

Unit III: Indian Evidence Act

Indian Evidence Act – Evidence and rules of relevancy in brief. Expert witness. Cross examination and re-examination of witnesses. Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141. Section 293 in the code of criminal procedure.

Unit IV: Acts Pertaining to Chemistry & Toxicology

Narcotic, Drugs and Psychotropic Substances Act. Drugs and Cosmetics Act. Explosive Substances Act, Poison Act. Prevention of Food Adulteration Act & rules

Unit V: Acts pertaining to Socio-economic & Environmental Crimes

Dowry Prohibition Act, Essential Commodity Act, Prevention of Corruption Act, Wildlife Protection Act, Environment Protection Act, Untouchability Offences Act and Arms Act.

Suggested Readings:

1. Ratanlal & Dhirajlal, The Indian Penal Code

2. Dr.J.N.Pandey, Consitutional Law of India
3. Government of India, The Constitution of India Bare Act with Amendments
4. C K Takwani, Civil Procedure with Limitation Act 1963
5. LexisNexis, The Code of Civil Procedure, 1908
6. Government of India, The Code of Criminal Procedure 1973 (CRPC) Bare Act with Amendments
7. Batuk Lal, The Law of EVIDENCE
8. Lawmann's, Information Technology Act, 2000
9. Government of India, The Narcotic Drugs and Psychotropic Substances Act 1985 (NDPS) Bare Act with Amendments
10. The Commersial Law Publishers, The ARMS Act, 1959
11. Professional book Publisher, The Explosives Act, 1884
12. Rajeev Babel, Laws relating to Intellectual Property Rights in India
13. LexisNexis, The Prevention of Food Adulteration Act, 1954
14. MAGAZINE R, DRUG AND COSMETIC ACT 1940 AND RULES 1945
15. Lawmann's, Dowry Prohibition Act 1961
16. Commercial Law Publishers (India) Pvt. Ltd., The Environment (Protection) Act, 1986
17. Lawmann's, Essential Commodities Act, 1955 (Act No. 10 of 1955)

SEMESTER-V
COURSE 15: FORENSIC LAWS

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Case study on Rape Case.
2. Case study on Murder Case.
3. Case study on Explosive Case.
4. Case study on NDPS Case.
5. Moot court on rape case.
6. Moot court on murder case
7. Moot court on kidnapping case
8. Moot court on drug trafficking case
9. Moot court on property case
10. Moot court on patent case

Suggested Co-curricular Activities:

- Visit to court.

SEMESTER-VII

COURSE 16: FORENSIC ODONTOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Odontology

Learning Outcomes: After studying this course the students will know-

- Introduction to Forensic odontology
- Oral embryology and applied aspects
- Tooth Morphology
- Bite-mark analysis

Unit 1: Tooth Morphology

History of Forensic Dentistry. Human dentition. Endodontic anatomy: Description, Morphology, Types and functions of teeth, (permanent & individual), Chronology of development. Morphology of Deciduous teeth. Occlusion: Definition, Factors influencing occlusion.

Unit 2: Oral Embryology

Development of teeth: Epithelial-mesenchymal interaction, stages of development of crown, root & supporting tissues, formation of calcified tissues, Disorders in development of teeth. Tooth Eruption: Mechanisms, deciduous and permanent teeth. Role of gubernacular cord, Clinical or Applied aspects. Shedding of teeth: Factors, mechanisms of shedding of deciduous teeth, Complications, Forensic significance.

Unit 3: Oral Physiology

Saliva: Formation and Composition. Mastication: Masticatory force & its measurement, Peculiarities of masticatory muscles, Masticatory cycle and Masticatory reflexes. Different types of dental records i. Dental charts ii. Dental radiographs iii. Study casts iv. Denture marking v. Photographs. Detailed microscopic study of: - Enamel, Dentine, Cementum, & Applied aspects (Clinical and forensic significance) of the above. Dental records: Types, identical charts, dental radiographs, case studies, dental markings, photographs, microscopic study of enamel, Dentine, Cementum, Pulp tissue, Age changes; Clinical and forensic significance.

Unit 4: Bite-Mark Analysis

History, anatomy & types. Collection and preservation of bite-mark evidences: non-invasive Forensic dental photography (alternate light imaging, fluorescence imaging technique, UV, IR) & invasive techniques. Bite-mark as biological evidence, factors affecting bite mark in perishables & bite-mark diagnosis. Histological examination of human bite, comparison of bite-marks, factors affecting.

Unit 5: Odontology - Evidences and Analysis

Development and scope role in mass disaster and anthropology, structural variation in teeth (human and non-human). Photography and evaluation of bite marks. Determination of age from teeth: eruption sequence, Gustafson's method, dental anomalies - significance in personal identification. ABFO bite-mark scoring guide, reliability of bite-mark evidences. Legal aspects of bite marks.

Suggested Readings:

1. Forensic Dental evidence, Mike Bowers, Elsevier Publ
2. Forensic Radiology, B.G.Brogdon, 2nd Ed, CRP Press, 2010
3. Forensic Radiology, B.G. Brogdon, 1st Ed, CRP Press, 1998
4. Bite Mark Evidence, Robert BJ Dorian, 1st Ed, CRP Press, 2004
5. Dental Autopsy, William E Silver, Richard R Souviron, 1st Ed, CRP Press, 2009
6. Forensic Dentistry, Senn DR and PG Simson, 2nd Ed, CRP Press, 2010
7. Forensic Photography, Sanford L Weiss, 1st Ed, Prentice Hall, 2008
8. Manual of Forensic odontology, Herschaft EE, Alder ME, Ord DK, Rawson RD & Smith ES, 4th Ed, ASFO, 2007
9. A color atlas of forensic dentistry, Whittaker DK and Mc Donald DG, 1st Ed, Mosby Yr Book, 1989
10. Digital analysis of bite mark evidence, RJ Johanson & Bowers CM

SEMESTER-VII

COURSE 16: FORENSIC ODONTOLOGY

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Processing of hard and soft tissues for microscopic study
2. Basic histochemical staining patterns of oral tissues.
3. Expert opinion on clinical cases of medico legal importance.
4. Examination of dental and dental mark photographs.
5. Sex determination in adults from dental morphology
6. To collect and cast the given bite-mark evidences.
7. Collection and preservation of tooth sample.
8. Analysis of bite marks.

Suggested co-curricular activities

- Visits to Odontology Lab
- Poster presentation on Forensic Odontology

SEMESTER-VII

COURSE 17: FORENSIC NANOTECHNOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Nanotechnology

Learning Outcomes: After studying this course the students will know-

- About Forensic nanotechnology
- How it is helpful for the forensic analysis
- Its stability in detection of evidence

Unit 1: Nanoscience and Nanotechnology

Introduction and History, Definitions: nanoscience, nanomaterials, nanotechnology, Nanomaterials: Classification and Properties, Crystal symmetries, crystal directions, crystal planes, band structure. Recent advancements in the field of nanotechnology. Future of nanotechnology.

Unit 2: Synthetic Techniques of Nanomaterials

Methods of preparation- Top-down approaches (Mechanical milling, Electrospinning, Lithography, Sputtering, The arc discharge method and Laser ablation) and Bottom-up approaches (Chemical vapor deposition (CVD), Solvothermal and hydrothermal methods, The sol-gel method, Soft and hard templating methods and Reverse micelle methods).

Unit 3: Characterization Techniques

X-Ray Diffraction and Scherrer method, Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Probe Microscopy, Atomic Force Microscopy, Piezo-Response Microscopy, X-Ray Photoelectron Spectroscopy, XANES and XAFS, Angle Resolved Photoemission Spectroscopy, Diffuse Reflectance Spectra, Photoluminescence Spectra, Raman Spectroscopy.

Unit 4: Forensic Applications of Nano technology

Visualization of Fingerprints: Introduction to latent fingerprints. Latent Fingerprint Development: Traditional Powders and Nanomaterials. Analysis of Drugs and Pesticides: Introduction to drugs and pesticides. Detection of drugs and pesticides: Nano Chips, Nano Sensors, Nano Probes. Analysis of explosives: Introduction to explosives. Detection of explosives: Nano Chips, Nano Sensors, Nano Probes.

Unit V: Other Applications of Nanotechnology

Industrial applications, Agricultural applications, Automobile applications, Medicinal applications, Pharmaceutical applications and other related applications.

Suggested Readings:

1. Nano science and nano technology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers.
2. Introduction to Nano Technology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers.
3. Introduction of Forensic Nanotechnology as Future Armour (Nanotechnology Science and Technology), Ritesh Kumar Shukla, Nova Science Publishers Inc., ISBN-10 : .1536160407
4. Nanotechnology by Jermy J Ramsden, Elsevier publishers
5. Nano Materials- A.K.Bandyopadhyay/ New Age Introdu.
6. Nano Essentials- T.Pradeep/TMH.
7. Nanotechnology the Science of Small by M.A Shah, K.A Shah, Wiley Publishers.
8. Principles of Nanotechnology by Phani Kumar, Scitech.

SEMESTER-VII**COURSE 17: FORENSIC NANOTECHNOLGY**

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Greener and chemical synthesis of various nanomaterials by top-down approaches.
2. Greener and chemical synthesis of various nanomaterials by bottom-up approaches.
3. Characterization of nanomaterials by SEM and TEM with EDS.
4. Characterization of nanomaterials by XRD and XRF.
5. Characterization of nanomaterials by UV-visible spectroscopy.
6. Characterization of nanomaterials by TG, DTA and DSC.
7. Dielectric and magnetic study of nanomaterials by using LCR meter and VSM respectively.
8. Development of latent fingerprint by using nanomaterials.
9. Identification of drugs and pesticides by using nanomaterials.
10. Identification of explosives by using nanomaterials.

Suggested co-curricular activities

- Visits to Nanotechnology Lab
- Visit to Central Instrumentation Lab

SEMESTER-VII

COURSE 18: FORENSIC ENGINEERING

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Engineering

Learning Outcomes:

1. This paper describes and explains the investigation of various accidents.
2. Use of forensic investigation techniques to determine of causes failure.
3. assess vulnerable engineering details such as electrical MCB Circuit, eccentric connections, rating criteria of electrical appliances, using well documented failure case studies.
4. Rigorous assessment and evaluation of engineering mistakes such as fire cases.
5. Causes of arson -automotive failure- vehicular fire

Unit I: Engineering and Various Types of Failures

Initiation of Failures and associated investigations (Electrical, Mechanical, Structural)- An overview of Electrical System failure (House hold materials such as cables, wires, switchboards/MCBs, MCB faults, Improper Ratings/layout of appliance fitting according to safety criterion etc.) Mechanical Failures manufacturing defects, inadequate quality control measures, Structural Failures (Structural material composition analysis leading to failures, an investigation view of multi components failures due to any one module manufacturing defects, etc.)

Unit II: Investigation of Arson and Incendiary Fires

General - Arsonist Profile - Typical Characteristics of an Arson or Incendiary Fire Daisy Chains and Other Arson Precursors - Liquid Accelerant Pour Patterns, Spalling, Detecting Accelerants after a Fire. Automotive Fire Failure: General, Vehicle Arson and Incendiary Fires, Electrical and Mechanical Causes

Unit III: Rail Accident

Rail accident – Introduction and Types. Reasons behind accidents - Infrastructure Defects, Human errors, Signaling Failures, Unmanned level crossings (UMLCs). Measures to reduce accidents - Rashtriya Rail Sanraksha Kosh (RRSK), Technological Upgradation, LHB Design Coaches, GPS based Fog Pass Device, Modern Track Structure, Ultrasonic Flaw Detection (USFD), Mechanization of Track Maintenance, Interlocking System, Elimination of Unmanned Level Crossings (UMLCs). Various Committees recommendation to ensure Railways Safety. Scientific investigation of rail accident.

Unit IV: Traffic, Road Safety Failures, Traffic Accidents

Vehicle Performance: Engine Limitations, Deviation from Theoretical Mode, Peel Out, Lateral Tyre Friction, Bootlegger's Turn.
General, Basic Momentum Equations, Properties of an Elastic Collision, Coefficient of Restitution, Properties of Plastic Collision, Analysis of Forces during Fixed Barrier

Impact, Energy Losses, Centre of Gravity, Moment of Inertia, Torque, Angular Momentum, Simple Skids, Tyre Friction, Skid Deceleration and Speed Reduction, Brake Failure, Low Velocity Impacts, Measuring Roadway Curvature, Motorcycle Turns, Simple Vehicular Falls

Unit V: Investigation of Civil and Structural Failures

Forensics of Building Failure - Forensics of Bridge Failure - Forensics of Civil Engineering Materials Failure (Bricks, Mortar, Concrete etc.) Buildings/ Bridges / Flyovers / Roads Multi storeyed Buildings / Parking Lots - Surface Inadequacies of Road Profile- Airport Runways and Railway Tracks - Forensics of Civil Engineering Structures after Natural Disasters.

Building Collapses, Bridge Collapses - Activities in the Investigation Process, Site Investigation and Sample Collection

Suggested Readings:

1. Structure Elucidation of Organic Compounds by Spectroscopic Techniques Dr. Pradip V Tekade
2. Crime Scene Management A Forensic Approach Dr M S Rao
3. Recurrent Neural Network and Application Neeraj Sahu.
4. Network Analysis Technique for Project Management Dr R K Tewari
5. Forensic Engineering Fundamentals By Harold Franck.
6. Elements of Civil Engineering By Mimi Das Saikia
7. Electronic Principles By Albert Malvino and D. J. Bates.
8. Electronics Communication Systems By Kennedy and Davis
9. Measurement, Instrumentation and Experiment Design in Physics and Engineering By Michael Sayer and Abhaaiman Singh.
10. Randall K. Noon: Forensic Engineering Investigation CRC Press, 2000
11. Robert R.: Forensic Structural Engineering Handbook. 2a edn. McGraw-Hill, 2009
12. Robert D.: Forensic Geotechnical and Foundation Engineering, 2a edn. McGraw-Hill, 2011
13. Stephen E. P.: Forensic Engineering: Damage assessments for Residential and Commercial Structures. CRC Press. 1^o edn, 2013
14. Kennet L. C.: Forensic Engineering, (Civil engineering- Advisors). 2nd edn. 1998
15. Harol F., Darren F.: Forensic Engineering Fundamentals. CRC Press. 1" edn. 2012

SEMESTER-VII

COURSE 18: FORENSIC ENGINEERING

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Analysis of fire debris by GC
2. Simulation of Arson case
3. Simulation of Vehicle accident case.
4. Collection of samples at scene of vehicle accident.
5. Simulation of rail accident.
6. Collection of samples at scene of fire
7. Analysis of cement samples
8. Examination of mortar samples
9. Examination of bricks samples
10. Analysis of iron rod sample.

Suggested curricular activities:

- Accident Reconstruction Project
- Road accident crime scene visits
- Learning Techniques of collection of tyre impressions from RTO offices
- Visits to RTO offices
- Visits to fire station
- Guest lectures on structural failures on building
- Learning the rules for prevention of automotive accident

SEMESTER-VII

COURSE 19: FORENSIC PHOTOGRAPHY AND VIDEOGRAPHY

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Photography and Videography

Learning Outcomes: The student will learn about

1. Basics of Photography and Videography.
2. Forensic working groups on photography.
3. Significance of Forensic Photography and Videography.

Unit I: Photography

Introduction to Photography, fundamentals of light and vision, photographic instruments: types of camera and lenses, light sources, optical filters, Basic principles and techniques of Black & White and color photography, Spectral sensitivity of photographic materials, Concepts of colored photography, Camera exposure determination.

Unit II: Camera and Photographs

Linkage of cameras and film negatives, Concepts of digital photography, its applications and limitations, Digital Image formation: Image Sensors, Different Capturing Method: Digital camera, Scanner, Frame Grabber, Digital camera types: Floppy Disc type, Flash Card type, Hard Disc type, Method of storing and processing digital image: Raster and Vector method, Representation of digital image: Resolution, Pixel Depth, Pixel Aspect Ratio, Dynamic Colour Range, File Size, Colour Models, Image Compression, File Formats, Calculating image resolution for outputs, related case studies.

Unit III: Image Editing

Image editing: tools & techniques used, adjustment of brightness, contrast, tonal and colour values, experimenting with level and curve; Digital Manipulation in images: Applying selective effects to images and filters with masks and different digital darkroom effects, related case studies.

Unit IV: Videography

Introduction to videography: cameras, lenses and camera movements, capturing of videos: frames and Pixelization, technical aspects of video evidences, high speed videography and its forensic applications, manipulation in video files, source determination of video evidences, tools for video analysis, related case studies

Unit V: Forensic Photography, Videography and Court Presentation

Crime scene photography and videography, photomicrography, macro photography, photography/videography of forensic evidences, IR and UV photography, Underwater Photography and Surveillance Photography photogrammetry, Report Writing, Court

representation and admissibility in judicial system.

Suggested Readings:

1. Marsh, N. (2014). Forensic Photography. John Wiley & Sons.
2. Schultz, D. (1977). Crime scene investigation. Englewood Cliffs, N.J.: Prentice-Hall.
3. Sutton, R., Trueman, K., & Moran, C. Crime scene management.
4. Wright, M. (2006). Digital photography. Irvington, NY: Hylas Publishing.
5. Sartore, J. Fundamentals of photography.
6. Ang, T. Digital photography essentials.

SEMESTER-VII

COURSE 19: FORENSIC PHOTOGRAPHY AND VIDEOGRAPHY

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. To study the basics of Forensic Photography.
2. To study the different parts of camera.
3. To study the Photographic technique by using SLR/ Digital camera.
4. To study the forensic significance of crime scene photography.
5. To perform photographic analysis of vehicular accident case.
6. To perform photographic analysis of hanging case.
7. To perform photographic analysis of shooting case.
8. To perform photographic analysis of dacoit case.
9. To perform videography of different crime scenes.
10. To write the forensic photography report.

Co-curricular Activities:

- Forensic Photography Exhibition
- Workshop on Forensic Photography and Videography

SEMESTER-VII

COURSE 20: FORENSIC ENTREPRENEURSHIP

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Entrepreneurship

Learning Outcomes: After studying this course the students will know-

- About challenges in the field of Forensic Entrepreneurship.
- Emerging fields in forensics

Unit-I: Entrepreneurship

Definition and Concept of entrepreneurship, Characteristics of Entrepreneur, Classification of Entrepreneurs, Role of Entrepreneurship in Economic Development, Start-ups.

Unit-II: Idea Generation and Project Formulation

Ideas in Entrepreneurships – Sources of New Ideas – Techniques for Generating Ideas – Preparation of Project Report: Contents, Guidelines for Report preparation, Project Appraisal Techniques – Economic Analysis-Financial Analysis-Market Analysis.

Unit-III: Supporting Institutions and Taxation Benefits

Central level Institutions: NABARD; SIDBI – State Level Institutions –DICs – SFC - Government Policy for MSMEs – Tax Incentives and Concessions.

Unit IV: Challenges and Opportunities

Factors affecting forensic business: (finance, infrastructure, equipment, manpower, resources, project location, end result, quality issues, etc) Assessing opportunities: Challenges, pitfalls and critical factors of new venture; Business and Entrepreneurial development organizations.

Unit V: Forensic Entrepreneur

Characteristics, Case studies of successful and unsuccessful Forensic-entrepreneurs. Core concept of Market: Identification and evaluation of market potential of various Forensic entrepreneur sectors. Development in emerging new emerging fields in forensic science.

Suggested Readings:

1. Arya Kumar, Entrepreneurship, Pearson, Delhi
2. Poornima MCH, Entrepreneurship Development –Small Business Enterprises, Pearson, Delhi
3. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
4. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi
5. Anil Kumar, S., ET.al., Entrepreneurship Development, New Age International Publishers, New

Delhi

6. Khanka, SS, Entrepreneurship Development, S. Chand, New Delhi

7. Peter F. Drucker, Innovation and Entrepreneurship

8. A.Sahay, M. S. Chhikara, New Vistas of Entrepreneurship: Challenges & Opportunities

9. Dr B E V L Naidu, Entrepreneurship. Seven Hills Publishers

SEMESTER-VII

COURSE 20: FORENSIC ENTREPRENEURSHIP

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Identify the possible domains for the forensic entrepreneurship.
2. Identify the challenges of forensic entrepreneurship.
3. Forensic business idea proposals.

Co-curricular Activities:

- Workshop on Forensic Entrepreneurship

SEMESTER-VIII

COURSE 21: FORENSIC BIOMETRICS

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of Forensic Biometrics

Learning Outcomes: After studying this course the students will know-

- Fundamental Aspects of Biometry
- Identification and Verification of Biometry.
- Assessing the privacy risks of biometrics.

Unit I: Fundamental Aspects of Biometry

Definition, Biometric vs traditional techniques. Classification of biometric systems – Physiological and Behavioral. Merits and demerits of physiological and behavioral biometrics. Multimodal biometrics.

Unit II: Key Biometric Processes

Key Biometric Processes – Enrolment, Identification and Verification. Positive and Negative Identification. Performance measures used in biometric systems – FAR, FRR, GAR, FTA, FTE and ATV.

Unit III: Physiological Biometrics

Fingerprints, palm prints, geometry of hand; components, working principles, strength and weakness.

Iris, Retina and Face geometry; components, working principles, strength and weakness

Unit IV: Behavioral Biometrics

Handwriting, Signatures, Keystrokes, Gait and Voice; components, working principles, strength and weakness.

Unit V: Standards in Biometrics

Assessing the privacy risks of biometrics, need for standards, different biometric standards.

Suggested Readings:

1. Massimo Tistarelli, Handbook of Biometrics for Forensic Science.
2. Archana Singh, Biometrics & It's Uses: 3 (Forensic Science).
3. Monique Mann and Gregor Urbas Marcus Smith, Biometrics, Crime and Security.
4. S. Nanavati, M. Thieme and R. Nanavati, Biometrics, Wiley India Pvt. Ltd. (2002).

5. P. Reid, *Biometrics for Network Security*, New Delhi (2004).
6. J.R. Vacca, *Biometric Technologies and Verification Systems*, Butterworth-Heinemann, Oxford (2007).

SEMESTER-VIII

COURSE 21: FORENSIC BIOMETRICS

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Security of existing biometric system (fingerprint recognition).
2. Security of existing biometric system (face recognition).
3. Security of existing biometric system (iris recognition).
4. Security of existing biometric system (voice recognition).

Co-curricular Activities:

- Poster presentation on Forensic Biometrics.

SEMESTER-VIII

COURSE 22: MICROBIAL FORENSICS

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Microbial Forensics

Learning Outcomes: After studying this course the students will know-

- Types and identification of bacteria and viruses
- Microbial Forensic Analysis
- Theory and basic principles of forensic microbes

Unit I: Bacteria and Viruses

Introduction and Classification; Food borne bacteria. *Shigella*, *Salmonella*. Introduction to virus classification. Naturally emerging viruses: West Nile, SARS, Monkey Pox, H1N1, Severe acute respiratory syndrome (SARS), HIV. Revolution in virology, Synthetic Poliovirus, Determining source of an engineered virus.

Unit II: Microbial Forensics

Types and identification of Bacteria and Viruses, Microbial profiles as identification tools, Microorganisms in bioterrorism, Anthrax, Transmission of HIV as a criminal act, Role of microbes in food poisoning. Forensic aspects of biological toxins, Microbial Forensic Analysis of Trace and Unculturable Specimens.

Unit III: Microbes of Forensic Importance

Bacillus anthracis, *Yersinia pestis*, *Francisella tularensis*, *Brucella spp.*, *Burkholderia pseudomallei*, *Clostridium botulinum*, *Listeria monocytogenes* and their morphological & biochemical studies. DNA of microbes in soil for crime detection, Fungi of forensic importance: Opportunistic mycoses, *Chytridiomycota* *zygomycota*, *Aspergillus fumigates*, *Microsporidium*, *pneumocytosis jiroveci*, *Asp.flavus* & *Candida spp.*, epidemiology, Antifungal agents.

Unit IV: Bioterrorism

Introduction and Historical Perspectives - Definitions and History, Theory behind Categories of Bioagents, Biosurveillance and Biodiagnostics. Environment, Health and Global Security - Novel Detections Methods for Bioagents, Bioagent Dissemination in the Atmosphere, Bioagent Dissemination by Zoonotic Transmission, Biosecurity in the Food Industry, Bioagent Dissemination in Water and Food, Genetically Engineered Microbes. Infectious Disease and Vaccines - Infectious Diseases: An International Approach, Vaccines and Vaccinations, Industrialized Production of a Vaccine for a Bioagent, Vaccine Development and Usage.

Unit V: Microbial Forensic Techniques

Viral forensics, Engineering Novel Viruses: Recombinant DNA.

PCR, Terminal Restriction Fragment Length Polymorphism (TRFLP), Amplified Fragment Length Polymorphism (AFLP), Single Stranded Conformation Polymorphism Analysis (SSCP), Thermal and Denaturing Gradient Gel Electrophoresis (TGGE, DGGE), Amplified Ribosomal DNA Restriction Analysis (ARDRA), Randomly Amplified Polymorphic DNA (RAPD). Non-PCR DNA Fingerprinting Techniques with Applicability in Forensic Studies- Restriction Fragment Length Polymorphisms (RFLP) and Ribotyping. Forensic Interpretation of DNA Data, Isotopic Testing and Correlation to Contaminant Source.

Suggested Readings:

1. Prescott's Microbiology by J. M. Willey, K. Sandman and D. Wood. 11th edition. McGraw Hill Higher Education, USA. 2019.
2. Microbiology: An Introduction by G.J. Tortora, B.R. Funke, C.L. Case, D. Weber and W. Bair. 13th edition. Pearson Education, USA. 2019.
3. Brock Biology of Microorganisms by M.T. Madigan and J.M. Martinko. 15th edition. Prentice Hall International Inc., USA. 2017.
4. Microbiology: A Laboratory Manual by J. Cappuccino and C.T. Welsh. 11th edition. Pearson Education, USA. 2016.
5. Phycology by R.E. Lee. 4th edition. Cambridge University Press. 2008.
6. Introduction to fungi by J. Webster and R. Weber. 3rd edition. Cambridge University Press. 2007.
7. Principles of Microbiology by R. M. Atlas. 2nd edition. W.M.T. Brown Publishers, USA. 1997.
8. Introductory Mycology by C.J. Alexopoulos, C.W. Mims, C.W. Blackwell. 4th edition. Wiley and Sons, UK. 1996.
9. Microbiology by M. J. Pelczar, E. C. S. Chan and N. R. Krieg. 5th edition. McGraw Hill, USA. 1993.
10. General Microbiology by R.Y. Stanier, J.I. Ingrahm, M.L. Wheelis and P.R. Painter. 5th edition. McMillan Press, UK. 1987.

SEMESTER-VIII
COURSE 22: MICROBIAL FORENSICS

Practical

Credits: 3

3 hrs/week

List of Experiments:

1. Microscopic measurements, micrometer (ocular and stage), haemocytometer.
2. Preparation of Microbial media (bacteria, yeast, mold, algae, protozoa)
3. Estimation of DNA by diphenyl amine method
4. Sampling and quantification of microorganisms in air, soil and water.
5. Isolation of bacteria (Streak plate, spread plate, pour plate, serial dilution)
6. Methods of inoculation of different microbes in selective media.
7. Tissue Culture – Callus culture, Cell suspension.

Co-curricular Activities:

- Poster presentation on Microbial Forensics
- Seminar on Microbial Forensics
- Group Discussion on Microbial Forensics

SEMESTER-VIII

COURSE 23: WILDLIFE FORENSICS

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Wildlife Forensics.

Learning Outcomes:

- To be able to define entomology and forensic entomology and give example
- To be able to list and describe the various types of arthropods that invade a body after death
- to be able to describe the contributions of forensic entomology to the determination of the presence of drugs and poisons in a body
- able to classify endangered species of animal wildlife.
- To identify the natural habitat of different species
- To investigate the drowning cases using diatoms
- Analysis of Botanical evidences

Unit I: Wildlife Forensics

Importance of wildlife and Environment; Wildlife (Protection) Act- 1972, Protected and endangered species of animals and plants; Sanctuaries and their importance; Types of wildlife crimes, recovering evidence at poaching scenes, locating the burial: Wild animals as pharmacopeias, Wildlife artifacts (Bones, skin, fur, hair, nails, blood, feather, etc.), Trade in wild animals.

Unit II: Entomology

Introduction, Insects & their Biography, the life cycle of insects, collecting insects at the scene of crime, the PMI, classification of insects, rearing insects' calculation if PMI, other Forensic use and case study.

Unit III: Forensic Botany and Botanical Evidence

Introduction, types, location, collection evaluation and forensic significance of fungi and plants in forensic science, wood and pollen grains, Methods of identification and comparison, various types of planktons and diatoms and their forensic importance; Limnology.

Unit IV: Environmental Forensics

Introduction to Environmental Forensics. Mercury- Natural and anthropogenic sources, detecting mercury in indoor environment and forensic aspects. Asbestos-sources and detection in air, water, fibres etc. Arsenic- sources, compounds, analytical methods and forensic aspects.

Unit V: Environment and Ecosystems

Concept of biosphere, communities and ecosystems; Ecosystem characteristics structure and function; Xenobiotic and recalcitrance, Bioremediation using microorganisms and plants, Genetically Modified Organisms to treat effluents; introduction to BOD and COD, use of biosensors, bioremediation of solid waste, industrial effluent containing organic pollutants and metal ions. Environmental Management Introduction and scope of environmental management, basic concepts of sustainable development, Environmental Impact

Assessment. Wildlife Protection Act 1972, Forest Conservation Act 1981, Environment (protection) Act 1986.

Suggested Readings:

1. Forensic biology – Richard Li
2. Forensic Medicine – P.V. Guharaj & M. R. Chandran
3. A textbook of Medical jurisprudence and toxicology- Modi
4. Wildlife forensic investigation-Principles and practice: Cooper and Cooper, CRCpress
5. Forensic Palynology in the United States of America (1990)- Bryant, V.M. Jr, Mildenhall, D.C.and Jones, J.G.14.PP.193-208
6. Textbook of Pollen Analysis 4th Edition- Faegri, K. Iverson, J. and Krzywinski, K. John Wiley& Sons, New York 1989.
7. Microbial forensics -Roger Breeze, Bruce Budowle, Steven E. Schutzer. Elsevier AcademicPress
8. The Forensic Laboratory Handbook Procedures and Practice - Ashraf Mozayani, CarlaNoziglia. 2nd edition. 2011. Human Press.
9. Forensic Science in Wildlife Investigations - Adrian Linacre Taylor and Francis,2009
10. The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature B Donna M.
11. Jackson, Wendy Shattil, Bob Rozinski Universal Athenaeum (Denver, CO, U.S.A.)
12. Forensic palynology Dallas Mildenhall, Patricia Wiltshire, Vaughn Bryant Elsevier, 2006
13. Forensic palynology: an in-depth look at its indispensable value National University,SanDiego,2002
14. Medical microbiology by Ananthnarayan.

SEMESTER-VIII

COURSE 23: WILDLIFE FORENSICS

Practical

Credits: 1

2 hrs/week

List of Experiments:

1. Identification of starch granules
2. Identification and classification of diatoms
3. Identification of pollen grains to genus level
4. Identification of wood using physical and anatomical features
5. Section and cutting of plant material and their examination
6. Staining techniques and laboratory exercises for identification of different plant cell types
7. Collection and packaging of wildlife evidences.
8. Extraction of plant poisons
9. Separation of plant poisons by TLC.
10. Quantification of plant poisons by UV-Visible spectrophotometer

Suggested co-curricular activities

- Visits to wildlife sanctuaries and Zoos
- Visits to botanical gardens for poisonous plants
- Visits to LaCONES, CCMB & CDFD
- Collection of pollen grains related to criminal activities

SEMESTER-VIII

COURSE 24: FORENSIC JOURNALISM

Theory

Credits: 3

3 hrs/week

Learning Objectives: The student will be able to understand the basics and importance of Forensic Journalism.

Learning Outcomes:

Gives awareness to the students on

- Writing news
- Portraying news to the public
- Things to be delivered and not to be delivered to the public.

Unit 1: Mass communication

Media, Types of Media, Concepts of Global Media, Mass Communication: Definitions, Characteristics, Scope, Mass Communication and Mass Culture, Theories of Mass Communication: Cognitive Theory, Dissonance Theory, Agenda Setting Theory, Cultivation Theory, Authoritarian Theory, Libertarian Theory, Social Responsibility theory, Soviet communist theory, Magic Bullet theory, two step flow theory, Gratification theory and their uses. Cyber Laws and cyber journalism. derision

Unit 2: Tools of Mass Communication

Newspapers, Magazines, Radio, TV, Films, Internet, Mobile Phones. Advertising, Public Relations & Public Affairs, Traditional & Folk Media, Media and modern society, Media and democracy. DTH, Cable, Terrestrial transmission, Video on demand, interactive TV, Wi-Fi, Wireless cable, Fiber Optics.

Unit 3: Investigative News and Report

Investigative news: Definitions, Nature of news, Types of news, Value of news, Hard and Soft News, Orientation and Perspective, Objectivity Fairness, News as a process, Verification, Special interest; News media operations: Functioning of News Media (Newspapers and Magazines), Local, Regional and National Press. Press Organization: PIB, RNI, DAVP, Press Council of India. Investigative Reporter: Qualities, Essentials and Role of Reporter / Journalist. Career and Opportunities.

Unit 4: Investigative Journalism

Journalism: Introduction, Types: Online vs Traditional Journalism; Crime and Legal Journalism, Inter-perspective and Investigative Journalism, Center for Investigative Journalism (CIJ), Ethical / Unethical use of Sting Operations; Confidentiality of source information, Evidences, Records; Issues of Contempt, Definitions; Right to Privacy and Official Secret Act.

Unit 5: Media Law and Ethics

Code of Ethics of the press - Reader and his interests, understanding public taste -Press as a tool of social service. Newspaper Organization - The role of press as an agency of communication. Print Media in India: An overview. Ethical and legal considerations: Ethical and legal considerations in global media environment, impact of technology. Working Journalist Act Defamation, Contempt of Court, Press Council Act, Official Secret Act.

Suggested Readings:

1. Mass Media Laws & Regulations C S Rayudu, S B Nageshwar Rao
2. Press in the Indian Constitution R K Ravindran
3. Principles & Ethics of Journalism Dr. Jan R Hakemuldar, Dr. Fay AC de Jouge, P P Singh
4. News Writing - George Hough (Indian edition by Kanishka Publishers, No. 4697/5-21A. Ansari Road. Daryaganj, New Delhi – 110 002. Ph. 3270497.3288285. Fax no.: 3288285).
5. The Professional Journalism - M. V. Kamath
6. The Journalist 's Handbook - M.V. Kamath

SEMESTER-VIII

COURSE 24: FORENSIC JOURNALISM

Practical

Credits: 3

3 hrs/week

List of Experiments:

1. Conducting Interview of Politician on Scam for News.
2. Conducting Interview of Criminal on Crime for News
3. Prepare Investigative News on Bribe Case.
4. Prepare Investigative News on Smuggling
5. Case study on Sting Operation.

Co-curricular Activities:

- Workshop on Forensic Journalism

SEMESTER-VIII

COURSE 25: SECURITY DOCUMENT ANALYSIS

Theory

Credits: 3

3 hrs/week

Learning objectives: The student will be able to understand the basics and importance of Security Document Analysis.

Learning Outcomes:

- Understanding of different types of security documents.
- Fake security documents.
- Numismatic forgery.
- Security features.

Unit I: Documents

Document and Questioned Document- Definition, Types, Nature, Components etc. Forensic Document Examination: scope & importance; Documents: Classification, Care, handling, preservation. Preliminary examination of documents, examination of paper & inks, Document Expert in trial courts.

Unit II: Security Documents

Examination and Printing: Characteristics and Examination. Photocopiers – types, characteristics & examination of Photocopied documents. Examination & Characteristics of Facsimile Documents. Working and Examination. Security printing – Holograms, UV Vis Print, Rainbow printing, Micro printing, Gullioche, etc., Examination of Security Documents – Travel Documents –Financial Documents, Property documents, Education Documents.

Unit III: Currency Note and Passport Examination

Currency Note- History, Various security features, Type of frauds with currency. Counterfeit Currency. Forensic examination. Case study.

Passport – Indian History of Passport, Classification of different passports, Security features, Passport frauds, Fake passport, VISA, Forensic examination. Case study.

Unit IV: Plastic Cards Examination

Types of Plastic cards, Security features of cards, Examination of credit, debit and other plastic cards. Case studies.

Unit V: Numismatic Forgery

Introduction, History, Tools & equipment, Methods of forgery- alteration, tooling, embossing, application and plating. Casting: Rubber mold model, wax model from mold, burn out wax, Treatment of casting, creating dye- Cutting by hand, plating, casting and hobbling. Explosive impact copying.

Suggested Readings:

1. Cross Examination of handwriting Expert – B.Lal&R.Chandra
2. Forensic Science in Criminal Investigation in trials – B.R.Sharma
3. Scientific Examination of Documents Methods and techniques – David Ellen _
3rded
4. Forensic Document examination: Fundamentals & Current Trends – Jane A.Lewis
5. The Problem of Proof – A.S.Osborn – Universal Law
6. Typewriting Identification ISQD – Thomas CC – Billy Prior Bates1971
7. Suspect Documents: Their Scientific Examination, Universal Law Publishers
8. Forensic Handwriting Identification Fundamental Concepts and Principles –
Morris, Ron –
Academic Press.
- 9.Hilton O. (1982) The Scientific Examination of Questioned, Elsevier North Holland
Inc. Newyork.

SEMESTER-VIII

COURSE 25: SECURITY DOCUMENT ANALYSIS

Practical

Credits: 3

3 hrs/week

B.Sc.	SECURITY DOCUMENT ANALYSIS LAB	Credits: 1
Course: 8.2		Hrs/Wk: 2

Security Document Analysis Practical's

1. Examination of Currency note.
2. Examination of Passport.
3. Examination of Plastic cards.
4. Examination of Coins.

Co-curricular Activities:

- Visit to Currency Note Press