

Department of Criminology & Forensic Science
School of Applied Sciences



Curriculum Framework
of
Master of Science

Based on National Education Policy- 2020
2024-2026

Doctor Harisingh Gour Vishwavidyalaya
(A Central University)
Sagar-Madhya Pradesh-470003

About the Department

In 1950, UNESCO realized the significance of the teaching of criminal justice at the college and university levels in Asia, and in 1955, a consensus emerged at a symposium held in London. University of Saugor (Sagar) responded to that consensus first and as a result, the Department of Criminology & Forensic Science was established on 18th July 1959 largely due to the initiative taken by Shri D. P. Mishra, (the then Vice Chancellor, 1956-1962, and later Chief Minister of Madhya Pradesh). The former Chief Justice of the Madhya Pradesh High Court, Justice G. P. Bhatt, was appointed as its first regular Professor and Head of the Department. The Department of Criminology and Forensic Science is running two different courses under the School of Applied Sciences. The department is involved in teaching Criminology and Forensic Science at the graduate and postgraduate levels, leading to B.A./M.A. in Criminology and B.Sc./M.Sc. in Forensic Science degrees, respectively, along with research facilities for Ph.D. in both the disciplines. The department is recognized as a DST-FIST-sponsored department. The contributions of the department are varied and remarkable in teaching and research. The alumni of the department are currently occupying outstanding positions and are globally known for their achievements.

Curriculum Framework based on National Education Policy-2020

NEP-2020 has conceptualized the idea to develop well rounded competent individuals to make the nation a self-reliant and global leader. In the same spirit, we at the Department of Criminology and Forensic Science have developed a curriculum framework to encompass the goals of NEP 2020. To this end, we have incorporated choice of subject/disciplines of study, creating academic pathways having constructive combinations of disciplines for study with multiple entry and exit points, as well as focusing on experiential learning for students by introducing multidisciplinary and skill enhancement courses and actual Hands on training in the recent and trending aspects of the area of concern.

Postgraduate Curriculum Framework for Master of Science

1. Name of the Programme: M.Sc. Forensic Science

2. About the Programme:

M.Sc. Forensic Science is a 4 Semester (2 years) Post Graduate program providing knowledge and developing skills in the disciplines of Forensic Sciences. This PG program shall have a "Choice Based Credit System" (CBCS). There shall be a total of 4 Multi Disciplinary Major (MDM) of 4 credits each; 4 Multidisciplinary Major practical of 2 credits each. In addition there would be a total of 4 Discipline Specific Major (DSM) of 4 credits each; 4 Discipline Specific Major (DSM) practical of 2 credits each; There shall be 4 Skill enhancement courses (SEC) of 4 credits each in each semester respectively and a disstertaion of 16 credits.

3. Objectives of the Programme

After completion of course, the students will have a specialized and focused knowledge about:

1. Principle, scope, ethics in Forensic Science.
2. Physical evidence including forensic ballistics, medicine and jurisprudence.

3. General and emerging trends in forensic chemistry, forensic toxicology, forensic biology, questioned documents, etc., along with instrumental analyses.

4. Ideas about popular techniques, like different testing kits, DNA analysis, etc.

4. Programme Learning Outcomes:

The programme learning outcomes are attained by learners through the essential learning acquired on completion of selected courses of study within a programme. The outcomes and attributes described in qualification descriptors are attained by students through learning acquired on completion of a programme of study.

- a. Organizational, hierarchical sets of FSL & CFSL, DSSB, and mobile forensic units.
- b. Knowledge about civil and criminal cases and the court system with basic knowledge of fundamental rights, IPC, and IEA.
- c. Learn about the search methods used in outdoor, indoor, and mobile crime scenes, their sketching methods, and their crime scene reconstruction methods.
- d. Knowledge Of Forensic Biology. Forensic Medicines, Forensic Toxicology, Forensic Ballistics, Questioned Documents, and Emerging Trends and Techniques in Forensic Science.

5. Structure of the Programme:

SEMESTER-I				
Nature of Course		Course Code	Course Title	Credits
Discipline Specific Major-1		FSC-DSM-121	Forensic Physics & Ballistics: Theory	4
		FSC-DSM-122	Forensic Physics & Ballistics: Practical	2
Discipline Specific Major-2		FSC-DSM-123	Instrumental Method-Biological: Theory	4
		FSC-DSM-124	Instrumental Method-Biological: Practical	2
Multi-Disciplinary Major-3		FSC-MDM-121	Forensic Science Investigation and Criminal Justice System: Theory	4
		FSC-MDM-122	Crime Scene Investigation: Practical	2
Skill Enhancement Course (SEC)		FSC-SEC-121	Dactylography and Biometrics: Theory	3
		FSC-SEC-122	Dactylography and Biometrics: Practical	1

SEMESTER-II				
Nature of Course		Course Code	Course Title	Credits
Discipline Specific Major-1		FSC-DSM-221	Instrumental Method-Physical: Theory	4
		FSC-DSM-222	Instrumental Method-Physical: Practical	2

Discipline Major-2	Specific	FSC-DSM-223	Instrumental Chemical: Theory	Method-4
		FSC-DSM-224	Instrumental Chemical: Practical	2
Multi-Disciplinary Major-3		FSC-MDM-221	Forensic Medicine and Medical Jurisprudence: Theory	4
		FSC-MDM-222	Forensic Medicine: Practical	2
Skill Enhancement Course (SEC)		FSC-SEC-221	Emerging Trends in Forensic Science: Theory	3
		FSC-SEC-222	Emerging Trends in Forensic Science: Practical	1

SEMESTER-III			
Nature of Course	Course Code	Course Title	Credits
Multi-Disciplinary Major-1	FSC-MDM-321	Forensic Biology, Serology and DNA : Theory	4
	FSC-MDM-322	Forensic Biology, Serology and DNA: Practical	2
Multi-Disciplinary Major-2	FSC-MDM-323	Forensic Toxicology and Pharmacology: Theory	4
	FSC-MDM-324	Forensic Toxicology and Pharmacology: Practical	2
Skill Enhancement Course (SEC)-1	FSC-SEC-321	Questioned Document and Cyber Forensics: Theory	3
	FSC-SEC-322	Questioned Document and Cyber Forensics: Practical	1
Skill Enhancement Course (SEC)-2	FSC-SEC-323	Forensic Chemistry and Explosives: Theory	3
	FSC-SEC-324	Forensic Chemistry and Explosives: Practical	1

SEMESTER-IV			
Nature of Course	Course Code	Course Title	Credits
Discipline Specific Project	FSC-DSP-421	Dissertation	16

6. Teaching Learning Approach:

This programme will mainly transact the under given pedagogic approach-

- Lecture/ Seminar format
- Demonstration
- Readings/written assignments and field projects
- Group discussions/tutorial
- Community visit
- Project work

g. Field Visit/Survey/Dissertation

7. Assessment

The learners in the programme will be assessed throughout the duration of the programme in formative and summative evaluations, i.e., mid (I & II) and end of semester examinations. To be eligible to appear in End semester examination a student must appear in Mid semester examinations along with 75 per cent attendance in classroom processes.

SEMESTER I

FSC-DSM-121 Forensic Physics and Forensic Ballistics : Theory								
Level Or Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem I	FSC-DSM- 121	Forensic Physics and Forensic Ballistics : Theory	4	0	0	4	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

Forensic Physics is the application of physics for the examination of different physical evidence for courtroom purposes whereas forensic ballistics aims to impart specific knowledge of firearms and ammunition and their related phenomenon for solving shooting incidences.

2. Course Learning Outcomes :

Understanding firearms and their ammunition, Different fields of forensic ballistics which include Internal Ballistics, External and Terminal ballistics, Methods of investigation in shooting cases.

Unit-I: Forensic Physics

15 hrs

Density, Refractive Index, Birefringence; Other Optical Properties of Crystalline Material. Examination of the Following- 1.Hair and Fiber 2. Soil 3. Dust 4. Paints 5. Glass 6. Glass Fracture 7. Tool Marks 8. Explosives Restoration of Erased / Obliterated Marks. Examination of Wire/ Cables, Counterfeit Coins. Physical Matching of Severed / Broken Objects. Speaker Identification and Tape Authentication: Voice Production Theory-Vocal Anatomy, Speech Signal Processing & Pattern Recognition- Basic Factors of Sound in Speech, Acoustic Characteristics of Speech Signal, Fourier Analysis, Frequency & Time Domain Representation of Speech Signal, Analogue to Digital Signal and Conversion, Fast Fourier Transform, Quantization, Digitization, and Speech Enhancement, Analysis of Audio-Video Signal for Authenticity, Introduction to the Techniques of Pattern Recognition and Comparison.

Unit-II: Introduction to Ballistics

15 hrs

History and background, their classification and characteristics, Shotgun and rifled firearms (including pistols, revolvers and assault rifles), Various Components of Firearms: Barrel: chamber,lead, bore (calibre and its nomenclature Rifling, Purpose of Rifling, Types of Rifling), Action: its components and various types including manual, semiautomatic and automatic; Stock, Improvised/Country-Made/Imitative Firearms and their Constructional Features. Ammunition:, Classification and Constructional Features of Different Types of Cartridges, Types of Primers and Priming Composition, Propellants and their Compositions, Various Types of projectiles, Bullets and Compositional Aspects, Safety Aspects for Handling Firearms.

Unit-III: Internal and External Ballistics**10 hrs**

Definition, Ignition of Propellants, Shape and Size of Propellants, Manner of Burning, Various Factors affecting the Internal Ballistics, Theory of recoil, Exterior Ballistics, Vacuum Trajectory, Effect of external and internal factors on Trajectory of cylindro-conoidal bullets and shotgun projectiles, Ricochet bullets, maximum and effective range.

Unit- IV: Terminal Ballistics (Wound Ballistics)**10 hrs**

Concept of wound formation, Temporary and Permanent Cavities, Threshold Velocity for Penetration of Skin/Flesh/Bones, Effect of various types of projectiles on hitting the target, effect of various factors on wound formation: function of bullet shape, striking velocity, striking angle of intermediate target, tumbling of bullets, effect of instability of bullets, effect of intermediate targets, influence of range, yaw, stopping power.

Firearm Injuries: Nature of Wounds of Entry, Exit, and Initial Track with Various Ranges and Velocities with Evaluation of Injuries Caused by Shot-Gun, Rifle, Handguns, and Country Made Firearms, Post-Mortem and Antemortem Firearm Injuries.

Unit- V: Identification of Firearms**10 hrs**

Matching of crime and test: Principles and Practice of Identification of Firearms with fired projectiles in regular firearms and country made firearms.

Gun-shot residue: its formation and analysis (chemical and instrumental methods), Reconstruction of crime scene: Range of fire, Time of Fire, Different Method Employed and their Limitations.

Essential Readings:

1. O'Hara C.E. & Osterburg, J.W. (1972). An Introduction to Criminalistics. Blomington, Indiana University Press.
2. Nickolls, L.C. (1956). Scientific Investigation of Crime. London, Butterworth.
3. Ordog G.J. (1983). Management of Gunshot Wounds. USA, Elsevier.
4. Rose P. (2001). Forensic Speaker Identification: Forensic Science Series. London, Taylor and Francis.
5. Saferstein R. (1988). Forensic Science Handbook. NJ, Prentice Hall, Englewood Cliffs.
6. Sears F.W., Zemansky M.W., and Young H. D. (1988). University Physics. California, Addison-Wesley Pub.
7. Sellier et al K. G. (1994). Wound Ballistics and the Scientific Background. London, Elsevier.

8. Warlow T.A. (1996). Firearms: The Law and Forensic Ballistics. London, Taylor and Francis.
9. Working Procedures Manual: Ballistics. (2000) India, BPR & D Pub.
10. Sharma, B.R. (2002). Firearms in Criminal Investigation and Trials. Universal Law Publishing co. ltd.

Suggested Reading:

1. Bengold&Moryson N. (1999). Speech and Audio Signal Processing. USA, John Wiley & Sons.
2. Caddy B. (2001). Forensic Examination of Glass and Paint Analysis and Interpretation. UK, Taylor and Francis.
3. Hatcher, Jury, & Weller (1977). Firearms Investigation, Identification, and Evidence. Harrisburg, Stackpole Books.
4. Heard B.J. (1997). Handbook of firearms and ballistics. London, John Willey.
5. Hogg. V. (1982). The Cartridges Guide – A Small Arms Ammunition Identification Manual. Harrisburg, The Stackpole Co.
6. Jenkins and White, (2003). Fundamentals of Optics. USA, McGraw Hill.
7. Johari M. (1980). Identification of Firearms, Ammunition and Firearms Injuries. India, BPR&D.
8. Maio V.D. (1999). Gunshot Wounds. US, CRC Press.
9. Mathews, J.H. & Thomas, C.C. (1973). Firearms Identification, Vols. 1, 2, & 3. Illinois, Springfield.
10. Murray, R.C. & Tedrew J.C.F. (1991). Forensic Geology. New Jersey, Prentice hall.

FSC-DSM-122 Forensic Physics and Forensic Ballistics : Practical								
Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem I	FSC-DSM- 122	Forensic Physics and Forensic Ballistics : Practical	0	0	2	2	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To give practical knowledge about traces of evidence like dust, soil, glass, etc. and basic knowledge of techniques used to compare them.

2. Course Learning Outcomes :

Understanding of the density gradient method for matching soil, glass, glass fractures and the refractive index of glass. chemical treatment of erased tool marks, lifting and casting of footmarks, tyre marks, handling of a comparison microscope.

List of Practicals

60 hrs

1. Identification and Matching of Dust/ Soil Sample by Physical Method (Including Density Gradient Method).
2. Physical Matching of Cloth Sample and Identification of Glass Fractures.
3. Calculate the refractive index of glass with Abbe's Refractometer.
4. Restoration of an Erased Punched Mark on a Metal Piece by Chemical Treatment.
5. Lifting, Casting, and Evaluation of Tyre/Footwear Impressions Using Transo Scan Imaging.
6. Comparison of the Questioned Impression with Known Shoes Using Transo Scan Imaging.
7. Comparison of Tool Marks and Fired Cartridge/ Bullet Using Comparison Microscope.
8. Identification of Shots and Pallets.

Essential Readings:

1. O'Hara C.E. & Osterburg, J.W. (1972). An Introduction to Criminalistics. Blomington, Indiana University Press.
2. Nickolls, L.C. (1956). Scientific Investigation of Crime. London, Bulterwest.
3. Ordog G.J. (1983). Management of Gunshot Wounds. USA, Elsevier.

4. Rose P. (2001). Forensic Speaker Identification: Forensic Science Series. London, Taylor and Francis.
5. Saferstein R. (1988). Forensic Science Handbook. NJ, Prentice Hall, Englewood Cliffs.
6. Sears F.W., Zemansky M.W., and Young H. D. (1988). University Physics. California, Addison-Wesley Pub.
7. Sellier et al K. G. (1994). Wound Ballistics and the Scientific Background. London, Elsevier.
8. Warlow T.A. (1996). Firearms: The Law and Forensic Ballistics London, Taylor and Francis.
9. Working Procedures Manual: Ballistics. (2000) India, BPR & D Pub.

Suggested Readings:

1. Bengold & Moryson N. (1999). Speech and Audio Signal Processing. USA, John Wiley & Sons.
2. Caddy B. (2001). Forensic Examination of Glass and Paint Analysis and Interpretation. UK, Taylor and Francis.
3. Hatcher, Jury, & Weller. (1977). Firearms Investigation, Identification, and Evidence. Harrisburg, Stackpole Books.
4. Heard B.J. (1997). Handbook of Firearms and Ballistics. London, John Wiley.
5. Hogg. V. (1982). The Cartridges Guide – A Small Arms Ammunition Identification Manual. Harrisburg, The Stackpole Co.
6. Jenkins and White, (2003). Fundamentals of Optics. USA, McGraw Hill.
7. Johari M. (1980). Identification of Firearms, Ammunition and Firearms Injuries. India, BPR&D.
8. Maio V.D. (1999). Gunshot Wounds. US, CRC Press.
9. Mathews, J.H. & Thomas, C.C. (1973). Firearms Identification, Vols. 1, 2 & 3. Illinois, Springfield.
10. Murray, R.C. & Tedrew J.C.F. (1991). Forensic Geology. New Jersey, Prentice hall.

FSC-DSM-123 Instrumental Methods – Biological: Theory								
Level Or Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem I	FSC-DSM- 123	Instrumental Methods in Biological: Theory	4	0	0	4	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide knowledge about biological/chemical analysis, centrifugation techniques, enzyme techniques, electrophoresis, immunochemical techniques, and molecular biology techniques.

2. Course Learning Outcomes :

Understanding the basics of biological/ chemical analysis, pH and its measurement, Basic principles of sedimentation, types of centrifuges, enzyme kinetics, purification & protein estimation, enzyme assay techniques, immunochemical methods, gel electrophoresis and its working. 6. Outline of genetic manipulation enzyme, introduction to microfluidics.

UNIT-I: General Principles of Biological/Chemical Analysis

10 hrs

Ionization Equilibrium in Acid and Base Aqueous Solutions, pH and its Measurement, Buffers, Physiological Solutions, Cell and Tissue Culture, Gene Cloning, Cell Disruption, Cell Fractionation, Biological Variation, etc.

UNIT-II: Centrifugation Techniques and Flow Cytometry

10 hrs

Basic Principles of Sedimentation, Types of Centrifuges, Density Gradient Centrifugation, Prerogative Centrifugation, Analysis of Subcellular Fractions, Refrigerated & Ultra-Centrifuge. Flow Cytometry Principles and Applications.

UNIT-III: Enzyme Techniques

10 hrs

Enzyme Kinetics, Purification and Protein Estimation, Enzyme Assay Techniques, Visible, UV Spectrophotometric Methods, Luminescence Methods, Radioisotope Methods, Immuno-Chemical Methods, Automated Enzyme Analysis, Immobilized Enzymes.

UNIT-IV: Electrophoresis and Immunochemical Techniques

15 hrs

Gel Electrophoresis, Isoelectric Focusing etc. General Idea and Working of Gel Electrophoresis, PAGE, SDS-PAGE, Capillary Electrophoresis, Forensic Application of Electrophoresis. Production of Antibodies, Precipitation Reaction, Gel Immunodiffusion, Immune-Electrophoresis, Complement Fixation.

UNIT-V: Molecular Biology Techniques, DNA Profiling and Microfluidics

15 hrs

Outline of Genetic Manipulation Enzymes, Enzymes in Genetic Manipulation, Cloning Procedures, Isolation of Specific Nucleic Acid Sequences-Complementary DNA, Gene Libraries, Colony Hybridization, Nick Translation, Oligo-nucleotide Probes, Expression of Genes. DNA Profiling: Structure of DNA, Damage to DNA, Variation in DNA, DNA as an Excellent Polymorphic Marker, Basis of DNA Typing and Techniques: PCR, RFLP, etc. The Introduction of Microfluidics. Theory, Instrumentation, and its Applications.

Essential Readings:

1. Li R. (2008). Forensic Biology: Identification and DNA Analysis of Biological Evidence. USA, Taylor & Francis.
2. McClintock J. T. (2014). Forensic Analysis of Biological Evidence, A Laboratory Guide for Serological and DNA Typing. NY, CRC Press.
3. Oates D.W., Brown, C.W., & Weigel, D.L. (1974). Blood and Tissue Identification of Selected Birds and Mammals. JPR study Projects Lincoln, NE, Nebraska Game and Perks Commission. Philadelphia, Staff Research Publications.
4. Triggs C. M., Buckleton, J. S., & Walsh, S. J. (2004). Forensic DNA Evidence Interpretation. NY, CRC Press.
5. Walker J. M., and Rapley, R. (2009). Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.
6. Williams, P. L., & Warwick, R. (1980). Gray's Anatomy, London, Churchill Livingstone.

Suggested Readings:

1. (1978). Biology Methods Manual. London: Metropolitan Police Forensic Science Laboratory.
2. Albert S., Bray B., Lewis D., Roberts K., and Watson J.D. (1989). Molecular Biology of Cell. New York, Garland Pub.
3. Clifford B.J.(1971). The examination and typing of bloodstains in the Crime Laboratory. USA, US Court Printing Press.
4. Edwin & Caney, H. M.(1993). Human Genetics: The Molecular Revolution. London, Jones & Bartlett Pub.
5. Eppelen J. T., and Lubjumhin, T.(1995). DNA Profiling and DNA Fingerprinting. Basel, Birkhäuser Verlag.
6. Gardner E.J., Simmons M.I. & Snustad D.P.(1991). Principles of Genetics. New York, John Wiley.
7. Glover, D.M., & Hames, B.D.(1995). DNA Cloning, vol. 1 to 4. England, Oxford University Press, Oxford Pub.
8. Joshi A. R. (2002). A Textbook of Practical Biochemistry. India, B. Jain Publishers.

FSC-DSM-124 Instrumental Methods—Biological: Practical								
Level Or Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem I	FSC-DSM-124	Instrumental Methods Biological: Practical	0	0	2	2	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide knowledge about the handling and working of instruments used for biological samples like Pcentrifugefuge, SEM, TEM, etc.

2. Course Learning Outcomes :

Understanding of the working and handling of polymerase chain reaction instruments; protein estimation of biological samples; separation of cell organelles using centrifuge, Gel electrophoresis; SEM, TEM, UV spectrophotometer etc.

List of Practicals

60 hrs

1. Demonstration of Handling and Working of PCR.
2. To Perform Protein Estimation of Given Biological Samples.
3. To Separate Cell Organelles in Given Tissues using Centrifuge.
4. Demonstration of Working and Handling of Gel Electrophoresis.
5. Demonstration of Working and Handling of Compound, Stereo Microscope, SEM and TEM.
6. Demonstration of Working and Handling of the UV-Spectrophotometer for the Examination of Biological Samples.

Essential Readings:

1. Li R. (2008). Forensic Biology: Identification and DNA Analysis of Biological Evidence. USA, Taylor & Francis.
2. McClintock J. T. (2014). Forensic Analysis of Biological Evidence, A Laboratory Guide for Serological and DNA Typing. NY, CRC Press.
3. Oates D.W., Brown, C.W., & Weigel, D.L. (1974). Blood and Tissue Identification of Selected Birds and Mammals. JPR study Projects Lincoln, NE, Nebraska Game and Perks Commission. Philadelphia, Staff Research Publications.
4. Triggs C. M., Buckleton, J. S., & Walsh, S. J. (2004). Forensic DNA Evidence Interpretation. NY, CRC Press.
5. Walker J. M., and Rapley, R. (2009). Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.

6. Williams, P. L., & Warwick, R. (1980). *Gray's Anatomy*. London, Churchill Livingstone.

Suggested Readings:

1. (1978). *Biology Methods Manual*. London: Metropolitan Police Forensic Science Laboratory.
2. Albert S., Bray B., Lewis D., Roberts K., and Watson J.D. (1989). *Molecular Biology of the Cell*. New York, Garland Pub.
3. Clifford B.J.(1971). *The examination and typing of bloodstains in the Crime Laboratory*. USA, US Court Printing Press.
4. Edwin & Caney, H. M.(1993). *Human Genetics: The Molecular Revolution*. London, Jones & Bartlett Pub.
5. Epplen J. T., and Lubjumhin, T.(1995). *DNA Profiling and DNA Fingerprinting*. Basel, Birkhäuser Verlag.
6. Gardner, E.J., Simmons M.I. & Snustad D.P.(1991). *Principles of Genetics*. New York, John Wiley.
7. Glover, D.M., & Hames, B.D.(1995). *DNA Cloning*, vol. 1 to 4. England, Oxford University Press, Oxford Pub.
8. Joshi A. R. (2002). *A Textbook of Practical Biochemistry*. India, B. Jain Publishers.

FSC-MDM-121 Forensic Science Investigation and Criminal Justice System: Theory								
Level Or Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem I	FSC-MDM-121	Forensic Science investigation and Criminal Justice System: Theory	4	0	0	4	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives :

To provide knowledge about basic concepts of forensic science, crime, criminal theories, criminal investigation, management of crime scenes, and collection and packaging of different types of evidence and certain laws related to crimes in India.

2. Course Learning Outcomes :

The fundamental principles and functions of forensic science and their significance to human society, the art of collecting, packaging, and preserving different types of physical and trace evidence at crime scenes, the importance of chain of custody, different types of crime scenes; various tools and techniques for analysis of different types of crime scene evidence and their processing in courts.

Unit-I: Introduction to Forensic Science

10 hrs

Basic Principles and their Significance. The History and Development of Forensic Science, The Nature and Scope of Forensic Science. Organizational Structure of Forensic Science Laboratories at Central & State Level. Ethics in Forensic Science.

Unit-II: Crime, Criminal Theories and Criminal Investigation

15 hrs

Definition, Theories of Causation of Crime: Pre-Classical and Neo-Classical, Constitutional, Geographical, Economic, Psychological, Sociological, Multiple Causation Approach. General Factors of Crime, Forms of Punishment in Brief, Radical Theory of Crime. Scene of Crime: Types, Protection of Scene of Crime, Crime Scene Documentation, Note Taking, Videography, Photography and Sketching Methods. Physical Evidence: Meaning, Types, Searching Methods, Collection and Preservation, Forwarding, chain of custody. Collection, Preservation, Packing and Forwarding of: Blood, Semen and Other Biological Stains, Firearm Exhibits, Documents, Fingerprint, Viscera, Hair & Fiber, Glass, Soil and Dust, Petroleum Products, Drugs and Poisons, etc. Investigation of the Following Crimes: Murder, Theft and House Breaking, Road Accident, Railways and Air Accidents, Arson, Sexual Assault Cases, Dowry Cases and Explosion Cases.

Unit-III: Crime Scene Management and Reconstruction

15 hrs

Elements of Crime Scene Management- Information Management, Technology Management, Man-Power Management, and Logistic Management. An Introduction to Crime Scene Reconstruction, The Nature of Reconstruction, Physical Evidence and Reconstruction (Recognition, Identification, Individualization, and Reconstruction), Stages in Reconstruction, Types of Reconstruction, Pattern

Evidence in Reconstruction (Bloodstain Pattern Analysis for Reconstruction, Glass Fracture Pattern Fire Burn Patterns, Tire and Skid Mark Patterns), Shooting Scenes, Requirements for Reconstruction after Crime Scene Released, Writing a Reconstruction Report

Unit-IV: Bhartiya Nyaya Sanhita, Bhartiya Nagarik Suraksha Sanhita and Bharatiya Sakshya Adhiniyam
10 hrs

Bhartiya Nyaya Sanhita (2023): Introduction, General Exceptions, Offences against Person, Offences against Property, Attempt to Suicide, Sexual Offences. Bhartiya Nagarik Suraksha Sanhita (2023): Introduction and General Idea of Sections: 173, 174, 175, 176, 177, 178, 179, 180, 181, 192, 193, 194, 195 and 196. Bhartiya Sakshya Adhiniyam (2023): Introduction and General Idea of Sections: 26, 39, 40, 41, 52, 53, 55, 72, 140, 141, 142 and 162.

Unit-V: Criminal Justice System **10 hrs**

Organization of Police in India, Organization of Courts in Courts Cases, Prosecution, F.I.R., Case Diary, Interrogation of Suspects, Interview of Witness, and Procedure in Court as Per Bhartiya Nagarik Suraksha Sanhita: Trial of Summons, Trial of Warrant, and Summary Trial. Report Writing and Evidence Evaluation Report Formats of Crime Scene and Laboratory Findings Court Testimony: Admissibility of Expert Testimony, Pre Court Preparation and Court Appearance

Suggested Readings:

1. Ahuja R. (2001). Criminology. India, Rawat Pub.
2. Aitken C.G.G. & Stoney, D.A. (1991). The Use of Statistics in Forensic Science. England, Ellis Harwood Limited.
3. Bowen R.T. (2016). Ethics and the Practice of Forensic Science. USA, CRC Press.
4. Burke R.H. (2013). An Introduction to Criminological Theory, 4th ed., UK, Routledge—Taylor & Francis Group.
5. Horswell J. (2016). The Practice of Crime Scene Investigation. USA, CRC Press.
6. Indian Penal Code, Criminal Procedure Code, Indian Evidence Act.
7. James, S.H., and Nordby, J.J. (2003). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, CRC Press.
8. James S.H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. UK, Taylor & Francis.
9. Nordby J. (1999). Dead Reckoning—The Art of Forensic Science Detection. USA, CRC Press.
10. O'Hara & Osterberg, (1949). An Introduction to Criminalistics. New York, The Macmillan Company.

FSC-MDM-122 Crime Scene Investigation: Practical								
Level Or Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem I	FSC-MDM-122	Crime Scene Investigation: Practical	0	0	2	2	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide practical knowledge about demonstration, photography of the scene of crime, methods for searching for physical evidence, sketching and reconstruction of crime scenes.

2. Course Learning Outcomes :

crime scene management and photography; different searching methods of crime scenes; different methods of crime scene sketching; collection, packing, labelling, and forwarding of physical evidence from the crime scene to the forensic science laboratory, methods of crime scene reconstruction.

List of Practicals

60 hrs

1. Demonstration of Crime Scene Management.
2. Photography of Scene of Crime Digital Camera.
3. Methods for Searching for Physical Evidence at the Scene of Crime.
4. Sketching of an Outdoor Scene of Crime (Homicide or Suicide).
5. Sketching of an Outdoor Scene of Crime (Accident).
6. Sketching of Indoor Scene of Crime (Theft or Dacoity or Robbery).
7. Sketching of an Indoor Scene of Crime (Murder or Suicide).
8. Sketching of a Mobile Scene of Crime (Hit & Run Case).
9. Collection, Packing, Labeling and Forwarding of Physical Evidence from Scene of Crime to Forensic Science Laboratory.
10. Reconstruction of a Scene of Crime.

Essential Readings:

1. Peter R. D. F. (1983). Forensic Science-An Introduction to Criminalistics. USA, McGraw-Hill.
2. Saferstein, R. (1995). Criminalistics – An Introduction to Forensic Science. USA, Prentice Hall Inc.
3. Sharma, B.R. (2003). Forensic Science in Criminal Investigation and Trials India, Universal Law

publishing company.

4. Sharma, J.D. (1988). Vidhi vigyan. Avam Vish Vigyan. India, Hindi Granth Academy.
5. Sharma J.D. (2011). Apradhon ka Vigyanik Anveshan. India,Hindi Granth Academy.
6. Siegel J. A. &Kathy M. (2006). Forensic Science: The Basics. USA, CRC Press.
7. Unnithan N.P. (2013). Crime and Justice in India. India:SAGE Pub.

Suggested Readings:

1. Ahuja R. (2001). Criminology. India, Rawat Pub.
2. Aitken C.G.G. & Stoney, D.A. (1991). The Use of Statistics in Forensic Science. England,Ellis Harwood Limited.
3. Bowen R.T. (2016). Ethics and the Practice of Forensic Science. USA, CRC Press.
4. Burke R.H. (2013). An Introduction to Criminological Theory, 4th ed., UK, Routledge—Taylor & Francis Group.
5. Horswell J. (2016). The Practice of Crime Scene Investigation. USA, CRC Press.
6. Indian Penal Code, Criminal Procedure Code, Indian Evidence Act.
7. James, S.H., and Nordby, J.J. (2003). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, CRC Press.
8. James S.H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. UK,Taylor & Francis.
9. Nordby J. (1999). Dead Reckoning—The Art of Forensic Science Detection. USA, CRC Press.
10. O'Hara &Osterberg. (1949). An Introduction to Criminalistics. New York,The Macmillan Company.

FSC-SEC-121 Dactylography and Biometrics: Theory								
Level/ Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8/ Sem I	FSC-SEC-121	Dactylography and Biometrics: Theory	3	0	0	3	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide knowledge about fingerprints, the development of fingerprints, biometrics, and face recognition.

2. Course Learning Outcomes :

Understanding about The basics of fingerprint, history, patterns & classification, types of fingerprint, location, development, photography & comparison, ear biometrics and iris recognition, retina biometrics and face recognition.

Unit-I: Introduction to Fingerprints

8 hrs

History of Fingerprints, Formation of Ridges, Different Fingerprint Patterns and Areas, Ridge Characteristics, Ridge Count, Ridge Tracing, Levels of Fingerprint Identification, Classification of Fingerprint- Henry system of classification, single digit classification, extension of the Henry system.

Unit-II: Development of Fingerprints

9 hrs

Types of Fingerprint; Latent, Visible, and Plastic Prints, Location of Fingerprints; Development of Latent Prints by Physical and Chemical Methods. Photography and Comparison of Fingerprints, 3-D Development of Fingerprints

Unit-III: Biometrics Part-1

10 hrs

Fingerprint Biometrics: Introduction to AFIS, Working of AFIS System, AFIS Components, Digitization & Processing of Fingerprints: Acquisition, Normalization & Segmentation, Enhancement, Binarization, Thinning & Post-processing, Minutiae Extraction, Fingerprint Matching in AFIS, Indexing & Retrieval. AMBIS- Integrated Biometric Identification System, CCTNS.

Unit-IV: Biometrics Part-2

10 hrs

Iris Recognition: Introduction, Anatomical and Physiological Underpinnings; Iris Signature Representation and Matching; Localization, Representation; Matching.

Retina Biometrics: Structure of Eye; Human Retina and Structure; Unique Pattern of Blood Vessels; Retina Pattern and Identification.

Voice Production, Theory-Vocal Anatomy, Speech Signal Processing & Pattern Recognition- Basic Factors of Sound in Speech, Acoustic Characteristics of Speech Signal. An Introduction to the Techniques of Pattern Recognition and Comparison.

Unit-V: Face Recognition and Facial Reconstruction**8 hrs**

Face Recognition: Introduction, Detection, Representation, and Classification, Techniques and their Applications.

Facial reconstruction: 2D & 3D Facial reconstruction.

Essential Readings:

1. Lee, H. C., & Ganesslen, R. E. (1991). Advances in Fingerprint Technology. CRC Press, London.
2. Malton D. (2009). Handbook of Fingerprint Recognition. Germany, Springer Science & Business Media.
3. Mehta M. K. (1989). Identification of Thumb Impression & Cross Examination of Fingerprints In India, N. M. Tripathi (P) Ltd.
4. Pierce, D. S. (2011). Mechanics of Impression Evidence. NY, CRC Press.
5. Stiefel C. (2011). Fingerprints: Dead People Do Tell Tales. NJ, Enslow Publishers.
6. Walker J. M., & Rapley, R. (2009). Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.
7. Wilson C. (2011). Vein Pattern Recognition: A Privacy-Enhancing Biometrics. NY, CRC Press.
8. Stephen P. Kasper, Latent Processing Guide, Elsevier, UK, 2016.
9. Hilary Moses Daluz, Fundamentals of Forensic Analysis, CRC Press, 2015.

Suggested Readings:

1. Albert S., Bray B., Lewis D., Roberts K., & Watson J.D. (1989). Molecular Biology of Cell. New York, Garland Pub.
2. Ashbaugh D. R., (1999). Quantitative and Qualitative Friction ridge analysis. NY, CRS Press.
3. Daluz H. M., (2014). Fundamentals of Fingerprint Analysis. NY, CRC Press.
4. Das R. (2014). Biometric Technology: Authentication, Bio Cryptography, and Cloud-Based

FSC-SEC-122 Dactylography and Biometrics: Practical								
Level/ Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8/ Sem I	FSC-SEC-122	Dactylography and Biometrics: Practical	0	0	1	1	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide practical knowledge about fingerprint collection methods, pattern identification, fingerprint development & lifting, lip print and examination.

2. Course Learning Outcomes :

Understanding about The record fingerprint chart by direct print and rolling methods, identifying fingerprint pattern and ridge counting and tracing by TransoScan, development of latent prints and their lifting, identification of chances prints on different surfaces.

List of Practicals

30 hrs

1. To Record a Fingerprint Chart by Direct Print Method and Rolling Method.
2. To Identify the Fingerprint Patterns along with Core and Delta.
3. To Perform Ridge Tracing and Ridge Counting of the Fingerprints.
4. Identification of Ridge Characteristics of Fingerprints by TrasoScan Lab Imaging System Method.
5. Development of Latent Prints by Powder Method and Chemical Methods on Porous and Non-Porous Surfaces.
6. Lifting of Fingerprints by Different Methods.
7. Identification of Chance Prints Found on Different Surfaces.
8. To Take Palm and Lip Prints and Their Examinations by TransoScan Lab Imaging System.

Essential Readings:

1. Lee, H. C., & Ganesslen, R. E. (1991). Advances in Fingerprint Technology. CRC Press, London.
2. Malton D. (2009). The Handbook of Fingerprint Recognition. Springer Science & Business Media, Germany.
3. Mehta M. K. (1989). Identification of Thumb Impression & Cross Examination of FingerPrints.

India, N. M. Tripathi (P) Ltd.

4. Pierce D. S. (2011). Mechanics of Impression Evidence. NY, CRC Press.
5. Stiefel C. (2011). Fingerprints: Dead People Do Tell Tales. NJ, Enslow Publishers.
6. Walker J. M., and Rapley, R. (2009). Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.
7. Wilson C. (2011). Vein Pattern Recognition: A Privacy-Enhancing Biometrics. NY, CRC Press.

Suggested Readings:

1. Albert S., Bray B., Lewis D, Roberts K., and Watson J.D. (1989). Molecular Biology of Cell. New York, Garland Pub.
2. Ashbaugh D. R., (1999). Quantitative and Qualitative Friction ridge analysis. NY, CRS Press.
3. Daluz H. M., (2014). Fundamentals of Fingerprint Analysis. NY, CRC Press.
4. Das R. (2014). Biometric Technology: Authentication, Bio Cryptography, and Cloud-Based Architecture. India, CRC Press.
5. Edwin & Caney, H. M. (1993). Human Genetics: The Molecular Revolution. London: Jones & Bartlett Pub.
6. Gardner E.J., Simmons M. I. & Snustad D.P., (1991). Principles of Genetics. New York, John Wiley.
7. Jain A., Ross A.A. & Flynn P. (2008). The Handbook of Biometrics. India, Springer Press.
8. Jain A., Ross A. A. & Nandakumar K., (2011). An Introduction to Biometrics. India, Springer Press.

SEMESTER II

FSC-DSM-221 Instrumental Methods, Physical: Theory								
Level/ Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem II	FSC-DSM-221	Instrumental Methods Physical: Theory	4	0	0	4	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide knowledge about the concept of analytical chemistry.

2. Course Learning Outcomes :

Understanding about the handling and preparation of samples, qualitative and quantitative analysis of different analytes and matrix, basic principle and working of spectroscopic technique that could lead to professional job opportunities in testing laboratories the electrochemical methods, colorimetry, voltammetry which may facilitate small scale start-ups.

Unit-I: Concepts of Instrumental Analytical Chemistry

12 hrs

Introduction to Analytical Chemistry, Analytical Approach (Defining the Problem, Designing the Analytical Chemistry, Sampling, Storage of Samples), Basic Statistics and Data Handling (Significant Figures, Accuracy and Precision, Types of Errors, Quantifying Random Error, Rejection of Results), Sample Preparation (Acid Dissolution & Digestion, Fusions, Dry Ashing And Combustion, Extraction), Performing the Measurement (Signals and Noise, Plotting Calibration Curves), Assessing the Data (Limit of Detection, Limit of Quantification).

Unit-II: Basic Concept of Spectroscopy

12 hrs

General Idea on Spectroscopy, The Electromagnetic Spectrum, Various Sources of Radiation, Their Utility and Limitations Interaction of Radiation with Matter, i.e., Reflection, Absorption, Fluorescence, Phosphorescence, Diffraction, Refraction, etc. Detection of Radiation, i.e., Photography, Photoelectric, etc. Optical Systems Used in Spectroscopy (Wavelength Selection Devices, Optical Slits, Detectors, Single- Beam and Double- Beam Optics), Dispersive Optical Layouts, and Fourier Transform Spectrometers. Forensic Applications of Spectroscopy.

Unit-III: Basic Concept of Atomic and Molecular Spectra

12 hrs

Atomic Spectra- Energy Level, Quantum Number and Designation of States, Selection Rule. Molecular Spectra- Quantitative Discussion of Molecular Bindings, Molecular Orbital, Types of Molecular Energies, Discussion of Rotational, Vibrational, and Electronic Spectra. Ultraviolet-Visible and Infrared Spectrophotometry: Basic Principles, Instrumentation, Qualitative and Quantitative Analysis, Interpretation of Spectra, etc. Quantitative Analysis through Ultraviolet-Visible Spectroscopy, Forensic Application of UV-Vis. and IR Spectrophotometry.

Unit-IV: Atomic Absorption/Emission and X-Ray Spectrometry**12 hrs**

Basic Principles, Instrumentation, Qualitative and Quantitative Analysis, Interpretation of Spectra, and Forensic Applications. Radiochemical Techniques: Basic Principles and Theory, Introduction about Nuclear Reactions and Radiations, Neutron Activation Analysis (NAA), Nuclear Magnetic Resonance Spectroscopy (NMR), Application of Radiochemical Techniques in Forensic Science.

Unit-V: Electroanalytical Chemistry**12 hrs**

Fundamentals of Electrochemistry, Electrochemical Cells (Line Notation for Cells and Half Cells, Standard Reduction Potentials, Sign Conventions, The Nernst Equation, Activity Series, Reference Electrodes, the Electrical Double Layer), and Electroanalytical Methods (Potentiometry, Colorimetry, Conductometric Analysis, Polarography, Voltammetry).

Essential Readings:

1. Sharma B.K., (2000). Instrumental Methods of Chemical Analysis. India, Krishna Prakashan Media.
2. Silverstein R.M. & Webster F.X., (1997). Spectrometric Identification of Organic Compounds. USA, John Wiley & Sons, Inc.
3. Skoog D.A., Holler F.J. & Stanley R.C. (2017). Principles of Instrumental Analysis, USA, Cengage Learning.
4. Subrahmanyam N. & Brij Lal (2004). A Text Book of Optics. India, S. Chand & Co.
5. Thompson K.C. & Renolds R.J. (1978). Atomic Absorption Fluorescence & Flame Emission Spectroscopy: Practical Approach. London, Charles Griffin & Co.
6. Willard H. & Lynne L.M. (1986). Instrumental Methods of Analysis. USA, CBS Publishers & Distributors.
7. Willard H.H., Merrett L. L. Frank J.A.D. & Settle A. (1986). Instrumental Methods of Analysis. USA, CBS Pub. & Distributors.

Suggested Readings:

1. Chatwal and Anand. (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
2. Churáček J. (1993). Advanced Instrumental Methods of Chemical Analysis. Michigan, E. Harwood,
3. Dean J. A. (1995). Analytical Chemistry Handbook. USA, McGraw Hill Inc.
4. Kalri P.S. (2001). Spectroscopy of Organic Compounds. India, New Age International Pub.
5. Khandpur R.S. (2004). Handbook of Analytical Instruments. USA, Tata McGraw Hill Pub. Co.
6. Khanna D.R. & Gulati H.R. (2002). Fundamentals of Optics Geometrical Physical & Quantum. India, R. Chand & Co.
7. Patania V.B. (2004). Spectroscopy. India, Campus Books International.
8. Robinson J.W. (1996). Atomic Spectroscopy, Revised & Expanded. NY, Marcel Dekkar, Inc.

FSC-DSM-222 Instrumental Methods Physical: Practical								
Level Or Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem II	FSC-DSM-222	Instrumental Methods Physical: Practical	0	0	2	2	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide practical knowledge about the concept of analytical chemistry.

2. Course Learning Outcomes :

Understanding of different sample preparation techniques, qualitative and quantitative analysis of different analytes, handling and operation of UV spectroscopy, handling and operating of FTIR spectroscopy, working of other spectroscopic techniques.

List of Practicals

60 hrs

1. To Understand the Working and Measurement of λ Max of Various Organic Compounds by UV-Vis. Spectrophotometer.
2. To Know the Concentration of Given Liquid by Colorimeter.
3. Sample Preparation and FTIR Analysis of Drugs of Abuse.
4. To Measure the pH of Different Substance using pH Meter.
5. To Know the Practical Working and Handling of Comparison Microscope.
6. To Know the Practical Working and Handling of Stereo Microscope.

Essential Readings:

1. Sharma B.K., (2000). Instrumental Methods of Chemical Analysis. India, Krishna Prakashan Media.
2. Silverstein, R.M., & Webster, F.X. (1997). Spectrometric Identification of Organic Compounds. USA, John Wiley & Sons, Inc.
3. Skoog D.A., Holler, F.J., and Stanley, R.C. (2017). Principles of Instrumental Analysis, USA, Cengage Learning.
4. Subrahmanyam N. & Brij Lal (2004). A Textbook of Optics. India, S. Chand & Co.
5. Thompson, K.C., & Renolds, R.J. (1978). Atomic Absorption Fluorescence & Flame Emission Spectroscopy: Practical Approach. London, Charles Griffin & Co.
6. Willard H. & Lynne L.M. (1986). Instrumental Methods of Analysis. USA, CBS Publishers & Distributors.
7. Willard H.H., Merrett L.L., Frank J.A.D., and Settle A. (1986). Instrumental Methods of Analysis. USA, CBS Pub. & Distributors.

Suggested Readings:

1. Chatwal and Anand. (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
2. Churáček J. (1993). Advanced Instrumental Methods of Chemical Analysis. Michigan, E. Harwood,
3. Dean J. A. (1995). Analytical Chemistry Handbook. USA, McGraw Hill Inc.
4. Kalri, P.S. (2001). Spectroscopy of Organic Compounds. India, New Age International Pub.
5. Khandpur R.S. (2004). Handbook of Analytical Instruments. USA, Tata McGraw Hill Pub. Co.
6. Khanna D.R. & Gulati H.R. (2002). Fundamentals of Optics Geometrical, Physical, and Quantum. India, R. Chand & Co.
7. Patania V.B. (2004). Spectroscopy. India, Campus Books International.
8. Robinson, J. W. (1996). Atomic Spectroscopy, Revised and Expanded. NY, Marcel Dekkar, Inc.

FSC-DSM-223 Instrumental Methods Chemical: Theory								
Level/Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem II	FSC-DSM-223	Instrumental Methods Chemical: Theory	4	0	0	4	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide knowledge about the basic concept of separation and sample extraction from various matrices.

2. Course Learning Outcomes :

Understanding about The sample handling and solvent extraction techniques the basic principle and working of chromatographic technique that could lead to professional job opportunities in testing and pharmaceutical laboratories, the basic principle and working of mass spectroscopy, electrophoresis technique and centrifugation methods

Unit-I: Relating Chromatography to Separations

15 hrs

Definition of Separation, Origin of Chromatography (Definition of Chromatography, Similarity of Chromatography to Separation Methods, Separation in Nature) Principal of Separations, Modes of Chromatography, Unified Separation Science, Selectivity and Detectability. Simple Separation Methods-Evaporation, Precipitation, Crystallization, Filtration, Membrane Separation. General Idea and Basic Principle of Distillation, Various Types of Distillation Techniques, Distribution Law, Solvent Extraction Techniques like LLE, SPE, SPME.

Unit-II: Sample Handling and the Chromatography

15 hrs

Introduction, Sample Collection Procedures (Sampling of Solid, Liquid & Gas), Sample Preparation, Recovery Procedures (Solvent Extraction, Supercritical Fluid Extraction, Volatilization Processes), Sample Cleanup Methods (Membrane Techniques, Chromatography, Solid Phase Extraction, Chemical Modification of the Sample by Pre- Column Reaction), Pre-Concentration Techniques, Contamination Effects. Introduction and Overview of Chromatography- and Historical Aspect of Chromatography, Classification of Chromatography (Mobile Phase Mode, Technique, Development Mode, Separation Mechanism & other Systems of Classification), Comparison of Chromatographic Techniques.

Unit-III: Theory of Chromatography

10 hrs

Introduction Chromatographic Retention (Parameters for Column and Planar Techniques), Peak Shape, Zone Broadening, and Measures of Efficiency (Plate Theory, Rate Theory, Van Deemter Plot, Extra Column Effects in Zone Broadening, other Measures of Separation optimizing Resolution, and Overall Systems Performance). General Principles and Working of Planer Chromatography: TLC, HPTLC, Forensic Application of Planar Chromatography, Brief Idea on Working of HPLC, GC, Ion Exchange Chromatography, Exclusion (Permeation) Chromatography, Affinity Chromatography etc. Forensic Application of Column Chromatography.

Unit-IV: Electrophoretic Techniques

10 hrs

General Principles, Classification of Electrophoresis, Factors Affecting Electrophoresis, Preparative, Horizontal, Vertical, Two Dimensional Electrophoresis A Brief Idea of Low Voltage Electrophoresis, High Voltage Electrophoresis, Gel Electrophoresis, Isoelectric Focusing, etc. General Idea And Working of Capillary Electrophoresis, Forensic Application of Electrophoresis.

Unit-V: Mass Spectrometry

10 hrs

Principle and Instrumentation, Correlation of MS with Molecular Structure. A Brief Idea About the Various Forms of Mass Spectrometry Coupling MS with GC, LC, and CE etc. Application of MS in Forensic Science.

Essential Readings:

1. Sharma B.K. (2000). Instrumental Methods of chemical Analysis. India, KrishnaPrakashan Media.
2. Shrivastava & Shrivastava (1991). Introduction to Chromatography. India, S.Chand & Co.
3. Smith and Bogusz M. (2007). Handbook of Analytical Separation. Germany, Elsevier Pub.
4. Srivastava M. (2010). High-Performance Thin-Layer Chromatography (HPTLC). Germany, Springer Science & Business Media.
5. Stahl E. (2013). Thin Layer Chromatography. Germany, Springer Science & Business Media.
6. Triggs C.M., Buckleton J.S. & Walsh S.J. (2004). Forensic DNA Evidence Interpretation. CRC Press, USA
7. Walker, J.M., and Rapley, R. (2009). Molecular Biology and Biotechnology. UK, Royal Society of Chemistry.
8. Willard, Merrit and Dean. (1974). Instrumental Methods of Analysis. USA, Van Nostrand.

Suggested Readings:

1. Chapman J.R. (1993). Practical Organic Mass spectrometry, A Guide for Chemical and Biochemical Analysis. New York, Wiley Pub.
2. Chatwal and Anand. (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
3. Harris H., Gaensslen R., and Lee H. (2007). An Introduction to Forensic Science. USA, McGraw-Hill Education
4. Jarris K.E., Gray A.L., and Hock R.S. (1992). EDS; handbook of Inductively Coupled Plasma Mass Spectrometry; Glasgow, Blockie Pub.
5. Lindsay, S. (1992). High Performance Liquid Chromatography. New York: Wiley Pub.
6. MacLafferty, F.W., and Turecek, F. (1993). Interpretation of mass spectra. US, Mill Valley, C A Univ. Science Books.
7. Robards K. Jackson P.E. & Haddad P.A. (2012). Principles and Practice of Modern Chromatographic Methods. Germany, Elsevier pub.
8. Saferstein R. (2001). Forensic Science Handbook Vol. I. London, Prentice Hall.

FSC-DSM-224 Instrumental Methods, Chemical: Practical								
Level/Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem II	FSC-DSM-224	Instrumental Methods Chemical: Practical	0	0	2	2	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide practical knowledge about the basic concept of separation and extraction of drugs and pesticides from various matrices.

2. Course Learning Outcomes :

Understanding the TLC method for plant alkaloid analysis and identification, dye identification using TLC methods, pesticide substance analysis in forensic exhibits, and the use and handling of chromatographic techniques.

List of Practicals

60 hrs

1. To Separate & Identify the Plant Pigments using Paper Chromatography.
2. To Identify the Dyes Present in Petroleum Products Using Thin Layer Chromatography.
3. To Know the Practical Working and Handling of High Performance Liquid Chromatography by Analyzing Depressant Drugs.
4. To Know the Practical Working and Handling of High Performance Thin Layer Chromatography by Analyzing the Ink Samples.
5. To Know Practical Working and Handling of Gas Chromatography by Analyzing Volatile Poisons.
6. To Know Practical Working and Handling of Low Voltage and High Voltage Electrophoresis by analyzing the Amino Acids & other Biochemical Samples.

Essential Readings:

1. Sharma B.K.(2000).Instrumental Methods of chemical Analysis.India, KrishnaPrakashan Media.
2. Shrivastava & Shrivastava(1991). Introduction to Chromatography. India, S.Chand& Co.
3. Smith and Bogusz M. (2007).Handbook of Analytical Separation.Germany,Elsevier Pub.
4. Srivastava M. (2010). High-Performance Thin-Layer Chromatography (HPTLC). Germany,Springer Science & Business Media.
5. Stahl E. (2013). Thin Layer Chromatography. Germany, Springer Science & Business Media.
6. TriggsC.M.Buckleton J.S. & Walsh S.J. (2004).Forensic DNA EvidenceInterpretation. CRC Press, USA
7. Walker, J.M., and Rapley, R.(2009). Molecular Biology and Biotechnology. UK,Royal Society of Chemistry.

8. Willard, Merrit and Dean. (1974). Instrumental Methods of Analysis. USA, Van Nostrand.

Suggested Readings:

1. Chapman J.R. (1993). Practical Organic Mass spectrometry, A Guide for Chemical and Biochemical Analysis. New York, Wiley Pub.
2. Chatwal and Anand. (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
3. Harris H., Gaensslen R., and Lee H. (2007). An Introduction to Forensic Science. USA, McGraw-Hill Education
4. Jarris K.E., Gray A.L., and Hock R.S. (1992). EDS; handbook of Inductively Coupled Plasma Mass Spectrometry; Glasgow, Blockie Pub.
5. Lindsay, S. (1992). High Performance Liquid Chromatography. New York: Wiley Pub.
6. MacLaffrty, F.W., and Turecek, F. (1993). Interpretation of mass spectra. US, Mill Valley, CA, Univ. Science Books.
7. Robards K. Jackson P.E. & Haddad P.A. (2012). Principles and Practice of Modern Chromatographic Methods. Germany, Elsevier pub.
8. Saferstein R. (2001). Forensic Science Handbook Vol. I. London, Prentice Hall.

FSC-MDM-221								
Forensic Medicine and Medical Jurisprudence : Theory								
Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester II	FSC-MDM-221	Forensic Medicine and Medical Jurisprudence : Theory	4	0	0	4	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To provide knowledge about forensic medicine and the concepts of medical jurisprudence, personal identification, thanatology, autopsy, post mortem examination, examination of injuries, and the importance of forensic anthropology and forensic odontology in forensic science.

2. Course Learning Outcomes :

Understanding the importance of personal identification in mass disaster cases, importance of autopsy, knowledge on different types of injury and wound, the different techniques of facial reconstruction and their forensic importance, importance of forensic odontology.

Unit-I: Forensic Medicine and Concept of Medical Jurisprudence

12 hrs

Definition, Developmental History, Brief knowledge about legal procedures in courts, inquests, criminal courts and their powers, subpoenas, and oaths of medical experts. Recording of Medical Experts' Evidence in Courts. Types of Medical Evidence, Kinds of Witness, and Rules for Giving Evidence.

Unit-II: Personal Identification

12 hrs

Definition and Importance of Personal Identification. Parameters Contributing to Personal Identity- Race, Sex, Age, Complexion, Features & Photographs, Anthropometry, Fingerprints, Footprints, Tattoo Marks, Lip Prints, Ear Prints, Brain Fingerprinting, Scars, Occupational Marks, Handwriting, Personal Belongings, Voice & Speech, DNA, Superimposition Techniques for Skull and Trace Evidence Factors. Disputed Paternity.

Unit-III: Thanatology, Autopsy and Post-Mortem Examination

12 hrs

Thanatology: Definition, Meaning, Death, Type of Death, Concept of Death, Modes of Death and their Causes and Sign (Immediate Changes, Early Changes, Late Changes) and Symptoms, Manner of Death, Cause of Death, Asphyxial Death, Suspended Animation and Medico Legal Importance of Death. Autopsy: Definition, Classification, Concepts, Objectives, Legal Formalities for Autopsy, Autopsy Procedure, Skin Incisions, etc. Post-Mortem Examination: Importance, Post-Mortem Report Format, External & Internal Examination in Brief. Viscera & Its Preservation. Examination of Asphyxial Death, Examination of Decomposed and Mutilated Bodies. Precautions to be taken during Post Mortem Examination.

Unit-IV: Injuries

12 hrs

Definition, classification, Mechanical Injuries (Abrasion, Contusion, Laceration, Fracture and Dislocation of Bone/ Teeth, Incised Wounds, Chop Wound, Stab Wounds and Firearm Wounds), Regional Injuries, Thermal Injuries (Injuries due to Cold and Heat), Chemical Injuries, Miscellaneous Injuries. Medico-Legal Aspects, Post Mortem & Ante Mortem Wounds, General Characteristics of Injuries from Burns, Scalds, Lightning, Electricity and Radiation.

Unit-V: Forensic Odontology and Anthropology**12 hrs**

Dentition Pattern, Types and Structure of Teeth, Age Determination- Identity of Person, Role in Mass Disaster, Disease of Teeth and their Significance in Personal Identification. Identification of Burnt Bones, Recovery and Identification of Skeletal Remains in Accident Cases and Mass Disasters, Facial Reconstruction.

Essential Readings:

1. Parikh C.K. (1972). Forensic Medicine and Toxicology. India, Medical Publications.
2. Polson C.J., Gee, D.J., and Knight, B. (1985). The Essentials of Forensic Medicine. France, Pergamon Press.
3. Simpsen K. & Knight B. (1996). Forensic Medicine 11th edit. USA, Taylor & Francis.
4. Taylor A. S. (1853). Medical jurisprudence. Philadelphia, Blanchard & Lea.
5. Thompson T., Black S. (2006). Forensic Human Identification: An Introduction. NY, CRC Press.
6. Vij K. (2014). Forensic Medicine & Toxicology: Principles & Practice. India, Elsevier Health Sciences.

Suggested Readings:

1. Adelman H. C. (2007). Forensic Medicine, NY, Infobase Publishing.
2. Aggrawal A. (2016). Textbook of Forensic Medicine and Toxicology. Avichal Publishing Company.
3. Catanese C. A. (2009). Color Atlas of Forensic Medicine and Pathology. NY, CRC Press.
4. Deoskar A. S., Tank A. H. (2010). Medical Jurisprudence, Toxicology and Forensic Science for Class Room, Investigation and Court Room with Case Laws, 3rd Ed. India, All India Refreshers.
5. Jason P. J., and Busuttil, A. (2003). Forensic Medicine: Clinical and Pathological Aspects. Cambridge University Press, England.
6. Jason P. J. & Simpson K. (2014). Simpson's Forensic Medicine, NY, CRC Press.
7. Mallet X. (2014). Advances in Forensic Human Identification. NY, CRC Press.
8. Modi J.S. (2011). Medical Jurisprudence and Toxicology, India, Law Publishers.
9. Molina D. K., & M.D. (2009). Handbook of Forensic Toxicology for Medical Examiners. USA, CRC Press.

FSC-MDM-222								
Forensic Medicine : Practical								
Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester II	FSC-MDM-222	Forensic Medicine: Practical	0	0	2	2	IA(Mid)-40 EA(End Sem)-60	

1. Learning Objectives:

To provide practical knowledge about bones of human body, age & sex of a person, bite marks, insects, pollen grains, diatoms, race & species and lip prints.

2. Course Learning Outcomes :

Understanding about Identification of bones for human and animal origin, determination of age and sex of a person from long bones and skull, casting and photography of bite marks, collection and identification of pollen grains and diatoms, race and species determination by blood grouping methods etc.

List of Practicals

60 hrs

1. Draw and label the bones of the human body.
2. Determination of Age and Sex of a Person from Long Bones.
3. Determination of Age and Sex of a Person from Skull.
4. Recording of Bite Marks by Casting& their Photography.
5. Collection and Identification of Important Insects for Forensic Studies.
6. Collection and Identification of Pollen Grains, Diatoms of Forensic Importance.
7. Determination of Race and Species by Blood Grouping Methods.
8. Examination of Lip Prints.

Essential Readings:

1. Parikh C.K. (1972). Forensic Medicine and Toxicology. India, Medical Publications.
2. Polson C.J., Gee D.J. & Knight B. (1985). The Essentials of Forensic Medicine. France, Pergamon Press.
3. Simpsen K. & Knight B. (1996). Forensic Medicine 11th edit. USA, Taylor & Francis.
4. Taylor A. S. (1853). Medical jurisprudence. Philadelphia, Blanchard & Lea.
5. Thompson T., Black S. (2006). Forensic Human Identification: An Introduction. NY, CRC Press.
6. Vij K. (2014). Textbook of Forensic Medicine & Toxicology: Principles & Practice. India, Elsevier Health Sciences.

Suggested Readings:

1. Adelman H. C. (2007). Forensic Medicine, NY, Infobase Publishing.
2. Aggrawal A. (2016). Textbook of Forensic Medicine and Toxicology. India, Avichal Publishing Company.
3. Catanese C. A. (2009). Color Atlas of Forensic Medicine and Pathology. NY, CRC Press.
4. Deoskar A. S., Tank A. H. (2010). Medical Jurisprudence, Toxicology and Forensic Science for Class Room, Investigation and Court Room with Case Laws, 3rd Ed. India, All India Refreshers.
5. Jason P. J. & Busuttil A. (2003). Forensic Medicine: Clinical and Pathological Aspects. England, Cambridge University Press.
6. Jason P. J. & Simpson K. (2014). Simpson's Forensic Medicine, NY, CRC Press.
7. Mallet X. (2014). Advances in Forensic Human Identification. NY, CRC Press.
8. Modi J.S. (2011). Medical Jurisprudence and Toxicology. India, Law Publishers.
9. Molina D. K. & M.D. (2009). Handbook of Forensic Toxicology for Medical Examiners. USA, CRC Press.

FSC-SEC-221:Emerging Trends in Forensic Science: Theory								
Level/ Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem II	FSC-SEC-221	Emerging Trends in Forensic Science: Theory	3	0	0	3	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To develop a basic understanding of emerging trends and techniques in forensic science.

2. Course Learning Outcomes :

Understanding Modern Surveillance Tools, Advancements in Detection of Street Drugs, Geo-Forensics, Environmental Forensics, Wildlife Forensics.

Unit-I: Modern Surveillance Tools

8 hrs

Surveillance using biometrics, ID cards, and communications data

Security Tools- Types (Airborne, Deployable, Fixed, Mobile, etc.), Advantages and Disadvantages.

Unit-II: Advancements in Detection of Street Drugs

10 hrs

Kit based detection, Instrument Advancements in Drugs, Hyphenated Chromatographic, 2D Gas Chromatography, Electronic Nose, Advance Kits, Drug Early warning system, Non invasive matrix in drug detection, Non Conventional Substance of Abuse.

Unit-III: Forensic Geology

9 hrs

Types of soil evidence, Color analysis, Particle analysis, Mineralogical analysis, Major and trace element composition, Procedures for soil and sediment sampling and storage, Analysis of gems/ colored stones, Evaluation of the significance of geological evidence.

Unit-IV: Environmental Forensics

10 hrs

Introduction, Environmental pollutants, Toxicity of environmental contaminants, Fate of chemicals in the environment, Bioconcentration, Bioaccumulation and Biomagnification, Groundwater contamination, atmospheric dispersion of pollutants.

Unit-V: WildLife Forensics

8 hrs

Introduction to Wildlife, Protected and Endangered Species of Animals and Plants, WildLife Species - Identification and Examination of Physical Evidence by Conventional and Modern Methods, Identification of Pug Marks of Various Animals, Wildlife Census, Wildlife and Environment Protection Act.

Essential Readings:

1. Murray, R.C. and Tedrow, J.C.F. (1975). Forensic Geology. Rutgers University Press, New

Brunswick, New Jersey.

2. Murray, R.C. and Tedrow, J.C.F. (1992). Forensic Geology, 2nd ed. Prentice Hall Inc Englewood Cliffs, New Jersey.
3. Pye, K. (2007). Geological and soil evidence forensic applications, CRC Press, Taylor & Francis group.
4. Brian L. Murphy & Robert D. Morrison, Elsevier (Academic Press): Introduction to Environmental Forensics, 3rd edition (2015)
5. Jane E. Huffman, John R. Wallace Wildlife Forensics: Methods and Applications, Wiley Blackwell.
6. Beiglböck, C., &Walzer, C. (2019). Handbook on Standard Operating Procedures (SOP) in Forensic Investigations of Suspected Illegal Killing of Wildlife.
7. Fred Smith. Elsevier (Academic Press): Handbook of Forensic Drug Analysis, 1st edition (2004).
8. Rabi A. Musah. Springer: Analysis of Drugs of Abuse, 1st edition (2018).
9. Gupta, R. S. (1994). Management of internal security. New Delhi: Lancer Publishers.
10. Dipak, H. (1989). Industrial security in India. New Delhi: Ashish , Publishing House.

Suggested Readings:

1. Murray, R.C. (2004). Evidence from the Earth: Forensic Geology and Criminal Investigation. Mountain Press, Publishing Company, Missoula, Montana.
2. Petraco, N., Kubic, T. (2000). A density gradient technique for use in forensic soil analysis. Forensic Science International.
3. Reynolds, J.M. (1997). An introduction to applied and environmental geophysics. John Wiley & Sons, Ltd, Chichester.
4. Wildlife DNA Analysis: Applications in Forensic Science. (2013, May 28). Wiley.Com

FSC-SEC-222:Emerging Trends in Forensic Science: Practical								
Level/ Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
L8 Sem II	FSC-SEC-222	Emerging Trends in Forensic Science: Practical	0	0	1	1	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To give practical knowledge about the emerging trends and emerging techniques in the field of forensic science.

2. Course Learning Outcomes :

Understanding about Identification and characterization of flora and fauna, drugs of abuse, soil, etc.

List of Practicals

30 hrs

1. Pugmark Identification and characterization of common large mammals.
2. Use of different techniques in identification of different parts and products of flora and fauna reported in the wildlife trade.
3. To identify drugs of abuse by spot tests/rapid test kit.
4. To separate drugs of abuse by thin layer chromatography.
5. Comparison of soil samples.

Essential Readings:

1. Murray, R.C. and Tedrow, J.C.F. (1975). Forensic Geology. Rutgers University Press, New Brunswick, New Jersey.
2. Murray, R.C. and Tedrow, J.C.F. (1992). Forensic Geology, 2nd ed. Prentice Hall Inc Englewood Cliffs, New Jersey.
3. Pye, K. (2007). Geological and soil evidence forensic applications, CRC Press, Taylor & Francis group.
4. Brian L. Murphy & Robert D. Morrison, Elsevier (Academic Press): Introduction to Environmental

Forensics, 3rd edition (2015)

5. Jane E. Huffman, John R. Wallace Wildlife Forensics: Methods and Applications, Wiley Blackwell.

6. Beiglböck, C., &Walzer, C. (2019). Handbook on Standard Operating Procedures (SOP) in Forensic Investigations of Suspected Illegal Killing of Wildlife.

7. Fred Smith. Elsevier (Academic Press): Handbook of Forensic Drug Analysis, 1st edition (2004).

8. Rabi A. Musah. Springer: Analysis of Drugs of Abuse, 1st edition (2018).

Suggested Readings:

1. Murray, R.C. (2004). Evidence from the Earth: Forensic Geology and Criminal Investigation. Mountain Press, Publishing Company, Missoula, Montana.

2. Petraco, N., Kubic, T. (2000). A density gradient technique for use in forensic soil analysis. Forensic Science International.

3. Reynolds, J.M. (1997). An introduction to applied and environmental geophysics. John Wiley & Sons, Ltd., Chichester.

4. Wildlife DNA Analysis: Applications in Forensic Science. (2013, May 28). Wiley.Com

SEMESTER III

FSC-MDM-321								
Forensic Biology, Serology and DNA : Theory								
Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester III	FSC-MDM-321	Forensic Biology, Serology and DNA : Theory	4	0	0	4	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To understand basic concepts of forensic biology and the analysis of forensic exhibits.

2. Course Learning Outcomes :

To understanding of the nature and importance of cells in the human body and different biological materials and their examination.

Unit I: Fundamentals of Biology

15 hrs

Definition, Meaning, and History of Histology. Cell: Definition, Theories, Classification and Significance of Cells in Forensic Science. Cell Organelles and their Functions, Difference between Eukaryotic and Prokaryotic Cell, Difference between Plant and Animal Cell. Cell Division: Definition, Types, Difference between Somatic, Germinal Cell, Totipotency and Apoptosis. Basic Concept in Brief for Anatomy and Physiology of Digestive, Respiratory, Circulatory, Skeleton, Nervous, Excretory, and Reproductive System, etc.

Amino Acids: Definition, Classification, General Properties and Reaction.

Proteins: Definition, Classification, General Properties and Reaction/Detection.

Carbohydrates: Definition, Classification and Detection.

UNIT-II: Forensic Biology

15 hrs

Hair: Structure, Development, Anatomy, Pigmentation, Identification Characters and Basic Characters for Forensic Examination of Hair Including Determination of Origin, Race, Sex, and Other Instrumental Analysis.

Fibers: Definition, Classification, Characters, Difference Between Plant and Animal Fiber, and Forensic Aspects of Fiber Examination– Density, Microscopy, Hot Stage Microscopy, Fluorescent, Optical Properties, Refractive Index, Birefringence, Dye Analysis, and Spectroscopic Techniques for Fiber Analysis.

Forensic Botany

Woods and their Identification and Matching. Diatoms and their Forensic Significance in Drowning Cases; Study and Identification of Pollen Grains, Starch Grains, Powder and Stains of Spices, etc. Classification and Identification of Forensically Important Microbes.

Forensic Entomology

Definition, Meaning, and Scope of Entomology. Forensically Significant Species of Insect: Classification, Habitat, Life Cycle. Factor Affecting the Growth of Insect in Dead Body. Determination of Age of Cadaver through Entomological Analysis. Significance of Entomology in Forensic Science.

UNIT-III: Examination of Biological Fluids and Immunology

10 hrs

Blood: Composition, Histology, Examination of Blood and Blood Stains, Blood Spatter Pattern Identification, Identification of Menstrual and Other Stains by Various Methods.

Semen: Composition, Structure of Spermatozoa, Forensic Methods of Detection and Identification of Semen and Seminal Stain.

Origin of Species: Determination of Human and Animal Origin from Bones, Hair, Flesh, Nails, Skin, Teeth, Body Tissue, Fluids/Stains viz. Blood, Menstrual Blood, Semen, Saliva, Sweat, Tear, Pus, Vomit, etc., Through Immuno-Diffusion and Immuno-Electrophoresis, Cross-Reactivity among Closely Related Species.

Immunology: Immune System, Immune Response, Epitopes, Paratopes, Haptens and Adjuvant, Antigens and Antibodies, Antigen-Antibody Reaction.

UNIT-IV: Basic Concepts of Genetics

10 hrs

Structure and Function of Cell, Mendel Ion Genetics, Genotypes, Phenotypes, Mutation, Multiple Alleles. Biochemical Markers of Individuality: General Understanding, Classification of Markers, Biochemical Basis of Genetic Variation. Expression of Gene, Transcription, and Translation of DNA and Gene Mapping. Analysis of Protein by Electrophoresis and Related Methods. Protein Polymorphism and Characterization by Electrophoretic Methods.

UNIT-V: Serogenetic Markers and DNA

10 hrs

Blood Groups: History, Biochemistry and Genetics of ABO, Rh, Mn, and other Systems, Methods of ABO Blood Grouping (Absorption-Inhibition, Mixed Agglutination, And Absorption Elution) from Blood Stains and other Body Fluids/Stains, Determination of Secreter/Non-Secreter Status, Lewis Antigen, Bombay Blood Group, Polymorphic Enzymes Typing- PGM, ESD, EAP, AK, etc., and their Forensic Significance, HLA Typing, Role of Serogenetic Markers in Individualization, Paternity Disputes, etc. Structure of DNA, Damage to DNA, Variation in DNA, DNA as Excellent Polymorphic Marker, and Sources of DNA as Forensic Evidence. Different Extraction Techniques of DNA, Basic DNA Typing Techniques; RFLP, PCR, Electrophoresis, and Detection Methods.

Essential Readings:

1. Kimball & John W. (1974). Biology. New Delhi, Arvind Publishing Co.
2. Lewis. B. (1980). Gene IV. England, Oxford University Press.
3. Mauersberger H. R. (1954). Mathews Textile Fibres – Their Physical, Microscopic and Chemical Properties. New York, John Wiley.
4. Morrison & Robert D. (2000). Environmental Forensics Principles and Applications. New York, CRC Press.
5. Oates D.W., Brown C.W. & Weigel D.L. (1974). Blood and Tissue Identification of Selected Birds and Mammals. JPR Study Projects Lincoln NE Nebraska Game and Parks Commission. Philadelphia, Staff Research Publications.
6. Pandey R.P. (1998). Plant Anatomy. New Delhi, S. Chand & Co.
7. Saferstein R. (1995). Criminalistics – An Introduction to Forensic Science. USA, Prentice Hall Inc.
8. Walker J.M. & Rapley R. (2009). Molecular Biology and Biotechnology. London, Royal Society of Chemistry.
9. Williams P. L. & Warwick R. (1980). Gray's anatomy. London, Churchill Livingstone.

Suggested Readings:

1. Albert S., Bray B. Lewis D, Roberts K. & Watson J.D. (1989). Molecular Biology of Cell. New York, Garland Pub.
2. Ball S., (1991). Environmental Law – The Law and Policy relating to Protection of Environment. India, Universal Law Pub Co, Delhi.
3. Biology Methods Manual (1978). London, Metropolitan Police Forensic Science Laboratory Pub.
4. Catts E.P. & Haskell N.H. (1990). Entomology and Death: A Procedural Guide. London, Joyce's Print Shop.
5. Clifford & B.J.(1971). The Examination and Typing of Bloodstains in the Crime Laboratory. USA, US Court Printing Press.
6. Edwin & Caney H. M. (1993). Human Genetics: The Molecular Revolution. London, Jones & Bartlett Pub.
7. Gardner E.J., Simmons M. I. & Snustad D.P.(1991). Principles of Genetics. New York, John Wiley.

FSC-MDM-322								
Forensic Biology, Serology and DNA : practical								
Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester III	FSC-MDM-322	Forensic Biology, Serology and DNA : practical	0	0	2	2	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To have practical knowledge about blood and blood groups, saliva, hair, fibres, and pollen.

2. Course Learning Outcomes :

Understanding about Blood/ blood group examination, origin of species by hair samples, identification of fibres by physical and chemical methods, microscopic examination of pollen and diatoms.

List of Practical

60 hrs

1. Primary and Confirmatory Examination of Blood/ Semen Samples.
2. Microscopic Examination of Seminal Stains for the Detection of Spermatozoa.
3. Identification of Species from the Hair Sample.
4. Examination of Fiber by Physical and Chemical Methods.
5. Determination of species from Blood Samples.
6. Detection & Examination of Salivary Stains.
7. Identification of different Plant Species using External Features.

Essential Readings:

1. Kimball & John W. (1974). Biology. New Delhi, Arvind Publishing Co.
2. Lewis. B. (1980). Gene IV. England, Oxford University Press.
3. Mauersberger H. R. (1954). Mathews Textile Fibres – Their Physical, Microscopic and Chemical Properties. New York, John Wiley.
4. Morrison & Robert D. (2000). Environmental Forensics Principles and Applications. New York, CRC Press.
5. Oates D.W., Brown C.W. & Weigel D.L. (1974). Blood and Tissue Identification of Selected Birds and Mammals. JPR Study Projects Lincoln NE Nebraska Game and Perks Commission. Philadelphia, Staff Research Publications.
6. Pandey R.P. (1998). Plant Anatomy. New Delhi, S. Chand & Co.

7. Saferstein R. (1995). Criminalistics – An Introduction to Forensic Science. USA, Prentice Hall Inc.
8. Walker J.M. & Rapley R. (2009). Molecular Biology and Biotechnology. London, Royal Society of Chemistry.
9. Williams P. L. & Warwick R. (1980). Gray's anatomy. London, Churchill Livingstone.

Suggested Readings:

1. Albert S., Bray B. Lewis D, Roberts K. & Watson J.D. (1989). Molecular Biology of Cell. New York, Garland Pub.
2. Ball S., (1991). Environmental Law – The Law and Policy relating to Protection of Environment. India, Universal Law Pub Co, Delhi.
3. Biology Methods Manual (1978). London, Metropolitan Police Forensic Science Laboratory Pub.
4. Catts E.P. & Haskell N.H. (1990). Entomology and Death: A Procedural Guide. London, Joyce's Print Shop.
5. Clifford & B.J.(1971). The Examination and Typing of Bloodstains in the Crime Laboratory. USA, US Court Printing Press.
6. Edwin & Caney H. M. (1993). Human Genetics: The Molecular Revolution. London, Jones & Bartlett Pub.
7. Gardner E.J., Simmons M. I. & Snustad D.P.(1991). Principles of Genetics. New York, John Wiley.

FSC-MDM-323								
Forensic Toxicology and Pharmacology: Theory								
Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester III	FSC-MDM-323	Forensic Toxicology and Pharmacology: Theory	4	0	0	4	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To understand basic concepts of forensic toxicology and Pharmacology.

2. Course Learning Outcomes :

To understanding of the nature and importance of various toxic substances and the pharmacological aspects of the substances.

UNIT-I: Forensic Toxicology (10hrs) Introduction, Concept, and Significance. Poisons: Definition, Classification of Poisons, Types of Poisoning, Mode of Action, Factors Modifying the Action of Poisons, Toxicological Exhibits in Fatal and Survival Cases, Their Preservation, Treatment in Cases of Poisoning, Analysis Report.

UNIT-II: Extraction, Isolation and Clean-Up Procedures- (15hrs)

Extraction of Non-Volatile Organic Poison, Stas-Otto, Dovbriey Nickolls(Ammonium Sulphate) Method, Acid Digest and Valov (Tungstate) Methods, Solid Phase Micro Extraction Techniques, Solvent Extraction Methods.

Volatile Poisons: Industrial Solvent Acid and Basic Distillation.

Toxic Cations: Dry Ashing and Wet Digestion Process.

Toxic Anions: Dialysis Method, Total Alcoholic Extract.

UNIT-III General Study and Analysis- (10hrs)

Barbiturates, Methaqualone, Hydromorphone, Methadone, Meprobamate, Mescaline, Amphetamines, LDS, Heroin, Cannabinoids, Phinothiazines.

Insecticides: Types, General Methods for their Analysis.

Alkaloids: Definition, Classification, Isolation and General Characterization.

Vegetable Poison: General Studies and Analysis of Some Vegetable Poisons, Opium, Abrus, Cyanogenetic Glycosides, Dhatura, Marking Nuts, Nux-Vomica, Oleander Aconite, etc.

UNIT-IV Examination and Analysis of Poisons- (10hrs)

Metallic Poisons: Arsenic, Mercury, Lead, Bismuth, Copper, Aluminium, Iron, Barium, Zinc, etc. Analysis of Ethyl Alcohol in Blood and Urine, Illicit Liquor, Methanol, Acetone, Chloroform, Phenol Snake Venoms and Other Animal Poisons, Irrespirable Gases, etc.

UNIT-V: Basics of Pharmacology (15hrs)

Pharmacological Studies: Absorption, Distribution, Metabolism, Pathways of Drug Metabolism. Pharmacodynamics: Introduction, Nature & Scope.

Essential Readings:

1. Parikh C.K. (1972). Forensic Medicine and Toxicology. India, Medical Publications.
2. Rao N.G.(2010). Textbook of Forensic Medicine & Toxicology. India, Jaypee Brothers Medical Publishers (P) Ltd.
3. Reddy K.S.N. (2014). Forensic Medicine. India, Jaypee Brothers.
4. Thompson T. & Sue B. (2006). Forensic Human Identification: An Introduction. USA, CRC Press.

Suggested Readings:

1. Aggrawal A. (2016). Textbook of Forensic Medicine and Toxicology. India, Avichal Publishing Company.
2. Bardale R. (2011). Principles of Forensic Medicine & toxicology. India, Jaypee Brothers Medical Publishers (P) Ltd.
3. Krishan V. (2014). Textbook of Forensic Medicine & Toxicology: Principles & Practice. UK, Elsevier Health Sciences.
4. Modi J.S. (2011). Medical jurisprudence and Toxicology. India, Law Publishers.

FSC-MDM-324**Forensic Toxicology and Pharmacology: practical**

Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester III	FSC-MDM-324	Forensic Toxicology and Pharmacology	0	0	2	2	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To have practical knowledge about various plant poisons and toxins by analysis of the exhibits.

2. Course Learning Outcomes :

Understanding about different Vegetable Poisons, Extraction and Identification of Insecticides and Pesticides, Identification of Drugs/ Toxicants, Identification of Metallic Poisons from Viscera.

List of Practical**60 hrs**

1. Identification of Common Plants i.e., Calotropis, Cannabis, Dhatura, Nux-Vomica, Marking Nut, Abrus precatorius, Opium Poppy etc. by Physical Examination and Color Test.
2. Identification of Different Vegetable Poisons by Thin Layer Chromatography etc.
3. Extraction and Identification of Insecticides and Pesticides by Colour Test/TLC.
4. Extraction and Identification of Drugs/ Toxicants from Biological Matrix and their Detection.
5. Identification of Salts and Metals by Simple Color Test in Case of Metallic Poisoning.
6. Extraction and Identification of Metallic Poisons from Viscera Using Dry Ashing Method Followed by Reinsch's Test.

Essential Readings:

1. Parikh C.K. (1972). Forensic Medicine and Toxicology. India, Medical Publications.
2. Rao N.G. (2010). Textbook of Forensic Medicine & Toxicology. India, Jaypee Brothers Medical Publishers (P) Ltd.
3. Reddy K.S.N. (2014). Forensic Medicine. India, Jaypee Brothers.
4. Thompson T. & Sue B. (2006). Forensic Human Identification: An Introduction. USA, CRC Press.

Suggested Readings:

1. Aggrawal A. (2016). Textbook of Forensic Medicine and Toxicology. India, Avichal Publishing Company.
2. Bardale R. (2011). Principles of Forensic Medicine & toxicology. India, Jaypee Brothers Medical Publishers (P) Ltd.
3. Krishan V. (2014).Textbook of Forensic Medicine & Toxicology: Principles & Practice. UK, Elsevier Health Sciences.
4. Modi J.S. (2011).Medical jurisprudence and Toxicology. India, Law Publishers.

FSC-SEC-321								
Questioned Document and Cyber Forensics: Theory								
Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester III	FSC-SEC-321	Questioned Document and Cyber Forensics: Theory	3	0	0	3	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To gain knowledge about nature & scope, tools in questioned documents, comparison of handwriting and questioned documents & forgeries.

2. Course Learning Outcomes :

Understanding about collection, handling, and preservation of questioned documents, basic tools for forensic document examination; alterations in documents; charred documents; and examination.

Unit- I: Nature, Scope of Questioned Documents, and Tools Used in Questioned Documents. 8 hrs

Definition of Questioned Document, Types of Questioned Document, Collection, Preservation & Handling of Questioned Document, Photography of Questioned Document, Preliminary Examination of Questioned Document.

Basic Tools Needed for Forensic Document Examination- Ultraviolet, Visible, Infrared, and Fluorescence Spectroscopy, Photomicrography, Microphotography, Visible Spectral Comparator, Electrostatic Detection Apparatus, Determining the Age and Relative Age of Documents.

Unit- II: Comparison of Handwriting and Questioned Documents 6hrs

Comparison of Handwriting, Development of Individuality in Handwriting, Natural Variations and Fundamental Divergences in Handwriting, Class & Individual Characteristics.

Standards for Comparison of Handwriting. Comparison of Paper, Ink, Printed Documents, Typed Documents, Xeroxed Documents.

Unit III: Forgeries 4 hrs

Alterations in Documents, Including Erasures, Additions, Over-Writing, and Obliterations. Indented and Invisible Writings. Charred Documents. Examination of Counterfeit Indian Currency Notes, Passports, Visas, and Stamp Pads.

UNIT-IV Cyber Forensics 6 hrs

What is Computer Forensic? Basic Introduction to Computers, Hardware and Accessories, Operating Systems and Software. Cyber Crime- Definition, Crimes on Internet, Hacking, Virus, Worms, Cookies, Obscenity and Pornography. Programme Manipulation. Software Piracy, Intellectual Property and Computer Security. Encryption and Decryption Methods.

UNIT-V Computers and Networking

6 hrs

Concept of Network Security and Cyber Crime Investigation. Basic of Security Planning: Multi Layered Security, Intrusion Triangle, Removing Intrusion Opportunities, Importance of Physical Security, Protecting Server, Work Station and Network Devices, Protection of Removable Storage Disks. Cryptography and Steganography. Cyber Crime Investigation, Relevant Section of Information Technology Act 2000.

Essential Readings:

1. Thomas C. C. (1971). I.S.Q.D. Identification System for Questioned Documents. USA, Billy Prior Bates Springfield, Illinois.
2. Hilton O. (1982). Scientific Examination of Questioned Documents. NY, Elsevier.
3. James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, Taylor & Francis Group.
4. Albert J. M. & Guillosoy F. (2012). Cyber Forensics: From Data to Digital Evidence. New Jersey, Wiley Corporate F&A.
5. Casey E. (2009). Handbook of Digital Forensics and Investigation. USA, Academic Press.
6. Marcella A. & Menendez D. (2007). Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes. NY, CRC Press.
7. EC-Council. (2016). Computer Forensics: Investigating Network Intrusions and Cybercrime (CHFI). US, Cengage Learning.

Suggested Readings:

1. Nordby James, S.H. & J.J. (2003). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, CRC Press.
2. O'Hara & Osterberg (1949). An Introduction to Criminalistics. New York, The Macmillan Company.
3. Nickolls, L.C. (1956). Scientific Investigation of Crime. London, Bulterwest.
4. Kelly J. S. & Lindblom B. S. (2006). Scientific Examination of Questioned Documents. NY, CRC Press.
5. Bayuk J. (2010). Cyber Forensics: Understanding Information Security Investigations. NY, Springer.
6. Santanam R., Sethumadhawan M. (2010). Cyber Security, Cyber Crime and Cyber Forensics: Applications and Cyber Forensics: Applications and Perspectives. NY, Information Science Reference.

7. Wiles J., Reyes A. (2007). The Best Damn Cybercrime and Digital Forensics Book Period. US, Elsevier.
8. Nelson B, Philips A., Steuart C. (2014). Guide to Computer Forensics and Investigations. US, Cengage Learning.

FSC-SEC-322**Questioned Document and Cyber Forensics: Practical**

Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester III	FSC-SEC-322	Questioned Document and Cyber Forensics	0	0	1	1	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To have practical knowledge about questioned documents , digital evidence, and finding the origin of E-mails.

2. Course Learning Outcomes :

Understanding about Collection, Preservation, Handling & Forwarding of Charred Document, Comparison of Forged and Genuine Document, Examination of ink by TLC, and Collection and Handling of Digital Evidence.

List of Practical**30 hrs**

1. Collection, Preservation, Handling & Forwarding of Charred Document.
2. Photographic Comparison of Handwriting & Signature.
3. Comparison of Forged and Genuine Document by VSC & Other Methods.
4. Decipher of Secret Writing by Physical and Chemical Methods.
5. Examination of Questioned Document & Currency by VSC.
6. Examination of ink by TLC.
7. Introduction of Computer, Accessories & Operating Systems.
8. Collection and Handling of Digital Evidence.
9. Detection of Origin of e-Mails (IP Address) etc.
10. Data recovery from various storage devices by using data recovery software.

Essential Readings:

1. Thomas C. C. (1971). I.S.Q.D. Identification System for Questioned Documents. USA, Billy Prior Bates Springfield, Illinois.
2. Hilton O. (1982). Scientific Examination of Questioned Documents. NY, Elsevier.
3. James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, Taylor & Francis Group.

4. Albert J. M. & Guillosoy F. (2012). Cyber Forensics: From Data to Digital Evidence. New Jersey, Wiley Corporate F&A.
5. Casey E. (2009). Handbook of Digital Forensics and Investigation. USA, Academic Press.
6. Marcella A. & Menendez D. (2007). Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes. NY, CRC Press.
7. EC-Council. (2016). Computer Forensics: Investigating Network Intrusions and Cybercrime (CHFI). US, Cengage Learning.

Suggested Readings:

1. Nordby James, S.H. & J.J. (2003). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, CRC Press.
2. O'Hara & Osterberg (1949). An Introduction to Criminalistics. New York, The Macmillan Company.
3. Nickolls, L.C. (1956). Scientific Investigation of Crime. London, Butterworth.
4. Kelly J. S. & Lindblom B. S. (2006). Scientific Examination of Questioned Documents. NY, CRC Press.
5. Bayuk J. (2010). Cyber Forensics: Understanding Information Security Investigations. NY, Springer.
6. Santanam R., Sethumadhawan M. (2010). Cyber Security, Cyber Crime and Cyber Forensics: Applications and Cyber Forensics: Applications and Perspectives. NY, Information Science Reference.
7. Wiles J., Reyes A. (2007). The Best Damn Cybercrime and Digital Forensics Book Period. US, Elsevier.
8. Nelson B, Philips A., Steuart C. (2014). Guide to Computer Forensics and Investigations. US, Cengage Learning.

FSC-SEC-323**Forensic Chemistry and Explosives: Theory**

Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester III	FSC-SEC-323	Forensic Chemistry and Explosives: Theory	3	0	0	3	IA(Mid)-40 EA(End Sem)-60	

1. Learning Objectives:

To understand concepts of forensic chemistry and Examination of GSR and Explosives .

2. Course Learning Outcomes :

Understanding about Recent Advancement in Drugs, Examination of Food and Petroleum Products, Chemistry of Combustion and Arson, Analysis of Gunshot Residues.

UNIT-I Forensic Chemistry**6hrs**

Forensic Chemistry and its Scope, Analysis of Beverages: Alcohol and Non-Alcoholic, Country Made Liquor etc. Adulterated food material. Drugs of Abuse: Introduction, Classification, Narcotic Drugs & Psychotropic Substances, Sampling, Specific Drugs Types (Cannabis, Heroin, Cocaine, Amphetamine), Drugs of Abuse in Sports. Brief Introduction to Drugs and Cosmetic Act, Excise Act, NDPS Act. An Overview of Clandestine Laboratories.

Recent Advancement in Drugs: Rave Drugs, Drug Designing, Doping, Drug Discovery Program, Structural Modification In Drugs, and Drug Monitoring Agencies.

UNIT-II Examination of Food and Petroleum Products**6 hrs**

Examination of Petroleum Products: Distillation & Fractionation, Various Fractions and their Commercial Uses. Standard Methods of Analysis of Petroleum Products for Adulteration. Trap Cases: Purpose, Examination of Chemicals Used in Trap Case.

UNIT-III Examination of Building Material**6 hrs**

Examination of Building Materials: Types of Cement and their Composition, Determination of Adulterants by Physical, Chemical and Instrumental Methods, Examination of Brick, Analysis of Cement Mortar and Concrete, Analysis of Gold and Other Metals in Cheating Cases.

UNIT-IV: Arson**4 hrs**

Chemistry of Combustion and Arson-Overview of Combustion, Four Aspects of Combustion (Thermodynamics, Kinetics of Combustion, Heat Transfer, Mass Transfer), Deflagration and Detonation. Fires: Nature and Chemistry of Fire, Classification, Igniters of Fires, Phases of Fires, Main Types of Fires, Examination of Scene of Fires. Arson: Relevant IPC Sections, Motives, Analysis of Accelerants.

UNIT-V: Examination of GSR and Explosive

8 hrs

Analysis of Gunshot Residues - Mechanism of Formation of GSR, Source and Collection, Spot Test, Chemical Test, Identification of Shooter and Instrumental Methods of GSR Analysis. Explosives: Devices, Explosives Classification, Detonation and deflagration, Primary and Secondary Explosives, Comparison and characterization of Explosives, Military and commercial Explosives, Detection of Explosophores (Anions), Detection of Black Powder, Nitrocellulose and Dynamite, Quantitative Determination. Energy Release, Explosive Output, Critical Diameter, Chemistry of Some Common Explosives, Military Explosives, Plastic Explosive, Commercial Explosives, Propellants, Terrorist use if Homemade Explosives, Peroxide Explosives, Exotic Explosives, Energetic Salts. Non-Solid Explosives, Detection of Explosives by Dogs, Colorimetric Detection of Explosives, X-Ray Technologies.

Essential Readings:

1. Sharma B.K., (2000). Instrumental Methods of Chemical Analysis. India, Krishna Prakashan Media.
2. Silverstein R.M. & Webster F.X., (1997). Spectrometric Identification of Organic Compounds. USA, John Wiley & Sons, Inc.
3. Skoog D.A., Holler F.J. & Stanley R.C. (2017). Principles of Instrumental Analysis, USA, Cengage Learning.
4. Subrahmanyam N. & Brij Lal (2004). A Text Book of Optics. India, S. Chand & Co.
5. Thompson K.C. & Renolds R.J. (1978). Atomic Absorption Fluorescence & Flame Emission Spectroscopy: Practical Approach. London, Charles Griffin & Co.
6. Willard H. & Lynne L.M. (1986). Instrumental Methods of Analysis. USA, CBS Publishers & Distributors.
7. Willard H.H., Merrett L. L. Frank J.A.D. & Settle A. (1986). Instrumental Methods of Analysis. USA, CBS Pub. & Distributors.

Suggested Readings:

1. Chatwal and Anand. (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
2. Churáček J. (1993). Advanced Instrumental Methods of Chemical Analysis. Michigan, E. Harwood,
3. Dean J. A. (1995). Analytical Chemistry Handbook. USA, McGraw Hill Inc.
4. Kalri P.S. (2001). Spectroscopy of Organic Compounds. India, New Age International Pub.
5. Khandpur R.S. (2004). Handbook of Analytical Instruments. USA, Tata McGraw Hill Pub. Co.
6. Khanna D.R. & Gulati H.R. (2002). Fundamentals of Optics Geometrical Physical & Quantum. India, R. Chand & Co.
7. Patania V.B. (2004). Spectroscopy. India, Campus Books International.

FSC-SEC-324**Forensic Chemistry and Explosives: Practical**

Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester III	FSC-SEC-324	Forensic Chemistry and Explosives: Practical	0	0	1	1	IA(Mid)-40 EA(End Sem)- 60	

1. Learning Objectives:

To have practical knowledge about chemicals used in trap cases, petroleum products etc.

2. Course Learning Outcomes :

Understanding about Examination of Chemicals Used in Trap Cases, Analysis of Petroleum Products, Identification of Volatile Liquid by Simple Distillation, Examination of Country-made Liquor by UV-VIS Spectrophotometry.

List of Practical**30hrs**

1. Preliminary & Confirmatory Examination of Chemicals Used in Trap Cases.
2. Preliminary & Confirmatory Examination of the Chemicals Seized in Case of Acid Attack.
3. Estimation Analysis of Petroleum Products using different methods like Density, Viscosity etc.
4. Detection of Adulterants in Cement Samples.
5. Determination of Percentage of Proof Spirit of Ethyl Alcohol in Illicit Liquor.
6. Separation and Identification of Volatile Liquid by Simple Distillation.
7. Chemical Examination of the Component of Crackers.
8. Preliminary Examination Black Powder.
9. Examination of Petroleum Products by GC & UV-VIS Spectrophotometry.
10. Examination of Country-made Liquor by UV-VIS Spectrophotometry.

Essential Readings:

1. Sharma B.K., (2000). Instrumental Methods of Chemical Analysis. India, Krishna Prakashan Media.
2. Silverstein R.M. & Webster F.X., (1997). Spectrometric Identification of Organic Compounds. USA, John Wiley & Sons, Inc.
3. Skoog D.A., Holler F.J. & Stanley R.C. (2017). Principles of Instrumental Analysis, USA, Cengage Learning.

4. Subrahmanyam N. & Brij Lal (2004). A Text Book of Optics. India, S. Chand & Co.
5. Thompson K.C. & Renolds R.J. (1978). Atomic Absorption Fluorescence & Flame Emission Spectroscopy: Practical Approach. London, Charles Griffin & Co.
6. Willard H. & Lynne L.M. (1986). Instrumental Methods of Analysis. USA, CBS Publishers & Distributors.
7. Willard H.H., Merrett L. L. Frank J.A.D. & Settle A. (1986). Instrumental Methods of Analysis. USA, CBS Pub. & Distributors.

Suggested Readings:

1. Chatwal and Anand. (2016). Instrumental Methods of Chemical Analysis. India, Himalaya Publishing House Pvt. Ltd.
2. Churáček J. (1993). Advanced Instrumental Methods of Chemical Analysis. Michigan, E. Harwood,
3. Dean J. A. (1995). Analytical Chemistry Handbook. USA, McGraw Hill Inc.
4. Kalri P.S. (2001). Spectroscopy of Organic Compounds. India, New Age International Pub.
5. Khandpur R.S. (2004). Handbook of Analytical Instruments. USA, Tata McGraw Hill Pub. Co.
6. Khanna D.R. & Gulati H.R. (2002). Fundamentals of Optics Geometrical Physical & Quantum. India, R. Chand & Co.
7. Patania V.B. (2004). Spectroscopy. India, Campus Books International.
8. Robinson J.W. (1996). Atomic Spectroscopy, Revised & Expanded. NY, Marcel Dekkar, Inc.

SEMESTER IV

FSC-DSP-421								
Dissertation								
Level / Semester	Course Code	Title of the Course	Credit				Marks	Course Coordinator
			L	T	P	C		
Semester IV	FSC-DSP-421	Dissertation	0	0	0	16	EA - 100	

1. Learning Objectives:

To have hands-on experience of different instruments and knowledge on research work.

2. Course Learning Outcomes :

Understanding about working of different forensic laboratories and various field of forensic science. Getting laboratory experience which will help to pursue forensic science in future.

Student will undergo a semester-long dissertation work in the subject/topic related to scope of Forensic Science, Forensic Chemistry and Toxicology, Forensic Biology and DNA, Forensic Physics and Ballistics, Fingerprints, Questioned Documents and Cyber Forensics or topics studied in their course etc. Student will submit hardbound copies of the dissertation/ project work in the departmental library. This course will be of 16 credits. The student at least give minimum of 480hrs at any institution/research laboratory/department/research centre/correctional institutions/courts of their choice

For the evaluation of Dissertation, the department will follow rules and guidelines prescribed by the University.