M.Sc. Forensic Science

FIRST YEAR					
I Semester					
Subject Code	**Course Title**	**Credits**	**Marks**		
			Int.	**Ext.**	**Total**
MFSC I	General Forensic Science & Criminalistics	04	25	75	100
MFSC II	Criminology & Law	04	25	75	100
MFSC III	Computer Forensic & Biometrics	04	25	75	100
MFSC IV	Forensic Ballistics and Explosives	04	25	75	100
Lab I	Practical I	04	25	75	100
Minor	Minor Elective (In the I or II semester)- Table 1	04	25	75	100
Major	Lab Visit/ Seminars/ Tutorials/ Assignments	04	25	75	100
	Total Credits	**28**			**700**
II Semester					
MFSC V	Forensic Chemistry & Toxicology	04	25	75	100
MFSC VI	Instrumental Methods – I	04	25	75	100
MFSC VII	Instrumental Methods- II	04	25	75	100
MFSC VIII	Good Laboratory Practices	04	25	75	100
Lab II	Practical II	04	25	75	100
Minor	Minor Elective (In the I or II semester)- Table 1	04	25	75	100
Major	Training at FSL/CFSL/Police Station /Court room	04	25	75	100
	Total Credits	**24**			**600**
SECOND YEAR					
III Semester					
MFSC IX	Questioned Documents & Fingerprints Examination	04	25	75	100
MFSC X	Instrumental Methods- III	04	25	75	100
MFSC XI	Forensic Biology & Serology	04	25	75	100
MFSC XII	Forensic Physical Anthropology & Forensic Medicine	04	25	75	100
Lab III	Practical III (MFSC IX & X)	04	25	75	100
Lab IV	Practical IV (MFSC XI & XII)				
Major	Lab Visit/ Seminars/ Tutorials/ Assignments	04	25	75	100
	Total Credits	**24**			**600**
IV Semester					
MFSC XIII	Quality Management	04	25	75	100
MFSC XIV	Research Methodology	04	25	75	100
Elective	**Option A: Specialization in Forensic Biology & Serology**				
MFSC XV	Advanced Forensic Biology	04	25	75	100
MFSC XVI	Advanced Forensic Serology	04	25	75	100
Lab V	Practical V (Forensic Biology & Serology)	04	25	75	100
Major	Dissertation/Project	04	25	75	100
	Total Credits	**24**			**600**
Elective	**Option B: Specialization in Forensic Chemistry & Toxicology**				
MFSC XV	Advanced Forensic Chemistry	04	25	75	100
MFSC XVI	Advanced Forensic Toxicology	04	25	75	100
Lab V	Practical V (Forensic Chemistry & Toxicology)	04	25	75	100
Major	Dissertation/Project	04	25	75	100
	Total Credits	**24**			**600**
Elective	**Option C: Specialization in Questioned Document and Fingerprint Examination**				
MFSC XV	Questioned Document Examination	04	25	75	100
MFSC XVI	Fingerprint Examination	04	25	75	100
Lab V	Practical V (Questioned Document and Fingerprint Examination)	04	25	75	100

Major	Dissertation/Project	04	25	75	100
	Total Credits	**24**			**600**
Elective	**Option D: Specialization in Forensic Physical Sciences**				
MFSC XV	Advanced Forensic Physics	04	25	75	100
MFSC XVI	Advanced Digital Forensics	04	25	75	100
Lab V	Practical V (Forensic Physics & Digital Forensics)	04	25	75	100
Major	Dissertation/Project	04	25	75	100
	Total Credits	**24**			**600**
	Total Credits for the Master in Forensic Science	**100**			**2500**

Table 1: Minor

(**Elective Course** from other Subject/ Faculty (In the I or II semester)

Minor (Elective Course from other Subject/ Faculty (In the I or II semester)	
1.	Mathematical Biology
2.	Conservation and Water Resource Management
3.	Natural Resources and Conservation
4.	Pollution: Causes and Mitigation
5.	Computational Resources
6.	Organic and Natural Farming
7.	Computer Hardware Handling
8.	Computer Software Handling
9.	Solar and Non Conventional Energy
10.	Cyber Crime
11.	Bee Keeping, Aquaculture and Fish Farming
12.	Entrepreneurship in Microbial and Botanical Products
13.	Ancient Medical Sciences
14.	Traditional Medical Therapy
15.	Vedic Mathematics
16.	Bio Medical Instrumentation and Health
17.	Disaster, Mitigation & Management
18.	Mining Plan and Resource Mapping
19.	Water Treatment System
20.	Climate Change and Environmental Degradation
21.	Medicinal and Aromatic Plants Cultivation, extraction and nutraceutical Values

22.	Non Conventional Energy Resources
23.	Soil and Water Testing

Note: University has approved 200 Value Added Courses. Candidate may study one course in each semester.

M.Sc. Forensic Science, Semester I

Paper I

General Forensic Science & Criminalistics

(Theory)

Program/Class: PG Degree	**Year: First**	**Semester: First**
Subject: Forensic Science		
Course Code: MFSC I	**Course Title: General Forensic Science & Criminalistics (Theory)**	

Course Objective

To introduce the students to Forensic Science and its role in the criminal investigation system. The students would be appraised about the function & principles of Forensic Science & its historical background. This course shall provide the students necessary information to understand the role of Forensic Laboratories in crime scene investigation, handling of evidence and their examination. Additionally, students will also learn about Indian Police system and various techniques used in criminal profiling.

Course Outcome

CO 1: To understand about Forensic Science, various Laboratories and their Set-Up.
CO 2: Significance of Forensic Science in Criminal Investigation & Indian Police System.
CO 3: To understand the nature, collection, analysis and preservation of Physical evidences.
CO4: To train the students in Crime Scene Management, report writing & case studies in different type of crimes.
CO 5: The detailed analysis & significance of Criminal Profiling for the purpose of justice.

Credits: 4	**MFSC I**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	**Forensic Science: An Introduction** Forensic Science: Definition, Basic Principles, Historical Development of Forensic Science in India and in Abroad, Branches of Forensic Science, Scope & Need, Ethics of Forensic Science, Tools and Techniques of Forensic Science. International Perspectives of Forensic Science. **Forensic Science Institutions:** Directorate of Forensic Science Services, Central Forensic Science Laboratories, State Forensic Science Laboratories, Regional Forensic Science Laboratories, Mobile Forensic Science Laboratory, Organizational Setup, GEQD, FPB, NCRB, etc. Education of Forensic Science in India, Role of Media, Human Rights. Criminal Justice System: Structure and Working. Duties and Qualification of Forensic Scientist. **Indian Police System:** Role & Function of Police, Organization Setup of Police at Central and State Level, Organization of Police Station, Police and Forensic Scientist Relationship with	**15**

	reference to Crime Investigation.	
II	**Crime Scene Management** **Crime Scene:** Introduction, Types, Significance, Role of Investigator, Steps of Crime Scene Management: Protection, Searching Methods, Documentation of the Scene (Photography, Videography, Sketching, Note Making: Types, Methods, Significance), Collection, Preservation, Packaging, Chain of Custody: Types, Significance and Evaluation, Forwarding Letter, Tools and Techniques, Report Writing. **Physical Evidences:** Types, Nature, Classification of Evidences, Collection and Preservation of different Physical Evidences. Tool Marks: Nature, Types of Tool Marks, Class and Individual Characteristics, Preparation of Test Tool Marks, Comparison. Trace Evidences: Definition, Nature, Collection, Preservation and Forensic Examination (Paint, Soil, Glass, Detective Dyes, GSR, Cement, Mortar, Fiber, etc.) Impression Evidences: Types, Significance and Examination of Tyre Marks, Skid Marks, Foot Prints, etc. Investigation, Examination of various types of cases (a) Murder (b) Rape (c) Burglary (d) Railway &Air Crashes (e) Road Accidents (f) Explosion Scene (g) Arson. **ase Studies**	**15**
III	**Criminal Profiling** Introduction, Profiling of Victim, Suspect and Culprit and its role in Crime Investigation. Narco Analysis: History, Method of Investigation, Importance as an Investigative Tool, Limitations & Legal Aspects. Brain Fingerprinting: History, Method of Investigation, Significance, Limitations & Future Perspectives of the Technique. Polygraphy: History, Principle, Methods of Investigation, Limitations and Legal Aspects. Voice Identification: Introduction, Significance, Theory of Generation of Voice Characteristics, Voice Spectrography, Recent Development of Computerized Speech Laboratory, Legal Aspects.	**15**
IV	**Forensic Examination** Counterfeit Coins: Blocks and Casts, Importance, Nature, Collection of Evidence and their Evaluation. Resuscitation: Introduction and Importance, Techniques commonly used to Obliterate Numbers, General experimental procedure and theoretical consideration with special reference to metal	**15**

	deformation and its effects. Methods of Restoration: Chemical, Electrolytic & Magnetic Particle Methods, Laboratory Procedure, Evaluation and Interpretation of Results. Presentation of Expert Evidence: Data, Reports, Evidence in the Court.	

Suggested Readings

1. Ahuja, R. Criminology, RawatPublication, Jaipur (2000)
2. Arrigo, B. and Shipley, S. Introduction to Forensic Psychology, Academic Press. London (2000)
3. Bag, R.K. Supreme Court on Criminal Law, Asia Law House, India (1999)
4. Bennett, W.W.and Hess, K.M. Criminal Investigation,Wordsworth Thompson Learning, (2001)
5. Bridges, B.C.; Vollmer, A. and Munir, M. Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting Expert Testimony Opinion Evidence, University Book Agency, Allahabad (2000)
6. David L. Shapiro, Forensic Psychology Assessment:An Investigative Approach, Bacon Publisher (1991)
7. Deb, R. Criminal Justice, The Law Book Co. (1998)
8. Dehaan, J.D. Kirk's Fire Investigation 5thed. Prentice Hall (2002)
9. Eckert, W.G and James, S.H. Interpretation of Blood Stains, Evidence of Crime Scene, Elseiver Publication, New York (1989)
10. Fisher, B.A.J. Techniques of Crime Scene Investigation 7thed. CRC Press, New York, (2003)
11. Gross, H. Criminal Investigation- A Practical Handbook for Magistrates, Police Officers and Lawyers, Universal Pub. Co. (2000)
12. Hess, A.K. and Weiner, I.B. Handbook of Forensic Psychology 2nd ed. Jhon Wiley & Sons (1999)
13. James, S.H Scientific and Legal Application of Bloodstain Pattern Interpretation, CRC Press, Boca Raton, (1998)
14. James, S.H. and Nordby, J.J. Forensic Science: An Introduction to Scientific and Investigative Techniques, CRC press, USA (2003)
15. Kleiner, M. Handbook of Polygraph Testing, Academic Press (2002)
16. Lyman, M.D. Criminal Investigation- The Art and the Science, Prentice Hall (2002)
17. Meguire, M.; Morgan, R. and Reiner, R. Oxford Handbook of Criminology, 2nded. Clarendon Press, New York (1997)
18. Mordby, J.J. Deed Reckoning- The Art of Forensic Detection, CRC Press, Boca Raton, (2000)

19. Nanda, B.B. and Tiwari, R.K.Forensic Science in India- A Vision for the Twenty First Century, Select Publisher, New Delhi (2001)
20. Niehaus, J. Investigative Forensic Hypnosis, CRC Press, (1998)
21. Saferstein, R. Criminalistics -An introduction to Forensic Science, Prentice Hall Inc, USA(1995)
22. Seigel, J.A.;Sukoo, R.J. and Knupfer, G.C. Encyclopaedia of Forensic Science vol. I, II& III. Academic Press (2000)
23. Sharma, B.R. Forensic Science in Criminal Investigation and Trails, Universal Publishing Co. (2003)
24. Swanson, C.R.; Territo, L.J. andTaylor, R.W. Police Administration: Structures, Processes, and Behaviour 8th ed. Prentice Hall, USA (1998)
25. Turrey, B.E. Criminal Profiling- An Introduction to Behavioural Evidence Analysis, Academic Press, London (1999)

M.Sc. Forensic Science, Semester I
Paper II
Criminology and Law
(Theory)

Program/Class: PG Degree	**Year: First**	**Semester: First**
Subject: Forensic Science		
Course Code: MFSC II	**Course Title: Criminology and Law (Theory)**	

Course Objective

The objective of this course is to introduce students about the concepts of Crime, Criminology and the factors that contribute to a person becoming antisocial. The students gain knowledge regarding Police Administration, Indian Judiciary & Criminal Justice System. To introduce the different sections of IPC, CrPC and the Indian Evidence Act& the Acts pertaining to Forensic Science.

Course Outcome

CO 1: To understand the concept of Criminology by focusing on historical perspective, techniques and criminal behavior.
CO 2: To understand the working and concepts of Indian Judiciary & Criminal Justice System.
CO 3: To understand about legal provisions focusing on different types of crimes.
CO 4: To learn about IPC, CrPC, IEA & Acts pertaining to Forensic Science.
CO 5: To gain knowledge about Juvenile delinquency.

Credits: 4	**MFSC II**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Crime and Society** Concept and Definition of Crime, Causes and Elements of Crime, Social Change and Crime, Control and Prevention of Crime, Hate Crime, Organized Crime, Cyber Crime, Industrialization, Criminal Behavior: Theories and Significance, Modus Operandi and Criminal Psychology, Crime Rate in India and in World, NCRB.	**15**
II	**Indian Judiciary and Criminal Justice System** Criminal Justice System: Introduction, Structure, Components and Working. Indian Judiciary: Introduction, Courts: Hierarchy, Types, Procedure, Power and Jurisdiction, Prosecution, Defense. Lok Adalat, Lokpal, Lokayukta, Juvenile Court Evidence, Fact, Enquiry, Investigation, Trial, FIR, Inquest Charge Sheet.	**15**
III	**Criminal Law and Legislation** Constitution of India: Preamble, Rights to Equality (Articles 14 to 18), Rights to Freedom	**15**

	(Articles 19 to 22) Indian Penal Code: Introduction, General Exceptions (Sections: 76, 77, 82, 83, 84, 90, 96 to 106) (i) Offences Against Person: Sections:299,300,302,304B,306,319,320,326,339,340,351,359,362,375,376 & 377. (ii) Offences Against Property: Sections: 378,383,390,405,415,441,463,471,499,503,511. Indian Evidence Act: Introduction, Sections 32,45,46,47,57,58,60,73,135,136,137,159. Code of Criminal Procedure: Introduction, Sections: 53, 54, 311A, 291, 292, 293.	
IV	**Act Pertaining to Forensic Science** Narcotic Drugs and Psychotropic Substances Act, Drugs and Cosmetics Act , Explosive Substances Act , Dowry Prohibition Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act, I.T. Act (Information Technology Act- 2000), POSCO Act, The Criminal Procedure(Identification) Act-2022.	**15**

Suggested Readings

1. Adler, F.: Mueller, G.O.W. and Laufer, W.S. (2006) Criminology 5th ed. McGraw Hill.
2. Arrigo, B.A. (2002): Introduction to Forensic Psychology,Academic Press Inc.
3. Barak, G.(1998): Integrative Criminology, Dartmouth Publishing Co. Ltd.
4. Bare Acts with short notes on the following: Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Food Adultration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act.
5. Biderman, A.D. and Zimmer, H. (1961): The Manipulation of Human Behavior, Wiley, New York.
6. Constitution of India
7. Cooke, G. (1980): The role of Forensic Psychologist,Sprinfield.
8. Criminal Procedure Code.
9. Goldstein, A.M. and Weiner, I.B. (2003) Handbook of Psychology, John Wiley &Sons.
10. Haward, L (1981): Forensic Psychology, Batsford Academic andEducation Ltd., London.
11. Howitt, D.(2002): Forensic and Criminal Psycholgy,Prentic Hall Publication.
12. Indian Evidence Act
13. Indian Penal Code.

14. Johnson, E.H. (2016): Crime, Correction and Society.
15. Reid, S.T. (2011): Crime and Criminology 13th ed. Oxford University Press, USA.

M.Sc. Forensic Science, Semester I

Paper III

Computer Forensic & Biometrics

(Theory)

Program/Class: PG Degree	**Year: First**	**Semester: First**
Subject: Forensic Science		
Course Code: MFSC III	**Course Title: Computer Forensic & Biometrics (Theory)**	

Course Objective

This course will introduce students to the fundamental concepts of Computers, Networking, Image Processing & Cryptography. Students will also gain knowledge about the Cyber Crimes, Digital Evidences, Data Acquisition and their recovery along with their legal provision. They will also acquire knowledge about Biometrics, Use of Biometric in Civil & Criminal cases. This course also gives information about traditional technologies & different Biometric Systems.

Course Outcome

CO 1: The concepts of computer, operating system and networking.
CO 2: The nature & types of Cyber Crimes & its management.
CO 3: The nature of digital evidences, their handling, Collection & analysis.
CO 4: The concepts & importance of Image processing & Cryptography.
CO 5: Significance and working of Biometric Systems.

Credits: 4	**MFSC III**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Fundamental of Computers and Networks** Introduction to File Systems and Types of File System, Application Software and System Software, The Memory Hierarchy and Cache Memory. Operating System Overview: Introduction, Objectives and Functions of Operating System. Types of Operating System- Windows, Linux, Mac. Network: Network Types and Topologies, Overview of OSI Model and TCP/IP Protocol. Different Types of IP Addresses and Classes, Subnet Masks, Sub netting and Super netting. Concept of Internet: Introduction, Applications and Working of Internet. Search Engines, Chat, E-mails.	**15**
II	**Investigation of Cyber Crimes** Introduction to Cyber Crime, Types of Cyber Crimes: (a) Crimes Targeting Computers. (b) Online Based Cyber Crimes. Internal and External Attacks, Investigation of Cyber	**15**

	Crimes: Investigation of Malicious Applications, Search and Seizure of Volatile and Non-volatile Digital Evidence. Imaging and Hashing Digital Evidence, Data Acquisition, Analyzing and Recovery of Deleted, Hidden and Altered Files and Reporting. Concealment Techniques, Introduction to IT Act, 2000.	
III	**Image Processing and Cryptography** Introduction and Process, Image Enhancement and Restoration. Investigation of Erased Tapes and Analysis of Signals (Analog Video Image Processing), Compression, Encryption Methods. Methods for Digital Video Recording, Digitalization Techniques, Investigation of Integrity of Images and Videos. Cryptography, Symmetric and Asymmetric Cryptosystem Encryption Techniques– Substitutional Cipher and Transpositional Ciphers. Types of Keys – Public Key and Private Key. Advanced Encryption Techniques and Security Issues. Various Types of Attacks including Cipher Text-Only Attack, Known-Plaintext Attack, Chosen-Plaintext Attack, Chosen-Cipher Text Attack.	**15**
IV	**Biometrics** Introduction, Definition, Physiological and Behavioral Characters, F.P. Live Scanning System, Major Types of Biometrics –Fingerprint, Iris, Signature, Gait etc., Use of Biometrics in Civil and Police Work, increase in use of Biometrics in day-to-day life, Future of Biometrics, Multi-modal Biometrics Systems, Performance Measures used in Biometric Systems – FAR, FRR, GAR, FTA, FTE and ATV, Biometric versus Traditional Technologies.	**15**

Suggested Readings

1. Daniel, W.W. (2013): Biostatistics-A Foundation for Analysis in the Health Science, John Willey & Sons.
2. Ewens, W.J. and Grant, G.R. (2006): Statistical Methods in Bioinformatics: An Introduction, Springer.
3. Goyal, R.M. and Pawar, M.S. (1994): Computer Crimes- concept, control and prevention, Sysman Computer Pvt. Ltd.
4. Jain, A.K.; Flynn, P. and Ross, A.A. (2008): Handbook of Biometrics, Springer Publications, Springer.
5. Kävrestad, J (2017): Guide to Digital Forensics: A Concise and Practical Introduction, Springer.
6. Liu, B.H. (1997) Statistical Genomics- Linkage, Mapping and QTL Analysis, CRC Press.
7. Mahajan, T.S. and Singh, D. (2003): Computer Networking and HTML, Gurunanak Publication, Patiala.
8. Maras, M.H.(2015): Computer Forensics- Cybercriminals, Laws, and Evidence, 2nd ed., Jones & Bartlett Learning.
9. Moore, R. (2015): Cybercrime- Investigating High-Technology Computer Crime,2nd ed., Routledge.
10. Mount, D.W. (2004): Bioinformatics-Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, USA.

11. Rastogi, S.C. and Mendiratta, N. (2006): Bioinformatics Concepts, Skills and Applications, CBS.
12. Reiber, L. (2016): Mobile Forensic Investigations- A Guide to Evidence Collection, Analysis, and Presentation 1st ed., McGraw-Hill.
13. Sensen, C.W. (2002): Essentials of Genomics and Bioinformatics, Wiley VCH.
14. Stern D.L. (1993): Preventing Computer Frauds, McGraw Hill.
15. Tiwari, R.K., Sastry, P.K. and Ravikumar, K.V. (2003): Computer Crime & Computer Forensics, Select Publisher, New Delhi.
16. Tsai, C.S. (2002): An Introduction to Computational Biochemistry, John Willey & Sons.
17. Wold, G.H. and Shriver R. (1993): Computer Crime Techniques Prevention, Galgotia Book Source, New Delhi.

M.Sc. Forensic Science, Semester I
Paper IV
Forensic Ballistics and Explosives
(Theory)

Program/Class: PG Degree	**Year: First**	**Semester: First**
Subject: Forensic Science		
Course Code: MFSC IV	**Course Title: Forensic Ballistics and Explosives (Theory)**	

Course Objective

This objective of this course to provide knowledge about historical development of firearms, ammunition & explosives. The students will also learn about various branches of Forensic Ballistics such as Internal, External & Terminal. The students shall learn regarding practical approach of Gun Shot Residues(GSR) with the help of various techniques. They will also gain knowledge about Firearms Injuries, its nature and identification.

Course Outcome

CO 1: Explain about various types of firearms and their mode of operations.
CO 2: To recognize the range of firearms, their sequence of events & reconstruction.
CO 3: To assess the nature of firearm injuries inflicted to the body from various ranges.
CO 4: To identify the types of propellant, primer and their composition of GSR.
CO 5: To interpretate the velocity of bullet, recoil force, barrel pressure, ballistic coefficient, angle of elevation in shooting cases.
CO 6: To understand the nature of explosives and investigation of post blast cases.

Credits: 4	**MFSC IV**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**History& Development of Fire Arms** Introduction, Early History of Firearms, The Fifteenth Century Match Lock, Sixteenth & Seventeenth Century Small Arms, The Age of the Flint Lock, The Percussion Lock Firearms. **Firearms**: Classification, details of various Small Arms used in Crime – Shotguns, Rifles, Revolvers, Pistols, Carbines, Improvised Firearms. Firing Mechanism of Smooth Bored Firearms, Bore and Calibre, Choke, Suppressor, Automatic Mechanisms employed in Small Arms, Rifling – Class Characteristics of Rifled Bore, Purpose of Rifling, Types of Rifling, Methods to Produce Rifling, Various Locks used in Small Arms. Classification, Nomenclature and Construction of Country Made Firearms. **Ammunition:** Types, Cartridge Components (Cartridge Case, Primer Propellant, Bullets, Pellets and Wads). Various types of Primers/ Priming Mixtures, Propellants, Shotgun Ball Ammunition, Various Types of Bullets, Head-stamp Markings. Various Physical, Ballistic &	**15**

	Functional Tests of Ammunitions.	
II	**Branches of Forensic Ballistics** **Internal Ballistics*:*** Introduction, Definition, Ignition and Burning of Propellants, Manner of Burning, Piobett's Law, Shape and Size of the Propellants, Degressive and Progressive Powders, Pressure Space Curve, Shot Start Pressure. All Burnt Point, Velocity, Space Curve, Le due's Formula, Muzzle Velocity, Factors Affecting Muzzle Velocity, Theory of Recoil. **External Ballistics:** Definition- Trajectory Drop in the Flight of the Projectiles Force of Gravity, Air Resistance-base Drag, Yaw, Determination of Velocity of Shot-charge, Doppler-radar Method. Shape of Bullet (Spherical Ball, Cylinder-Conical, Flat Nose, Round Nose, etc.) Ballistic Coefficient, Effective Range, Extreme Range. **Terminal Ballistics:** Definition, Interaction and Penetration of various types of Projectiles in various Tissues, various aspects of Wound Ballistics including Wounds of Entrance/ Exit/ Track of Projectile, Gunshot Injuries caused by different types of Firearm Ammunitions, Remaining Velocity, Stopping Power, Ricochet.	**15**
III	**Arms- Ammunition Linkage & GSR** Matching of Crime & Test Bullets and Cartridge Cases in Regular Firearms, Identification of Bullets, Pellets & Wads Fired from Improvised Country Made Firearms. Automated Method of Cartridge Case and Bullet Comparison. Determination of Range of Fire, Time of Fire. Visual and Chemical, Instrumental Methods with Special Reference to the Applications of Neutron Activation Analysis, Atomic Absorption Spectroscopy, Scanning Electron Microscopy and other Miscellaneous Methods. **Gun Shot Residues (GSR):** Mechanism of Formation of GSR, Modern Methods of Analysis of GSR from the Shooting Hand & Target with Special reference to Clothing. Firearm Injuries: Ballistic Aspect of Firearm Injuries, Nature, Effect on Target, Velocity, Constructional Features and Range on the Wounding, Identification of Firearm Injuries. Evaluation of Firearm Injuries, Reconstruction: Accident, Suicide, Murder and Self-defence.	**15**
IV	**Explosives** Introduction, Classification, Composition and Characteristics of Explosives, Pyrotechnics, IEDs, Explosion Process and Affects, Types of Hazard, Effect of Blast Wave on Structures, Human, etc. Specific Approach to Scene of Explosion, Post- blast Residue Collection, Reconstruction of Sequence of Events, Evaluation and Assessment of Scene of Explosion, Systematic Examination of Explosives and Explosion Residues in the Laboratory using Chemical and Instrumental Techniques and Interpretation of Results.	**15**

Suggested Readings

14. Boundreau, J.F.; Qwan, Q.Y.; Faragher, W.E. and Denault, G.C. Arson and Arson Investigation: Survey & Assessment, National Institute of Law Enforcement, U.S. Dept. of Justice, Printing Press; (1977)
15. Dehaan, J.D. Kirk's Fire Investigation, 5th ed. Prentice Hall, Eaglewood Cliffs, N.J; (2002)
16. Dimaio, J.M. Gunshot Wounds. CRC press, Washington DC; (1999)
17. Heard, B.J. Handbook of Firearms and Ballistics. Jhon Willey, England; (1997)
18. Hogg, I.V. The Cartridges Guide- A small arms Ammunition Identification Manual. The Stackpole co. Harrisburg, PA; (1982)
19. Howard, M.J. Firearms Identification, vols. 1,2 & 3. Springfield, Illinois; (1973)
20. Johari, M. Identification of Firearms, Ammunition and Firearms Injuries. BPR& D, New Delhi; (1980)
21. Jury, F.J.; Hatcher, J.S. and Weller, J. Firearms Investigation, Identification and Evidence. Stackpole Books, Harrisburg, PA; (1977)
22. Ordog, G.J. Management of Gunshot Wounds. Elseiver, New York; (1983)
23. Sellier, K.G.and Kneubuehl, B.P. Wound Ballistics and the Scientific Background. Elsevier, London; (1994)
24. Siddiqui, M.A. Law of Firearms & Explosives with Principles of Forensic Ballistics. Pakistan; (2018)
25. Warlow, T.A. Firearms, the Law and Forensic Ballistics. Taylor& Francis, London; (1996)
26. Watson, C.A. Official and Standardized Methods of Analysis. Royal Society of Chemistry, UK; (1994)
27. Working Procedure Manuals of Chemistry, Explosives and Narcotics. BPR& D Pub., New Delhi; (2000)
28. Yinon, J. and Zitrin, S. Modern Methods & Application in Analysis of Explosives. John Wiley & Sons, England; (1993)

M.Sc. (H) Forensic Science, Semester I

Lab I

(Practical)

Program/Class: PG Degree	**Year: First**	**Semester: First**
Subject: Forensic Science		
Course Code: Lab I	**Course Title: Practical I**	

Course Objective

The objective of the course is to develop practical approach among the students in different types of crime scenes, their management and reconstruction. They will also learn about collection, packaging, forwarding and examination of various types of physical evidences found at crime scene.

Course Outcome

CO 1: To reconstruct indoor & outdoor crime scenes.
CO 2: To develop the art of collection, packaging, preservation & analysis of trace evidences.
CO 3: To understand the nature of various tools & techniques used in Forensic Examination.
CO 4: The usefulness of Photography & Videography for recording the crime scenes.
CO 5: To determine the type of firearm, cartridge, bullets and GSR.

Credits: 4	**Practical I**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

S.No.	**Practical**	**No. of Lectures**
I	Reconstruction and Evaluation of Indoor and Outdoor Scene of Crime (Hit and Run, Murder, Mass Disaster, Shooting Cases, etc.).	
II	Examination of Soil, Glass, Paint by different Methods.	
III	Miscellaneous Examination (Cloth, Bangles, Threads, etc.)	
IV	Lifting of Prints and Impressions by Caste and Replicas.	
V	Identification of Firearms, Cartridges, Bullets, Gunpowder, etc.	
VI	Examination and Comparison of Fired Bullets and Fired Cartridge Cases – Caliber, Rifling Characteristics, Probable Type of Firearms, different types of Marks on Bullets and Cartridge Cases.	
VII	Determination of Shot Number from Size and Weight of Shots.	
VIII	Determination of Range and Time of Firing.	
IX	Chemical Analysis of Powder Residues, and Barrel Wash.	

X	Collection, Preservation and Seizure of various Digital Evidences.	
XI	Identification of Gait Pattern.	

Suggested Readings

1. Anderson, T.M., Gardener, T.J. and Gardner, W. Criminal Evidence: Principles and Cases, 9th ed.Wadsworth Publishing; (2015).
2. Ballistics Manual, DFS: India; (2005).
3. Byrd, M.CrimeSceneEvidence:A GuidetotheRecoveryandCollectionofPhysicalEvidence. CRC Press: BocaRaton; (2001).
4. Heard, B.J. Handbook of Firearms and Ballistics. John Willey: England;(1997).
5. James, S.H. and Nordby, J.J. Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd ed. CRC Press: London; (2005)
6. Mozayani, A. and Noziglia, C. The ForensicLaboratoryHandbookProceduresandPractice 2nd ed. Humana Press: India;(2011).
7. Rao, M.S. and Maithil, B.P. Crime Scene Management: A Forensic Approach 3rd ed. Selective & Scientific Publication: India; (2013).
8. Saferstein, R. Criminalistics- An introduction to Forensic Science 9th ed. Pearson; (2006).
9. Thompson, R.B. and Thompson, B.F. Illustrated Guide to Home Forensic Science Experiments. O'Reilly Media: USA; (2012).
10. Tilstone, W.J.; Hastrup, M.L. and Hald, C. Fisher's Techniques of Crime Scene Investigation. CRC Press: Boca Raton; (2012).

M.Sc. Forensic Science, Semester II
Paper I
Forensic Chemistry & Toxicology
(Theory)

Program/Class: PG Degree	**Year: First**	**Semester: Second**
Subject: Forensic Science		
Course Code: MFSC V	**Course Title: Forensic Chemistry & Toxicology (Theory)**	

Course Objective

The students will able to understand the various types of drugs, commonly abused along with their presumptive & instrumental analysis. They will know the legal provisions & Forensic investigation regarding drugs, cosmetics, fire and arson evidences. The students shall also learn regarding various types of poison, their nature, action sign & symptoms with standard procedure of examination in poisoning cases. They will also get to know medicolegal aspect of poisons and the management of toxicological cases.

Course Outcome

CO 1: Understand the basics of Forensic Chemistry & Toxicology, their scope, role & significance.
CO 2: Learn about the drugs and its abuse with their various identification techniques.
CO3: Understand nature of Arson Scene and Forensic investigation of Arson cases.
CO 4: Gain knowledge about ADME of poisons and methods of collection and preservation of evidences.
CO 5: The principles of management of toxicological cases.

Credits: 4	**MFSC V**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Forensic Chemistry** Introduction, Role of Forensic Chemist, Types of Cases which require Chemical Analysis, Sampling of Evidences, Presumptive Tests (Colour/Spot Tests), Microcrystal Tests, Limitations of Forensic Samples, Elemental Analysis (Organic and Inorganic), Instrumental Methods and Equipments. Examination of Contact Traces: Introduction to Cosmetics and Detective Dyes, Collection, Sampling, Analysis and Forensic Importance. Analysis of Illicit Liquors including Methyl and Ethyl Alcohol.	**15**
II	**Drugs of Abuse:** Introduction, Drug Addiction and its Problems. Classification of Drugs of Abuse, Analgesics, Depressants, Stimulants, Hallucinogens and Narcotics. Designer Drugs. Identification, Field Tests and Laboratory Tests.	**15**

	Drug Abuse in Sports: Introduction, Common Prohibited Substances, Analytical Approach. **Arson:** Introduction, Legal Definition, Chemistry of Fire, Fire Accelerants and their Types, Scientific Investigation and Evaluation of Clue Materials, Collection and Preservation, Analysis of Fire Scene Evidences, Instrumental Methods for Fire Debris Analysis. Analysis of Petroleum Products in Adulterant Cases.	
III	**Forensic Toxicology** Introduction, Role of the Toxicologist, Significance of Toxicological Findings, Poisons, Definition, Classification on the Basis of their Origin, Physiological Action and Chemical Nature, Absorption, Distribution, Metabolism and Excretion of Poisons, Factors Affecting (ADME), Poisoning in India.	**15**
IV	**Management of Toxicological Cases** Introduction, Principles of Management of Poisoning Cases, Duties of a Doctor in Poisoning Cases, Signs and Symptoms of Common Poisons, Types of Antidotes, Detection of Poisoning in the Dead. Selection, Collection and Preservation of Viscera for Various Types of Poisons: Choice of Preservatives, Containers and Storage. Different Methods of Extraction, Isolation, Identification, Estimation of Poisons from Biological Specimens.	**15**

Suggested Readings

1. Brown, W. Drinking, Drugs & Driving Drunk: How Different Drugs Affect the Driving Experience 2nd ed. William Gladden Foundation Press: (2011).
2. Clarke, E.G.C. and Moffat, A.C. Clarke's Isolation and Identification of Drugs: In Pharmaceuticals, Body Fluids and Post Mortem Material. Pharmaceutical Press: (1986).
3. Connors, K.A. A text book of Pharmaceuticals Analysis 2nd ed. Wiley: New York;(1975).
4. Crown. D.A. The Forensic Examination of Paints and Pigments. Thomas:(1968).
5. Cunliffe, F. Criminalistics and Scientific Investigation (Prentice-Hall series in criminal justice). Prentice Hall: (1980).
6. Curry, A.S. Advances in Forensic Chemical Toxicology. CRC Press:(1972).
7. Curry, A.S. Analytical Methods in Human Toxicology: Part II. Wiley VCH:(1986).
8. Curry, A.S. Poison Detection in Human Organs. Springer:(1976).
9. Froede, R.C. The Laboratory Management of the Medico-Legal Specimen. *Annals of Clinical & Laboratory Science*, 6(3), (1976).
10. Gosselin, R.E.; Hodge, H.; Smith, R.P. and Gleason, M.N. Clinical Toxicology of Commercial Products: Acute Poisoning 4th ed. Williams & Wilkins: Baltimore; (1969).
11. Hodgson, E. A Textbook of Modern Toxicology 4th ed. John Wiley & Sons: Canada; (2010).
12. Klaassen, C. Casarett& Doll's Toxicology: The Basic Science of Poisons 8th ed. Mc Graw Hill: (2013).

13. Lundquist, F. and Curry, A.S. Methods of Forensic Science. Inderscience Publisher: California; (1963).
14. Maehly, A. and Stromberg, L. Chemical Criminalistics. Springer: New York; (2011).
15. Matsumura, F. Toxicology of Insecticides. Springer: New York; (1985).
16. Moenssens, A.A.andMoses, R.E. Scientific Evidence in Criminal Cases. Founadation Press: New York; (1973).
17. Sharma, B.R.Forensic Science in Criminal Investigation & Trials, 6th ed. Lexis Nexis: India;(2019).
18. Stoleman, A. Progress in Chemical Toxicology.Academic Press: (2013).
19. Sunshine, I. Guidelines for Analytical Toxicology Program. CRC Press:(1950).
20. Sunshine, I. Handbook of Analytical Toxicology.CRC Press: Cleveland: (1969).
21. Sunshine, I. Methods for Analytical Toxicology. CRC Press: USA;(1975).
22. Swarbrick, J. Clarke's Isolation and Identification of Drugs, 2nd ed. Pharmaceutical Press: London; (1986).
23. Turner, W. Drugs & Poison (Police Evidence Library). Aqueduct: (1965).
24. Winger, G., Woods, J.H. and Hofmann, F.G. A Handbook on Drug and Alcohol Abuse 4th ed. Oxford University Press: London; (2004).

M.Sc. Forensic Science, Semester II
Paper II
Instrumental Methods I
(Theory)

Program/Class: PG Degree	**Year: First**	**Semester: Second**
Subject: Forensic Science		
Course Code: MFSC VI	**Course Title: Instrumental Methods I (Theory)**	

Course Objective

The objective of this course is to understand the basic & advances analytical instrumental techniques or methods for identification, characterization & quantification of different exhibits found at crime scene. The students will be able to learn different destructive and non-destructive spectroscopic techniques along with their use & forensic significance. They will also gain knowledge about principles & working of different spectroscopy techniques.

Course Outcome

CO 1: To learn the basic concept of atomic and molecular spectroscopy and interaction of radiation with matter.
CO 2: The forensic significance of different instrumental techniques such as UV-Vis, AAS, IR, Raman.
CO 3: To understand working, principles & applications of spectroscopic techniques.
CO 4: To gain knowledge about the X-ray spectroscopy, X-Ray absorption & X-Ray diffraction.
CO 5: The elemental analysis of various evidences by instrumental methods.

Credits: 4	**MFSC VI**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Concepts of Atomic Spectroscopy** What is Spectroscopy, Electromagnetic Spectrum, Sources of Radiations, their Utility and Limitations, Conventional Sources for UV, Visible and Infrared Rays, Sources for Shorter Wavelength Radiations (X-Ray Tubes) Radioactivity, Gamma Rays and Beta Rays. Laser (He, Ne, Argon Ion, Dye Lasers, Semi Conductor Lasers) as Source of Radiation. Interaction of Radiation with Matter: Reflection, Absorption, Transmission, Fluorescence, Phosphorescence and their Forensic Applications.	**15**
II	**Concepts of Molecular Spectroscopy** Molecular Spectra: Introduction, Molecular Orbital, Types of Molecular Energies, Vibrational and Electronic Spectra, Atomic Spectra, Energy Levels, Quantum Numbers and Designation of States, Selection Rules, Augur Effect. Detection of Radiations, Photographic Detectors, Thermal Detectors, Photoelectric Detectors, Radiation Filters,	**15**

	etc.	
III	**Absorption Spectroscopy** **Ultra Violet and Visible Spectrophotometry:** Types of Sources and Stability, Wavelength Selection, Filters-Cells and Sampling Devices, Detectors, Resolution, Applications of UV- Visible Spectroscopy, Difference/ Derivative Spectroscopy. **Fluorescence and Phosphorescence Spectrophotometry:** Types of Sources, Structural Factors, Instrumentation and its Applications. **Atomic Absorption Spectrometry:** Introduction, Instrumentation and Techniques, Interference in AAS, Background Correction Methods, (GFAAS) Quantitative Analysis. It's Applications In Forensic Science. **Infrared Spectrophotometry:** Instrumentation of Dispersive and Fourier Transform Spectrophotometry, Sample Handling, Quantitative Analysis and Interpretation of IR Spectra.	**15**
IV	**Raman Spectroscopy:** Basic Principle, Sample Handling, Instrumentation, Structural Analysis, Stokes and Anti-Stokes Lines, Forensic Applications. **Atomic Emission Spectrometry:** Introduction, Arc/Spark Emission, Instrumentation and Techniques, ICP-AES, Comparison of ICP Vs. AAS Methods, Its Applications. **X-Ray Spectroscopy:** Elements of X-Ray Spectroscopy, X-Ray Absorption and Fluorescence Methods, X-Ray Diffraction, Auger Emission Spectroscopy (AES), and Dispersive X-Ray Analysis (EDX), Wavelength Dispersive X-Ray Analysis (WDX). **Nuclear Magnetic Resonance Spectroscopy**: Basic Principles, Theory and Instrumentation.	**15**

Suggested Readings

1. Chatwal, G.R. and Anand, S. Instrumental Methods of Chemical Analysis, Himalaya Pub. House, (2004).
2. Colin N. Banwell& Elaine M, Mc. Cash; Fundamentals of Molecular Spectroscopy 4th ed. McGraw-Hill Pub Co. New Delhi, (1995).
3. Dean, J.A. Analytical Chemistry Handbook. McGraw Hill Inc, (1995).
4. Khandpur, R.S. Handbook of Analytical Instruments. McGraw Hill Pub., New Delhi,(2004)
5. Lindon, J.; Tranter, G.E. and Holmes, J.L.Encyclopaedia of Spectroscopy & Spectrometry, Academic Press, (2000).
6. Patania, V.B. Spectroscopy. Campus Books International, (2004).

7. Robinson, J.W. Atomic Spectroscopy, 2nd ed. Revised & Expanded. Marcel Dekker Inc. NY, (1996).
8. Silverstein, R.M.; Webster, F.X.; Kiemle, D.J. and Bryce, D.L. Spectrometric Identification of Organic Compounds, 8thed. John Wiley & Sons, (2014).
9. Sivaprasath, K. and Murugeshan, R. Optics & Spectroscopy. S. Chand Publishing, (1997).
10. Thompson, K.C. and Renolds, R.J. Atomic Absorption Fluorescence & Flame Emission Spectroscopy-A Practical Approach, 2nd ed. Charles Griffin &Co. (1978).
11. Willard, H.H.; Merritt, L.L.; Dean, J.A. and Settle, F.A. Instrumental Methods of Analysis, 7th ed. CBS Pub & Distributors, New Delhi, (1986)
12. Williams, D.H. and Fleming, I. Spectroscopic Methods in Organic Chemistry, 4th ed. McGraw-Hill Pub. New Delhi, (1994).
13. Workman, J. Applied Spectroscopy- A Compact Reference for Practitioners, 1st ed. Academic Press, (1997).

M.Sc. Forensic Science, Semester II
Paper III
Instrumental Methods II
(Theory)

Program/Class: PG Degree	**Year: First**	**Semester: Second**
Subject: Forensic Science		
Course Code: MFSC VII	**Course Title: Instrumental Methods II (Theory)**	

Course Objective

The objective of the courses to provide knowledge about the different types of microscopes. The students will able to understand the concept of microscopy along with their principles, working & applications. Additionally, they will also understand the concept of photography & radiochemical techniques.

Course Outcome

CO 1: To understand the basics of microscopy and its uses in Forensic Science.
CO 2: To understand the working and significance of electron microscope such as SEM & TEM
CO 3: To acquire knowledge about basic and advance technique of Photomicrography.
CO 4: To study the principles, theory & significances of different Radio Chemical Techniques.

Credits: 4	**MFSC VII**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Fundamentals of Microscopy** Introduction, History, Basic Principles, Structures, Working and Forensic Applications of Following Microscopes: 1) Compound Microscope 2) Comparison Microscope 3) Fluorescence Microscope 4) Polarized Microscope 5) Stereomicroscope 6) Infra-red Microscope	**15**
II	**Electron Microscopy** Introduction, Historical Review, Types of Electron Microscopes. Scanning Electron Microscope (SEM): Theory & Principle, Specific Features, Instrumentation, Sample Preparation, Specimen Interaction, Specimen Interaction Volume, Signal Produced by Specimen & Forensic Applications.	**15**

	Transmission Electron Microscope (TEM): Theory and Basic Principles, Instrumentation, Recent Advancements and Applications in Forensic Science.	
III	**Photography** Photography, Microscope, Camera, Light System, Film, Filters, Photographic Papers, Photo Capture, Development of Film, Positive Photograph Preparation, Developer, Stop- Bath, Fixing. Ultra- Violet Photography, Infra-Red Photography, Microphotography and Photomicrography.	**15**
IV	**Radiochemical Techniques** Basic Principles and Theory, Introduction about Nuclear Reactions and Radiations, Neutron Sources, Neutron Activation Analysis (NAA). Thermal Analysis Methods: Basic Principles and Theory, Differential Scanning Colorimetry and Differential Analysis, Thermogravimetry, Forensic Applications.	**15**

Suggested Readings

1. Carpenter, W. B. and Dallinger, W. H. (1901). The Microscope and Its Revelations, 8th ed. Blakiston's Sons and Co., Philadelphia.
2. Duncan, C. D. (2010). Advanced Crime Scene Photography. CRC Press, Ukrain
3. Hartley, W, G. (1993). The Light Microscope: Its Use and Development. Senecio Press, Oxford.
4. Lawson, D. (1972). Photomicrography. Academic Press.
5. Marsh, N. (2014). Forensic Photography: A Practitioner's Guide. Wiley Blackwell.
6. Martin, L. C. (1966). The Theory of the Microscope. Graham York Rare Books, UK.
7. Martin, L. C. and Johnson, B. K. (1962). Practical Microscopy. Blackie and Son, London.
8. McLaughlin, R. B. (1975) Accessories for the Light Microscope. Microscope Publications Ltd., London.
9. Richardson, J. H. (1991). Handbook for the Light Microscope – AWorking Manual. Noyes Publications, USA.
10. Shukla, R.K., Kapoor, N., and Badiye, A. (Eds.). (2022). Forensic Microscopy: Truth Under the Lenses, 1sted. CRC Press.
11. Slayter, E. M & Slayter, H. S. (1992). Light and Electron Microscopy. C. U. P.
12. Smith, R. F. (1994). Microscopy and Photomicrography – A Working Manual, 2nded. CRC Press.
13. Thomas, C. and Woolnough, L. (2014). Understanding and Using the Light Microscopes. Milton Contact Ltd.

14. Thomson, D. J. and Bradbury, S. (1987). An Introduction to Photomicrography. Oxford Science Publications.
15. Wheeler, B. P. (2021). Practical Forensic Microscopy: A Laboratory Manual. Wiley.
16. Woolnough, L. (2010). The Stereomicroscope: Understanding and Using. Quekett Microscopical Club.
17. Zieler, H. W. (1972, 1973).The Optical Performance of the Light Microscope, Parts I and II. Microscope Publications Ltd, Chicago.

M.Sc. Forensic Science, Semester II
Paper IV
Good Laboratory Practices
(Theory)

Program/Class: PG Degree	**Year: First**	**Semester: Second**
Subject: Forensic Science		
Course Code: MFSC VIII	**Course Title: Good Laboratory Practices (Theory)**	

Course Objective

The students will able to understand about the good laboratory practices and their management. They will also learn about the various standards of the laboratory and laboratory safety measures along with accreditations of the laboratories.

Course Outcome

CO 1: Aware about different safety measures and standards required in the laboratories.
CO 2: Understand the Good Laboratory Practices and their Significances.
CO 3: Laboratory management system and its importance in Forensic Science.
CO 4: Understand various certification and accreditation bodies.

Credits: 4	**MFSC VIII**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	**Standards for Analysis** Introduction and Definition, Basic Standards, Need of Standards in Analytical Sciences, Basic Chemical Standards, Analytical Standards, Reference Materials, High Purity Substances, Certified Reference Materials, Working or Secondary Standards, Matrix Effect in Standards, Biological Standards, Biochemical Standards.	**15**
II	**Laboratory Management** Administration of Laboratories, Types of Laboratories, Connection between Filed Work and Laboratory, Educational Requirements of Laboratory Personnel, Routine Laboratory Work, Research and Development, Internal Organization of a Laboratory, Architectural Requirements, Laboratory Design, Receipt of Reports and Remnants, Record Management, Requirement of Equipments, Glassware, Chemicals and other Materials, Purchase Procedure, Security of the Premises, Importance of Laboratory Management in Forensic Science.	**15**
III	**Laboratory Safety Measures**	**15**

	General Rules/Protocols for Lab Safety Measures, Handling of Radiations, Bio-hazards and other Toxic Experimental Materials. Proper Storage and Disposal of Hazardous Materials (Chemical and Biological), Management and User Responsibility in Proper Utilization of the Facilities.	
IV	**Good Laboratory Practices** Introduction, History, Definition, Objectives of GLP, Quality Assurance, Basic Elements in GLP (Personnel, Documents, Facility, Test and Control Articles, Maintenance and Calibration of Equipment, Reagent/Material Certification, Standard Operating Procedure (SOP). Test and Control Articles, Analyst Certification, Laboratory Accreditation (NABL, ISO, IEC, BIS), Documentation and Maintenance of Records.	**15**

Suggested Readings

1. Clair, J. S. Crime Laboratory Management 1st ed. Academic Press, 2002
2. Dale, W. M. and Becker, W. S. Forensic Laboratory Management. CRC Press, Boca Raton, 2014
3. Diwan, P.Quality in Totality: A Manager's Guide to TQM and ISO 9000. Deep & Deep Publications, India, 2000
4. Duncan, L. W. Total Quality: Key Terms and Concepts. Amacom Publisher, 1995
5. Dux, J. P. Hand Book of Quality Assurance for Analytical Chemistry Laboratory. Van Nostrand Reinhold, New York, 1986
6. Guide for Safety in The Chemical Laboratory. Manufacturing Chemist's Association, Van Nost Reinhold Publisher, 1972
7. Gyani, G. J.Training Manual on ISO 9000; 2000 and TQM, Raj Publishing House, 2006
8. Kumar, S. Total Quality Management. Laxmi Publications Private Limited, 2016
9. Olson, M. H. and Davis, G. B. Management Information Systems, McGraw Hill, 1998
10. Ross, J. E. Total Quality Management. Vanity Books, India, 1995
11. Seiler, J. P. Good Laboratory Practice, Springer, 2005
12. Shah, D. H.QA Manual. Business Horizons, 2002
13. Siegel, J. A.; Saukko, P. J. and Houck, M. M. Encyclopedia of Forensic Sciences. Academic Press, London, 2013
14. Specific Guidelines for Accreditation of Forensic Science Laboratories, DST, 2008
15. Steere N. V. Hand Book of Laboratory Safety, CRC Press, Cleveland, 1967
16. Woodget, B. W.; Cooper, D. and Chapman, N. B. Sample and Standards. Wiley, New York, 1987

M.Sc. (H) Forensic Science, Semester II

Lab II

(Practical)

Program/Class: PG Degree	**Year: First**	**Semester: Second**
Subject: Forensic Science		
Course Code: Lab II	**Course Title: Practical II**	

Course Objective

The students shall perform the practicals related to identification of various drugs with the help of chemical & instrumental methods. They shall also perform the analysis of chemical residues found in trap cases along with separation and analysis of drugs with the help of chromatographic techniques.

Course Outcome

CO 1: The preliminary examination of different drugs.
CO 2: The microscopic examination of various forensics evidences.
CO 3: The instrumental analysis of various substance used in forensic science.
CO 4: The examination of chemicals used in trap cases.
CO 5: The chromatographic techniques used in the analysis of various Forensic evidences.

Credits: 4	**Practical II**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

S.No.	**Practical**	**No. of Lecture**
I	Preparation of the Normal, Molar and Standard & Buffer Solutions.	
II	Colour/spot tests for common drugs of abuse.	
III	TLC separation of drugs of abuse.	
IV	TLC separation of pesticides/insecticides.	
V	TLC separation of anabolic steroids.	
VI	Identification of NDPS drugs by spectroscopic methods.	
VII	Identification of commonly encountered inorganic poisons Arsenic, Antimony, Bismuth, Mercury by colour test and microscopic examination.	
VIII	Identification of ethyl alcohol and methyl alcohol by colour tests and microscopic examination	
IX	Determination of pH of a solution using pH meter.	
X	Analysis of accelerants and incendiary in Arson cases by TLC and UV visible spectrophotometry.	
XI	Analysis of phenolphthalein in trap cases.	

XII	M.P, B.P and flash point determination.	
XIII	Working on Stereo and Comparison microscope for visualizing the materials of Forensic interest.	
XIV	Working on Compound microscope for visualizing the materials of Forensic interest.	

Suggested Readings

1. Gardner, R. M. and Krouskup, D. (2012) Practical Crime Scene Processing and Investigation. CRC Press.
2. Geberth, V. J. (2006) Practical Homicide Investigation: Tactics, Procedures, and Forensic Techniques. CRC Press.
3. Genge, N. E. (2002) The Forensic Casebook: The Science of Crime Scene Investigation. Ballantine Books.
4. Langford, A. M.; Dean, J.; Reed, R.; Holmes, D.; Weyers, J. and Jones, A. (2005) Practical Skills in Forensic Science. Prentice Hall.
5. Pyrek, K. M. (2017) Pioneers in Forensic Science: Innovations and Issues in Practice. CRC Press.
6. Tamilmani, K. (2017) Practical Guide for Forensic Medicine and Toxicology. Jaypee Publications.
7. Thurman, J. T. (2017) Practical Bomb Scene Investigation, 3rd ed. CRC Press.

M.Sc. Forensic Science, Semester III
Paper I
Questioned Documents & Fingerprints Examination
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Third**
Subject: Forensic Science		
Course Code: MFSC IX	**Course Title: Questioned Documents & Fingerprints Examination (Theory)**	

Course Objective

The objective of this course is to know the different types of questioned documents, the types of forgery generally encountered along with the methods of their detection, identification and examination of handwriting samples. To acquire knowledge regarding fingerprint patterns, the different types of fingerprints, their classification and the various methods of fingerprint development and their collection. They will also understand about type writer, its working and identification of type written and printed documents.

Course Outcome

CO 1: Gain knowledge about documents, their handling, collection and preservation.
CO 2: Learn about the nature and problem related to document examination.
CO3: Understand the various types of forgery and their examination.
CO 4: Examine the different type written and printed documents.
CO 5: Gain knowledge about fingerprints, their formation, types and methods of development.
CO 6: Learn about Automated Fingerprint Identification System (AFIS).

Credits: 4	**MFSC IX**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Document in General:** Importance, Classification & Preliminary Examination. Nature & Problems of Document Examination. Handling & Preservation of Documents. Basic Tools needed for Forensic Document Examination and their use. Writing instruments and their influence on Writing. Examination of Paper and Ink. **Handwriting:** Basic Principle of Handwriting Identification, Handwriting Characteristics- General and Individual. Development of Individuality in Handwriting, Comparison of Handwriting, Natural Variations, Fundamental Divergences. Standard for Comparison. **Signatures**: Characteristics of Genuine and Forged Signatures and their Examination.	**15**
II	**Forgery:** Definition, Types, Characteristics and their Detection. **Disguised Writing and Anonymous Letters**: Definition, Characteristics and Identification of Writer. **Sequence of Strokes:** Definition and Determination of Sequence of Strokes.	**15**

	Alteration in the Document: Examination of Erasures, Additions, Overwriting and Obliteration. Decipherment of Secret Writing, Indented and Invisible Writing, Charred Documents. Examination of Seal Impression and other Mechanical Impressions. **Age of Document**: Absolute/Relative Age, Determination of Age of Documents by Examination of Printed Matter, Types Script Writing, Signatures, Paper and Ink.	
III	**Type Writing:** Working of Type Writer, Various Type of Typewriting Devices, Identification of Type Scripts, Typist. **Printed Matter:** Various Type of Printing Processes, Examination of various Types of Printed Matter. Preparation of detailed report with reasons and illustrative charts, Use of Standard Terminology. **Photography:** Basic Principles and Techniques, Exposing, Developing and Printing, Modern Developments in Photography, Digital Photography, Videography/High Speed Videography, Crime Scene and Laboratory Photography.	**15**
IV	**Fingerprints Examination**: History and Development of Fingerprints, Formation of Ridges, Pattern Types, Pattern areas, Classification of Fingerprints- Henry System of Classification, Single Digit Classification, Search of Fingerprints, Fingerprint Bureau. Chance Fingerprints-Types of Chance Prints, Composition of Sweat, Development of Latent Fingerprints. Conventional Methods of development of Fingerprints. Digital Imaging & Enhancement, Application of Laser & other Radiations to develop Latent Fingerprints. Photography of Fingerprints, Digital Transmission, Comparison of Fingerprints, Automated Fingerprint Identification System (AFIS).	**15**

Suggested Readings

1. Ames, D. T. (2010): Ames on Forgery: Its Detection and Illustration with Numerus Causes Celebres,Kessinger Publishing.
2. Brewster, F. (1932): Contested Documents and Forgeries. The Eastern Law House, Calcutta.
3. Bridges, B. C. (1942): Practical Fingerprinting. Funk and Wagnalls Co. New York.
4. Cherril, F.R.(1954): The Finger PrintSystem at Scotland Yard. Her Majesty's office, London.
5. Conway, J.V.P. (1978): Evidential Documents. Charles C. Thomas, Illinois.
6. Cummins, H and Midlo, C. (1943): Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics.Philadelphia.

7. Ellen, D (1997): The Scientific Examination of Documents, Methods and Techniques, 2nd ed.Taylor & Francis Ltd.
8. Harrison, W.R. (1966): Suspect Documents:Their Scientific Examination. Sweet & Maxwell Ltd., London.
9. Hawthorne, W.H. and Wentworth, B. (2004): Personal Identification: Methods for the Identifications of Individuals, Living or Dead. Gunstock Hill,USA.
10. Hilton, O. (1982): The Scientific Examination of Questioned Document. Elsevier North Holland Inc., New York.
11. Huber, A. R. and Headrich, A.M. (1999): Handwriting Identification: Facts and Fundamental. CRC Press.
12. Madinger J. (2012): Money Laundering- A Guide for Criminal Investigation, 3rd ed. CRC Press.
13. Manning, G.A. (2011): Financial Investigations and Forensic Accounting, 3rd ed. CRC Press.
14. Mehta, M. K.(1966): The Identification of Handwriting & Cross Examination of Experts. N.M. Tripathi, Bombay.
15. Mehta, M. K.(1980): Identification of Thumb Impression & Cross Examination of Finger Print Experts, 3rd ed. National Institute of Justice, USA.
16. Moenssens, A. A. (1971): Fingerprints Techniques. Chilton Book, New York.
17. Morris, R. N. (2000): Forensic Handwriting Identification: Fundamental Concepts and Principles. Academic Press Inc.
18. Osborn, A. S.(1929): Questioned Documents. Boyd Printing, Chicago.
19. Saferstein, R.(1990): Criminalistics. Prentice Hall, New York.
20. Saxena, B.L. (1963): Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery. Central Law Agency, Allahabad.
21. Sulner, H.F. (1966): Disputed Documents: New Methods for Examining Questioned Documents. Oceana Publications, New York.

M.Sc. Forensic Science, Semester III
Paper II
Instrumental Methods III
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Third**
Subject: Forensic Science		
Course Code: MFSC X	**Course Title: Instrumental Methods III (Theory)**	

Course Objective

The objective of this course is to understand the basic and advance chromatographic techniques, their types, principles, working and Forensic applications. The students will be able to learn about different detectors used in advanced chromatography techniques. They will also understand the process of Electrophoresis and Immunological techniques and their uses in Forensic Science.

Course Outcome

CO 1: To understand the concept of basic chromatography with their working principles.
CO 2: To understand the basic principle of advanced chromatographic techniques.
CO 3: To understand working, principles and applications of Electrophoresis.
CO 4: To gain knowledge about the detector, their types and Forensic significance.
CO 5: To explain the concept behind immunological techniques along with their forensics applications.

Credits: 4	**MFSC X**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	**Basic Chromatography** Introduction, Principle, Theories of Chromatography: Rate Theory, Plate Theory, Classification of Chromatographic Techniques. **Thin Layer Chromatography:** Definition, Principle, Experimental Procedure, Rf Value,Forensic Applications, Advantages and Limitations. **Paper Chromatography:** Definition, Principle, Experimental Procedure, Types of Paper Chromatography, ForensicApplications. **Column Chromatography:** Basic Principle, Experimental Procedure, Advantages & Disadvantages, Forensic Applications.	**15**
II	**Advanced Chromatography** **HPTLC:** Introduction, Principle, Instrumentation, Experimental Procedure, Qualitative andQuantitative Analysis, Forensic Application.	**15**

	Gas Chromatography: Introduction, Principle, Types of GC, Instrumentation and Technique, Columns: Type, Feature and Significance, Stationary Phases, Detectors: Type, Feature and Significance, Pyrolysis GC, GC-MS, Head Space GC, Forensic Applications. **Liquid Chromatography:** Introduction, Instrumentation, Procedure, Technique,Columns, Detectors, LC-MS, Forensic Applications. **Detectors:** Introduction, Types, Structure, Working and Forensic Significance.	
III	**Electrophoresis** Introduction, Basic Principles, Various factors affecting Electrophoresis, Instrumentation & Forensic Applications of Various Electrophoresis Techniques: Moving Boundary Electrophoresis, Zone Electrophoresis (Paper Electrophoresis, Cellulose Acetate Membrane Electrophoresis, Gel Electrophoresis, Agrose Gel Electrophoresis, Polyacrylamide Gel Electrophoresis), Sodium dodecyl Sulphate (SDS) Polyacrylamide Gel Electrophoresis, Two Dimensional Electrophoresis, Capillary Electrophoresis, Immuno Electrophoresis, Isoelectric Focusing.	**15**
IV	**Immunological Techniques** Introduction, Immune System, Types of Immunity, Types of Immunological Techniques **Radioimmunoassay (RIA):** Basic Principle, Procedure, Labelling of Antigen and Technique of Assay &Applications. **Enzyme Linked Immuno Sorbent Assay (ELISA):** Introduction, Procedure, Competitive Method, Sandwich Method, Indirect Method & Applications.	**15**

Suggested Readings

1. Lurie, I. S. and Wittwer, J.D. (1983):High Performance Liquid chromatography in Forensic Chemistry. Marcel Dekker, New York.
2. Newman, R.; Gilbert, M. W. and Lothridge, K. (1997):GC-MS Guide to Ignitable liquids. CRC Press.
3. Brown,P.R and Grushka, E. (1993):Advances in Chromatography. CRC Press.
4. Settle,F.A.(1997):Handbook of Instrumental Techniques for Analytical Chemistry. Prentice Hall, New Jersey.

5. Carlin, M. G. and Dean, J. R. (2017): Forensic Application of Gas Chromatography. Taylor and Francis.

M.Sc. Forensic Science, Semester III
Paper III
Forensic Biology & Serology
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Third**
Subject: Forensic Science		
Course Code: MFSC XI	**Course Title: Forensic Biology & Serology (Theory)**	

Course Objective

The objective of this course is to impart complete knowledge to students regarding the various aspects of Forensic Biology and Serology. The various methods of analysis and examination of different types of body fluids. The students will be introduced to DNA and its profiling in paternity and maternity disputes. The student will also gain knowledge about Botanical evidences and Wildlife Forensics.

Course Outcome

CO 1: Understand the concept of Forensic Biology and Serology.
CO 2: To learn about forensic examination of different body fluids, botanical evidences and Wildlife evidences.
CO 3: To know about the nature, location, collection and evaluation of hair and fibers.
CO 4: To acquire knowledge about serological techniques along with proteomics.
CO 5: To understand the nature, structure, extraction and quantification of DNA and its use in Forensic Science.

Credits: 4	**MFSC XI**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Introduction to Forensic Biology** **Biological Evidence:** Importance, Nature, Location, Collection and Evaluation. **Botanical Evidence:** Importance, Nature, Location, Collection and Evaluation (Pollen Grains, Wood, Leaves,Seeds, Diatoms, etc.) **Wild Life Forensics:** Introduction, Importance, Identification of Wild Life Evidences: Skin, Bone, Nails, Horn, Teeth, etc. **Hair and Fibers:** Importance, Nature, Location, Collection, Evaluation and Tests for theirIdentification.	**15**
II	**Body Fluid Analysis** **Blood:** Composition and Functions, Collection and Species Identification, Blood	**15**

	Groups: Inheritance and Determination from Fresh and Dried Blood, Blood Spatter Analysis, Detection and Identification of Blood Stains. **Semen:** Composition, Location, Collection, Evaluation and Tests for Identification. Collection, Examination of other Body Fluids: Saliva, Milk, Sweat, Vaginal Fluid, etc. Blood Grouping from Stains of Blood, Semen, Saliva and other Body Fluids. Method of Absorption- inhibition, Absorption-elution and Mixed agglutination Techniques, Determination of Secretors and Non-Secretors.	
III	**Introduction to Forensic Serology** **Immune System:** Introduction, Immune Response, Innate and Acquired Immunity, Antigens, Antibody, Immunoglobulin: Types, Properties and Functions, Antigen-Antibody Reaction, Lectins: Definition and Forensic Significance. **Immunoassays:** Principles, Types, Techniques and Applications **Paternity and Maternity Dispute:** Introduction, Calculation of Paternity Index, Various Serological and Biochemical Methods. **Forensic Proteomics:** Introduction and Forensic Significance.	**15**
IV	**DNA Profiling** **DNA:** Nature, Definition, Structure, DNA Extraction and Quantification Techniques. **DNA Profiling Techniques:** Introduction, Significance and Procedure of: PCR, RFLP, VNTR, SNP, STR, Y-STR, NGS, Mitochondrial DNA Profiling: Introduction and Significance. **Polymorphic Enzymes:** Forensic Significance, Identification from Fresh Blood and Stains.	**15**

Suggested Readings

1. Boorman, K. E.; Dodd, B. E. and Lincoln, P. J. (1988): Blood Group Serology. Churchill Livingston.
2. Chatterjee, C. C. (1975): Human Physiology. CBS Publisher, India
3. Chowdhuri, S. (1971): Forensic Biology. B P R & D, Govt. of India.
4. Culliford, B. J. (1971):Examination and Typing of Blood Stains in the Crime Laboratory. US Dept. of Justice, Washington.

5. Dunsford, I.; Bowley, C. C. and Race, R. R. (1967): Blood Grouping Techniques. Oliver & Boyd, Edinburgh.
6. Eckert, W. G. and James, S.H. (1999): Interpretation of Blood Stain Evidence at Crime Scenes, 2nd ed.CRC Press, New York.
7. Giblet, E. R. (1969): Genetic Markers in Human Blood.Blackwell Scientific, Oxford.
8. Harris, H. and Hopkinson, D. A. (1976): Handbook of Enzyme Electrophoresis in Human Genetics. North Holland, Amsterdom.
9. Modi, J.K. (1988): Medical Jurisprudence and Toxicology, N.M. Tripathi Pvt. Ltd., India.
10. Race, R. R. and Sangar, R. (1975): Blood Groups in Man, 6th ed. Blackwell Scientific Publications, Oxford.
11. Roberts, J.A. F. (1965): An introduction to Medical Genetics. Oxford University Press.
12. Robertson, J. (1996): Forensic Examination of Hair. Taylor and Francis, USA.
13. Saferstein, R. (1982): Science Handbook, vol. I, II and III. Prentice Hall, New Jersey.

M.Sc. Forensic Science, Semester III
Paper IV
Forensic Physical Anthropology & Forensic Medicine
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Third**
Subject: Forensic Science		
Course Code: MFSC XII	**Course Title: Forensic Physical Anthropology & Forensic Medicine (Theory)**	

Course Objective

The objective of this course is to understand legal procedures followed in a medical profession. To study the various parameters of personal identification and the procedures followed in autopsy. To learn about the cause, manner and mechanism of death. Students shall learn about the types of injuries and its medicolegal aspects. They will also introduce to Forensic Odontology and the forensic significance of bite marks.

Course Outcome

CO1: To gain knowledge about different types of bones and their use in personal identification.
CO 2: To determine age and sex from skeleton remains.
CO 3: To understand the nature of mass disaster cases with the help of Forensic Odontology.
CO 4: To understand the nature of Antemortem, Postmortem and Artificial injuries.
CO 5: To determine the time since death in various cases.

Credits: 4	**MFSC XII**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	**Forensic Anthropology**: Definition, Scope and Objectives, Human Skeleton, Comparative Skeletal Anatomy of Human and Non-human. Identification of Bones and Determination of Side: Age Determination from Skeletal Remains: General Considerations, Classification of Bones, Suture Closure in Skull and Ossification in Other Bones. Sex Determination from Skeletal Remains: Skull, Pelvis, and other Bones. Estimation of Stature from Skeletal Remains with Special Reference to Long Bones.	**15**
II	Personal Identification Techniques (Somatoscopy, Somatometery, Osteometery and Craniometery) & their Importance in Determination of Age and Sex. Portrait Parle/Bertillon System, Introduction and Importance of Photofit/Identi Kit System for Facial Reconstruction. Cranio Facial Super Imposition Techniques (Photographic Super Imposition, Video-Superimposition, Roentgenographic Superimposition). Use of Somatoscopic and Craniometric Methods in Reconstruction. Importance of Tissue Depth to Reconstruct various Facial Features/Genetic and	**15**

	Congenital Anomalies: Causes, Types, Identification and their Forensic Significance.	
III	**Forensic Odontology**: Development and Scope, Role in Mass Disaster. Structural Variation in Teeth (Human and Non-human), Types of Teeth and their Functions, Determination of Age from Teeth: Eruption Sequence, Gustafson's Method, Dental Anomalies, and their Significance in Personal Identification. Bites Marks: Forensic Significance, Collection and Preservation of Bite Marks, Photography of Bite Marks, and Evaluation of Bite Marks. Legal Aspects of Bite Marks.	**15**
IV	**Forensic Medicine:** Medico Legal Aspects of Death, Causes of Death (Asphyxial Death, Starvation, Electrocution, Accidents). Determination of Time Since Death by various methods including, Histopathological Methods. Determination of Age of Living Person, Medico-legal Investigation of Sexual Offences, including Examination of Victim and Suspect. Injuries: Types and Classification of Injuries, Anti-mortem and Post-mortem Injuries, Aging of Injuries, Artificial Injuries.	**15**

Suggested Readings

1. Beals, R.L. and Hoijer, H. An Introduction to Anthropology. Macmillan, New York, 1965.
2. Biswas, G. (2021) Review of Forensic Medicine and Toxicology. Jaypee Brothers Medical Publishers.
3. Clement, J. G. andRanson, D. L. (Eds.) Craniofacial Identification in Forensic Medicine, Oxford University Press, New York, 1998.
4. Comas, J. A Manual of Physical Anthropology. Charles C. Thomas, Springfield,1960.
5. Cummins, H. and Midlo, C. Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics. Blackiston Co., Philadelphia, 1944.
6. El-Najjar, M. Y. and McWilliams, K. R. Forensic Anthropology. Charles C. Thomas, 1978.
7. Glaister, J.; Rentoul, E. and Smith, H.Glaister's Medical Jurisprudence and Toxicology. Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh, 1973.
8. Gray, H.; Williams, P. L. and Bannister, L. H. Gray's Anatomy- The Anatomical Basis of Medicine and Surgery. Churchill Livingston, New York, 1999.
9. Haglund, W. D. and Sorg, M. H. (Eds.) Forensic Taphonomy. CRC Press, London, 1997.
10. Hooton, E.A. Up from the Ape. Macmillan, New York, 1946.
11. Jensen, R. A. Mass Fatality and CausalityIncidents: A Field Guide. CRC Press, 2017.
12. Krogman, W.M. and Iscan, M. Y. Human Skeleton in Forensic Medicine 2nd ed. Charles C. Thomas, Springfield, 1986.

13. Modi, J.K. Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd., India, 1988.
14. Mukherjee, J.B.Forensic Medicine & Forensic Toxicology, 5th ed. Academic Publisher, Kolkata, 2018.
15. Nath, S. An Introduction to Forensic Anthropology. Gian Publishing House, New Delhi, 1987.
16. Roberts, J. A. F. An Introduction to Medical Genetics. Oxford University Press, 1960.
17. Singh, I.P. and Bhasin, M. K. Anthropometry. Kamla-Raj Publications, Delhi, 1968.
18. Stimson, P. G. and Mertz, C. A. (Eds.) Forensic Dentistry. CRC Press, London, 1997.
19. Taylor, K. T. Forensic Art and Illustrations. CRC Press, Boca Raton, 2000.
20. Whitaker, D.K. and MacDonald, D. G. A Color Atlas of Forensic Dentistry. Wolfe Medical Publications, London, 1989.

M.Sc. (H) Forensic Science, Semester III
Lab III (MFSC IX & X)
(Practical)

Program/Class: PG Degree	**Year: Second**	**Semester: Third**
Subject: Forensic Science		
Course Code: Lab III	**Course Title: Practical**	

Course Objective

The students shall perform the practicals related to identification of class and individuals characteristics, comparisons and variations in handwriting. They will also learn the detection of forged & disguised documents. During fingerprint examination, they will learn to identify fingerprint patterns and perform ridge tracing and ridge counting along with classification. The students will perform practicals to separate and analyze forensic evidences with the help of chromatographic techniques.

Course Outcome

CO 1: The examination of questioned documents.
CO 2: The comparison of handwriting samples.
CO 3: The instrumental analysis of ink.
CO 4: To examine forged documents and Indian currency.
CO 5: Identification of fingerprints and method used to develop latent fingerprints.
CO 6: The chromatographic techniques used in analysis of various Forensic evidences.

Credits: 2	**Practical III (MFSC IX & X)**
Max. Marks: 50	**Min. Passing Marks: 20**

Total No. of Lectures: 30

S.No.	Practical	No. of Lectures
I	Identification of Handwriting General Characteristics.	
II	Study of natural variations in handwriting.	

III	Study of fundamental divergences.	
IV	Identification of individual characteristics.	
V	Study of disguise in handwriting.	
VI	Comparison of handwriting.	
VII	Detection of simulated forgery.	
VIII	Detection of traced forgery.	
IX	To perform examination of Indian currency.	
X	To perform chromatographic examination of ink.	
XI	To obtain plain and rolled inked finger prints.	
XII	To identify the finger print patterns.	
XIII	To perform ridge tracing and ridge counting.	
XIV	To identify the ridge characteristics.	
XV	To compare finger prints.	
XVI	To develop latent finger prints with powder method.	
XVII	To develop latent finger prints with fuming method.	
XVIII	To develop latent finger prints with chemical methods.	
XIX	To perform Paper Chromatography.	
XX	To prepare TLC plate and its activation.	
XXI	To perform Gas Chromatography and HPLC.	
XXII	To perform Gel Electrophoresis.	

Suggested Readings

1. Gardner, R. M. and Krouskup, D. (2012) Practical Crime Scene Processing and Investigation. CRC Press.
2. Geberth, V. J. (2006) Practical Homicide Investigation: Tactics, Procedures, and Forensic Techniques. CRC Press.
3. Genge, N. E. (2002) The Forensic Casebook: The Science of Crime Scene Investigation. Ballantine Books.

4. Langford, A. M.; Dean, J.; Reed, R.; Holmes, D.; Weyers, J. and Jones, A. (2005) Practical Skills in Forensic Science. Prentice Hall.
5. Pyrek, K. M. (2017) Pioneers in Forensic Science: Innovations and Issues in Practice. CRC Press.
6. Tamilmani, K. (2017) Practical Guide for Forensic Medicine and Toxicology. Jaypee Publications.
7. Thurman, J. T. (2017) Practical Bomb Scene Investigation, 3rd ed. CRC Press.

M.Sc. (H) Forensic Science, Semester III
Lab IV (MFSC XI & XII)
(Practical)

Program/Class: PG Degree	**Year: Second**	**Semester: Third**
Subject: Forensic Science		
Course Code: Lab III & IV	**Course Title: Practical**	

Course Objective

The students shall perform the practicals related to isolation and identification of diatoms and pollen grains. They will also perform examination of Human hair, blood sample and identification of body fluids such as semen, saliva and urine. They will also learn to determine the age from skull & teeth, sex from skull & pelvis, stature from long bones along with Somatometric measurements.

Course Outcome

CO 1: To identify and examine hair and blood.
CO 2: To perform microscopic examination of human and animal hair.
CO 3: To perform preliminary and confirmatory test for body fluids.
CO 4: To perform osteometric, craniometric and somatometric measurements.
CO 5: To extract DNA from biological samples.

Credits: 2	**Practical IV (MFSC XI & XII)**
Max. Marks: 50	**Min. Passing Marks: 20**

Total No. of Lectures: 30

S.No.	Practical	No. of Lectures
I	Morphological & Microscopic Examination of Human and Animal Hair.	
II	To prepare slides of scale patterns of human hair.	
III	To examine human hair for cortex and medulla.	
IV	To examine Barr bodies from hair root.	
V	To examine Blood Spatter Pattern.	
VI	Blood grouping from fresh and dried blood.	
VII	To Identify Semen Stains by preliminary and confirmatory methods.	
VIII	To Identify Saliva Stains by preliminary and confirmatory methods.	
IX	To identify Urine Stains by preliminary and confirmatory methods.	
X	To determine Species of Origin from Blood, Semen and Saliva.	
XI	Isolation and Identification of pollen grains.	

XII	Isolation and Identification of diatoms.	
XIII	Determination of Age from Skull Sutures and Teeth.	
XIV	Determination of Sex from Skull.	
XV	Determination of Sex from Pelvis.	
XVI	To Perform Osteometric measurements on long bones.	
XVII	To Perform Craniometric measurements on skull.	
XVIII	Study of human skeletal system.	
XIX	Estimation of stature from long bones.	
XX	To perform Somatometric measurement on living. (a) Height Vertex (b) Head Length (c) Head Breadth (d) Foot Length (e) Foot Breadth (f) Nasal Height (g) Nasal Breadth (h) External Biorbital Breadth (i) Internal Bi-Orbital Breadth (j) Bigonial Breadth (k) Bizygomatic Breadth	
XXI	To extract DNA from biological samples.	

Suggested Readings

1. Gardner, R. M. and Krouskup, D. (2012) Practical Crime Scene Processing and Investigation. CRC Press.
2. Geberth, V. J. (2006) Practical Homicide Investigation: Tactics, Procedures, and Forensic Techniques. CRC Press.
3. Genge, N. E. (2002) The Forensic Casebook: The Science of Crime Scene Investigation. Ballantine Books.
4. Langford, A. M.; Dean, J.; Reed, R.; Holmes, D.; Weyers, J. and Jones, A. (2005) Practical Skills in Forensic Science. Prentice Hall.
5. Pyrek, K. M. (2017) Pioneers in Forensic Science: Innovations and Issues in Practice. CRC Press.
6. Tamilmani, K. (2017) Practical Guide for Forensic Medicine and Toxicology. Jaypee Publications.
7. Thurman, J. T. (2017) Practical Bomb Scene Investigation, 3rd ed. CRC Press.

M.Sc. Forensic Science, Semester IV
Paper I
Quality Management
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XIII	**Course Title: Quality Management (Theory)**	

Course Objective

The objective of the course is to provide an understanding of the process of managing quality and managing services. The principles of Quality, Quality Assurance, and Total Quality Management will provide an insight into the concepts of Excellence and Best Values and the contribution of quality to strategic management.

Course Outcome

CO 1: The basic concepts of quality management and quality assurance.
CO 2: Various standards and their use in the field of research.
CO 3: Testing and calibration of the laboratories.
CO 4: Concepts and significance of audit and assessment of institutions and laboratories.

Credits: 4	**MFSC XIII**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	Quality, Standards, Standards Requirement and Purpose, Competence, Competence of Individual and Organizational, Certification and Accreditation, Quality Management (QM), Quality Control (QC), Quality Assurance (QA), Assessment, Accreditation, Quality Management System (QMS), Quality Planning. Cognitive Bias, Metrology: Accuracy, Validation, Reliability, Measurement, Measurement Error, Uncertainty of Measurement, Traceability, Commutability, Harmonization.	**15**
II	Frye Standard and Doubert Standard, Code of Ethics and Standards of Professional Conduct: Professionalism, Competency and Proficiency, Communication and Organizational Responsibility. Bodies Working on Standards for Forensic Science (ASTM, NIST, ANSI, ANAB, UKAS, ISO, IEC, BIS, ILAC).Validation of New Methods: Selectivity, Limit of Detection, Limit of Quantification, Precision, Robustness.	**15**
III	General Requirement for the Competence of Testing and Calibration of Laboratories. Management Requirements: Organizational, Document Control, Subcontracting of	**15**

	Tests and Calibrations, Control of Non-conforming Testing/ Calibration Work, Corrective and Preventive Actions, Management Review. Technical Requirements: Test and Calibration Methods and their Validation, Measurements, Standards and Reference Material, Sample and Data Handling in the Laboratory, Sample Disposal, Protocols for Sample Preparation, Analyte Recovery and Analysis, Replication, Assessment-Interpretation and Reporting of Results, Avoidance of Contamination.	
IV	Internal Audits: Terminology, Objectives, Organization. Planning of Audit, Implementation of Internal Audits, Follow up of Corrective Action. Records and Reports of Internal Audits. External Audits, Additional Unscheduled Audits. Assessor Guide, Assessor's Role, Assessor Assignment Procedure. Procedure of Assessment of New Applicant Laboratories, Pre-assessment Visit. Guide of Assessors to Formulate Recommendations for NABL. Procedure for Conducting Closing Meeting.	**15**

Suggested Readings

1. Aitken, C.G.G. and Stoney, D. A. The Use of Statistics in Forensic Science. CRC Press, England, 1991.
2. ASCLD Guidelines for Forensic Science Laboratory Practices.
3. Clair, J. S.Crime Laboratory Management. Academic Press, 2002.
4. Clark, G. B.Systematic Quality Management- Practical Laboratory Management Series. Amar Society of Clinical, 1995
5. Cooper, M. S. Quality Control in Pharmaceutical Industry. Academic Press, 1972.
6. Duncan, W. L. Total Quality- Key Terms and Concepts.Amacom, 1995.
7. Gitlow, H. S.Quality Management Systems: A Practical Guide. CRC Press, 2000.
8. Merritt, W. and Settle, D. Instrumental Methods of Analysis, 7th ed. CBS Publishers.
9. NABL -113
10. NABL -113A
11. Prichard, E.Quality in the Analytical Chemistry Laboratory. Wiley Blackwell, 1995.
12. Rabbitt, J. T. and Bergh, P. A. The ISO 9000 Book: A Global Competitor's Guide to Compliance and Certification. Amacom, 1994.
13. Rao, C. R. Advanced Statistical Methods in Biometric Research. Wiley, 1952.

14. Rao. Biostatistics- A Manual of Statistical Methods for Use in Health, Nutrition and Anthropology. Jaypee Brothers Medical Publishers, 2009.
15. Ratliff, T. A.The Laboratory Quality Assurance System: A Manual of Quality Procedures and Forms, 3rd ed. John Wiley & Sons, 2003.
16. Saferstein, R. Forensic Science Handbook, Vols. I, II, & III, Prentice Hall, New Jersey. 1982.
17. Sokal, R.R. and Rolf, F.J. Biometry-The Principles and Practices of Statistics in Biological Research, 3rd ed. Freeman and Co., New York.
18. Taylor, J. K.Quality Assessment of Chemical Measurements. CRC Press, 1987.

M.Sc. Forensic Science, Semester IV
Paper II
Research Methodology
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XIV	**Course Title: Research Methodology (Theory)**	

Course Objective

This course offers an overview of research methodology including basic concepts employed in different research methods. It also includes research ethics and report writing.

Course Outcome

CO 1: Basic concepts and understanding of research.
CO 2: Method of data collection and its analysis.
CO 3: Intellectual Property Rights and basics of research ethics.
CO 4: Computer applications in the field of research.

Credits: 4	**MFSC XIV**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	**Research Formulation and Design** Motivation and Objectives – Research Methods vs. Methodology. Types of Research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Concept of Applied and Basic Research Process, Criteria of Good Research. Defining and Formulating the Research Problem, Selecting the Problem, Necessity of Defining the Problem, Importance of Literature Review in Defining a Problem, Literature Review-Primary and Secondary Sources, Reviews, Monograph, Research Databases, Web as a Source, Searching the Web, Critical Literature Review, Identifying Gap Areas from Literature and Research Database, Development of Working Hypothesis.	**15**
II	**Data Collection and Analysis** Introduction of Method Validation, Observation and Collection of Data, Methods of Data Collection, Sampling Methods, Data Processing and Analysis Strategies and Tools, Analysis of Variance (ANOVA), Outliers, Missing Values, Test of Significance, Degree of Freedom, T-Test and Chi-Square Test, Test of	**15**

	Correlation(R), Correlation and Linear Regression, Correlation Coefficient, Hypothesis Testing.	
III	**Research Ethics, IPR and Scholarly Publishing** Ethics-Ethical Issues, Ethical Committees (Human & Animal); IPR- Intellectual Property Rights and Patent Law, Commercialization, Copy Right, Royalty, Trade Related Aspects of Intellectual Property Rights (TRIPS); Scholarly Publishing- IMRAD Concept and Design of Research Paper, Citation and Acknowledgement, Plagiarism, Reproducibility and Accountability.	**15**
IV	**Soft Computing & Report Writing** Computer and its Role in Research, Use of Statistical Softwares (Sigma STAT, SPSS or R Softwares) in Research, Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions.	**15**

Suggested Readings

1. Coley, S.M. and Scheinberg, C. A. (1990) Proposal Writing, 2nd ed. Sage Publications.
2. Correa, C.M. (2000). Intellectual Property Rights, The WTO and Developing Countries: The TRIPS Agreement and Policy Options. Zed Books, New York.
3. Day, R.A. (1992) How to Write and Publish a Scientific Paper. Cambridge University Press.
4. Fink, A. (2005) Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
5. Graziano, A.M. and Raulin, M.L. (2013) Research Methods- A Process of Inquiry 8th ed.Pearson.
6. Kothari, C. R. (2011) Research Methodology: Methods and Techniques. New Age International, New Delhi.
7. Leedy, P.D. and Ormrod, J.E. (2010) Practical Research: Planning and Design, 9th ed. Pearson.
8. Satarkar, S. P. (2000) Intellectual Property Rights and Copyrights. EssEss Publications.

M.Sc. Forensic Science, Semester IV
Option A- Specialization in Forensic Biology & Serology
Paper III
Advanced Forensic Biology
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XV	**Course Title: Advanced Forensic Biology (Theory)**	

Course Objective

The objective of this course is to appraise the students about different aspect of Forensic Biology. They will explore the detailed examination of various biological evidences such as hair, fiber, teeth, bones, body fluid and botanical evidences such as diatoms, wood, pollen grains, leaves and seeds. Additionally, the content of Wildlife Forensics and Entomology has been added so that students understand about wildlife crimes and forensic examination of entomological evidences.

Course Outcome

CO 1: To explain about various sources and examination of different biological evidences.
CO 2: To understand wildlife forensics and related crimes.
CO 3: To understand the role of insects in forensic science along with their identification and examination.
CO 4: To interpretate the concept of forensic botany and examination of botanical evidences.
CO 6: To explain the role of insects during death investigation.

Credits: 4	**MFSC XV**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Biological Evidences** **Biological Evidences:** Introduction, Identification and Examination of- **Hair:** Nature, Development, Structure, Species Origin, Individualization and Examination. Variation in different major population groups, Somatic Origin. **Fiber:** Nature, Type, Classification, Microscopic and Instrumental Analysis, Weaving Pattern. Fibre Transfer and Persistence. Fibre Recovery: At the Scene, in the Laboratory, Contamination and its Prevention. **Teeth:** Nature, Types, Dentition, Evidence Collection, Bite Marks, Forensic Examination. **Bone:** Nature, Types, Evidence Collection, Forensic Examination. **Body Fluids:** Brief Introduction, Types, Location, Collection and Forensic	**15**

	Significance. **Blood Stain Spatter Analysis:** Introduction, Formation, Types of Blood Stain Spatter, Analysis of Blood Spatter.	
II	**Wild Life Forensics** Introduction, Significance of Wild Life Forensic, Endangered and Protected Species of Animals and Plants, Determination of Geographic Origin of Animal and Plant Samples, Identification and Examination of Wild Life Materials by Conventional and Modern Methods: Skin, Bones, Fur, Nail, Teeth, Horn, Wood, Seed, Flowers, etc. Pug Marks: Nature and Identification of Different Animals, Illegal Trade, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Introduction to Wild Life Protection Act.	**15**
III	**Forensic Entomology** Definition, Nature and Arthropod Biology, Insects of Forensic Importance, Collection of Entomological Evidences during Death Investigations, the Role of Aquatic Insects in Forensic Investigations, Insect Succession on Carrion and its Relationship to Determine Time Since Death, its Application to Forensic Entomology.	**15**
IV	**Forensic Botany** Introduction and Significance of Botanical Evidences in Forensic Science. **Diatoms:** Nature, Types, Location, Structure, Extraction of Diatoms from different Tissues including Bone Marrow, Preparation of Slides, Identification, Comparison and Forensic Significance. **Wood:** Nature, Types, Identification and Examination, Forensic Significance. **Seed:** Nature, Types, Identification, Seeds of Forensic Interest. **Pollen Grain:** Nature, Types, Structure, Identification, Examination and Forensic Significance **Other Botanical Evidences:** Leaves, Flowers, etc. Identification and Forensic Significance. **Forensic Microbiology:** Nature, Importance, Identification of Microbial Organisms and Collection from Crime Scene, Role of Microbial Organisms in Bioterrorism.	**15**

Suggested Readings

1. Byrd, J. H and Castner, J. L. Forensic Entomology 2nd ed. CRC Press,London, 2009.
2. Chowdhuri, S. Forensic Biology. BPR&D, Govt. of India, 1971.

3. Lundquist, F. and Curry, A. S. (1965) Methods of Forensic Science.Interscience Publisher, New York, 1962.
4. Robertson, J. R. (Eds) Forensic Examination of Hair. CRC Press, London, 2002.
5. Safersstein, R. (Ed) Forensic Science Handbook, Vol. III, 2nd ed. Prentice Hall, New Jersey.
6. Saferstein, R. and Hall, A. B. Forensic Science Handbook, Vol I, 3rd ed. Prentice Hall, CRC Press, Boca Raton, 2020.
7. Saferstein, R. Forensic Science Hand Book, Vol I. Pearson, 2001.

M.Sc. Forensic Science, Semester IV
Option A- Specialization in Forensic Biology & Serology
Paper IV
Advanced Forensic Serology
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XVI	**Course Title: Advanced Forensic Serology (Theory)**	

Course Objective

The student will learn the different aspects of Forensic Serology and their related evidences. They will know about detailed examination of body fluids with various assays. The student will also gain information about proteomics and DNA profiling techniques. The student will also understand about the nature of antigen, antibody and their interaction.

Course Outcome

CO 1: To understand the concepts of immunology.
CO 2: The detailed forensic analysis of different bodily fluids.
CO 3: The conceptual and detailed information regarding DNA profiling techniques.
CO 4: To understand about proteomics with its forensic applications.
CO 6: To gain knowledge about HLA system used in Forensic Science.

Credits: 4	**MFSC XVI**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	**Immunology** Introduction, Immune System, Immune Response, Immunity: Innate and Acquired Immunity, H aptenes and Adjuvants. **Antigens:** Nature, Structure, Condition, Types, Antigenicity. **Antibodies:** Types, Structure, Physio-Chemical Properties and Functions, Raising of Antisera, Monoclonal and Polyclonal Antibodies. **Antigen-Antibody Reaction:** Precipitation, Agglutination, Complement Fixation. **Lectins:** Definition, Forensic Significance, Buffers and Serological Reagents, Methods of SterilizationEmployed for Serological Work. **HLA System:** Its Applications in Paternity Testing, Pitfalls of HLA System.	**15**
II	**Body Fluid Analysis** Introduction, Nature, Preservation, Evidence Handling, and Forensic Examination of **Blood:** Composition, Presumptive Assay, Confirmatory Assay, Species of Origin	**15**

	(Immunodiffusion and Immunoelectrophoresis), Blood Grouping, Enzyme Typing and Individualization, Menstrual Blood, Anti-mortem and Post-mortem Blood. **Semen:** Composition, Functions And Morphology Of Spermatozoa, Identification (Preliminary And Confirmatory Assays including Azoospermic Semen Stains), Individualization (Blood Grouping, Seminal Fluid Isozymes Typing. **Saliva:** Composition, Identification (Presumptive and Confirmatory Assay). **Vaginal Fluid:** Composition, Significance and Methods for Identification. **Urine:** Composition, Significance, Presumptive and Confirmatory Assays for Identification. **Sweat:** Composition, Significance, Methods of Identification. **Milk:** Composition, Significance, Different Methods of Identification. Determination of Secretor and Non-Secretor Status.	
III	**DNA Profiling** Introduction, History of DNA Typing, Human Genetics- Heredity, Alleles, Mutations and Population Genetics, Molecular Biology of DNA, Variations, Polymorphism, Steps of DNA Profiling. **Polymerase Chain Reaction (PCR**): Introduction, Method, Significance, Types. **Restriction Fragment Length Polymorphism (RFLP):** Introduction, Method, Interpretation of Results and Forensic Significance. **Short Tandem Repeats (STR):** Introduction, STR Loci, Method, Interpretation of Results, Forensic Significance, Y-STR. **Single Nucleotide Polymorphism (SNP):** Introduction, Method, Next Generation Sequencing (NGS), Forensic Significance. **Mitochondrial DNA Profiling (Mt-DNA):** Introduction, Significance, Method. **CODIS**: Introduction**,** Indexes**,** Data Base, DNA Lab Quality Assurance and Quality Control**,** International Quality Standards**,** Certification**.** Legal Admissibility of DNA Evidence.	**15**
IV	**Proteomics** Introduction, Definition, Types: Structural and Functional Proteomics, Method: Sample Preparation, Data Acquisition, and Data Analysis, Applications of Forensic Proteomics using Human Sample (Hair, Bone, Tissues and Body Fluids, Fingermark, Brain and Cerebrospinal Fluid).	**15**

Suggested Readings

1. Boorman, K.E.; Dodd, B. E. and Lincoln, P. J.(1977) Blood Group Serology. Churchill Livingston, Edinburgh.
2. Chatterjee, C. C. (1975): Human Physiology. CBS Publisher, India.
3. Chowdhari, S. (1971) Forensic Biology. BPR&D, Govt. of India.
4. Culliford, B. J. (1971) The Examination and Typing of Blood Stains in the Crime Laboratory. US Dept. of Justice, Washington.
5. Curry, A. S. (1964) Methods of Forensic Science, Vol III. Inter Science, London.
6. DNA Technology in Forensic Science (1992) National Academy Press, Washington.
7. Dunsford, I.; Bowley, C. C. and Race, R. R. (1967) Blood Grouping Techniques, Oliver & Boyd, London.
8. Eckert, W. G. and James, S. H. (1999) Interpretation of Blood Stain Evidence at Crime Scene.CRC Press, USA.
9. Epplen, J. T. and Lubjuhn, T. (Eds) (2000)DNA Profiling and DNA Fingerprinting. Switzerland.
10. Farley, M.A. and Harrington, J.J. (1991) Forensic DNA Technology. CRC Press, Boca Raton.
11. Giblett, E. R. (1969) Markers in Human Blood. Blackwell Scientific, Edinburgh.
12. Harris, H. and Hopkinson, D.A. (1976) Handbook of Enzyme, Electrophoresis. North, Holland, New York.
13. Kirby, L. T.(1990) DNA Fingerprinting Technology. Macmillan, London.
14. Lee, H. C. and Gensslen, R. E. (1990)DNA and Other Polymorphism in Forensic Science.Year Book Medical Publishers.
15. National Research Council (1992) : DNA Technology in Forensic Science, Washington DC National Academy Press.
16. Parslow, T.; Stites, D.; Terr, A. and Imboden, J. (2001) Medical Immunology 10th ed.McGraw Hill Education.
17. Race, R.R, and Sanger, R. (1975) Blood Groups in Man. Blackwell Scientific, Oxford.
18. Saferstein, R. (1982): Forensic Science Handbook, Vols. I, II, & III, Prentice Hall, New Jersey.
19. Sinden, R. (1994) DNA Structure and Function. Academic Press.
20. Stern, C. (1960) Principles of Human Genetics, 2nd ed. Freeman and Co., San Francisco.

M.Sc. (H) Forensic Science, Semester IV
Option A- Specialization in Forensic Biology & Serology
Lab V (Forensic Biology & Serology)
(Practical)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: Lab V	**Course Title: Lab V (Forensic Biology & Serology) Practical**	

Course Objective

The objective of the practicals is to perform examination on blood, fibers and hairs. The students will also learn about collection, packaging and examination of various types of Biological and Serological evidences found at crime scene. They will also learn to prepare Gel plate for examination of electrophoresis.

Course Outcome

CO 1: To perform microscopic examination of Blood, Hair and Fibers.
CO 2: To Perform Electrophoresis for separation of various polymorphic enzymes.
CO 3: To perform immunodiffusion test for species identification.
CO 4: To examine botanical evidences such as diatoms.
CO 5: To perform chemical examination of blood, semen and urine sample.
CO 6: Identification and examination of bite marks.

Credits: 4	**Lab V**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

S.No.	Practical	No. of Lectures
I	To determine titre of antisera.	
II	To perform precipitin test for species of origin determination.	
III	To perform Immunodiffusion test for species of origin.	
IV	To determine blood group from fresh blood and various body fluids with Absorption-inhibition, mixed agglutination and absorption-elution techniques.	
V	Crystal Tests for Blood.	
VI	To prepare gel plates for electrophoresis.	
VII	To perform electrophoresis for separation of Haptoglobins.	
VIII	To perform electrophoresis for separation of various polymorphic enzymes.	
IX	Examination of diatoms.	
X	Examination of hair of different animals such as cat, dog, cow, horse and goat.	
XI	Extraction and isolation of DNA from blood and other body fluids.	
XII	Blood Spatter Pattern Analysis.	

XIII	Bite Mark Examination.	
XIV	Microscopic Examination of Fibers.	
XV	Examination of Seminal Stains by preliminary and confirmatory tests.	
XVI	Urine Identification.	

Suggested Readings

1. Gardner, R. M. and Krouskup, D. (2012) Practical Crime Scene Processing and Investigation. CRC Press.
2. Geberth, V. J. (2006) Practical Homicide Investigation: Tactics, Procedures, and Forensic Techniques. CRC Press.
3. Genge, N. E. (2002) The Forensic Casebook: The Science of Crime Scene Investigation. Ballantine Books.
4. Langford, A. M.; Dean, J.; Reed, R.; Holmes, D.; Weyers, J. and Jones, A. (2005) Practical Skills in Forensic Science. Prentice Hall.
5. Pyrek, K. M. (2017) Pioneers in Forensic Science: Innovations and Issues in Practice. CRC Press.
6. Tamilmani, K. (2017) Practical Guide for Forensic Medicine and Toxicology. Jaypee Publications.
7. Thurman, J. T. (2017) Practical Bomb Scene Investigation, 3rd ed. CRC Press.

M.Sc. Forensic Science, Semester IV
Option B- Specialization in Forensic Chemistry & Toxicology
Paper III
Advanced Forensic Chemistry
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XV	**Course Title: Advanced Forensic Chemistry (Theory)**	

Course Objective

The objective of this course is to understand the Narcotics and Psychotropic drugs with their presumptive and instrumental analysis. The students will get to know the legal provisions and Forensic analysis regarding alcohol, drugs, petroleum products and explosives. They will also understand the nature, working and handling of various sophisticated instruments used in the analysis of chemical evidences.

Course Outcome

CO 1: Understand the advanced Forensic Chemistry, its scope, role and significance.
CO 2: Learn about the alcohol and drugs and their abuse with various methods of examination.
CO3: Understand the nature of explosive and post blast investigation of crime scene.
CO 4: Analyse petroleum products, adulterants and their traces in Forensic exhibits.
CO 5: Differentiate between beverages and their forensic analysis.

Credits: 4	**MFSC XV**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Analysis of Petroleum Products** Distillation and Fractionation, Various Fractions and their Commercial Uses, Standards/Methods of Commercial Analysis of Petroleum Products as per ASTM and BIS, Analysis of Traces of Petroleum Products in Forensic Exhibits, Comparison of Petroleum Products, Detection of Adulterants of Petroleum Products, Characterization of Petroleum Products in Oil Spills, Application of Conventional and Modern Techniques in the Analysis of Petroleum Products.	**15**
II	**Narcotic Drugs and Psychotropic Substances** Laws Related to Forensic Interest, Common Terminologies, Role of Forensic Drug Chemist, Analysis of NDPS Evidence by Various Procedures Prescribed By U.N. Manual,	**15**

	DFS Manual, Spot Tests, Microcrystal Tests, Various Extraction Methods, TLC, UV-Vis Spectrophotometry, IR Spectrophotometry, GC-HPLC, MS, GC-MS, NMR and XRD as Exemplified by Cocaine, Cannabis, Barbiturates, Benzodiazepines, Amphetamines, Opiates and Hallucinogens (LSD, Psilocybine and Mescaline), Detection of Common Adulterants and Determination of Percentage Purity in Seized Samples, Evidence Handling Techniques, Clandestine Laboratory Investigation and Designer Drugs.	
III	**Explosive and Explosion** Introduction, Classification, Composition and Characteristics of Explosives, Pyrotechnics, IEDs, Equipment used for Detection of Explosives and Explosive Devices, Explosion Process and Affects, Types of Hazards, Effect of Blast Wave on Structures, Human, etc, Role of Forensic Scientist in Post Blast Investigation, Specific Approach to Scene of Explosion, Post Blast Residue Collection, Reconstruction of Sequence of Events, Evaluation and Assessment of Scene of Explosion, Systematic Examination of Explosives and Explosion Residues in the Laboratory using Chemical and Instrumental Techniques and Interpretation of Results.	**15**
IV	**Analysis of Beverages** Alcoholic and Non-alcoholic Beverages and their Composition, Analysis of Alcoholic Beverages as per BIS and PFA Act, Detection and Determination of Ethanol, Furfural, Organic Acids, Aldehydes, Chloral Hydrate, Methanol and Ethylene Glycol in Liquors by Colour Tests, TLC, GC, and GC-MS Methods, Distinction between Licit and Illicit Liquors, Relevant Sections of Excise Act.	**15**

Suggested Readings

1. Brown, W. (2011) Drinking, Drugs and Driving Drunk: How Different Drugs Affect the Driving Experience. William Gladden Foudation Press.
2. Clark, E. C. G. and Moffat, A.C. (Ed) (1986) Clark's Isolation and Identification of Drugs: In Pharmaceuticals, Body Fluids and Post Mortem Materials. Pharmaceutical Press.
3. Crown, D. A. (1968) The Forensic Examination of Paint and Pigments. Springfield.
4. Cunliffe, F and Piazza, P. B. (1980) Criminalistics and Scientific Investigation. Englewood Cliffs, New Jersey.
5. Curry, A. S. (1964)Methods of Forensic Science, Vol III.Interscience, London.
6. Maehly, A and Stromberg, L. (2011) Chemical Criminalistics. Springer.

7. Moenssens, A. A.; Mosses, R. E. and Inbau, F. E.(1975) Scientific Evidence in Criminal Cases. Foundation Press.
8. O'Hara, C. E. and Osterberg, J. (1952) Introduction to Criminalistics. Macmillan.
9. Saferstein, R. (1982): Forensic Science Handbook, Vols. I, II, & III, Prentice Hall, New Jersey.
10. Sharma, B.R. (2014) Forensic Science in Criminal Investigation & Trials, 5th ed. Universal Law Publishing.
11. Winger, G.; Woods, J. H. and Hoffman, F. A Handbook on Drugs and Alcohol Abuse. Oxford University Press.

M.Sc. Forensic Science, Semester IV
Option B- Specialization in Forensic Chemistry & Toxicology
Paper IV
Advanced Forensic Toxicology
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XVI	**Course Title: Advanced Forensic Toxicology (Theory)**	

Course Objective

The students will able to understand the various types of drugs, poisons and mechanism of interaction with the human body. The content provides the information about collection, isolation, identification, extraction and estimation of poisons from viscera. They will also learn about the pathways of drug metabolism and post analysis with help of immunoassay techniques.

Course Outcome

CO 1: To detect common poisons from biological specimens.
CO 2: To understand the metabolism and excretion of different drugs and poison.
CO3: To get knowledge about immunoassays used in Forensic Toxicology.
CO 4: To gain knowledge about ADME of poisons and methods of collection and preservation of toxicological evidences.
CO 5: To analyze various types of poison such as vegetable, animals, volatile and non-volatile.

Credits: 4	**MFSC XVI**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Detection of Poisons from Viscera, Blood and Urine** Modern Methods of Extraction, Isolation, Identification, Estimation of following Poisons from Viscera, Blood and Urine. a. Common Narcotics (as Poisons): Opium and its Derivatives. b. Barbiturates, Benzodiazepines Derivatives, Amphetamines. c. Insecticides/Pesticides: Organochloro, Organophosphorus and Carbamates, Pyrethroids, Aluminum phosphide and Zinc phosphide. d. Common Inorganic Poisons, Salts of Arsenic, Mercury, Lead and Cyanides.	**15**
II	**Analysis of Vegetable, Animal, Gases and Volatile Poisons** **Vegetable Poisons**: Nature, Type, Active Principles, Mode of Action, Extraction, Isolation, Identification of the Following:	**15**

	a. Poisonous Seeds: Abrus *precatorius,* Atropa *belladonna,* Argemone *mexicana,* Cerbera *thevetia,* Croton *tiglium,* Datura *fastuosa,* Ricinus *communis.* *b.* Poisonous Fruits: Semicarpus *anacardium,* Urginea *scilla.* *c.* Poisonous Roots: Digitalis, Aconitum *napellus*, Plumbago *rosea.* d. Poisonous Mushrooms. **Animal Poisons**: Snake Venom, Composition, Site of Action, Mode of Action, Sign and Symptoms, Isolation of Poison from Biological Material and Tests for Identification. **Gases and Volatile Poisons**: Action Mechanism, Significance, Signs and Symptoms, Methods of Diagnosis, Tests for Identification.	
III	**Metabolism and Excretion of Poisons** Introduction, Pathways of Drug Metabolism: Non Synthetic Pathway or Phase- I Reactions like Oxidation, Hydroxylation, N-and –O dealkylation and sulphoxide formation, Synthetic Pathways or Phase II Reactions like Conjugation, Acetylation, Methylation of Drugs/Poisons as exemplified by Alcohols, Aldehydes, Ketones, Aliphatic Amines, Carbamates, Phenols, Cyanides, Barbiturates, Amphetamines and Opiates.	**15**
IV	**Post Analysis Work and Immunoassays** Interpretation of Toxicological Data, Limitations of Methods, Limits of Detections: Residue Levels, Toxic Levels, and Therapeutic Levels, Fatal Levels of Commonly Encountered Poisons in Blood, Urine and Tissues. Immunoassays: Basic Principles, Separation of Bound and Unbound Drug, Different Techniques: Radio-Immunoassays, Optical-immunoassays, Enzyme-immunoassays, Fluoro-immunoassays, Luminescence-immunoassays, Their Basic Principles and Applications in Forensic Work.	**15**

Suggested Readings

1. Biswas, G (2016) Practical and Postmortem Record Book of Forensic Medicine and Toxicology. Jaypee Brothers Medical Publishers
2. Clark, E. C. G. and Moffat, A.C. (Ed) (1986) Clark's Isolation and Identification of Drugs: In Pharmaceuticals, Body Fluids and Post Mortem Materials. Pharmaceutical Press.
3. Connors, K.A. A text book of Pharmaceuticals Analysis 2nd ed. Wiley: New York;(1975).

4. Curry, A.S. Advances in Forensic Chemical Toxicology. CRC Press:(1972).
5. Curry, A.S. Analytical Methods in Human Toxicology: Part II. Wiley VCH:(1986).
6. Curry, A.S. Poison Detection in Human Organs. Springer:(1976).
7. Froede, R.C. The Laboratory Management of the Medico-Legal Specimen. *Annals of Clinical & Laboratory Science*. 6(3): (1976).
8. Gosselin, R.E., Hodge, H.C., Smith R.P., Gleason, M.N. Clinical Toxicology of Commercial Products. The Williams & Wilkins: Baltimore; (1969).
9. Hodgson, E. A Textbook of Modern Toxicology 4th ed. John Wiley & Sons: Canada; (2010).
10. Ignatius, P. C. (2019) Textbook of Forensic Medicine and Toxicology. Elsevier, India.
11. Klaassen, C. Casarett& Doll's Toxicology: The Basic Science of Poisons 8th ed. Mc Graw Hill: (2013).
12. Levine, B. (2003) Principles of Forensic Toxicology. AACC Press.
13. Manual of Toxicology, Directorate of Forensic Science, MHA
14. Matsumura, F. Toxicology of Insecticides. Springer: New York; (1985).
15. Moenssens, A. A.; Mosses, R. E. and Inbau, F. E.(1975) Scientific Evidence in Criminal Cases. Foundation Press.
16. Parikh, C. K. (2007) Parikh' Textbook of Medical Jurisprudence Forensic Medicine and Toxicology. CBS Publishers, India.
17. Reddy, K. S. N. (2017) The Synopsis of Forensic Medicine and Toxicology. Jaypee Publisher, India
18. Saferstein, R. (1982): Forensic Science Handbook, Vols. I, II, & III, Prentice Hall, New Jersey.
19. Stoleman, A. Progress in Chemical Toxicology.Academic Press: (2013).
20. Sunshine, I. Guidelines for Analytical Toxicology Program. CRC Press:(1950).
21. Sunshine, I. Handbook of Analytical Toxicology.CRC Press: Cleveland;(1969).
22. Sunshine, I. Methods for Analytical Toxicology, CRC Press: USA;(1975).
23. Swarbrick, J. Clarke's Isolation and Identification of Drugs 2nd ed. Pharmaceutical Press: London. (1986).
24. Turner, W. Drugs & Poison (Police Evidence Library). Aqueduct: (1965). Curry, A. S. (1964) Methods of Forensic Science, Vol III.Interscience, London.

M.Sc. (H) Forensic Science, Semester IV
Option B- Specialization in Forensic Chemistry & Toxicology
Lab V (Forensic Chemistry & Toxicology)
(Practical)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: Lab V	**Course Title: Lab V (Forensic Chemistry & Toxicology) Practical**	

Course Objective

On completion of this course students will able to perform the practical regarding analysis of beverages, petroleum products, explosives and poisons. They will learn to use various spectroscopic and chromatographic techniques for the analysis of Narcotics and Psychotropic Substances.

Course Outcome

CO 1: To detect and examine the type of drugs and poisons in viscera and foodstuff.
CO 2: To perform qualitative and quantitative analysis of explosive residues.
CO 3: To detect metallic poison (As and Hg) in viscera.
CO 4: To perform analysis of volatile and non-volatile substances.
CO 5: To analyze drugs and poisons from various instrumental techniques.

Credits: 4	**Lab V**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

S.No.	**Practical**	**No. of Lectures**
I	Analysis of alcoholic liquor as per BIS specifications.	
II	Determination of methanol and ethanol in alcoholic liquors.	
III	Analysis of gasoline as per BIS specifications.	
IV	Analysis of explosive residues (Qualitative).	
V	Systematic identification of Narcotic Drugs and Psychotropic Substances (opiates, cannabis and barbiturates, benzodiazepines and amphetamines) by spot colour tests.	
VI	Thin layer chromatographic analysis of above NDPS.	
VII	UV/Vis and IR spectroscopic analysis of barbiturates, benzodiazepine and amphetamines.	
VIII	Systematic extraction and identification of acidic and basic drugs from viscera (simulated sample).	
IX	Detection of metallic poisons (arsenic and mercury) in viscera and food stuff (simulated samples).	

X	Analysis of viscera (simulated sample) for different insecticides and pesticides by TLC.	
XI	Identification of vegetable poisons.	

Suggested Readings

1. Biswas, G (2016) Practical and Postmortem Record Book of Forensic Medicine and Toxicology. Jaypee Brothers Medical Publishers
2. Brown, W. (2011) Drinking, Drugs and Driving Drunk: How Different Drugs Affect the Driving Experience. William Gladden Foudation Press.
3. Clark, E. C. G. and Moffat, A.C. (Ed) (1986) Clark's Isolation and Identification of Drugs: In Pharmaceuticals, Body Fluids and Post Mortem Materials. Pharmaceutical Press.
4. Connors, K.A. A text book of Pharmaceuticals Analysis 2nd ed. Wiley: New York;(1975).
5. Crown, D. A. (1968) The Forensic Examination of Paint and Pigments. Springfield.
6. Cunliffe, F and Piazza, P. B. (1980) Criminalistics and Scientific Investigation. Englewood Cliffs, New Jersey.
7. Curry, A. S. (1964) Methods of Forensic Science, Vol III.Interscience, London.
8. Curry, A.S. Advances in Forensic Chemical Toxicology. CRC Press:(1972).
9. Curry, A.S. Analytical Methods in Human Toxicology: Part II. Wiley VCH:(1986).
10. Curry, A.S. Poison Detection in Human Organs. Springer:(1976).
11. Froede, R.C. The Laboratory Management of the Medico-Legal Specimen. *Annals of Clinical & Laboratory Science*. 6(3): (1976).
12. Gosselin, R.E., Hodge, H.C., Smith R.P., Gleason, M.N. Clinical Toxicology of Commercial Products. The Williams & Wilkins: Baltimore; (1969).
13. Hodgson, E. A Textbook of Modern Toxicology 4th ed. John Wiley & Sons: Canada; (2010).
14. Ignatius, P. C. (2019) Textbook of Forensic Medicine and Toxicology. Elsevier, India.
15. Klaassen, C. Casarett& Doll's Toxicology: The Basic Science of Poisons 8th ed. Mc Graw Hill: (2013).
16. Levine, B. (2003) Principles of Forensic Toxicology. AACC Press.
17. Maehly, A and Stromberg, L. (2011) Chemical Criminalistics. Springer.
18. Manual of Toxicology, Directorate of Forensic Science, MHA
19. Moenssens, A. A.; Mosses, R. E. and Inbau, F. E.(1975) Scientific Evidence in Criminal Cases. Foundation Press.
20. Parikh, C. K. (2007) Parikh' Textbook of Medical Jurisprudence Forensic Medicine and Toxicology. CBS Publishers, India.
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22. Saferstein, R. (1982): Forensic Science Handbook, Vols. I, II, & III, Prentice Hall, New Jersey.
23. Sharma, B.R. (2014) Forensic Science in Criminal Investigation & Trials, 5th ed. Universal Law Publishing.
24. Stoleman, A. Progress in Chemical Toxicology.Academic Press: (2013).
25. Sunshine, I. Guidelines for Analytical Toxicology Program. CRC Press:(1950).
26. Swarbrick, J. Clarke's Isolation and Identification of Drugs 2nd ed. Pharmaceutical Press: London. (1986).
27. Turner, W. Drugs & Poison (Police Evidence Library). Aqueduct: (1965). Curry, A. S. (1964) Methods of Forensic Science, Vol III.Interscience, London.
28. Winger, G.; Woods, J. H. and Hoffman, F. A Handbook on Drugs and Alcohol Abuse. Oxford University Press.

M.Sc. Forensic Science, Semester IV
Option C- Specialization in Questioned Document & Fingerprint Examination
Paper III
Questioned Document Examination
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XV	**Course Title: Questioned Document Examination (Theory)**	

Course Objective

The objective of this course is to know the different types of documents and questioned documents. The students will learn about the methods of detection, identification and comparisons of handwriting and their collection. They will also understand about types of e-documents, digital signature and printed documents. Additionally, this course provides information about Photostat machines and Fax machines. They learn about ink and paper examination.

Course Outcome

CO 1: Gain knowledge about Questioned documents, their handling, collection and preservation.
CO 2: Learn about the nature and problems related to document examination.
CO3: Understand the various techniques used in ink and paper examination.
CO 4: Examine the different types of currency and printed documents.
CO 5: Understand the working principle of VSC, ESDA and Printers.

Credits: 4	**MFSC XV**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	**Handwriting** Origin of Alphabet, Teaching of Handwriting, Writing Systems, Principle of Handwriting Identification, Copy Book Form, Deviations from Copy Book Form, Development of Individuality in Handwriting, Classification of Characteristics: Class and Individual Characteristics, Natural Characteristics and Accidental Characteristics in Handwriting. Various Types of Characteristics Contributed due to (A) Element of Style as Arrangement, Connection, Design, Size and Relative Size, Slant, Spacing (B) Elements of Execution as Abbreviations, Alignment, Commencement and Termination, Diacritic and Punctuation, Embellishment, Legibility, Pen Control Leading to Pen Scope, Pen Pressure, Pen Lift, Pen Pause, Writing Movements, Line Quality.	**15**
II	**Comparison of Handwriting**	**15**

	Natural Variations in Handwriting, Range of Variations (Consistency), Fundamental Divergences in Handwriting. Interpretation of these Two in Relation of Identification of Handwriting, Individual Characteristics, Significant Individual Characteristics, Relative Weightage of Characteristics of Handwriting, Consideration of Various Writing Instruments Used in Writing. Forgeries of Signature: Classes of Forgery and their Examination, Disguise in Handwriting, Anonymous Letters, Handed Ness and Ambidexterity, Examination of Numeral and Initials.	
III	**Alterations in the Document** Advanced Methods of Examination of Alterations as Projectina, Video- Spectral Comparator (VSC) and ESDA, their Working Principles and Uses. Modern Typewriting Devices as Check Writing Machine, Electronic Type Writer, Proportional Spacing Type Writer, Computer Printing Devices as Dot Matrix Printer, Inkjet Printer and Laser Printer, their Working, Identification and Limitations. Composition of Ink, Paper and their Examination.	**15**
IV	Types and Working of Photostat Machine, Fax Machines, Identification of Photocopies and Photocopier, Fax Machines. Desktop Printing including Image Processing Devices, their Role in Counterfeit Currency and Certificate, etc. Plastic Currency: Examination of Credit Cards and Similar Material, Holographic Marks and their Examination. Examination of e-Documents & Digital Signatures, etc. Preparation of Detailed Report with Reasons and Illustrative Charts, Use of Standard Terminology.	**15**

Suggested Readings

1. Bates, B.P. I.S.Q.D.-Identification System for Questioned Documents. Charles C. Thomas: (1970).
2. Bates, B.P. Typewriting Identification I.S.Q.T Ident. Charles C. Thomas: (1971).
3. Bisesi, M.S., Kelly, J.S. and Lindblom, B.S. Scientific Examination of Questioned Documents-Forensic and Police Science Series. CRC Press: (2006).
4. Convey, V.P. Evidential Documents. Charles C. Thomas Publishing: (1978).
5. Ellen, D., Day, S. and Davies, C. Scientific Examination of Documents-Methods and Techniques 4th

ed. CRC Press: (2018).

6. Hardless, H.R. and Rao, C.S. H.R. Hardless's Disputed Documents, Handwriting and Thumbprint Identification (Profusely Illustrated). Low Book Publishing: Allahabad; (1988).

7. Harralson, H.H. and Miller, L.S. Huber and Headrick's Handwriting Identification-Facts and Fundamentals 2nd ed. CRC Press: (2017).

8. Harrison, W.R. Forgery Detection-A Practical Guide. Praeger: (1964).

9. Harrison, W.R. Suspect Documents-Their Scientific Examination. Burnham Publishing: (1958).

10. Hilton, O. Scientific Examination of Questioned Documents. CRC Press: Boca Raton; (1993).

11. Kurtz, S. Graphotypes: A New Slant on Handwriting Analysis. Treadgold Press: (1989).

12. Lerinson, J. Questioned Documents: A Lawer's Handbook. Academic Press: London; (2000).

13. Morris, R.: Forensic Handwriting Identification-Fundamental Concepts and Principles 2nd ed. Academic Press: London; (2020).

14. Osborn, A.S. Questioned Documents (Professional and Technical Series). Nelson Hall Publishing: (1974).

15. Osborn, A.S. The Problem of Proof: Especially as Exemplified in Disputed Documents Trails (Professional/Technical Series). Burnham Publishing: (1975).

M.Sc. Forensic Science, Semester IV
Option B- Specialization in Questioned Document & Fingerprint Examination
Paper IV
Fingerprint Examination
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XVI	**Course Title: Fingerprint Examination (Theory)**	

Course Objective

The objective of this course is to acquire knowledge regarding fingerprint patterns, their types, classification and the various methods used to develop fingerprint patterns and their collection. The students will learn about conventional and advanced methods to develop latent fingerprints on various porous and non-porous surfaces. They will also learn about Automated Fingerprint Identification System (AFIS).

Course Outcome

CO 1: Gain knowledge about fingerprints, their formation, types and various methods of developments.
CO 2: Learn about various system of classification of fingerprints.
CO 3: To understand the conventional techniques to develop latent fingerprints on different surfaces.
CO 4: learn about Automated Fingerprint Identification System (AFIS).
CO 5: To present fingerprint as legal evidence in court of law.

Credits: 4	**MFSC XVI**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	History and Development of Finger Prints as a Science for Personal Identification, Structure of Ridged Skin, Morphological Plan of Volar Pads and Configurational Areas. Development of Volar Pads, Ridges, Factors affecting Alignment of Ridges, Transition of Configuration, Types, and Variations in Finger Prints: Causes and Genetics, Population Variations.	**15**
II	Basics of taking Inked Prints, taking Inked Prints of Living and Dead: Plain and Rolled Prints, other Devices and Material for Recording Prints. Classification of Finger Prints, Pattern Types, Pattern Area, Henry System of Classification (Primary to Tertiary and Key Classification) Extension of Henry System, Searching of Finger Prints, Classification System, Single Finger Print, Finger Prints Bureau.	**15**

III	Chance Finger Prints: Latent Prints, Plastic Prints & Visible Prints, Causes, Composition of Sweat. Development of Latent Finger Prints: Conventional Methods- Fluorescent Powders (Black, Grey, White, Magnetic Powder). Fuming Methods: Iodine and Cynoacrylate Methods. Chemical Methods: Ninhydrin and its Analogue Silver Nitrate, Enhancement of Latent Prints, Application of Laser Technologies, Metal Deposition Method.	**15**
IV	Systematic Approach to Latent Print Processing, Preserving and Lifting of Finger Prints. Photography of Finger Prints, Comparison of Finger Prints: Basis of Comparison, Class Characteristics, Individual Characteristics, Various Types of Ridge Characteristics. Automated Finger Print Identification System (AFIS) and its Variants, Digital Image Processing of Finger Prints and their Enhancement. Presentation of Expert Evidence on Finger Prints in Court.	**15**

Suggested Readings

1. Bridges, B.C., Vollmar, A. and Munir, M. Criminal Investigation, Practical Fingerprinting, Thumb Impressions, Handwriting, Expert Testimony Opinion Evidence. University Book Agency: Allahabad;(2000).
2. Chatterjee, S.K.Speculation in Fingerprint Identification. Calcutta; (1981).
3. James, S.H. and Nordby, J.J. Forensic Science-An Introduction to Scientific and Investigation Techniques 4th ed. CRC Press: London;(2015).
4. Nanda, B.B. and Tewari, R.K. Forensic Science in India-A Vision for the Twenty-First Century. Select Publishers: New Delhi;(2001).
5. Saferstein, R. Criminalistics, An Introduction to Forensic Science 6thed. PrenticeHall: New Jersey;(1998).
6. Sharma, B.R. Forensic Science in Criminal Investigation and Trials 3rd ed. Universal Law Publishing: New Delhi;(2001).

M.Sc. (H) Forensic Science, Semester IV
Option C- Specialization in Questioned Document & Fingerprint Examination
Lab V (Questioned Document & Fingerprint Examination)
(Practical)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: Lab V	**Course Title: Lab V (Questioned Document & Fingerprint Examination)** **Practical**	

Course Objective

The practical aspects of the course are to provide knowledge about various tools and techniques related to examination of Questioned Documents, Handwriting sample and Indian Currency. They will also perform practical related to Fingerprints, their developments and examination.

Course Outcome

CO 1: To perform TLC of writing materials.
CO 2: To understand the nature of handwriting and determine the alteration in handwritten samples.
CO 3: To develop fingerprints and compare it.
CO 4: To examine currency note and printed documents by using different techniques.
CO 5: To develop the skill of photography to collect and preservation of various documents.

Credits: 4	**Lab V**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

S.No.	Practical	No. of Lectures
I	To study class and individual characteristics of handwriting.	
II	To study the handwriting written on unusual surfaces.	
III	To study the initials.	
IV	To examine the different types of forgeries.	
V	To perform TLC of writing inks and papers.	
VI	To study alterations, obliterations and addition in the documents.	
VII	To study the indented and invisible writings.	
VIII	To photograph the watermarks in the document.	
IX	To examine currency notes.	
X	To study the type scripts and printed matter from various computer print devices.	
XI	To study sequence of intersecting strokes.	

XII	To develop latent fingerprints by physical and chemical methods.	
XIII	To classify the fingerprints from Primary classification to key classification.	
XIV	To compare the fingerprints.	

Suggested Readings

1. Bates, B.P. I.S.Q.D.-Identification System for Questioned Documents. Charles C. Thomas: (1970).
2. Bates, B.P. Typewriting Identification I.S.Q.T Ident. Charles C. Thomas: (1971).
3. Bisesi, M.S., Kelly, J.S. and Lindblom, B.S. Scientific Examination of Questioned Documents-Forensic and Police Science Series. CRC Press: (2006).
4. Bridges, B.C., Vollmar, A. and Munir, M. Criminal Investigation, Practical Fingerprinting, Thumb Impressions, Handwriting, Expert Testimony Opinion Evidence. University Book Agency: Allahabad;(2000).
5. Chatterjee, S.K.Speculation in Fingerprint Identification. Calcutta; (1981).
6. Convey, V.P. Evidential Documents. Charles C. Thomas Publishing: (1978).
7. Ellen, D., Day, S. and Davies, C. Scientific Examination of Documents-Methods and Techniques 4th ed. CRC Press: (2018).
8. Hardless, H.R. and Rao, C.S. H.R. Hardless's Disputed Documents, Handwriting and Thumbprint Identification (Profusely Illustrated). Low Book Publishing: Allahabad; (1988).
9. Harralson, H.H. and Miller, L.S. Huber and Headrick's Handwriting Identification-Facts and Fundamentals 2nd ed. CRC Press: (2017).
10. Harrison, W.R. Forgery Detection-A Practical Guide. Praeger: (1964).
11. Harrison, W.R. Suspect Documents-Their Scientific Examination. Burnham Publishing: (1958).
12. Hilton, O. Scientific Examination of Questioned Documents. CRC Press: Boca Raton; (1993).
13. James, S.H. and Nordby, J.J. Forensic Science-An Introduction to Scientific and Investigation Techniques 4th ed. CRC Press: London;(2015).
14. Kurtz, S. Graphotypes: A New Slant on Handwriting Analysis. Treadgold Press: (1989).
15. Lerinson, J. Questioned Documents: A Lawer's Handbook. Academic Press: London; (2000).
16. Morris, R.: Forensic Handwriting Identification-Fundamental Concepts and Principles 2nd ed. Academic Press: London; (2020).
17. Nanda, B.B. and Tewari, R.K. Forensic Science in India-A Vision for the Twenty-First Century. Select Publishers: New Delhi;(2001).
18. Osborn, A.S. Questioned Documents (Professional and Technical Series). Nelson Hall Publishing: (1974).

19. Osborn, A.S. The Problem of Proof: Especially as Exemplified in Disputed Documents Trails (Professional/Technical Series). Burnham Publishing: (1975).

20. Saferstein, R. Criminalistics, An Introduction to Forensic Science 6th ed. PrenticeHall: New Jersey;(1998).

21. Sharma, B.R. Forensic Science in Criminal Investigation and Trials 3rd ed. Universal Law Publishing: New Delhi;(2001).

M.Sc. Forensic Science, Semester IV
Option D- Specialization in Forensic Physical Sciences
Paper III
Advanced Forensic Physics
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XV	**Course Title: Advanced Forensic Physics (Theory)**	

Course Objective

The purpose of this course is to study the characteristics and properties of different evidences like glass, soil, paint, tool marks, which are mostly encountered at the scene of crime. To study the various methods by which these evidences can be examined in the laboratory. To study the different methods of speaker identification. To understand the role of Ballistics in Forensic Science, classification of firearms, internal and external ballistics, factors affecting ballistics and the effect of projectile on hitting the target. To introduce student about Cheiloscopy and Otoscopy.

Course Outcome

CO 1: To understand nature and examination of firearms, ammunition and physical evidences such as glass, paint, soil and tool marks.
CO 2: To study the classification, collection and identification of lip prints and ear prints.
CO 3: To understand the nature, collection, analysis and preservation of Physical evidences.
CO4: To understand the nature and analysis of GSR.
CO 5: To understand the detailed analysis and significance of speaker identification system.
CO 6: To trained the students about report writing.

Credits: 4	**MFSC XV**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	Topic	No. of Lectures
I	**Ballistics** Definition, Classification, Types of Firearms and Ammunition. Internal, External and Terminal Ballistics. Types of Evidences found at Crime Scene. Collection, Preservation, Packaging, Forwarding and their Laboratory Examination. Various Marks Produced on Bullets and Cartridge Cases during Firing. Techniques for obtaining Test Material from various types of Weapons. Methodology used in Linkage of Fired Bullets/ Cartridge Cases with Firearms. **Integrated Ballistic Identification System (IBIS):** Automated Examination and Comparison of Fired Bullets/ Cartridge Cases and Ballistics, Imaging Database of the Marking of Fired Bullets/ Cartridge Cases.	**15**

	GSR: GSR and its Analysis by Conventional and Advanced Methods. Report Writing and Expert Witness.	
II	**Tool Marks:** Introduction, Types of Tool Marks, Class & Individual Characteristics, Tracing, Photography, Lifting and Casting of Tool Marks, Examination, Identification and Comparison of Tool Marks. **Foot/Footwear/Tyre Impression:** Introduction, Collection, Tracing, Lifting, Casting of Impressions, Enhancement, Analysis & Comparison of Impressions, Moulds, Identification Characteristics, Skid Marks. **Lip Prints:** Introduction to Cheiloscopy and History of Lip Prints, Classification, Collection, Development, Identification and Comparison of Lip Prints. **Ear Prints:** Introduction, History, Morphology of the Ear, Procedures of taking Standards from the Suspects, Identification and Comparison of Ear Prints.	**15**
III	**Paint:** Introduction, Composition and Use of Paint, Types of Paint, Resins and Binders, Lacquers, Plasticizers, Water Based Polymers & Emulsions, Additives, Solvents, Pigment Types, Microscopic & Macroscopic Examination, Micro Chemical Tests, Differential Solubility and TLC, IR Spectroscopy, Pyrolysis GC-MS, Elemental Analysis of the Pigments. **Soil:** Introduction, Formation & Types of Soil, Composition & Color of Soil, Sample P reparation, Removal of Contamination, Microscopic Examination, Particle Size Distribution, Ignition Test, Density Distribution, pH Measurement, Differential Thermal Analysis (DTA), Elemental Analysis, Interpretation of Soil Evidence. **Glass:** Introduction, Types of Glass and their Composition. Forensic Examination of Glass Fractures under different conditions. Physical Measurement of Glass, Color and Fluorescence, Physical Matching, Density Comparison, Refractive I n d e x M e a s u r e m e n t (RI), Elemental Analysis and Interpretation of Glass Evidence. Introduction, Location, Collection, Packaging, Forwarding and Laboratory Examination of Fiber, Paper, Ink, Cement & Mortar, Polymers, etc.	**15**
IV	**Forensic Speaker Identification** Speaker Identification and Tape Authentication: Voice Production Theory, Speech Signal Processing and Pattern Recognition, Acoustic Parameters of Sound, Fourier Analysis, Frequency and Time Domain Representation of Speech Signal, Analogue	**15**

	to Digital Conversion-Sampling and Quantization, Fast Fourier Transform, Speech Enhancement, Authentication of Audio-Video Signal.	

Suggested Readings

1. Anderson, B. W. (1990) Gem Testing. A Butterworth-Heinemann Title.
2. Annual Book of ASTM Standard
3. Bauer, M. (1968) Precious Stones. Dover Publications.
4. Caddy, B.(2001) Forensic Examination of Glass and Paint: Analysis and Interpretation. CRC Press.
5. Cullity, B. D. (1978) Elements of X-ray Diffraction. Addison Wesley Publishing Company.
6. Kirk, P. L. (1995) Crime Investigation. Krieger Publishing Company.
7. Lea, F. M. (1971) The Chemistry of Cement and Concrete. Chemical Publishing, New York.
8. Maehly, A and Stromberg, L. (2011) Chemical Criminalistics. Springer.
9. Pitroda, S. G. (1985) Methods of Chemical Analysis of Hydraulic Cement. Bureau of Indian Standards.
10. Robertson, J.; Roux, C. and Wiggins, K. G. (2018) Forensic Examination of Fibers. CRC Press.
11. Saferstein, R. (1982): Forensic Science Handbook, Vols. I, II, & III, Prentice Hall, New Jersey.

M.Sc. Forensic Science, Semester IV
Option D- Specialization in Forensic Physical Sciences
Paper IV
Advanced Digital Forensics
(Theory)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: MFSC XVI	**Course Title: Advanced Digital Forensics (Theory)**	

Course Objective

The objective of this course is to teach students about the different aspects of digital, Cyber and Mobile Forensics. They will also explore the detailed examination and handling of digital evidences. Students will also get to know about various image and video enhancement techniques.

Course Outcome

CO 1: To learn about advance digital forensics.
CO 2: To gain conceptual knowledge about the cyber threat.
CO 3: To understand the nature of various data recovery tools.
CO 4: To acquired knowledge about image and video analysis software.
CO 5: To gain knowledge about mobile forensics.

Credits: 4	**MFSC XVI**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

Unit	**Topic**	**No. of Lectures**
I	**Digital Forensic** Introduction, Digital Crimes: Classification and Branches of Digital Forensics. Digital Evidences: Types of Digital Evidences, Acquisition, Handling and Chain of Custody. Evidence Imaging and File System Analysis (FAT and NTFS). Various Tools for Disc Imaging and Data Recovery (ENCASE, NUIX), Vulnerability Assessment Tools. Investigations on Various Imaging Methods (RAW, SMART, E01, AFF). Password and Encryption Techniques. Password Recovery Tools.	**15**
II	**Cyber Forensic** Definition and Types of Cyber-Crimes. HTML and Internet Protocols, Internet History and Topology, Internet Services and Access, Internet Protocols and Addressing, E-mail and Header Interpretation, E-mail Attachments, FTP, Telnet and IRC, Internet Chat, HTTP. Outlook Express, Virus and Trojan Infection, Different Types of Attacks, Internet Research & Investigating Tools.	**15**
III	**Image Analysis**	**15**

	Formation of Image, Image Sampling and Quantization, Basics of Full-color Image Processing, Image Enhancement Techniques, Filters for Image Enhancement, JPEG, PNG, Header Data Analysis, Noise Analysis, Linkage of Camera. Image Steganography, Image Forgery Detection, Detection of Steganography from Image, Digital Watermark, Multimedia IPR, Forensic Analysis of Multimedia Files. **Video Analysis:** Forensic Video Analysis, Enhancement Techniques, Specific Frame Analysis, Resolution, Scope & its Forensic Application in the Field of Security.	
IV	**Mobile Forensics** History of Mobile Phones, Types of Mobile Phones, Advantage and Disadvantages of Mobile Phones and their Forensic Applications. Operating Systems: Introduction, Objective and Types of Operating System- Java, Symbian, Window, Android and iPhone. Evidence Collection from Mobile Phones and SIM Cards. Recovering and Reconstructing of Deleted Data (Call Records, Phone Books, Massages, Multimedia Files i.e. Image, Video, etc.) from Mobile Phones and SIM Cards. Process of Cloning of SIM Data and Password Extraction from Mobile Phones.	**15**

Suggested Readings

1. Boddington, R. (2016) Practical Digital Forensics. Packt Publishing.
2. Carrier, B. (2005) File System Forensic Analysis. Addison Wesley.
3. Carvey, H. (2009) Windows Forensic Analysis: DVD Toolkit. Syngress.
4. Casey, E (2009) Handbook of Digital Forensics and Investigation. Academic Press.
5. Farid, H. (2019) Fake Photos. MIT Press.
6. Greenberg, A. (2019) Sandworm: A New Era of Cyberwar and the Hunt for the Kremlin's Most Dangerous Hackers. Doubleday.
7. Kubica, J. (2016) The CS Detective: An Algorithmic Tale of Crime, Conspiracy, and Computation. Starch Press.
8. Ligh, M. H.; Case, A.; Levy, J. and Walters, A. (2014) The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory. Wiley.
9. Messier, R. (2015) Operating System Forensics. Syngress Publishing.
10. Nikkel, B. (2016) Practical Forensic Imaging: Securing Digital Evidence with Linux Tools. Starch Press.

M.Sc. (H) Forensic Science, Semester IV
Option D- Specialization in Forensic Physical Sciences
Lab V (Forensic Physics & Digital Forensics)
(Practical)

Program/Class: PG Degree	**Year: Second**	**Semester: Fourth**
Subject: Forensic Science		
Course Code: Lab V	**Course Title: Lab V (Forensic Physics & Digital Forensics) Practical**	

Course Objective

The objective of the course is to develop practical approach among the students in examination of bullet, cartridge, GSR and Tool marks. Students will also gain knowledge about the examination of physical evidences such as paint, soil and glass. They will also explore analysis of Digital evidences, Data acquisition and their recovery along with their legal provision.

Course Outcome

CO 1: To analyze digital data by various data recovery tools.
CO 2: To unfold hidden data from various storage media.
CO 3: To examine prints, impression and different tool marks
CO 4: To recover the data by using various software.
CO 5: To lift and analyze GSR by using various methods.

Credits: 4	**Lab V**
Max. Marks: 100	**Min. Passing Marks: 40**

Total No. of Lectures: 60

S.No.	Practical	No. of Lectures
I	examine various marks on bullet and cartridge cases.	
II	lift GSR and its analysis by different methods.	
III	rious types of Tool Marks and their Comparison.	
IV	ting of different Prints & Impressions and their Comparison.	
V	Examine Paint, Soil and Glass Samples.	
VI	Identify Various Types of Fibers by Different Methods.	
VII	tailed Analysis of FAT and NTFS File Systems.	
VIII	ctical Recovery of Data using Methods to preserve its Integrity.	
IX	thods of Recovering Deleted Files, Copying & Imaging.	
X	unfold Concealed Data from various Storage Media.	
XI	eries of Practical Lab Exercises by applying NUIX Software.	

XII	Recover Passwords by applying Password Recovery Software (Passware).	
XIII	To Understand Dynamic and Static Pages, Viewing HTML Source and HTTP Headers, and to get Header Information.	
XIV	traction of Data from various Mobile Phones.	
XV	ssword Extraction from Mobile Phones.	
XVI	ɔning of SIM data.	
XVII	traction of Data from SIM Cards.	

Suggested Readings

1. Anderson, B. W. (1990) Gem Testing. A Butterworth-Heinemann Title.
2. Annual Book of ASTM Standard
3. Bauer, M. (1968) Precious Stones. Dover Publications.
4. Boddington, R. (2016) Practical Digital Forensics. Packt Publishing.
5. Caddy, B.(2001) Forensic Examination of Glass and Paint: Analysis and Interpretation. CRC Press.
6. Carrier, B. (2005) File System Forensic Analysis. Addison Wesley.
7. Carvey, H. (2009) Windows Forensic Analysis: DVD Toolkit. Syngress.
8. Casey, E (2009) Handbook of Digital Forensics and Investigation. Academic Press.
9. Cullity, B. D. (1978) Elements of X-ray Diffraction. Addison Wesley Publishing Company.
10. Farid, H. (2019) Fake Photos. MIT Press.
11. Greenberg, A. (2019) Sandworm: A New Era of Cyberwar and the Hunt for the Kremlin's Most Dangerous Hackers. Doubleday.
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13. Kubica, J. (2016) The CS Detective: An Algorithmic Tale of Crime, Conspiracy, and Computation. Starch Press.
14. Lea, F. M. (1971) The Chemistry of Cement and Concrete. Chemical Publishing, New York.
15. Ligh, M. H.; Case, A.; Levy, J. and Walters, A. (2014) The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory. Wiley.
16. Maehly, A and Stromberg, L. (2011) Chemical Criminalistics. Springer.
17. Messier, R. (2015) Operating System Forensics. Syngress Publishing.
18. Nikkel, B. (2016) Practical Forensic Imaging: Securing Digital Evidence with Linux Tools. Starch Press.
19. Pitroda, S. G. (1985) Methods of Chemical Analysis of Hydraulic Cement. Bureau of Indian

Standards.

20. Robertson, J.; Roux, C. and Wiggins, K. G. (2018) Forensic Examination of Fibers. CRC Press.
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