



# Shri Vaishnav Vidyapeeth Vishwavidyalaya

M.Sc. (Forensic Science) 2022-2024

## SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
			THEORY			PRACTICAL			L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment	END SEM University Exam	Teachers Assessment*					
MSFSN201	DC	Forensic Chemistry and Explosive	60	20	20	30	20	4	0	2	5	

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\*Teacher Assessment shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Objectives:** The course aims to provide the students with

1. Chemistry of fire and arson cases.
2. Forensic analysis of beverages and effect of alcohol on body.
3. Analysis of Explosives and explosion process.
4. Collection, preservation and transportation of drug evidences.

**Course Outcomes:** After studying this course students will

1. Be able to know forensic investigation of fire
2. Be able to perform analysis of beverages
3. Be able to perform collection, preservation and transportation of evidences

**UNIT I: Introduction to Forensic Chemistry :** Definition and scope of Forensic Chemistry. Sampling of chemical evidences, presumptive screening (color/ spot test).

**Trap cases:** purpose, examination of chemicals used in trap case

**Metallurgical analysis:** Analysis of Gold and silver in cheating cases.

### UNIT II:

**Petroleum Products:** Various petroleum fraction and their commercial uses. Standard method of analysis of Petroleum products i.e Petrol, Kerosene, Diesel etc. Adulteration in Petroleum products using instrumental techniques.

Analysis of vegetable oil, detergents and cement.

**Arson:** Chemistry of fire, searching of fire scene, collection, preservation and examination of arson evidences.

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### UNIT III: Beverages:

Introduction and Classification of Beverages, analysis of beverages- alcoholic and non-alcoholic beverages. Country made liquor, Alcohol: effects of alcohol on body, sign & symptoms of alcohol Intoxication. Significance of alcohol in breath and breath screening devices. Difference between licit & illicit liquor, clinical and forensic analysis of alcohol.

### UNIT IV: Explosives:

Definition and Classification, Characteristics of explosives, Uses and abuses of explosives, Synthesis and characteristics of Tri-nitrotoluene (TNT), Pentaerythritol Tetranitrate (PETN), Diazodinitrophenol (DDNP) and Research and Development Explosives (RDX). Searching of scene of explosion. Post blast residue collection and analysis, Detection of explosives traces. Identification of explosives, Improvised explosive devices. Detection of hidden explosives.

### UNIT V: Drugs of Abuse

Natural and synthetic drugs of abuse. Drug dependence and Drug addiction, classification of drugs-Narcotics, Hallucinogens, Depressants, Stimulants, Anabolic steroids. Psychotropic and Psychedelic drugs of abuse. Collection, preservation and transportation of drug evidences. Field and laboratory tests of drugs of abuse and their instrumental methods of analysis.

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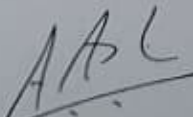
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## SEMESTER II

### Suggested Readings:

1. Working Procedure manual – Chemistry, Explosive and Narcotics BPR & D Pub. (2000)
2. Laboratory Procedure Manual: Petroleum Products, Directorate of Forensic Science, MHA, Govt. of India, 2005.
3. Working Procedure Manual on Chemistry; Directorate of Forensic Science, MHA Govt. of India.
4. Bureau of Indian Standard Specifications related to Alcohols and Petroleum Products.
5. Maudham Bassett et al : Vogel's textbook of Quantitative Chemical analysis, 6 th Ed., Longman Essex (2004)
6. . Burger : Medicinal Chemistry, Vol. II Wiley Interscience, NY (1970)
7. AD.A. Skoogm D.M. West, F.J. Holler : Analytical Chemistry – An Introduction, 7 th Ed., Saunder college Pub. Philadelphia, USA (2000)
8. F.G. Holfmann: Handbook of Drug and Alcohol Abuse.
9. Boudreau JE, etal ;Arson & Arson Investigation Survey & Assessment National Institute of Law Enforcement, U.S. Deptt. of Justice, US Govt. printing press (1977)
10. Dettean J.D. Kirk's fire Investigation, 5 th Ed., Practice Hall, Eaglewood Cliffs, N.J. (2002)
11. Yinon Jitrin : Modern Methods & Application in Analysis of Explosives, John Wiley & Sons, England ( 1993)

  
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## SEMESTER II

### Practicals

1. Detection of dyes used in trap cases
2. Analysis of petroleum products i.e petrol, diesel, kerosene.
3. To detect the adulteration in petrol with kerosene /diesel..
4. Analysis of liquor.
5. Analysis of non-alcoholic beverages.
6. Systematic analytical approach to pre-blast and post-blast explosives.
7. Any other related to the course

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSFSN202	DC	Instrumental Techniques (Chemical)	60	20	20	30	20	4	0	2	5

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;  
**\*Teacher Assessment** shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Objectives:** The course aims to provide the students with

1. Different separation and sample treatment Techniques.
2. The working principle and Forensic applications of different chromatographic techniques.
3. Forensic applications of Electrophoresis and its classification.

**Course Outcomes:** After studying this course students will

1. Be understand different separation techniques
2. Be able to perform chromatographic analysis.
3. Be know technique of electrophoresis

### UNIT I: Separation Technique

General idea and basic principle of distillation, various types of distillation techniques. Sample treatment techniques – Centrifuge, Filtration, Evaporation, Crystallization etc. Distribution Law, Solvent extraction technique like LLE, SPE, micro SPE.

### UNIT II: Chromatographic Techniques I

Theory of chromatography, Classification of chromatography, General idea on planar chromatography, Column chromatography, Adsorption, Partition Chromatography, General principles and working of Planer chromatography: TLC, PC, HPTLC Forensic Application of planar chromatography.

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### UNIT III: Chromatographic Techniques II

General principles and working of Column Chromatography Selection of mobile phase, column and detectors Ion-exchange chromatography Brief idea on working of HPLC, GC, Ion Exchange Chromatography, Exclusion (Permeation) chromatography, Affinity chromatography etc. Forensic Application of column chromatography

### UNIT IV: Electrophoresis Techniques

General principles, Classification of electrophoresis Factors affecting electrophoresis, Preparative, Horizontal, Vertical, two dimensional electrophoresis Brief idea of Low voltage electrophoresis, High voltage electrophoresis, Gel electrophoresis, Isoelectric focusing etc General idea and working of Capillary Electrophoresis Forensic Application of electrophoresis, electrochemical techniques: General principles Electron transport process, Polarography and variants.

### UNIT V: Mass Spectrometry


Mass Spectrometry (MS): Principle and Instrumentation, Correlation of MS with molecular structure. A brief idea about the various forms of Mass Spectrometry. Coupling MS with GC, LC, and CE etc. Application of MS in Forensic Science

### Suggested Readings:

1. Robinson, J.W; Atomic Spectroscopy, 2ndEd.Revised & Expanded, Marcel Dekkar, Inc, NewYork, 1996.
2. Workman, J; Art Springsteen; Applied Spectroscopy-A compact reference for Practitioners, Academic Press, London, 1997.
3. Subrahmanyam, N.&LalB; A text Book of Optics, S. Chand & Company, New Delhi, 2004.
4. Willard, H.H.LynneL. Merrett, J.Dean, A.Frank, A.Settle.J; Instrumental Methods of Analysis, 7<sup>th</sup> Edn. CB Spub. & Distributors, NewDelhi, 1986.
5. Khandpur, R.S; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi, 2004.
6. Thomson, K.C. &Renolds, R.J; Atomic Absorption Fluorescence & Flame Emission Spectroscopy, A Practical Approach, 2nd Edn. Charles Griffith & Company, New South Wales, 1978.
7. Dudley, H. Williams & Fleming, I; Spectroscopic Methods in Organic Chemistry, 4th Edn, Tata McGraw- Hill Publishing Company, New Delhi, 1994.

  
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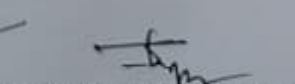
## SEMESTER II

### Practicals

1. To determine molarity of HCl pH metrically provided N/10 NaOH .
2. To find refractive index of the given liquid sample and find molar refraction and specific refraction
3. To verify Beer Lambert's law by colorimetric measurements.
4. Detailed study of the basic principle of Gas Chromatography and study its various parts.
5. Detailed study of Mass Spectrometer.
6. To study the principle fundamental law and application of UV – Visible Spectrometer.
7. To find the amount of dissolved oxygen in sample using DO meter.
8. How to trap a person while taking bribe.
9. Any other related to the course

  
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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSFSN203	DC	Forensic Dermatoglyphics and Other Impressions	60	20	20	30	20	4	0	2	5

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;  
**\*Teacher Assessment** shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Objectives:** The course aims to provide the students with

- 1 History and development of Dermatoglyphics.
- 2 Modern methodologies in finger printing.
- 3 Automated finger print identification system.
- 4 Modern techniques of Foot prints, tip prints and Ear prints.

**Course Outcomes:** After studying this course students will

1. Be understand historical aspects of fingerprint
2. Know moderns techniques of fingerprint
3. Be able to perform chromatographic analysis.
4. Know technique of electrophoresis

### UNIT I: Introduction to Dermatoglyphics

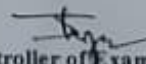
History and development of Dermatoglyphics, Practical Application in Identification. Formation of ridges characteristics of skin ridges, Ridge configurations, skin creases. Comparative Dermatoglyphics-Morphological plan of volar pads and configurational area, variation in Primates, Primate Affinities.

### UNIT II: Dactyloscopy-I

Fundamentals of finger-print construction, Pattern types, Transitions between pattern types. Methods of analysis, Ridge counting, Ridge Tracing, Ridge characteristics. Pattern size, Pattern form. Configurations of middle and proximal phalanges. Classification of fingerprints-Henry's system of classification, single-digit classification, Extension of Henry's classification.

  
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### UNIT III: Dactyloscopy-II

Composition of sweat, development of chance, latent, visible and plastic prints. Taking of finger prints from living and dead person, preserving and lifting of finger prints. Conventional methods of development of latent prints-fluorescent methods, magnetic powder method, fuming method, chemical method etc. Application of laser and other radiations to develop latent finger prints, metal deposition method and development of latent prints on skin. Automated Fingerprint Identification System(AFIS). Modern methodologies in fingerprinting.

### UNIT IV: Palm prints and foot Prints

Topography. Tracing and formulation of main lines of palm prints and foot prints. Formulation of axial triradii in palm prints and foot prints. Formulation of configurational areas in palm prints and sole/foot prints. Other methods of formulation. Comparison of palm prints on the basis of individual ridge characteristics. Collection, tracing, lifting and casting of foot prints. Enhancement of footwear impressions, analysis and comparison of foot, Gait pattern.

### UNIT V: Lip prints, Ear prints and their significance

**Lip Print:** Nature of Lip prints. Types of Lip prints, location, collection and evaluation of lip prints. Forensic Significance of Lip prints.

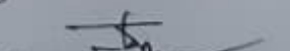
**Ear prints-** Nature of Ear print, location, collection and evaluation. Forensic significance of Ear prints. Modern techniques and developments of Lip prints and Ear prints

### Suggested Readings:

1. Bridges, B.C; Criminal Investigation, Practical Fingerprinting, Thumb Impression, Hand writing expert Testimony, Opinion Evidence., Univ. Book Agency, Allhabad, 2000.
2. Chatterjee, S.K; Speculation in Fingerprint Identification, Jantralekha printing Works, Kolkata, 1981.
3. Cossidy, M.J; Footwear Identification, Royal Canadian, Mounted Police, 1980.
4. Cowger James F; Friction Ridge Skin-Comparison & Identification of Fingerprints, CRC Press, NY, 1993.
5. Harold Cummins and Charles Midlo. Finger Prints, Palms And Soles: An Introduction To Dermatoglyphics
6. Henry, C.L. & Ganesslen, R.E; Advances in Fingerprint Technology, CRC Press, London, 1991.
7. Iannavelli, A.V; Ear Identification, Forensic Identification Series, Paramount, 1989.
8. Jain A.K., Flynn, P. & Ross A.A., Handbook of Biometrics, Springer, New York 2008
9. Mehta, M.K; Identification of Thumb impression & cross examination of Finger prints, N.M. Tripathi Pub. Bombay, 1980.

  
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### Practicals

1. Print your own 10 digit fingerprint card using black ink.
2. Primary and secondary classification of given finger print chart.
3. Identification of ridge characteristics.
4. Comparison of fingerprints by individual and class characteristics.
5. Development and lifting of latent fingerprints using various powders.
6. Development of latent fingerprint using iodine fuming method.
7. Development of latent fingerprint using chemical methods.
8. Documentation of Fingerprint evidence.
9. Casting and matching of foot/footwear print on soft surface.
10. Comparison and identification of individuals from lip print evidence.
11. Any other related to the course

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*					
MSFSN2051	E	Biometric Technologies in Forensic science	60	20	20	0	0	4	0	0	4	

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Objectives:** The course aims to provide the students with

1. Importance of biometric analysis
2. The significance of voice identification.
3. The information and working procedure in brain fingerprinting Narco analysis.

**Course Outcomes:** After studying this course students will

1. Be able to know importance of biometric system
2. Know significance of voice identification

### UNIT I: Introduction of Biometric systems

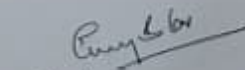
Introduction, Biometric systems: Enrolment and recognition phases, sensor module, feature extraction module, database module, matching module, Biometrics Functionality: Verification & Identification, Biometrics system errors performance measures, Design cycle of biometric System: Nature of the application, Choice of biometric trait, Data collection, Choice of features and matching, Application of biometric system, Security and privacy issues

### UNIT II: Security of Biometric

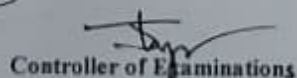
Introduction to Security of Biometric System, Adversary attacks: Insider Attacks, Infrastructure attacks, Attacks on user Interface: Impersonation, Obfuscation, Spoofing, Countermeasure of spoof detection, Attacks on biometrics processing: On system modules & at interconnections, Attack on template database & Countermeasures in biometric template security.

  
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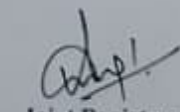
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### UNIT III: An Introduction to Statistical Measures of Biometrics

Recommended Biometric for Network Security: Introduction, Implementation of Biometrics for Network Security. Finger Biometrics, Voice Biometric, Definition & applications of FAR, FRR, FTE, EER. Biometric Transaction: User, Biometric reader, Matching location, Biometric Reader: Trusted, Non-Trusted.

### UNIT IV: Types of Biometric Technology and Verification Systems

Introduction, Biometric verification, Use of Biometric, Biometric Technologies for Personal Identification, Retina recognition, Signature Dynamics or Recognition, Keystroke Dynamics, Speaker recognition, RFID Chip implant Business and Federal.

### UNIT V: Applications of Biometric Technologies

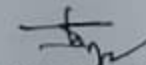
Applications of Biometric Technologies, Challenges and Issues in Using Biometrics, Risk Management Is the Foundation of Effective Strategy, Barriers to Future Growth, Biometric technologies under development: Blood pulse, Nailbed Identification, Body salinity Identification, Palm print, Palm print, vein Pattern, Facial thermography, Skin Luminescence, Brain Wave Pattern, Electronic Nose Identification, Foot Dynamics.

### Suggested Readings:

1. S. Nanavati, M. Thieme and R. Nanavati, Biometrics, Wiley India Pvt. Ltd. (2002).
2. P. Reid, Biometrics for Network Security, New Delhi (2004).
3. J.R. Vacca, Biometric Technologies and Verification Systems, Butterworth-Heinemann, Oxford (2007).
4. Jain A.K., Flynn, P. & Ross A.A., Handbook of Biometrics, Springer, New York 2008

  
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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSFSN2052	E	Microscopy in Forensic Science	60	20	20	0	0	4	0	0	4

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;  
**\*Teacher Assessment** shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Objectives:** The course aims to provide the students with

1. The use microscopy in different branch of forensic science.
2. The principle applications and working process of light microscope.
3. The working process and types of electron microscope and their importance.
4. The different photo micrographic methods their instrumentation application, etc.

**Course Outcomes:** After studying this course students will

1. know different branch of forensic science
2. Know working of light Microscope
3. Be able to perform photo micrographic methods

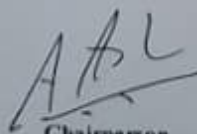
### UNIT I: Introduction to Microscopy:

History, Electromagnetic radiation, Properties of light, Magnification, Resolution, Resolving Power, Depth of field, Depth of Focus, Numerical aperture, Lens, Aberration of lenses.

**Simple Microscope:** Image formation.

### UNIT II: Light Microscopy I:

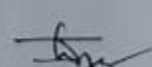
Principle of bright field and dark field microscopy. Theory, Principle & Working of Compound Microscope, Comparison microscope, Stereo Microscope, Fluorescence Microscope, Polarizing Microscope, Phase Contrast Microscope.



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### UNIT III: Light Microscopy II:

Theory, Principle & Working of Interference Microscope, Confocal Microscope, Oil Immersion Microscope, Ultraviolet Microscope, Infra-red Microscope, X-ray Microscope.

### UNIT IV: Electron Microscopy:

Introduction, Historical review, Types of Electron Microscopy, Scanning electron microscopy (SEM): Theory & Principle, Specific feature, instrumentation, sample preparation, specimen interaction, specimen interaction volume, signal produced by specimen & Forensic applications.

**Transmission electron microscopy (TEM):** Theory and basic principles, Instrumentation & Forensic applications. Comparison of SEM and TEM. Comparison of Light Microscopy and Electron Microscopy.

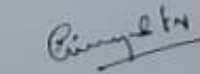
### UNIT V: Miscellaneous Microscopy:

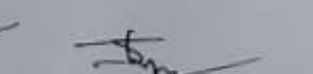
**Photomicrography:** Introduction, Principles & procedure of photomicrography, Ultra- Violet Photography Infra-red Photography, Microphotography, Comparison of Light Microscopy and Photomicrography. Principle and applications of Magnetic Resonance Microscope, Scanning Probe Microscope, Ultrasonic Microscope (Scanning acoustic microscope).

### Suggested Readings:

1. An Introduction to Microscopy, Suzanne Bell : Keith Morris
2. Forensic Science Handbook Volume I : Richard Saferstein
3. Light Microscopy, R. G. E. Murray : Carl F. Robinow
4. Fundamentals of Light Microscopy and Electronic Imaging : Douglas B. Murphy, Michael W. Davidson.
5. Physical Principles of Electron Microscopy An Introduction to TEM, SEM, and AEM: Ray F. Egerton.
6. The History of Photomicrography :Normand Overney and Gregor Overney

  
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# Shri Vaishnav Vidyapeeth Vishwavidyalaya

M.Sc. (Forensic Science) 2022-2024

## SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSFSN2053	E	Advance Criminalistics	60	20	20	0	0	4	0	0	4

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Objectives:** The course aims to provide the students with

1. The different types of physical evidences.
2. The management of different crime scene.
3. The evaluation of evidence report
4. The identification and individualization of impression i.e Tyre marks, Lip print etc.

**Course Outcomes:** After studying this course students will

1. Know types of evidences
2. Know management of crime scene
3. Be able to examine impression

### UNIT I : Crime Scene Investigation (CSI)

Types of crime scenes: indoor, outdoor, mobile, & hydro. Physical evidences, Crime scene search methods, Recovery & packaging of evidences, Crime scene documentation: Notes taking, Sketching, Photography & Videography. Chain of custody

### UNIT II: Various Crime Scenes

Homicide, Suicide, Accidents (Vehicular, Train, Air-crash, Industrial etc), Mass Murders, House Breaking and Theft (HBT), Dacoity, Cybercrimes, Terrorism, etc. Crime Scene Management (CSM), Introduction & Components of CSM, Technology & Equipment, Logistics Management. Role of various experts at crime scene. Security, safety and preservation of crime scene. Contamination control. Scene Survey and initial documentation.

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## SEMESTER II

### UNIT III: Physical Evidences

Physical evidences-definition, types, classes & individual characteristics. Principle of exchange, general information provided by physical evidences. Handling of physical evidence, packing, Labeling, preservation, transportation & forwarding of the following physical evidences-  
**Biological samples:** blood, semen, saliva, urine, vomit, fecal material, hair etc. **Chemical samples** volatile liquids, nonvolatile liquids, flammable liquids, solid chemicals etc.

### UNIT IV: Report and Evidence Evaluation

Components of reports and Report formats in Crime Scene and findings. Constitutional validity of Forensic Evidence, Expert Testimony: Admissibility in court of law, Pre-Court preparations & Court appearance.

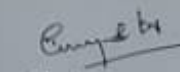
### UNIT V:

Tyre marks / prints and skid marks and comparison with control samples. **Cheiloscopy:** Nature, location, collection and evaluation of lip print. **Ear prints:** Introduction, growth & development, evaluation and analysis of ear print. Tool marks & Mechanical fits.

### Suggested Readings:

1. Bevel, T., Gardner, M. R., Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction, Third Edition.
2. Bevel, T., Gardner, M. R., Practical Crime Scene Analysis and Reconstruction
3. Lee, C. H., Palmbach, T., Miller, T. M., Henry Lee's Crime Scene Handbook
4. Moenssens: Finger Prints Techniques, Chitton Book Co., Philadelphia, New York.
5. Mehta, M. K.: Identification of Thumb Impression & Cross Examination of Finger Prints, N. M. Tripathi (P) Ltd. Bombay.
6. Bridges : Practical Finger Printing, Funk and Washalls Co. New York.
7. Holt : Genetics of Dermal Ridges.
8. William J. Bodziak Footwear Impression Evidence Elsevier Science Publishing Co. New York.
9. James, S.H and Nordby, J.J. Forensic Science: An introduction to scientific and investigative techniques CRC Press, USA.
10. Saferstien : Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
11. Kirk : Criminal Investigation, 1953, Interscience Publisher Inc. New York.
12. Cummins & Midlo : Finger Prints, Palms and Soles, The Blakiston office London.
13. O'Hara & Osterburg : Introduction to Criminalistics.

  
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