

**2 Years PG Programme**

**In**

**Forensic Science**

**2021-2022**

**School of Interdisciplinary Education and Research**

**Department of Forensic Science**

**Guru Ghasidas Vishwavidyalaya**

**Bilaspur (C. G)-495009**

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*July 23/03/2022*

PG COURSE IN FORENSIC SCIENCE  
(TWO YEARS / FOUR SEMESTERS)

|                               |                | M.Sc.1 <sup>st</sup> semester |   | Hours/<br>week | Credit      |
|-------------------------------|----------------|-------------------------------|---|----------------|-------------|
| M.Sc.1 <sup>st</sup> semester | Core -1        | FSPATT1                       | Forensic Science & Criminology                                  | 3              | 3           |
|                               | Core -2        | FSPATT2                       | Crime Scene management  | 3              | 3           |
|                               | Core -3        | FSPATT3                       | Instrumental analysis in Forensic sciences                      | 3              | 3           |
|                               | Core -4        | FSPATT4                       | Forensic Biology and Serology                                   | 3              | 3           |
|                               | Lab -1         | FSPALT1                       | Practical's Based on Crime Scene management                     | 6              | 3           |
|                               | Lab -2         | FSPALT2                       | Practical's Based on Forensic Biology and Serology              | 6              | 3           |
|                               |                |                               | FSPAST1   | Seminar        | 2           |
|                               |                |                               | <b>Total credits</b>  |                | <b>20</b>   |
| M.Sc.2 <sup>nd</sup> semester | Core -5        | FSPBTT1                       | Questioned Documents and Fingerprints                           | 3              | 3           |
|                               | Core -6        | FSPBTT2                       | Forensic Genetics and DNA Profiling                             | 3              | 3           |
|                               | Core -7        | FSPBTT3                       | Forensic Chemistry and Toxicology                               | 3              | 3           |
|                               | Core -8        | FSPBTT4                       | Research Methodology and Ethics                                 | 3              | 3           |
|                               | Elective- 1*   | FSPBTD1                       | Forensic Psychiatry   | 3              | 3           |
|                               | Elective- 2*   | FSPBTD2                       | Wildlife Forensics AND Forensic Entomology                      |                |             |
|                               | Lab -3         | FSPBLT1                       | Practical's Based on Forensic Genetics and DNA Profiling        | 6              | 3           |
|                               | Lab -4         | FSPBLT2                       | Practical's Based on Forensic Chemistry and Toxicology          | 6              | 3           |
|                               | Lab -5         | FSPBLD1                       | Practical's Based on Forensic Psychiatry                        | 6              | 3           |
|                               | Lab -6         | FSPBLD2                       | Practical's Based on Wildlife Forensics and Forensic Entomology |                |             |
|                               |                |                               | FSPBST1   | Seminar        | 2           |
|                               |                |                               | Summer / Field/Industrial Training                              | --             | 2           |
|                               |                |                               | <b>Total Credits</b>  |                | <b>26+2</b> |
| M.Sc.3 <sup>rd</sup> semester | Core -9        | FSPCTT1                       | Computer Forensics and Digital investigations                   | 3              | 3           |
|                               | Core -10       | FSPCTT2                       | Forensic Ballistics and Physics                                 | 3              | 3           |
|                               | Core -11       | FSPCTT3                       | Forensic Medicine   | 3              | 3           |
|                               | Core -12       | FSPCTT4                       | Forensic Anthropology   | 3              | 3           |
|                               | Elective – 3** | FSPCTD1                       | Forensic Genomics, Proteomics and Bioinformatics                | 2              | 2           |
|                               | Elective – 4** | FSPCTD2                       | Forensic Microbiology and Immunology                            | 2              | 2           |

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|                                |                  |         |   |   |           |
|--------------------------------|------------------|---------|---|---|-----------|
|                                | Lab -7           | FSPCLT1 | Practical's Based on Computer Forensics and Digital investigations    | 6 | 3         |
|                                | Lab- 8           | FSPCLT2 | Practical's Based on Forensic Ballistics and Physics                  | 6 | 3         |
|                                | Lab- 9           | FSPCLD1 | Practical's Based on Forensic Genomics, Proteomics and Bioinformatics | 6 | 3         |
|                                | Lab- 10          | FSPCLD2 | Practical's Based on Forensic Microbiology and Immunology             |   |           |
|                                | Open Elective    | FSPCTO1 | Modern advances in Drugs of abuse                                     | 2 | 2         |
|                                |                  | FSPCST1 | Seminar   |   | 2         |
|                                |                  |         | <b>Total Credits</b>  |   | <b>27</b> |
| M.Sc. 4 <sup>th</sup> Semester | Elective- 5***   | FSPDTT1 | Recent Advancement in Forensic Chemistry                              | 3 | 3         |
|                                | Elective- 6***   | FSPDTT2 | Recent Advancement in Forensic Toxicology and Pharmacology            | 3 | 3         |
|                                | Elective- 7***   | FSPDTT3 | Nano Forensics  | 3 | 3         |
|                                | Elective- 8***   | FSPDTT4 | Recent Advancement in Forensic Physics                                | 3 | 3         |
|                                | Elective- 9***   | FSPDTT5 | Recent Advancement in Forensic Ballistics                             | 3 | 3         |
|                                | Elective- 10***  | FSPDTT6 | Recent Advancement in Questioned Documents and Fingerprints           | 3 | 3         |
|                                | Elective- 11***  | FSPDTT7 | Recent Advancement in Forensic Photography                            | 3 | 3         |
|                                | Elective- 12 *** | FSPDTT8 | Recent Advancement in Forensic Biology                                | 3 | 3         |
|                                | Elective- 13***  | FSPDTT9 | Recent Advancement in Forensic Serology & Immunology                  | 3 | 3         |
|                                |                  | FSPDDT1 | Dissertation  |   | 12        |
|                                |                  |         | <b>Total Credits</b>  |   | <b>15</b> |
|                                |                  |         | <b>Overall Credits</b>  |   | <b>90</b> |

\*Students can opt any one Elective paper.

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**Program Objectives**  
**M.Sc. Forensic Science**  
**(Post graduate program offered by the department)**

**1. Name of the program: Master of Science in Forensic Science**

**2. Program Specifications:**

School of Studies: School of Studies of interdisciplinary Education and Research

Department: Forensic Science

Program: M.Sc. Forensic Science

**Mode of Study:** Full time (Semester system):

**Purpose of the course:** Build up a conceptual understanding of criminal justice system, rules of evidence collection, legal system, critical thinking and analysis in a stepwise fashion that builds through the sequence of courses. Laboratory skills to exacting standards of precision and care, including microscopy, Toxicological and Chemical methods of analysis, molecular biology methods, anthropological methods of Human identification, DNA and Next generation sequencing, wide approach analysis of evidence without bias. Apply concepts learned in the classroom and make conclusions based on scientific thinking. Work collaboratively in the laboratory to acquire and analyze data and to solve problems. Graduates are competitive for employment in a field that uses their degree courses.

**Program objectives (POs):** Our mission as a Forensic science program is to develop professional, ethical graduates whose competence in problem-solving, legal analysis and application, quantitative reasoning, investigation and scientific laboratory procedures can be applied to immediate employment or advanced study.

**Skills:** The Students will learn the following the skills after completion of the course:

- The basic analysis of biological samples found at the crime scene.
- To handle the evidences left out at the crime scene.
- The basic methods for examine the different types of questioned documents.
- Identify the different petroleum products by TLC examination.
- Examination of counterfeit Indian currency notes, passports and other mechanical impressions.
- Identify the classification and mode of different types of poisons.
- Understanding the classification of firearms and their mechanisms.

## **1. Programme specific objectives (PSOs):**

- To develop the Post graduate level students with the specific knowledge of handling different types of evidences and their examinations.
- To develop the laboratory skills in examining different types of evidences found at the crime scene.
- To prepare the students to compete for employment in State and central level Organizations.

**Programme outcomes:** On completion of the programme students will

- Apply the Laboratory skills to participate in the career needs of Forensic community.
- Become trained in the laboratory skills of different division of Forensic Science.
- Be able to work with different R&D organizations.

| <b>Course Specific Objectives and Outcomes</b> |  |  |  |
|--|--|--|--|
| <b>Course Code</b>                             | <b>Course Name</b>                         | <b>Course objectives</b>   | <b>Course outcomes</b>   |
| FSPATT1  | Forensic science & Criminology             | This course provides knowledge about Organizational setup of Forensic Science laboratories at state and central level, Ethics in Forensic science, white collar crimes, organized crimes, economic crimes, cyber crimes. This course will give details about various relevant sections of IPC, IEA and Cr.P.C, study of organizational structure of various departments such as Police organizations, CBI, BPRD, INTERPOL etc. | This course provides knowledge to students will learn details about structure of Forensic Laboratories, different types of crime in society, and various Acts and their relevant sections. Will have knowledge of working and function of Police Organization, CBI, BPRD etc.  |
| FSPATT2  | Crime Scene Management                     | Introduction to crime scene, types of crime scene, various methods of securing, searching and documenting crime scenes, collection, packaging and preserving different types of physical and trace evidence at crime scenes, maintaining chain of custody. Crime scene management in different cases such as Murder, Fire, Arson, theft, Burglary, also learns about death Investigation.                                      | Student will learn crime scene management steps, collection, Packaging and forwarding of evidences. Dealing with various aspects of crime scenes such as in case of Fire , Arson – Fire patterns , in case of theft and burglary – collection of evidences and Fingerprints etc. Will get to know about stages after death, determination of time since death etc. |
| FSPATT3  | Instrumental analysis in Forensic Sciences | This course will provide knowledge about various Forensic Profiling methods, basic Principle working and handling of different microscopes, basics of DNA fingerprinting, PCR, STR, RFLP etc. this course will Provide knowledge of various Instruments used in Forensic Examination. Study of various psychological tools their Principle and significance  | Students will learn basic Principles of various instruments such as Microscopes, DNA sequence Analyzer, NAA, DTA etc. Principle of Narco Analysis, Brain Mapping etc.  |

|         |                                       |  |  |
|---------|---------------------------------------|--|--|
| FSPATT4 | Forensic Biology and Serology         | Collection and evaluation of biological evidences, Forensic significance of blood, semen Hair, Fibres and plant materials as evidence. Examination of dried blood. Identification and examination of other body fluids/stains-vaginal, saliva, urine, pus, vomit, milk, sweat and tears. DNA Polymorphism. Forensic Significance of mt DNA and Y chromosome. | Students will be able to collect and evaluate the different types of biological evidences from the crime scene. Different characteristics of human and animal hairs. Forensic significance of DNA polymorphisms.   |
| FSPBTT1 | Questioned Documents and fingerprints | In this course students will get knowledge about Document, Questioned Document, types of Questioned Document, collection and Preservation of Questioned document, basic knowledge about Handwriting and Principles of Handwriting examination, Forgery and its type, determination of age of Document.   | In this course student will have knowledge of questioned document, their classification and examination. Basic Principles of handwriting and study of class and individual characteristics of handwriting. Preliminary examination of documents, Forgery and its way of detection. |
| FSPBTT2 | Forensic genetics and DNA profiling   |  |  |

|         |   |  |   |
|---------|---|--|---|
| FSPBTT3 | Forensic Chemistry and Toxicology             | Detection of adulteration in Petrol, Diesel and edible oils. method of analysis, Designer Drugs & Anabolic steroids. Methods of isolation of poison from Viscera, Collection and Preservation of Viscera. Extraction methods of poisons from viscera, blood and urine  | After completion of the course students will learn<br>Students will learn the methods of detection of adulteration in petrol, diesel and kerosene oil.<br>Extraction of poisons from human blood and urine.                           |
| FSPBTT4 | Research Methodology and ethics               | Essential requirements for the competence of testing and calibration laboratories. Random and non-random sampling procedures. Basic concepts of frequency distribution, measure of central values. Mean median and mode, measures of dispersion, Range, Mean deviation and standard deviation, Correlation and Regression analysis.  | Students will learn the basic concepts of frequency distribution and to measure the central values.<br>Basic concepts of Mean deviation and standard deviation with correlation and regression analysis.                              |
| FSPCTT1 | Computer Forensics and Digital investigations | To provide knowledge about the Difference between cyber and conventional crimes. Types of cyber crimes, Cyber stalking, Cyber pornography, forgery and fraud, Cyber terrorism, Spamming, Phishing, Privacy and National Security in Cyberspace. Use of Forensic Tool kit, preparation of the search of computer evidence to preparing courtroom testimony based upon the examination | After completion of course the students will have knowledge of<br>Different types of cyber crimes, cyber stalking, cyber frauds, cyber terrorism and cyber spamming.<br>Students will learn the different types of digital evidences. |



|         |                                 |   |  |
|---------|---------------------------------|---|--|
| FSPCTT2 | Forensic Ballistics and Physics | To provide knowledge about Internal, External and Terminal Ballistics. Classification, Characteristics and firing mechanism of smooth bored and Rifled firearms, Pistol, Revolver, and Rifles. Gun Shot Residues (GSR) analysis. Classification of explosives.  | Students will learn about the internal, external and terminal ballistics. The firing mechanism of smooth bored and rifled firearms.  |
| FSPCTT3 | Forensic Medicine               | The Forensic Autopsy, Post-mortem changes, Post-mortem Hypostasis, Post-mortem report, Role of Forensic Pathologist. Expert in the investigation of death, collection and preservation of post-mortem exhibits. Classification of injuries and deaths.  | Students will be able to learn about the ante mortem and post mortem changes. Role of Forensic pathologist in investigation of sudden death.   |
| FSPCTT4 | Forensic Anthropology           | Morphological and Anatomical Characteristics of human. Identification of humans from long bones. Identification of male and female from skull characteristic features. Personal identification techniques like Somatometry, craniometry, osteometry. Role of Forensic Anthropology in mass disasters. | After completion of the course students will learn The personal identification from long bones and skull. Identification of male and female by long bones and skull characteristics. |

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|--|--|---|--------------------|
|  |  | Principles and Forensic application of Atomic Absorption Spectrophotometer. | spectrophotometer. |
|--|--|---|--------------------|



**PG COURSE IN FORENSIC SCIENCE  
(TWO YEARS / FOUR SEMESTERS)**

|                                    |                | <b>M.Sc.1<sup>st</sup>semester</b> |   | <b>Hours/<br/>week</b> | <b>Credit</b> |
|------------------------------------|----------------|------------------------------------|---|------------------------|---------------|
| <b>M.Sc.1<sup>st</sup>semester</b> | Core -1        | FSPATT1                            | Forensic Science & Criminology                                  | 3                      | 3             |
|                                    | Core -2        | FSPATT2                            | Crime Scene management  | 3                      | 3             |
|                                    | Core -3        | FSPATT3                            | Instrumental analysis in Forensic sciences                      | 3                      | 3             |
|                                    | Core -4        | FSPATT4                            | Forensic Biology and Serology                                   | 3                      | 3             |
|                                    | Lab -1         | FSPALT1                            | Practical's Based on Crime Scene management                     | 6                      | 3             |
|                                    | Lab -2         | FSPALT2                            | Practical's Based on Forensic Biology and Serology              | 6                      | 3             |
|                                    |                | FSPAST1                            | Seminar   | 2                      | 2             |
|                                    |                |                                    | <b>Total credits</b>  |                        | <b>20</b>     |
| <b>M.Sc.2<sup>nd</sup>semester</b> | Core -5        | FSPBTT1                            | Questioned Documents  | 3                      | 3             |
|                                    | Core -6        | FSPBTT2                            | Forensic Genetics and DNA Profiling                             | 3                      | 3             |
|                                    | Core -7        | FSPBTT3                            | Forensic Chemistry and Toxicology                               | 3                      | 3             |
|                                    | Core -8        | FSPBTT4                            | Forensic Anthropology   | 3                      | 3             |
|                                    | Elective- 1*   | FSPBTD1                            | Forensic Psychiatry   | 3                      | 3             |
|                                    | Elective- 2*   | FSPBTD2                            | Wildlife Forensics AND Forensic Entomology                      |                        |               |
|                                    | Lab -3         | FSPBLT1                            | Practical's Based on Forensic Genetics and DNA Profiling        | 6                      | 3             |
|                                    | Lab -4         | FSPBLT2                            | Practical's Based on Forensic Chemistry and Toxicology          | 6                      | 3             |
|                                    | Lab -5         | FSPBLD1                            | Practical's Based on Forensic Psychiatry                        | 6                      | 3             |
|                                    | Lab -6         | FSPBLD2                            | Practical's Based on Wildlife Forensics and Forensic Entomology |                        |               |
|                                    |                | FSPBST1                            | Seminar   | 2                      | 2             |
|                                    |                |                                    | Summer / Field/Industrial Training                              | --                     | 2             |
|                                    |                | <b>Total Credits</b>               |   | <b>26+2</b>            |               |
| <b>M.Sc.3<sup>rd</sup>semester</b> | Core -9        | FSPCTT1                            | Computer Forensics and Digital investigations                   | 3                      | 3             |
|                                    | Core -10       | FSPCTT2                            | Forensic Ballistics and Physics                                 | 3                      | 3             |
|                                    | Core -11       | FSPCTT3                            | Forensic Medicine   | 3                      | 3             |
|                                    | Core -12       | FSPCTT4                            | Research Methodology and Ethics                                 | 3                      | 3             |
|                                    | Elective – 3** | FSPCTD1                            | Forensic Genomics, Proteomics and Bioinformatics                | 2                      | 2             |



|                                |                   |         |   |   |           |
|--------------------------------|-------------------|---------|---|---|-----------|
|                                | Elective – 4**    | FSPCTD2 | Forensic Microbiology and Immunology                                  | 2 | 2         |
|                                | Lab- 7            | FSPCLT1 | Practical's Based on Computer Forensics and Digital investigations    | 6 | 3         |
|                                | Lab- 8            | FSPCLT2 | Practical's Based on Forensic Ballistics and Physics                  | 6 | 3         |
|                                | Lab- 9            | FSPCLD1 | Practical's Based on Forensic Genomics, Proteomics and Bioinformatics | 6 | 3         |
|                                | Lab- 10           | FSPCLD2 | Practical's Based on Forensic Microbiology and Immunology             |   |           |
|                                | Open Elective     | FSPCTO1 | Modern advances in Drugs of abuse                                     | 2 | 2         |
|                                |                   | FSPCST1 | Seminar   |   | 2         |
|                                |                   |         | <b>Total Credits</b>  |   | <b>27</b> |
| M.Sc. 4 <sup>th</sup> Semester | Elective- 5****   | FSPDTT1 | Recent Advancement in Forensic Chemistry                              | 3 | 3         |
|                                | Elective- 6****   | FSPDTT2 | Recent Advancement in Forensic Toxicology and Pharmacology            | 3 | 3         |
|                                | Elective- 7****   | FSPDTT3 | Nano Forensics  | 3 | 3         |
|                                | Elective- 8****   | FSPDTT4 | Recent Advancement in Forensic Physics                                | 3 | 3         |
|                                | Elective- 9****   | FSPDTT5 | Recent Advancement in Forensic Ballistics                             | 3 | 3         |
|                                | Elective- 10****  | FSPDTT6 | Recent Advancement in Questioned Documents and Fingerprints           | 3 | 3         |
|                                | Elective- 11****  | FSPDTT7 | Recent Advancement in Forensic Photography                            | 3 | 3         |
|                                | Elective- 12 **** | FSPDTT8 | Recent Advancement in Forensic Biology                                | 3 | 3         |
|                                | Elective- 13****  | FSPDTT9 | Recent Advancement in Forensic Serology & Immunology                  | 3 | 3         |
|                                |                   | FSPDDT1 | Dissertation  |   | 12        |
|                                |                   |         | <b>Total Credits</b>  |   | <b>15</b> |
| <b>Overall Credits</b>         |                   |         |   |   | <b>90</b> |

\*Students can opt any one Elective paper.

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\*\*\*Students can opt any one Elective paper.



related to Forensic Science, Procedure for Investigation, Bail ,Pre Trial Proceedings, Trial, Parole, Remand, Rights of accused and Victim.

### **UNIT III**

**Criminology:** Definition & scope, crime & Criminal, Introduction to classification of Offences, theories of Crime causation Brief introduction to schools of Criminology; White Collor crime, Organized Crimes, Economic crimes, Cybercrimes, Crime against children and women.

### **UNIT IV**

**Police Science:** Police Organizations at State and Central Level, Introduction to CBI, BPR&D. Interpole its Role and functions. Introduction to Punishment, theories and types.

### **Recommended Book**

1. Sharma, B.R.: Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.
2. Lundquest & Curry: Forensic Science, Vol.ItoIV, 1963, Charls C. Thomas, Illinois, USA.
3. Saferstein : Forensic Science Handbook, VolII, II& III, Prentice Hall Inc. USA.
4. Saferstein: Criminalistics, 1976, Prentice Hall Inc. USA.
5. Kirk: Criminal Investigation, 1953, Interscience Publisher Inc. New York.
6. Lee & Gaensselen: Advances in Forensic Science (Vol.2) Instrumental Analysis.
7. Kleiner, Munay(2002):Handbook ofPolygraph testing. AcademicPress.
8. Hess, A.K.and Weiner,I.B.(1999)HandbookofForensicPsychology2ndEd.Johnwiley& sons.
9. BruceA. Arrigo (2000) Introduction to Forensic Psychology Academic Press, London
10. N. Gilbert; Criminal Investigation; Third edition, Macmillan Publishing Company, 1993.





## **Recommended Books**

1. Saferstein, Criminalistics: An Introduction to Forensic Science Prentice Hall INC, USA
2. James S.H. and Nordby,J.J. : Forensic Science- An introduction to scientific and Investigative Techniques, CRC Press USA.
3. Eckert W.G. Introduction to Forensic Sciences, CRC, NewYork
4. Siegel, J. A., Saukko, P. J. And Knupfer, G.C., Encyclopedia of Forensic Sciences, Academic Publishers, London
5. Kirk,P.L. Fire Investigations, John Wiley and Sons
6. Kirk,P.L.; Criminal Investigation, Interscience Publisher Inc New York.
7. Anita.Y. Wonder; Bloodstain Pattern Elsevier, London
8. Barry,A.J.Fisher.; Techniques ofCrimeSceneInvestigation,6<sup>th</sup>Edition Ed, C.R.C Press NY(2003)
9. Mordby, JDeed Reckoning; The Art of Forensic Detection, CRC Pre LLC(2000)
10. Eckett, W.G &James S.H; Interpretation of Bloodstains, Evidence of Crime Scene, Elsevier Pub. NY (1989)

**PG Course in Forensic Science**  
**Semester –I**                      **FSPATT3**  
**Instrumental analysis in Forensic Science**  
**(Core-3)**

**Maximum Marks: 100**

**Allotted credits: 03**

**UNIT I: Spectroscopy**

Concept of analytical forensic chemistry, qualitative and quantitative analysis. Basic concepts of Atomic spectra, Energy levels and Molecular spectra, Electromagnetic spectrum, Sources of radiation, Interaction of Energy and Matter, Introduction to spectroscopy, Basic Principle involve in various spectroscopic techniques, calibration methods, UV-Visible spectroscopy: Basic concepts, Principles and Forensic applications of UV-visible spectroscopy, Lambert-Beer law and its deviations, fluorescence spectroscopy, Luminometry, InfraRed (IR) and Raman spectroscopy, Fourier transform InfraRed (FTIR) spectrophotometer, Surface Plasma Resonance (SPR)., Nuclear Magnetic Resonance spectroscopy

**UNIT II: Chromatography**

Chromatography: General introduction to chromatography, Basic concepts, principles, performance parameter and functions. Adsorption chromatography, Partition chromatography Thin Layer chromatography (TLC), Affinity Chromatography, Gel Exclusion Chromatography, Ion Exchange chromatography, High Performance Liquid Chromatography (HPLC), Gas Chromatography (GC) and High-performance Thin layer Chromatography (HPTLC). Detector and its types.

**UNIT III: Spectrophotometry and Microscopy**

Spectrophotometry: General introduction, Basic concepts, Principles and Forensic application of Atomic Absorption Spectrophotometry (AAS), Atomic emission Spectrometry (AES), Inductive coupled plasma (ICP), X-ray diffraction (XRD), X-ray Photoelectron spectroscopy (XPS), Auger remission spectroscopy, Mass spectrometry. Differential Scanning Calorimeter (DSC), Differential Thermal Analyzer (DTA), Neutron Activation Analysis (NAA), Basic principles of Microscopy, Comparison microscope, Stereoscopic microscope, Fluorescent Microscopy, Infrared Microscope, Scanning Electron Microscope (SEM) & Transmission Electron Microscope (TEM)

**UNIT IV: Recombinant DNA Technology**

Molecular Biology Techniques: Basic principle of gene cloning and DNA analysis, cloning vectors- Plasmids and Bacteriophages, Genetic Manipulations, Gene cloning, Enzymes used in DNA manipulations- Nucleases, Ligases, polymerases, DNA modifying enzymes, Restriction Enzymes, DNA extraction from Plasmids, bacterial cells and animal cells, DNA sequencing, Gene Libraries construction, Colony Hybridization, Nick translation, Expression of Genes. Gene cloning and DNA analysis in Forensic Science.

### **Recommended Books**

1. Sharma, B.R. Scientific Criminal investigation, Universal Law Publishing Co.
2. Eckert W.G. Introduction to Forensic Sciences ,CRC, New York
3. Siegel, J.A., Saukko, P. J. And Knupfer, G.C., Encyclopedia of Forensic Sciences, Academic Publishers, London.
4. John C. Lindon, George E. Tranter & John L. Holmes; Encyclopedia of Spectroscopy & Spectrometry, Academic Press (2000)
5. Cottrell, C.T. Irish, D, Msters VM., and Steward, J.E. (1985) Introduction to ultraviolet and visible spectrophotometry, 2nd ed. Pye Unicam, Cambridge A Practical Guide to Modern NMR for Chemists, OUP, Oxford, 2000
6. Gunther, H., NMR Spectroscopy. Basic Principles, Concepts and Applications in Chemistry, 2nd Edn, Wiley, Chichester, 1995 Davis, R. and Frearson, M. (1987) Mass Spectrometry, Wiley, London Alan Gunn Essential forensic biology Jhon. Wiley
7. Barbara Wheeler Lori J. Wilson, P ractical Forensic Microscopy: A Laboratory Manual.
8. Bryan L. William & Keith Wilson; Principles & Techniques of Practical Biochemistry, Edward Arnold Pub. (1975)
9. Keith Wilson & John Walker; Practical Biochemistry- Principles & Techniques, 5th Ed., Cambridge University Press
10. George M. Malacinski; Essentials of Molecular Biology, 4th Ed. Jones and Bartlet Pub. (2003).
11. Gardnes & Snustd; Principles of Genetics 6th Ed., John Wiley & Sons
12. Working Procedure Manual Biology/ Serology, DFS Pub New Delhi, 2005

**PG Course in Forensic Science**  
**Semester –I**                      **FSPATT4**  
**FORENSIC BIOLOGY AND SEROLOGY**  
**(Core-4)**

**Maximum Marks: 100**

**Allotted credits: 03**

**Unit-1**

Introduction to Forensic Biology. Biological fluids of forensic significance (Blood, Semen, Saliva, Sweat, Urine, Vitreous humour, Amniotic fluid, Milk, Faecal matter). Cellular component of Blood. Hair and its forensic importance. Blood grouping systems (ABO, Rh, MN, Duffy, Kidd, Kell, Lutheran and P system). Biology of pollen and its forensic significance. Microbes of forensic importance.

**Unit-II**

Forensic Biochemistry. pH, Buffer. General Introduction of Biomolecules (Structure&Function). Antigen, Antibody & Lectins. Introduction to Enzyme& Hormones. Identification (Presumptive and confirmatory) of evidences of biological origin. Biochemical markers of Forensic significance.

**Unit-III**

Serological Techniques. Collection and preservation of biological evidence. Antigen-antibody interaction (Agglutination, Precipitation) and serological techniques based up on it (ELISA, RIA, Complement fixation, Immuno-diffusion). Electrophoresis (SDS-PAGE, Agarose Gel, Immuno-electrophoresis, Isoelectric Focussing). Species identification & Blood typing (Wet & Dry). Blood pattern analysis (Blood stain characteristics, types, documentation) & its application in forensic investigation.

**Unit-IV**

Wild Life Forensic &Entomology. Wildlife Forensic: Recovering evidence at poaching scenes; Illegal wildlife trade, Species identification, Protected and endangered species of animals and plants; Sanctuaries and their importance; Relevant provision of wild life and environmental act; Types of wildlife crimes, Wildlife artefacts(Bones, skin, fur, hair, nails, blood, feather, etc.).Insects of forensic importance; collection of entomological evidence during legal investigations, entomological samples( from the body, during autopsy, from buried remains from enclosed structures & aquatic habitats ).Factors that influence insect succession on carrion, molecular methods for Forensic Entomology.



## Recommended Books

1. Robertson, J. (1996): Forensic Examination of Hair. Taylor and Francis, USA.
2. Modi, J. K.: Medical Jurisprudence and Toxicology, N. M. Tripathi Pvt. Ltd.
3. Fraser, Roberts J. A. (1965): An introduction to Medical Genetics.
4. Chatterjee, C. C. (1975): Human Physiology.
5. Boorman, K. E: Blood Group Serology, Churchill, and Lincoln, P. J. (1988)
6. Race, R. R. and Sangar, R. Blood Groups in Man. Blackwell Scientific, Oxford.
7. Saferstein, R. (1982): Science Handbook, Vol. I, II and III, Prentice Hall,
8. Barris, H. and Hopkinson, D. A. (1976): Handbook of Enzyme, Electrophoresis, Elsevier, North, Holland, New York.
9. Gilblet, E. (1969): Marker's in Human Blood, Davis, Pennsylvania.
10. Culliford, B. E. (1971), the examination and Typing of Blood Stains, US Dept. of Justice, Washington.
11. Chowdhuri, S. (1971): Forensic Biology, BPR&D, Govt. of India.
12. Dunsford, I. and Bowley, C. (1967): Blood Grouping Techniques, Oliver & Boyd, London.
13. Eckert, W. G. & James, S. H. (1989): Interpretation of Blood Stain, Evidence, Elsevier, New York.
14. Coyle, H. M, Forensic Botany, CRC Press Working procedure manual: Biology/Serology; DFS, New Delhi.
15. Mary Alice Walker, Entomology and Palynology (Solving Crimes with Science: Forensics) Mason Crest Publisher.
16. Essential Forensic Biology, Alan Gunn, Wiley

**PG Course in Forensic Science**  
**Semester –I**                      **FSPALT1**  
**Lab:01- Crime Scene Management**

**Maximum Marks: 100**

**Allotted credits: 03**

1. Evaluation of Crime scene and photographs
2. Searching of physical evidence at crime scene.
3. Collection of evidence with individual characteristics: (1) Fingerprints (2) Tire tracks and foot impressions
4. Analysis of pattern Blood stain pattern, Fire pattern
5. Lifting of prints and impressions by caste and replicas.
6. Sole prints comparison and their lifting from the scene of crime.
7. Collection, packing and preservation of biological evidences
8. Reconstruction of crime scene
9. Preparation of report of the examination.

**Two year PG Course in Forensic Science**

**Semester – 1**

**FSPAL06**

**Lab- 02 : Practicals Based on Forensic Biology and Serology**

**Maximum Marks: 100**

**Allotted Credits: 03**

1. PBMC isolation and cell counting by hemocytometer.
2. ABO blood grouping.
3. Presumptive and confirmatory test of semen.
4. Presumptive and confirmatory test of blood.
5. Starch iodine test of saliva.
6. Immunodiffusion techniques.
7. Forensic report writing.
8. Identification of developmental stage of housefly.
9. Age estimation of plant by analysis of Annual Ring.

**M.Sc. Forensic Science**  
**Semester –I** **FSPAST1**  
**Seminar**

**Maximum Marks: 50**

**Allotted credits: 02**

**Seminar based on Recent trends in Research related to topics taught in current Semester.**



## **M.Sc. Forensic Science**

**Semester –II**

**FSPBTT1**

### **Questioned Documents and Fingerprints (CORE-5)**

**Maximum Marks: 100**

**Allotted credits: 03**

#### **UNIT I**

Nature and problems of Document examination, Classification of documents, Types of Forensic Documents; Collection of questioned Documents, Specimen and Requested handwriting, handling, preservation, marking and forwarding of documents to the laboratory; Writing instruments and their characteristics. Characteristic features in Handwriting: Principles of handwriting Identification, Comparison, Class and Individual Characteristic of Handwriting, Factors affecting hand writing.

#### **UNIT II**

Forgery, Types of Forgery, Examination of Forgery, Examination of Signature characteristics, Age determination of documents, Alterations in Documents, Examination of Paper & Ink, Examination of typed documents, Examination of Seal, rubber & other mechanical impressions, Handling and examination of charred documents, Examination of Forged currency notes. Basic tools needed for Forensic document examination, Photography of documents, Principle and Forensic significance of Video Spectral comparator (VSC), Electrostatic detection apparatus (ESDA). Disguised, Indented and secrete writings, Anonymous letters.

#### **UNIT III**

History and development of finger prints, Structure of ridged skin, Composition of Sweat Classification of finger Prints, pattern types, classification of Fingerprints (Primary to key classification), Ridge Counting, Ridge Tracing, and Minutiae Examination, Methods of taking fingerprint from living person: Rolled & Plain Searching of finger print evidence on crime scene.

#### **UNIT IV**

Chance Finger Prints: Conventional methods of development of latent finger prints, Development of Latent fingerprint: Physical, Chemical and Fuming method, Metal Deposition Techniques, Systematic approach to latent print processing, preserving and lifting of finger prints; Photography of Finger Prints, comparison of finger prints. Automatic Finger Print Identification system (AFIS), Expert evidence. Admissibility of Fingerprint, Admissibility of Fingerprint.

## **Recommended Books**

1. Hilton; O. Scientific Examination of Questioned Documents,, Elsevier, NY
2. Albert S. Osborn; Questioned Documents, 2nd Ed., Universal Law Pub., Delhi
3. WilsonR. Harrison; Suspect Documents Their Scientific Examination, Universal LawPub. Delhi Indian
4. Hardless H.R; Disputed Documents, Handwriting and Thumbs–Print identification, profusely illustrated, Law Book, Allahabad
5. Morris Ron N. Forensic Handwriting Identification; Academic Press, London.
6. RoyA Huber, A.M. Headrick; Handwriting Identification-Facts and Fundamental, CRC Press
7. Laboratory working procedure manual, Documents DFS, New Delhi, 2005
8. J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983).
9. D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton (2000).
10. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).
11. Lee and Gaensleen’s, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

**M.Sc. Forensic Science**  
**Semester –II** **FSPBTT2**  
**Forensic Genetics & DNA Profiling**  
**(Core-6)**

**Maximum Marks: 100**

**Allotted credits: 03**

**UNIT-I: Molecular Biology of gene**

DNA: An Introduction to Genetic Material, Structure of DNA, denaturation and renaturation of DNA, DNA binding proteins, factors affecting DNA stability, DNA Damage & repair, Chemical nature of DNA, Replication of DNA in prokaryotes and eukaryotes, genetic code, degeneracy and universality of genetic code, transcription and translation machinery.

**UNIT–II: Human Forensic Genetics**

Elements of human genetics: Introduction, heritability, human genetic variations, human chromosomes, Mendelian inheritances: Dominant inheritance, recessive inheritance, sex-linked inheritances, polymorphic traits; Heritable human diseases; Metabolic/molecular basis and detection of inherited disease, gene mapping; Genetic markers and their forensic significance.

**UNIT-III: DNA fingerprinting**

Biological evidence- Sources collection, characterization and storage; DNA extraction and Quantification; General principles of DNA extraction and quantification; Basic concept of sequence variation-VNTRs, STRs, Mini STRs, SNPs. Detection techniques-RFLP, PCR amplifications, Y- STR, Mitochondrial DNA Evaluation of results, frequency estimate calculations and interpretation, Allele frequency determination, Match probability – Database

**UNIT–IV: DNA fingerprinting Methods and its application**

STR Profiling: Structure of STR loci; The development of STR multiplexes; Detection of STR polymorphisms; Interpretation of result; Assessment of STR profiles: Stutter peaks. Sp. Pull-up; Degraded DNA; Statistical Assessment of STR profiles; estimating the frequencies of STR profiles. History of DNA profiling applications in disputed paternity cases, child swapping, missing person's

identity, civil immigration, limitations of DNA profiling, Analysis of SNP, DNA chip technology- Microarrays Cell free DNA, Use and application of DNA typing in wildlife investigations.

**Recommended Books:**

1. Saferstein, Richard, Hand book of forensics cience, Vol.I, II, (Ed.) Prentice hall, Eaglewood cliffs, NJ;
2. William goodwin, Adrian linacre, Sibtehadi; An Introduction to Forensic Genetics Johnwiley&Son's Ltd, UK.
3. Coyle, H. (Ed.) Non-human DNA typing, International forensic science and investigation series, CRC Press, Bocaraton.
4. Linacre,A.(Ed.)Forensic science in wildlife investigations, International forensic science and investigation Series, CRC Press, Boca Raton.
5. Bruce budowle, Steven.Schutzer, Rogerg. Breeze And Paul S. Keim Microbial Forensics.
6. Niels Morling, Handbook of Forensic Genetics (Forensic Science And Medicine)Humana Press.
7. Johnm.Butlerforensicdnatyping,Secondedition:Biology,Technology,And genetics of STR Markers Elsevier Academic Press.

## M.Sc. Forensic Science

Semester –II

FSPBTT3

### Forensic Chemistry & Toxicology (Core-7)

**Maximum Marks: 100**

**Allotted credits: 03**

#### UNIT I

Forensic chemistry Definition and scope, Introduction to Narcotic drugs, Depressants, stimulants, and Hallucinogens their Active components and method of analysis, Designer Drugs & Anabolic steroids, Analytical methods of analysis of IMFL, Country and Illicit liquor, Denatured spirits and their analysis.

#### UNIT II

Fire and Arson investigation- Methods of flammable oil residues detection from debris; Detection of adulteration in Petrol and Diesel, edible oils, Examination of chemicals used in trap cases, Analysis of metals in cheating cases, Explosives: Introduction, classification and various methods of analysis of Explosives.

#### UNIT III

**Forensic Toxicology:** Definition and scope, Poisons–Definition and Classification. Methods of isolation of poison from Viscera, Collection and Preservation of Viscera and other relevant materials, Analysis of ethyl alcohol and methyl alcohol in biological fluids.

#### UNIT IV

Extraction methods of poisons from viscera, blood and urine. Isolation and identification of Plant Poisons, opium and its derivatives, Benzodiazepine tranquilizers, Metallic Poison, Insecticides and Pesticides. Basic concepts of Poisonous Mushrooms, Poisonous fungi, Food Poisoning, Common vegetable abortifacients, Animal poison, Snake venom.

#### Recommended Books:

1. Khan, JaVed I., Ho, Mat H. Analytical Methods in Forensic Chemistry. New York: Working Procedure Manua Chemistry/Toxicology/Explosives/Narcotics, DFS Pub. New Delhi
2. Kennedy, Thomas J., Christian, Jr., Donnell Basic Principles of Forensic Chemistry, Springer
3. Saferestein, Criminalistics: An Introduction to Forensic Science. Prentice Hall

4. Maudham.B.et.al; Vogel's Textbook of Quantitative Chemical. Analysis, Longman
5. John D. DeHaan ; Kirk's Fire Investigation, Prentice Hall Eaglewood Cliffs, N.J
6. Yinon J; Modern Methods & Application in Analysis of Explosives, John Wiley.
7. C.A. Watson; Official and standardized Methods of Analysis. Royal Society of Chemistry, UK.
8. Goutam, M. P. and Goutam S Analysis of Plant Poison, Selective & Scientific Books, New Delhi.
9. Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi.
10. Curry A.S; Analytical Methods in Human Toxicology, Part II, CRC Press Ohio
11. Clark, E.G.C.; Isolation and Identification of Drugs, Vol I&II, Academic Press, Sunshine I; Year book of Toxicology, CRC Press Series, USA
12. Michael J. Deverlanko et al: Hand Book of Toxicology CRC Press, USA.
13. Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology. CBS Pub. New Delhi.

**M.Sc. Forensic Science**  
**Semester –II** **FSPBTT4**  
**Forensic Anthropology**  
**(Core-8)**

**Maximum Marks: 100**

**Allotted credits: 03**

**UNIT –I: Introduction to Anthropology**

History of Anthropology. Definition and scope of Physical/Biological Anthropology The scope of anthropology (Paleoanthropology, skeletal biology and human osteology, Paleopathology and Bio-archeology, Forensic Anthropology), Fundamental of Physical/Biological Anthropology: Human evolution Fossils evidence of Human Evolution, Human variation. Concepts of Medical Anthropology, Dental Anthropology, Forensic Anthropology and Sports Anthropology.

**UNIIT II: Forensic Anthropology**

Forensic Anthropology definition scope and Problems, Human skeleton, comparative skeletal anatomy of human and non-human. Bones- Identification, Classification and determination of Site, Morphological and Anatomical Characteristics, Determination of Age, Sex, Race and Stature determination from skeletal remains: skull, Pelvis, and other bones.

**UNIT- III Personal identification techniques**

Introduction and forensic importance; Significance of somatoscopy, somatometry, osteometry and craniometry in Personal Identification; Portrait Parle/Bertillon system, Facial reconstruction, Super imposition technique.

**UNIT III: Forensic Odontology**

Development and scope, Types of dentitions, Basic structure of human teeth, types of teeth & their morphology. Age determination from teeth: dental anomalies and their role in Personal Identification, Its role in mass disaster and anthropology, Forensic significance of Bites marks: Types & forensic importance; Collection and preservation of samples, analysis of Bite marks, presentation of bite mark evidences in court of law Photography, evaluation and legal significance of bite marks. Role of Forensic Odontology in mass disaster victim identification; Dental Charting; Comparison of Ante-mortem and postmortem dental records



## Recommended Books

1. Bernard H.R. (1940). Research Methods in Cultural Anthropology. Newbury Park: Sage Publications.
2. Davis K. (1981). Human Society. New Delhi: Surjeet Publications.
3. Ember C. R. et al. (2011). Anthropology. New Delhi: Dorling Kindersley.
4. Steven N. Byers Introduction to Forensic Anthropology. Allyn & Bacon.
5. Karen Ramey Burns ,Forensic Anthropology Training Manual, The (2nd Edition) Prentice Hall
6. Debra Komar Jane Buikstra, Forensic Anthropology: Contemporary Theory and Practice , Oxford University Press, USA
7. M. Anne Katzenberg (Editor), Shelley R. Saunders, Biological Anthropology of the Human Skeleton, Wiley-Liss
8. Tim D. White , Michael T. Black, Pieter A. Folkens ,Human Osteology, Third Edition , Academic Press
9. D. Gentry Steele, Claud A. Bramblett, The Anatomy and Biology of the Human Skeleton ,Texas A&M University Press
10. Forensic Dentistry by Paul G. Stimson, Curtis A. Mertz; CRC Press, LLC, 1999.
11. Craniofacial Identification in forensic Medicine, edited by John. G Clement and David. L. Ranso; Oxford University, Press; 1998.
12. Forensic Taphonomy, edited by William D. Haglernd, Marculla H. Sorg; CRC Press, LLC, 1997.
13. Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd

## **M.Sc. Forensic Science**

**Semester –II**

**FSPBTD1**

### **Forensic Psychiatry**

**(Elective-A)**

**Maximum Marks: 100**

**Allotted credits: 03**

**Introduction to forensic Psychology**, Historical Perspective- Indian and Global concern, Roles of Forensic psychology and forensic Psychologist, Introduction to crime, elements of crime, Modus Operandi, Classification of Crime, Types of Crime- Economic crime, organized crime, white collar crime, Crime against women, Juvenile delinquency etc.

#### **UNIT II-**

**Theories of criminal offences** -Theories of Criminal behavior- Biological, Physiological, Economical, Sociological, etc. Theories of punishment (Deterrent, Retributive and Reformative). Criminal profiling, Deductive and Inductive Profiling.

#### **UNIT III –**

**Legal Aspect in Forensic Psychology**, Mental Health Act 1987, Human Rights of mentally ill person, Competency to stand trial, insanity defence, relevant sections of IPC, Correctional measures- rehabilitation of mentally ill, correctional home.

#### **UNIT IV-**

**Assessment and Evaluation-** Clinical Interviews, Mental status Examination, Psychological test, personality test, Intelligence test, Aptitude test etc. Therapeutic approaches – type of therapies ( cognitive behavioural therapy ,Psychodynamic, Humanistic etc)Tools used in Forensic Psychology- Polygraph , Narco-analysis, Brain mapping, Hypnosis, Psychological autopsy

**Recommended Books:**

1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4th Edition, The Foundation Press, Inc., New York (1995).
2. R. Saferstein, *Criminalistics*, 8th Edition, Prentice Hall, New Jersey (2004).
3. J.C. DeLadurantey and D.R. Sullivan, *Criminal Investigation Standards*, Harper & Row, New York (1980).
4. J. Niehaus, *Investigative Forensic Hypnosis*, CRC Press, Boca Raton (1999).
5. E. Elaad in *Encyclopedia of Forensic Science*, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).
6. *Psychology-An Introduction*, Thakkar P., Dr. Ambekar A.,
7. *Introduction to Psychology*, (1986) Morgan C.T., King R.A., Weisz J.R., Schopler J., McGraw-Hill Book Co.
8. *Psychological Interventions of Mental Disorders*, S. K. Shrivastava, Nayanika Singh, Shivani Kant, Edition 1st, 2013, Sarup Book Publishers, PVT. LTD.
9. *'Forensic Criminology'*, Petherick W. A., Turvey B. E., Ferguson C. E., [2010], Elsevier Inc.

**M.Sc. Forensic Science**  
**Semester –II** **FSPBTD2**  
**Wildlife Forensics**  
**(Elective-B)**

**Maximum Marks: 100**

**Allotted credits: 03**

**Unit I**

Wildlife ecology, Definition of wildlife, free living, domestic, captive and feral animals, wildlife conservation and its importance, Zoographic regions and biomes of India, Uniqueness of Indian biodiversity, reason and causes of wildlife depletion, rare ,threatened and endangered species of India.

**Unit II**

Introduction to Wildlife Crimes and its types, Investigation of a wildlife crime scene, Different methods of killing and poaching of wildlife animals, Techniques of Species identification, types of wildlife evidences, wildlife artefacts, tools and techniques of wildlife crime investigation.

**Unit III**

Illegal wildlife trade, Identification of pug marks of different animals, Wildlife Protection Act, 1972, Introduction to Wildlife conservation agencies-WWF, IUCN, CITES, WCCB, Wildlife conservation society, Defenders of Wildlife, Biglite Foundation, International fund for Animal welfare, National wildlife federation, Red Data Book, TRAFFIC.

**Unit IV**

Definition, nature and scope of Forensic entomology. Types of forensic insects, collection of entomological evidence, Insect succession, molecular methods for forensic entomology. Life cycle of Insects.

**M.Sc. Forensic Science**  
**Semester –II** **FSPBLT1**  
**Lab 03: Forensic genetics and DNA profiling**

**Maximum Marks: 100**

**Allotted credits: 03**

1. Extraction and isolation of DNA from body fluid.
2. Extraction and isolation of mitochondrial DNA.
3. Study of DNA-protein interaction study using non-radioactive electrophoretic mobility assay (EMSA)
4. To perform the DNA denaturation and renaturation kinetics.
5. To perform DNA Fragmentation Assay
6. Gender identification using Amelogenin gene PCR amplification.
7. To perform DNA typing using PCR.
8. Detection of Single nucleotide polymorphism in STR alleles.

**M.Sc. Forensic Science**  
**Semester –II, FSPBLT2**

**Lab- 04: Forensic Chemistry and Toxicological  
analysis**

**Maximum Marks: 100**

**Allotted credits: 03**

1. Determination of methanol and ethanol in liquor sample.
2. Analysis of narcotic drugs by TLC
3. Determination of Ethanol and Methanol in alcoholic liquors
4. Examination of inorganic acid in partially burnt clothe
5. Detection of adulterant in vegetable oil
6. Identification of opium/ dhatura alkaloids by TLC
7. Identification of poisonous seeds- Ricinus, Croton and Argemone.
8. Analysis of viscera(simulated sample) for Organo Chloro and Organo Phosphorous pesticides

**M.Sc. Forensic Science**  
**Semester –II** **FSPBLD1**  
**Lab- 05A: Forensic Psychiatry**

**Maximum Marks: 100**

**Allotted credits: 03**

1. To cite a criminal case in which narco analysis was used as a means to detect deception.
2. To review a crime case involving serial murders. Comment on the psychological traits of the accused.
3. To study a criminal case in which hypnosis was used as a means to detect deception.
4. Assessment of intelligence through inventories.
5. Assessment of mental status through interviews.
6. Assessment of personality using EPI.
7. Assessment of personality using MMPI.
8. To prepare a report on relationship between mental disorders and forensic psychology.

**M.Sc. Forensic Science**  
**Semester –II** **FSPBLD2**  
**Lab- 05B: Wildlife Forensics and Entomology**

**Maximum Marks: 100**

**Allotted credits: 03**

- 1.To perform collection and preservation of entomological evidence
- 2.To study the lifecycle of different insect families.
- 3.To perform microscopic examination of hair of wildlife species.
- 4.To prepare the report of wildlife crime investigation.
- 5.To study the cases related to wildlife crimes in Indian scenario.



**M.Sc. Forensic Science**

**Semester –II**

**FSPBST1**

**Seminar**

**Maximum Marks: 50**

**Allotted credits: 02**

**Seminar based on Recent trends in Research related to topics taught in current Semester.**

## **M.Sc. Forensic Science**

**Semester –III**

**FSPCTT1**

### **Computer Forensics and Digital Investigations (CORE-9)**

**Maximum Marks: 100**

**Allotted credits: 03**

#### **UNIT-I: Basics of Computer**

Introduction to computer, Operating System Windows/Unix: Operating system and operating environments DOS, Window 95 and 98, Windows NT, Windows2000, Windows XP, Windows Vista, Windows7andUnix. Limitations of operating system, Networking, LAN, WAN, Internet and their forensic significance.

#### **UNIT-II: Computer Crimes**

Introduction; Classification; Difference between cyber and conventional crimes; Types of cybercrimes– Cyberstalking; Cyber pornography; forgery and fraud; Cyber terrorism; Spamming, Phishing, Privacy and National Security in Cyberspace, Cyber Defamation and hate speech, computer vandalism economic crimes, Internet or another telecommunication. Hacking, computer viruses and investigative techniques.

#### **UNIT-III: Forensics Tools**

Open Source versus Closed Source. Portable Devices & Mobile Phone Forensics, functioning of mobile phone and their operating. Search, Seizure, packaging and transporting of the digital evidence from the scene of crime. Use of Forensic Tool, FTK, Access data Forensic Tool Kit and preparation of the search of computer evidence to preparing court room testimony based upon the examination. Password Recovery Tools.

#### **UNIT-IV: Network Forensics**

Advance practice in Digital Investigation Electronic format and representation in the court as per the Law suit. Fundamentals of current, domain administration; file system management; networked printers; user management; and workstation configuration. Linux Systems, key components of the Linux/UNIX operating system. History of its evolution, selection criteria for Linux/UNIX as an alternative (or cooperative) operating environment in the business world.

#### **Recommended Books:**

1. Relevant sections of Information technology Act 2000.

2. Esharenana, Adoni, Frame works for ICT Policy Government, Social and Legal Issues. Information Science Reference, Harsey, New YORK.
3. Robert C. Newman, Computer Forensics: Evidence Collection and Management Auerbach Publications.
4. Eoghan Casey, Handbook of Computer Crime Investigation: Forensic Tools and Technology, Academic Press
5. Clark, Franklin, and Diliberto, Ken,(1996).Investigating computer Crime, CRC Press, Boca Raton, Florida, USA
6. Tewari, R.K., Sastry, P.K. and Ravikumar, K.V. (2003): Computer Crime & Computer Forensics, Select Publisher, New Delhi.
7. Lang, DavidL.,(2002).Introduction to Computer forensics, CRC Press LLC, Boca Raton, Florida, USA
8. Middleton, Bruce(2001).Cyber Crime Investigator's Field Guide, CRC Press
9. Vacca John R; Computer Forensics, Computer Crime Scene Investigation, Firewall Medial, An imprint of Laxmi Pub.(2002)

**M.Sc. Forensic Science**  
**Semester –III** **FSPCTT2**  
**Forensic Ballistics and Physics**  
**(Core-10)**

**Maximum Marks: 100**

**Allotted credits: 03**

**UNIT- I**

**Ballistics:** Introduction, History and Scope, Internal, External and Terminal Ballistics, Firearms, Definition and Classification, Characteristics and firing mechanism of smooth bored and Rifled firearms (Pistol, Revolver, and Rifles, etc), Classification, nomenclature and construction of country made firearms.

**UNIT -II**

**Ammunition:** Definition, classification and constructional features of different types of Cartridge, Types of primer & priming composition, propellant and their compositions, Bullets, Pellets and wads. Gun Shot Residues (GSR) analysis, Explosives: definition, types and classification of explosives, Arms and Explosives Act, Firearm injuries.

**UNIT- III**

**Forensic Physics:** Definition, area and scope, Types and Characteristics of Tool marks: Glass: Types of glass and their composition, Types and Identification of glass fractures, examination and its forensic significance.

**UNIT- IV**

Forensic analysis of Paint, Soil, Papers, Foot Prints and Tyre Impression, Principle & Technique of Restoration, Itching Reagents, Fibres - Classification and Characteristics examination of fibres, Physical matches of broken objects.

**Recommended Books**

1. Working Procedure Manual Ballistics/Physics, DFS, New Delhi,2005

2. Hatcher Jury & Weller, 1987: Firearm Investigation Identification and Evidence, the University Book Agency, Allahabad.
3. Gunther & Gunther, 1935: The Identification of Firearms, Willies, New York.
4. Jauhri, M. 1980: Monograph on Forensic Ballistics, Govt. of India Publication, New Delhi.
5. Burrad, 1951: The Identification of Firearms and Forensic Ballistics.
6. Sharma, B.R.: Firearms in Criminal Investigation and Trails, 1990.
7. Dimado: Gunshot Wounds, 1987.
8. Kumar K: Forensic Ballistics in Criminal Justice, 1987
9. Raymond C Murray & John C.F Tedrew; Forensic Geology, Prentice Hall NJ.
10. B. Caddy; Forensic Examination of Glass and Paints Analysis and Interpretation ISBN 0784 05749 (2001)
11. Safferstein, R, Handbook of Forensic Science, Vol. I, II, (Ed.) Prentice Hall, Eaglewood Cliffs, NJ.
12. Siegel, J. A., Saukko, P. J. And Knupfer, G.C., Encyclopedia of Forensic Sciences, Academic Publishers, London.
13. Philip Rose; Forensic Speaker Identification, Taylor and Francis, Forensic Science Series, London (2002).
14. Eckert W.G. Introduction to Forensic Sciences, CRC, New York.
15. Nickolls LC; Scientific Investigation of Crime, Butler west, London (1956)

**M.Sc. Forensic Science**  
**Semester –III** **FSPCTT3**  
**Forensic Medicine**  
**(Core-11)**

**Maximum Marks: 100**

**Allotted credits: 03**

**Unit-I**

Forensic Medicine- Definition, Scope and Importance, The Forensic Autopsy, Postmortem changes, Postmortem Hypostasis, Postmortem report, Role of Forensic Pathologist and medicolegal Expert in the investigation of death, collection and preservation of postmortem exhibits.

**Unit II**

Death: Definition, types, and nature Scene Investigation, Introduction to Sudden and unexpected Death, Infanticide, Thermal Deaths, Anesthetic and operative death, Death due to Drowning and Electrocution, Starvation and its types, Asphyxial Death, Time of Death-Time Indicators Bladder content, Stomach Content, Lividity, Cooling of body, Rigor Mortis,

**Unit - III**

Injuries-Definition and Nature, Age of injuries, Ante-mortem and Post mortem, Fatal injuries, Incapacitation. After effects of Fatal injuries, Introduction to Trauma to the human body, Wounds Due to Blunt Trauma. Blunt Trauma Injuries of the Trunk and Extremities, Trauma to the Skull and Brain: Craniocerebral Injuries, Wounds Due to Pointed and Sharp, Edged. Classification -Abrasion, contusion, Bruise, Laceration, Punctured Incised, Gun shot.

**Unit -IV**

Burns-Classification of burns Ante-mortem and Post mortem Burns, Cause of death, Scalding, Electrocution the Effects of Heat & Cold: Hyperthermia & Hypothermia, Deaths Due to Fire, Carbon Monoxide Poisoning.

**Recommended Books**

1. David Dolinak, Evan Matshes , Emma O. Lew .Forensic Pathology: Principles and Practice , Academic Press

2. Dominick DiMaio , Vincent J.M. DiMaio M.D.Forensic Pathology, Second Edition (Practical Aspects of Criminal & Forensic Investigations) CRCPress.
3. Matshes & Dolinak & Lew Forensic Pathology, Principles and Practice 1st Edition Academic Press
4. Jay Dix , Robert Calaluce, M Guide to Forensic Pathology,. CRC
5. Vincent J.M. DiMaio , Suzanna E. Dana Handbook of Forensic Pathology, Second Edition,CRC
6. Richard Shepherd. Simpson's Forensic Medicine, Hodder Arnold;
7. Payne-James, Jason (ed.; et al.) Encyclopedia of Forensic & Legal Medicine. Amsterdam; Boston: Elsevier Academic Press
8. Werner U. Spitz (Author, Editor), Daniel J. Spitz. Spitz and Fisher's Medicolegal Investigation of Death: Guidelines for the Application of Pathology to Crime Investigation [Hardcover] Charles C Thomas Pub Ltd
9. Parikh C.K. Text book of Medical Jurisprudence, forensic medicine and toxicology. CBS Publishers and Distributors , New Delhi
10. Subrahmanyam B.V.; Modi's Medical Jurisprudence & Toxicology, LexisNexis Butterworths, India .

**M.Sc. Forensic Science**  
**Semester –III** **FSPCTT4**  
**Research Methodology and Ethics**  
**(CORE-12)**

**Maximum Marks: 100**

**Allotted credits: 03**

**UNIT- I: Quality Managements**

Elements of a Quality Management System: Quality, Total Quality, Quality assurance, Quality control Quality system. Quality Planning, Quality Audit: Internal and External Audit & MRM, History and development of ISO, Terminology of NABL. Benefits of ISO9000 series of standards. ISO9001 Requirements.

**UNIT –II: Sampling**

Sampling: sampling procedures (random and non-random), sampling statistics, Physical state, homogenization, size and hazards in sampling, Significance of statistics in forensic science. Basic concepts of frequency distribution, measure of central values - Mean, median and mode, measures of dispersion, Range, Mean deviation and standard deviation, Correlation and Regression analysis. Probability- Definition, Theory, Classical and types.

**UNIT- III: Research Methods**

Meaning of research Problem: Research, definition, Objectives of research. Types of research-From the view point of application, Objectives, Inquiry mode. Search for existing literature, hypothesis, Interpretation and report writing.



## **UNIT- IV: Research Ethics**

Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgements and reactions Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, Fabrication" and Plagiarism (FFP), Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

### **Recommended Books:**

1. ISO/IEC/17025:2005, NABL NABL -113, NABL -113A, 131, guidelines of NABL.
2. International Standard on General requirements for the competence of testing and calibration laboratories, 1st Ed., 1999-12-15, ISO/IEC 17025:1999(E). C.G.G.
3. Kothari, C.R. Research Methodology Methods and Techniques. Wiley Eastern Limited, New Delhi.
4. Saferstein R. Forensic Science Handbook I, II, III.
5. William L. Duncan: Total Quality, Key Terms and Concepts.
6. Murray S. Cooper: Quality control in the Pharmaceutical Industry.
7. John T. Rabbitt, Peter A Bergh: The ISO 9000 Book.
8. Willard Merritt, Dean & Settle: Instrumental Methods of Analysis.
9. Jami St. Clair Crime Laboratory Management: Academic Press.
10. Thomas A the Laboratory Quality Assurance system: A manual of Quality Procedures and forms.
11. Ratliff. 2003 3rd ed. John Wiley & Sons.
12. Gary B Clark Systematic Quality Management. Practical Laboratory Management Series.

## **M.Sc. Forensic Science**

**Semester – III**

**FSPCTD1**

### **Forensic Genomics and Proteomics**

**(Elective-A)**

**Maximum Marks: 100**

**Allotted Credits: 02**

#### **UNIT-I: Human Genome organization**

Human genome: Genome project history, organization and goals of human genome project, Mapping strategies, DNA segment nomenclature, Human genome diversity, organization of human genome, Comparative genomics: Overview of prokaryotic and eukaryotic genomes, C-value, number of genes and complexity of genomes, Conservation and diversity of genomes, Comparative genomics as an aid to gene mapping and study of human disease genes.

#### **UNIT-II: Genome analysis**

Structure and organization of eukaryotic genomes- nuclear and mitochondrial; Computational analysis, Databases, Finding STR markers; Tools for genome analysis– PCR, RFLP, DNA fingerprinting, RAPD, SNP detection, SSCP, FISH to identify chromosome landmarks; Human Genome mapping methods, BAC libraries and shotgun libraries preparation, Physical map, Cytogenetic map, Contig map, Restriction map, UCSC browser.

#### **UNIT-III: Recants advances in genome sequencing**

Experimental protocol (Isolation of DNA/RNA), Introduction to sequencing, Maxam and Gilbert method, Sanger Sequencing techniques and applications; Next Generation sequencing (NGS), Introduction to NGS, , quality check, Library Preparations, sequencing reaction); Platform overview (Illumina, 454 (Roche), SOLiD (Life technology), Ion Torrent, Nanopore, PacBio; Types of NGS, DNA-sequencing - Whole genome sequencing, exome sequencing, Deep sequencing, Data Processing and Analysis: Data Quality Check, filtering and Genome assembly and mapping to reference genomes, mapping tools (bowtie, maqetc.), Sequence Alignment formats: Sequence Alignment/Map (SAM) format, Binary Alignment/Map (BAM) format, Application of different sequencing technique, DNA sequence analyser

#### **UNIT-IV: Proteomics**

Overview of protein structure-primary, secondary, tertiary and quaternary structure, Relationship between protein structure and function; Outline of a typical proteomics experiment, Identification and analysis of proteins by 2D analysis, Spot visualization and picking; Tryptic digestion of protein and peptide fingerprinting, Mass spectrometry : ion source (MALDI, spray sources), analyzer (ToF, quadrupole, quadruple ion trap) and detector; Post translational Modifications: Quantitative proteomics, clinical proteomics and disease biomarkers, far western analysis, surface plasmon resonance technique; Protein interaction maps, Protein arrays-definition; applications- diagnostics, expression profiling. Human forensic proteome, Non-traditional Forensics, Proteomics for microbial forensics

### **Recommended text book and Reference books reading**

1. Brown TA (2006) *Genomes*, 3rd Edition, Garland Science.
2. Campbell AM and Heyer LJ (2007) *Discovering Genomics, Proteomics and Bioinformatics*. Benjamin Cummings.
3. Primrose S and Twyman R (2006) *Principles of Gene Manipulation and Genomics*, 7th Edition, Blackwell.
4. Rehm H (2006) *Protein Biochemistry and Proteomics*, 4th Edition, Academic Press.
5. Twyman RM. (2013) *Principles of Proteomics*, Second Edition by Garland Science Taylor & Francis Group New York and London.
6. Liebler DC (2002) *Introduction to Proteomics: Tools for the New Biology*, Humana Press, Totowa NJ. USA.

## **M.Sc. Forensic Science**

**Semester – III**

**FSPCTD2**

### **Forensic Microbiology and Immunology**

**(Elective-B)**

**Maximum Marks: 100**

**Allotted Credits: 02**

**Unit I: Introduction to Forensic Microbiology:** Microbes and Forensic Science: General characteristic of Virus, Bacteria and fungus (Morphology, Nutrition, reproduction & economic importance). Bacteria of Forensic importance. Fungi of forensic importance, Anti-bacterial & Antifungal agents. Forensic Aspects of Biological Toxins. Forensic Analysis of Trace and Unculturable Specimens etc.

**Unit II: Applied Forensic Microbiology:** Biological agents in warfare: Collection, transportation and preservation of microbial forensic samples, Sterilization (Physical & Chemical) Categories of biological weapons; Toxins and their mode of action & identification, laboratory setup, epidemiologic investigation for public health, investigation of suspicious disease outbreak; Biosafety and biosecurity, Bio-surveillance documentation and case studies.

**Unit III: Introductory Immunology:** Introduction to Immune system: Cells and organs of Immune system. Innate immunity: Complement system, phagocytosis, extravasation, Toll like receptors, Host-microbe interaction. Acquired Immunity: B-cell and T-cell proliferation and maturation, Major Histo-compatibility complex (MHC-I & MHC-II), Antigen presentation, Hypersensitivity, Immunization.

**Unit IV: Applied Immunology:** Immunological communication and immunological receptors, Immunological mediators, Humoral & Cell mediated Immunity, Hybridoma technology and monoclonal antibodies. Animal cell culture for immunological research (Cell line, Culture media, Culturing technique & aseptic condition). Scope in forensic immunology, Toxin & drug mediated immune-modulation, Animal model for forensic immunological research. ELISA, Western Blotting, Flow Cytometry.

**M.Sc. Forensic Science**  
**Semester –III** **FSPCLT2**  
**Lab- 01: Forensic Ballistics and**  
**Physics**

**Maximum Marks: 100**

**Allotted Credits:03**

1. Identification of firearms, cartridges, bullets, gunpowder, etc.
2. Matching by comparison microscope bullets and cartridge cases.
3. Lifting of prints and impressions by cast and replicas.
4. Sole prints comparison and their lifting from the crime scene
5. Comparison of Tool Marks
6. Comparison of soil samples by Density gradient tube method.
7. Comparison of broken glass bangles.
8. Restoration of erased identification marks.
9. Physical matching of broken pieces of different objects.
10. Determination of density of glass

**Recommended text book and Reference books reading**

1. Kindt, T. J., Goldsby, R. A., Osborne, B. A., & Kubly, J. (2006). *Kubly Immunology*. New York: W.H. Freeman.
2. Paul, W. E. (1993). *Fundamental Immunology*. New York: Raven Press
3. AK Abbas, (2015), *Cellular and Molecular Immunology*. 8th Edition, Elsevier.
4. Ananthanarayan and Paniker, *Textbook of Microbiology*, 8th Edition.
5. Baveja CP, (2001) *Textbook of Microbiology*. 5th Ed., McGraw Hill Education.

**M.Sc. Forensic Science**

**Semester –III**

**FSPCL08 (A)**

**Lab-03A: Forensic genomics and Proteomics**

**Maximum Marks: 100**

**Allotted credits: 03**

1. Isolation of nuclear and mitochondrial DNA.
2. Analysis of STR markers using PCR.
3. Gene mapping in genetic disease.
4. SNP detection in housekeeping gene.
5. Restriction Mapping
6. Protein isolation from forensic sample for proteomic analysis.
7. Protein separation using SDS and Native PAGE.
8. Collection of protein information from Edman degradation and Mass spectrometry data base using web tools.

**M.Sc. Forensic Science**

**Semester –III**

**FSPCL08 (A)**

**Lab- 03 B: Forensic Microbiology and Immunology.**

**Maximum Marks: 100**

**Allotted credits: 03**

1. Hand on practices of sterilization techniques.
2. Culture Media preparation and sterilization.
3. Four Flame streaking techniques.
4. Bacterial Culture.
5. MTT based toxicity assay.
6. Single and double immunodiffusion.
7. ELISA.
8. Animal Cell Culture.

## **PG Course in Forensic Science**

**Semester-I**

**FSPATO 01**

**Modern advances in Drugs of abuse**

**(Open elective paper)**

**Maximum Marks: 100**

**credits:02**

### **UNIT-I: Introduction to Drugs and its abuse**

Definition and Concept of drug abuse, what constitute drug abuse? Prevalence of drug abuse, Difference between drug abuse, drug dependence and drug addiction, Concept of drug tolerance, Physical and psychological dependency.

### **UNIT-II: Classification of abused drugs**

Classification of abused drugs, Stimulant: Amphetamines, Cocaine, Nicotine, Depressants: Alcohol, Barbiturates- Nembutal, Seconal, Phenobarbital Benzodiazepines –Diazepam, Alprazolam, Flunitrazepam, Narcotics: Opium, morphine, heroin, Hallucinogens: Cannabis & derivatives (marijuana, hashish, hash oil), Steroids, Inhalants

### **UNIT-III: Scope of drug testings and relevant acts**

Drug and cosmetics act 1940, NDPS act, other relevant sections in IPC, prevention of substance abuse, substance use disorder and its treatment, Sports doping, Workplace testing

### **UNIT-IV: Identification methods of abused drugs**

Methods of sample collection, Type of sample: blood, urine, saliva, hair, sweat, breast milk, semen and nails; Abused drugs detection methods: Presumptive tests, color test, immunoassays: Enzyme multiplied immunoassay technique (EMIT), Fluorescence polarization immunoassay (FPIA), Cloned Enzyme donor assay (CEDA), Radioimmunoassay (RIA), Enzyme-linked immune assay (ELISA), Lateral Flow Assay (LFA); Chromatographic techniques: TLC, HPLC, GC; Mass spectrometry: LC-MS, GC-MS; Electrophoretic technique;



### **Recommended Books:**

1. A. Musah (2018) *Analysis of Drugs of Abuse*, Humana Press, New York, NY.
2. Steven B. Karch (2006) *Drug abuse Handbook* 2<sup>nd</sup> edi., CRC Press Taylor & Francis
3. Carl Hart and Charles Ksir (2014) *Drugs, Society, and Human Behavior*, 17<sup>th</sup> Edition, McGraw-Hill Education, 2 Penn Plaza, New York, NY.
4. Raphael C. Wong, Harley Y. Tse (2006) *Drugs of Abuse: Body Fluid Testing*, Humana Press Inc., Totowa, New Jersey
5. Frederick P. Smith, Jay A. Siegel *Handbook of Forensic Drug Analysis* (2005) , Elsevier Academic Press, London , UK

**PG Course in Forensic Science**

**Semester –I**

**FSPCDDT1**

**Seminar**

**Maximum Marks: 50**

**Allotted credits: 02**

**Seminar based on Recent trends in Research related to topics taught in current Semester.**

## **PG Course in Forensic Science**

### **Semester –IV, FSPDTT1**

#### **Recent Advance in Forensic Chemistry**

**Maximum Marks: 100**

**Allotted credits: 03**

#### **UNIT -I**

Analysis of beverages: Alcoholic and non-alcoholic beverages, IMFL, country made liquor, licit and

illicit liquors, Analysis of Proof spirit, Rectified spirit, denatured spirits, Special denatured spirit, Blood alcohol analysis by chemical methods; Significance of blood alcohol, Breath Screening devices

#### **UNIT -II**

Arson: chemistry of fire, pattern of fire, investigation and evaluation of clue material, analysis of arson exhibits by instrumental method, Examination of petroleum products: distillation and fractionation, standard methods of analysis of petroleum products like kerosene, petrol, diesel, lubricating oil, greases.

#### **UNIT -III**

Drugs of abuse: introduction, classification of drugs of abuse, drugs of abuse in sports, designers drugs and their forensic examination. Qualitative and quantitative analysis of Opium and opiates. Forensic examination of precursor chemicals and drugs under NDPS Act 1985

#### **UNIT -IV**

Analysis of trace evidence: cosmetics, dyes, paints, pigments, fibers, oils, fats, greases, soil and industrial dusts, chemicals; Analysis of corrosive chemicals- acids and alkalies; Chemistry and examination of detective dyes uses in trap cases; Examination of cement and concrete, consumer item as gold, silver etc.

#### **Recommended Books:**

1. Clark, E.G.C.: Isolation and identification Drugs, Vol. I and Vol.II, (1986).

2. Vogel's Qualitative Inorganic Analysis (7th Edition) revised by G.Svehia (2nd Impression 2006).
3. Working Procedure Manual – Chemistry, DFS Publications (2005).
4. IS:3752; 1988 Indian Standard Alcoholic Drinks – Methods of Test, First Revision (1988)
5. IS:323-1959, Indian Standard Specification for rectified spirit, revised, 9th reprint, December (1989)
6. The ISI Specification for Kerosene (IS: 1459/1974)
7. The ISI Specification for Motor Gasoline (IS: 2796/2000)
8. The ISI Specification for Diesel (IS: 1460/2000)
9. The Indian Standard Methods of Test for Petroleum Products IS:1448
10. The ISI Specification for Gear Lubricants (IS: 2297/1997)
11. The ISI Specification for Petroleum Hydrocarbon Solvents (IS: 1745/1978)
12. Fire and Arson Investigation, J. Kennedy, Chicago (1962)
13. Forensic Science Hand Book, by Saferstein, R., Printice Hall : N. Jersey, 1982

## **PG Course in Forensic Science**

**Semester – IV**

**FSPD TT2**

### **Paper –II**

#### **Advanced Forensic Toxicology and Pharmacology**

**Maximum Marks: 100**

**Allotted credits: 03**

##### **UNIT- I**

Poisons: Definition, classification, types of poisoning, collection and preservation of toxicological

exhibits in fatal and survival cases, mode of action and its effect on vital functions, specific analysis

plan/ approach to toxicological examination of poisoning samples, significance and concept of forensic

toxicological examination and law relating to poison.

##### **UNIT – II**

Extraction, Isolation/Separation and clean-up procedures of poisons and drugs: using conventional as well as modern techniques, Identification and estimation of following poisons from viscera, blood and urine, Barbiturates Benzodiazepines and its derivatives, Amphetamines. Insecticides/ Pesticides: Organochlorines, organophosphorus and carbamates.

##### **UNIT - III**

Vegetable poisons: Nature, type, mode of action, extraction, isolation, Identification of the Poisonous seeds, fruits and roots. Animal Poisons: Snake venom, composition, site of action, mode of action, effect on the body as a whole, and tests for identifications, Analysis of metallic poisons. Carbon monoxide poisoning: significance, signs and symptoms, methods of diagnosis, tests for identification.

##### **UNIT –IV**

Forensic Pharmacological studies, Ingestion of drugs, absorption, distribution, metabolism, pathways of drug metabolism, drug metabolism and drug toxicity, excretion of drugs and poisons, detection of poisons on the basis of their metabolic studies, interpretation of

analytical data and forming of opinion. Spectrum of Toxic Effects, Dose and Response, Absorption, Distribution, Excretion and Influencing Factors; Dose – Response Relationship – Lethal dose 50, Effective dose 50

**Recommended Books:**

1. Curry, A.S.: Poison Detection in Human Organs, C. Thomas Springfield, Illinois USA, (1963).
2. Clark, E.G.C.: Isolation and identification Drugs, Vol. I and Vol.II, (1986)
3. Working Procedure Manual – Toxicology, DFS Publications (2005)
4. Sunshine, I: Guidelines for Analytical Toxicology Programme, Vol. I, CRC Press, (1950).
5. Michael J. Deverlanko etal: Hand Book of Toxicology CRC Press, USA (1995)
6. Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology. CBS Pub. New Delhi (1999)
7. Goutam,M.P. and Goutam ,S Analysis of Plant Poison,Selective & Scientific Books,New Delhi
8. Balraj S. Parmar etal; Pesticide Formulation, CBS Publishers, New Delhi (2004)
9. Cravey R.H, Baselt, R.C; Introduction to Forensic Toxicology, Biochemical Pub. Davis C A (1981)
10. Niesink RJM; Toxicology- Principles and Applications, CRC Press (1996).
11. Sunshine, I: Handbook of Analytical Toxicology, Press, (1969)

## **PG Course in Forensic Science**

**Semester – IV**

**FSPD TT3**

### **Nano Technology**

**Maximum Marks: 100**

**Allotted credits: 03**

#### **UNIT-1: Basics of nanotechnology**

The role of proteins- amino acids- nucleic acids- lipids and polysaccharides in modern biomaterials. Overview of natural Bio nanomachines: Thymidylate Synthetase, ATP synthetase, Actin and myosin, Opsin, Antibodies and Collagen, basics of nonmarital synthesis, principal of microfluidics, quantum dots, Electrochemical sensors, development of DNA aptamer sensors, optical sensors, colorimetric sensors

#### **UNIT-2: Methods for nanomaterials characterization**

Introduction, Structural Characterization, X-ray diffraction (XRD), Scanning electron, microscopy (SEM), Transmission electron microscopy (TEM), Scanning probe microscopy (SPM). Chemical Characterization, Isothermal chemistry titration (ICT), Surface Plasma Resonance, Circular dichroism, Physical Properties: Thermal stability and lattice constant, Mechanical properties, Optical properties, Electrical conductivity, Ferroelectrics and dielectrics, Superparamagnetic, Emission spectroscopy, luminescence spectroscopy, Raman spectroscopy.

#### **UNIT-3: Biosensors in Forensic Science**

Device for testing in Forensic Science laboratory, Device for drug of abused testing, Device for testing of explosive content, development of sensors based of Lateral Flow, immunoassays based on nanomaterials, biosensors-based methods used for detection of latent fingerprints, pesticides, toxins, venom etc.

#### **UNIT-4: Application of protein and DNA based nanostructures in Forensics**

DNA Aptamer technology and its application in forensics. Protein based nanostructures building blocks and templates – Proteins as transducers and amplifiers of biomolecular recognition events. DNA based nanostructures– Topographic and Electrostatic properties of DNA and proteins – Hybrid conjugates of gold nanoparticles – DNA oligomers

**Learning Outcomes:**

1. Students will be able to understand the basic knowledge of nanomaterial and nanotechnology.
2. They will be able to understand the methods used for nanomaterial characterization.
3. They will also learn basic concepts of sensors-based devices.
4. They will also learn the application of protein and DNA based sensors in forensic sciences.

**Recommended Reading:**

1. Niemeyer.C.M. Mirkin C. A “Nanobiotechnology: Concepts, Applications and Perspectives”, Wiley – VCH, 2004
2. Challa. S.S.R, Kumar, Josef Hormes, Carola Leuschaer,” Nanofabrication Towards Biomedical Applications, Techniques, Tools, Applications and Impact”, Wiley – VCH, 2005.
3. Nicholas. A, Kotov, “Nanoparticle Assemblies and Superstructures”, CRC, 2006.
4. David. S, Goodsell, “Bionanotechnology”, John Wiley & Sons, 2004
5. Surface Plasmon Resonance Based Sensors in Springer Series on Chemical Sensors and Biosensors; Volume Four; Ed.Jiri Homola; Springer, Berlin; 2006
6. Biosensors and modern biospecific analytical techniques, Volume 44 of Wilson & Wilson's Comprehensive Analytical Chemistry; Ed. L Gorton; Elsevier, Amsterdam, London; 2005
7. The Immunoassay Handbook; Ed. David Wild; 3rd ed.; Amsterdam: Elsevier; 2005 11.
8. Alternative Immunoassays; Ed. W P Collins; Chichester: Wiley; 1985
9. Electrochemical Methods: Fundamentals and Applications; Allen J Bard and Larry R Faulkner; Wiley, New York, Chichester: 2nd ed.; 2001



**PG Course in Forensic Science**  
**Semester – X** **FSPDTT4**  
**Recent Advanced Forensic Physics**

**Maximum Marks: 100**

**Allotted credits: 03**

**UNIT – I**

Soil as evidence and challenges to forensic scientist, Composition and types of soil, Methods of examination of Preliminary discrimination methods and Density gradient tube technique. Glass: Types of glass and their composition, examination of glass fractures under different conditions, determination of direction of impact: cone- fracture, rib marks, hackle marks, backward fragmentation, colour and fluorescence, physical matching, density comparison, physical measurements, Refractive index by Refractometer, Elemental analysis, Interpretation of glass evidence.

**UNIT- II**

Tool marks: Types of tool marks: compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks. Physical, chemical and instrumental methods of examination of strings/ropes, fibers, threads & fabrics, Wires/cables, seals, counterfeit coins, Physical match of broken objects. Restoration of erased/obliterated marks in different surfaces.

**UNIT –III**

Forensic analysis of paint: Macroscopic & instrumental analysis like IR spectroscopy, Raman spectroscopy & X-ray diffraction, elemental analysis, Interpretation of Paint evidence.

**UNIT- IV**

Speaker identification and tape authentication: Introduction to techniques of pattern recognition and comparison .Legal aspects. Principle and forensic application of Brain fingerprinting, Narco analysis and Lie detection.

## **Recommended Books**

1. C.E.O Hara and J.W. Osterburg; An Introduction to Criminalistic, Indiana University Press, Blomington.
2. Raymond C Murray & John C.F Tedrew; Forensic Geology, Prentice Hall NJ
3. Working Procedure Manual : Physics DFS, New Delhi Publication (2000)
4. B. Caddy; Forensic Examination of Glass and Paints Analysis and Interpretation ISBN
5. Goutam, S and Goutam, M.P.: Physical Evidences-Introduction & Bibliography on their Forensic Analysis. Shiv Shakti Book Traders, New Delh
6. James Michael Curran, Tachia Natilie Hicks and John S.Buckleton; Forensic Interpretation of Glass Evidence, CRC Press (2000)
7. David A. Crown; The Forensic Examination of Paints and Pigments, Tolyor & Francis,
8. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Kooupfer; Encyclopedia of Forensic Science, Academic Press (2000).
9. Robertson, J and Grieve, M, Forensic Examination of Fibers, CRC.
10. Philip Rose; Forensic Speaker Identification, Taylor and Francis, London.
11. Bengold & Nelson Moryson; Speech and Audio signal processing, John Wiley & Sons, USA (1999)

**PG Course in Forensic Science**  
**Semester – X, FSPD TT5**  
**Recent Advanced Forensic Ballistics**

**Maximum Marks: 100**

**Allotted credits: 03**

**UNIT- I**

Firearms, Definition, History, classification and characteristics of firearms. Examination and identification of fire arms. Identification of origin, improvised/ country-made/ imitative firearms and their constructional features, Velocity and pressure characteristics under different conditions; various types of bullets and compositional aspects, latest trends in their manufacturing and design

**UNIT- II**

Internal Ballistics: Definition, ignition of propellants, shape and size of propellants, manner of burning, Piobett's law, pressure space curve, shot start pressure. various factors affecting the internal ballistics: All burn point, velocity, space curve Le Due's formula, muzzle velocity, factors affecting muzzle velocity, theory of recall External Ballistics: Definition- trajectory drop in the flight of the projectiles force of gravity air resistance-base drag, Yaw, shape of bullet, (Spherical ball, Cylindrical-conical, flat nose, round nose etc), effective range, extreme range. Terminal Ballistics: Definition, behavior of various type of bullets on the target, remaining velocity, stopping power, Ricochet.

**UNIT- III**

Different types of marks produced during firing process on cartridge-firing pin marks, breech face

marks, chamber marks, extractor and ejector marks and on bullet number/direction of lands and grooves, striation marks on the lands and grooves. Class and individual characteristics. Determination of range of fire-burring, scorching, blackening, tattooing and metal fouling, shots dispersion and GSR distribution, time of firing, different method employed, and their limitations Analysis of Gunshot Residues: Mechanism of formation of GSR.

**UNIT -IV**

Firearm injuries: Evaluation of injuries caused due to shot-gun, rifle, handguns and country made firearms, methods of measurements of wound ballistics parameters, post-mortem and ante mortem firearm injuries; Report writing and expert's evidence.

### **Recommended Books:**

1. Arms Act, 1959. And Arms Rule, 1962.
2. Working Procedure Manual: Ballistics, DFS New Delhi Publication, 20005.
3. Bhattacharyya C.N., (2000) Particle Analysis for Detection of Gunshot Residues – A State-of-the-Art Technique, The Indian Police Journal, BPR&D, Vol. XLVII, No. 4, pp. 113-127
4. Burrad, G., (1951) The Identification of Firearm and Forensic Ballistics, Herbert, Jenkins, London.
5. Kumar, K., (1987) Forensic Ballistics in Criminal Justice, Eastern Book Co
6. Davis, J.E., (1958) An Introduction to Tool marks, Firearms and the Striagraph Charles C 7. Thomas, Springfield, Illinois, USA.
8. DiMaio, J.M., (1985) Gunshot Wounds, Elsevier, USA.
9. Feigl, F., (1962) Spot Tests in Inorganic Analysis, Elsevier Publishing Co., Netherlands.

## **PG Course in Forensic Science**

**Semester – IV**

**FSPDTT6**

### **Recent Advancement Questioned Documents**

**Maximum Marks: 100**

**Allotted credits: 03**

#### **UNIT – I**

Questioned Document–Definition, Nature and History of document examination, Classification of Forensic documents-Admitted, Request and Typescript specimens, Holographic documents, Care and Handling of documents, Basic tools needed for Forensic Document Examination - Hand lens, Stereo microscope, Electrostatic detection device (EDD), Video Spectral Comparator (VSC)

#### **UNIT – II**

Handwriting : Principle, General qualities, Writing habits, Individual Characteristics; Factors that causes changes in Handwriting, Systematic Examination of Handwriting; Examination of signatures, Characteristics of genuine and forged signatures; Alteration of Documents, Secret writings, Anonymus writing, Disguised writing, indented writings, Charred documents.

#### **UNIT – III**

Forgery : Various types of forgery and their examination, Determination of sequence of strokes; Age of Documents, Examination and Identification of Paper, Ink, Typescripts, seal, rubber, Carbon copies & other mechanical impressions, counterfeiting and examination of forged currency notes, Presentation of evidence in court.

#### **UNIT -IV**

Photography; Basic principles and techniques of Black & White and colour photography, Cameras and lenses, developments and printing, Different kinds of developers and fixers, Linkage of Cameras and Film negatives, Digital photography, digital water marking & digital imaging, Photogrammetry and videography, crime scene and laboratory photography IR, UV and Portrait photography, Recent developments in photography.

## **Recommended Books:**

1. Ordway Hilton; Scientific Examination of Questioned Documents, Elsevier, NY
2. Albert S. Osborn; Questioned Documents, 2nd Ed., Universal Law Pub., Delhi
3. Albert S Osborn; The Problem of Proof, 2nd Ed., Universal Law Pub. Delhi
4. Charles C. Thomas; I.S.Q.D. Identification System for Questioned Documents, Willy Prior Bates Springfield, Illinois, USA
5. Wilson R. Harrison; Suspect Documents Their Scientific Examination, Universal Law Pub. Delhi Indian Reprint
6. Goutam, Shubhra and Goutam M.P. Physical Evidences- Introduction and Bibliography on their forensic analysis, Shiv Shakti Book Traders, New Delhi.
7. Morris Ron N; Forensic Handwriting Identification, Acad .Press, London (2001)
8. Lerinson Jay; Questioned Documents, Acad Press, London
9. Mcmenamin, G. R; Forensic Linguistics- Advances in Forensic Stylistics, CRC
10. Ellen David; Questioned Documents- Scientific Examination, Taylor & Francis, Washington (1997)
11. H.L. Blitzer and J.Jacobia; Forensic Digital Imaging and Photography, Academic Press (2002)

**PG Course in Forensic Science**  
**Semester – IV                      FSPD TT7**  
**Forensic Photography**

**Maximum Marks: 100**

**Allotted credits: 03**

**Unit I:**

Photography definition and scope, Introduction to Camera, lens, shutter depth of film

**Unit II:**

Videography, Videography for fire and crime scene, motor vehicle accident scene, surveillance photography and photographic aspects of injuries.

**Unit III:**

Basics of Digital photography, digital imaging, resolution, digital cameras, Monitors and scanners.

**Unit IV:**

Crime scene photography, photography of foot and fingerprints, Significance of photography in document examination, Photography in hit and run cases.

**Recommended Books:**

1. David R Redicker: The practical methodology Forensic photography: (second edition) CRC press
2. Duckworth J E: Forensic photography. Springfield I L. Charles C Thomas
3. Samsone SJ: Modern photography for police and fireman, Cincinnati OH WH. Anderson Company. 1971

## **PG Course in Forensic Science**

**Semester – IV                      FSPDTT9**

### **Advanced Forensic Serology & Immunology**

**Maximum Marks: 100**

**Allotted credits: 03**

#### **UNIT-I**

Blood: Composition and functions, collection and species identification, Structure and function of serum proteins, Haemoglobin and its variants, Haptoglobins. Blood groups – history, biochemistry and genetics of ABO, Rh, Mn and other systems. Methods of ABO blood grouping (absorption-inhibition, mixed agglutination and absorption elution) from blood stains and other body fluids/stains viz. menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail. Secretors and non-secretors. Blood groups that make racial distinctions.

#### **UNIT-II**

Analysis of Blood in Forensic Serology: Identification of blood, Chemical test for Blood identification, Species Origin determination in Blood Stains. Blood Pattern Analysis: History of Bloodstain Pattern interpretation, Properties of human blood, Size, Shape and Directionality of bloodstains, Spattered blood, other Bloodstain Patterns, Interpretation of Bloodstain on clothing and footwear.

#### **UNIT-III**

Forensic Identification of Biological Fluids and Stains: Composition of Semen and morphology of spermatozoa, identification of Semen, Qualitative Assays of seminal fluids: Acid phosphatase, microscopic identification of Spermatozoa, Oligospermia and Azoospermia. Identification of Azoospermia Semen stains, Prostate specific Antigen (PSA, P30) as an indicator of Semen. Saliva: Composition, Identification tests

#### **UNIT-IV**

Immunology: Immune system, immune response, innate and acquired immunity and antigens, Immunoglobulin: Types, physio-chemical properties and function, Rising of antisera. Lectins: Forensic significance, buffers and serological reagents, methods of sterilization employed for serological work. Antigen-Antibody Reactions: Precipitation, agglutination, complement, neutralization, immunofluorescence



## **Recommended Books**

1. Working Procedure Manual Serology, DFS, New Delhi.
2. Danniell P. Stites, Abba I. Jerr, Tristram G. Parstow Medical immunology, Ninth edition; Prentice Hall International Inc. 1997.
3. Saferstein, R. (1982): Science Handbook, Vol. I, II, & III, Prentice Hall New Jersey.
4. Stern, C. (1964) : Principles of Human Genetics, Freeman, California.
5. Beerman, K.E.: Blood Group Serology, Churchill, and Lincoln, P.J. (1988)
6. Race, R.R, and Sanger, R. (1975) : Blood Groups in Man. Blackwell Scientific, Oxford.
7. Gilblet, E. (1969) : Markers in Human Blood, Davis, Pennsylvania
8. Culliford, B.E. (1971) The Examination and Typing of Blood Stains, US Deptt. of Justice, Washington
9. Chowdhari, S. (1971) : Forensic Biology, B P R & D, Govt, of India.
10. Dunsford, I and Bowley, C. (1967) : Blood Grouping Techniques, Oliver & Boyd, London