KURUKSHETRA UNIVERSITY, KURUKSHETRA

MASTER OF FORENSIC SCIENCE
(A Self Financing course)

IN THE FACULTY OF LIFE SCIENCES

SCHEME AND SYLLABUS

(Based on CBCS-LOCF Pattern)
(Effective from 2020-21 in phased manner)

DEPARTMENT OF ZOOLOGY

Programme Outcomes (POs) for PG courses of Faculty of Life Sciences

The PG Courses of Faculty of Life Sciences will be able:

1. To acquaint students with recent knowledge and techniques in basic and applied biological sciences.
2. To develop understanding of organismal, cellular, biochemical and environmental basis of life
3. To provide insight into ethical implications of biological research for environmental protection and good laboratory practices and biosafety.
4. To develop problem solving innovative thinking with robust communication and writing skills in youth with reference to biological, environmental and nutritional sciences.
5. To understand application of biotic material in health, medicine, food security for human well being and sustainable development.
6. To impart practical and project based vocational training for preparing youth for a career in research and entrepreneurship in fields of life sciences for self reliance.

Programme Specific Outcomes (PSOs) of the M.Sc. Forensic Science of the Department of Zoology

PSO1   Students will gain knowledge to comprehend with the basics of Forensic Science including resolving the criminal and civil cases by applying fundamental principles of Forensic Science

PSO2   Students will be empowered with skills to identify, examine and evaluate the problems related to Forensic to solve the crime cases.

PSO3   Students will develop subject specific expertise by analytical and experimental work.

PSO4   Students will be capable of using research-based knowledge and research methods with problem solving expertise and robust communication and Scientific inquiry skill with reference to Forensic Science

PSO5   Forensic specialist youth will come out with a thorough knowledge of Ethics and law with all recent developments and emerging trends in Forensic Science.

PSO6   Students will be trained with excellence in Forensic Science for career in teaching, research, industry and independent Forensic Science cases solving capacity personnel.

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Scheme of Examination for M.Sc. Forensic Science (CBCS-LOCF)
w.e.f. the session 2020-2021 in phased manner

Semester wise distribution of course and credits in Forensic Science

Paper No.	Title of the Paper	Nature of paper	Credits	Contact hours per week T + S + P	Term Exam. Marks	Internal Assessment Marks	Total Marks	Exam Duration in Hours
Semester I								
M-FSC 101	General Forensic Science	Core	4	4 + 0 + 0	80	20	100	3
M-FSC102	Instrumental Analysis- I	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 103	Forensic Biology	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 104	Forensic Psychology and Statistics	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 105	Practical (Based on Papers M-FSC 101 & M-FSC 102)	Core	4	0 + 0 + 8	80	20	100	4
M-FSC 106	Practical (Based on Papers M-FSC 103 & M-FSC 104)	Core	4	0 + 0 + 8	80	20	100	4
	Total		**24**	**16+0+16**			**600**	
Semester II								
M-FSC 201	Forensic Chemistry and Toxicology	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 202	Instrumental Analysis II	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 203	Questioned Document Examination	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 204	DNA Profiling	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 205	Seminar	Core	1	0 + 1 + 0		25	25	-
M-FSC 206	Basics of Forensic Science	Open Elective	2	2 + 0 + 0	40	10	50	3
M-FSC 207	Practical (Based on Papers M-FSC 201 & M-FSC 202)	Core	4	0 + 0 + 8	80	20	100	4
M-FSC 208	Practical (Based on Papers M-FSC 203 & M-FSC 204)	Core	4	0 + 0 + 8	80	20	100	4
	Total		**27**	**18+1+16**			**675**	

Summer Training and Project Report (Mandatory) : Minimum Duration 30 days, after examinations of Semester-II in summer vacations during months of May, June and till 15, July.

Semester III								
M-FSC 301	Forensic Ballistics and Explosives	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 302	Computer Forensics and Recent Advances	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 303	Forensic Medicine	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 304	Forensic Anthropology and Biometrics	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 305	Seminar	Core	1	0 + 1 + 0		25	25	-
M-FSC 306	Methods of Solving Forensic Cases	Open Elective	2	2 + 0 + 0	40	10	50	3
M-FSC 307	Practical (Based on Papers M-FSC 301 & M-FSC 302)	Core	4	0 + 0 + 8	80	20	100	4
M-FSC 308	Practical (Based on Papers M-FSC 303 & M-FSC 304)	Core	4	0 + 0 + 8	80	20	100	4
	Total		**27**	**18+1+16**			**675**	
Semester IV								
M-FSC 401	Forensic Physics	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 402	Forensic Dactylography and other impressions	Core	4	4+ 0+ 0	80	20	100	3
M-FSC 403	Forensic Genetics, Serology and Bioinformatics	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 404	Forensic Pharmachology and Drug Analysis	Core	4	4 + 0 + 0	80	20	100	3
M-FSC 405	Practical (Based on Papers M-FSC 401, M-FSC 402 & M-FSC 403)	Core	4	0 + 0 + 8	80	20	100	4
M-FSC 406	Practical (Based on Papers M-FSC 404 & Viva of training report)	Core	4	0 + 0 + 8	Practical = **40 + 50** {report (20)+ Viva (30)}	10	100	4
	Total		**24**	**16+0+16**			**600**	
Grand Total Semester I to Semester IV							**2550**	

T – Theory; S – Seminar; P – Practical
Total Credits: Core 96 + Seminar 2 + Open 4 = 102

SEMESTER – I

Paper: M-FSC 101 (Core)
General Forensic Science
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objectives: The Course aims to give basic knowledge to students about the concepts of Forensic Science. To familiarize students to crime scene management, including the basics of photography. Brief overview of the various sections of the law that are involved during Forensic Investigations.

Course outcomes:
CO1: Students will be able to understand about the history and background of Forensic Science.
CO2: Learners will be able to understand the crime scence managements and knowledge about the handling of crime exhibits.
CO3: Students will be able to describe reconstruction of scene of crime, basic principles of photography and its relevance.
CO4: Students will gain knowledge of the structure of police and judiciary organisations and fingerprints evidences.

Note:
1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Forensic Science : History, basic concept of Forensic Science, development, and need of Forensic Science, branches of Forensic Science. Basic Principles of Forensic Science, Ethics in Forensic Science, Duties of Forensic Scientist. Physical evidence. Organizational setup of Forensic Science Laboratories: CFSL, SFSL, GEQD, DFSS, NICFS, NCRB, Mobile Forensic Science Laboratory.

Crime Scene Managements:: Introduction, characteristics and types of crime scene, Protection and recording of crime scene, 2D and 3D recording methods of Crime Scene, search of physical clues, preservation, chain of custody, packing and forwarding of physical clues, blood pattern analysis.

Unit - II

Forensic Photography- Basic principles and techniques of photography, black and white photography, working of digital camera and basics of digital imaging, lenses, shutters, depth of field, film exposing, development and printing techniques. UV, IR, fluorescence illumination guided photography. digital photography, videography, Surveillance photography. Crime scene and laboratory photography, microphotography.

Unit - III

Criminal Justice System : Structure of Police & Judicial Organizations. Introduction of sections of IPC, IEA, and CrPC 1973 related to inquest, evidence in enquiries and trials, bailable/non-bailable offences, cognizable/ non-cognizable, summon and warrant cases, expert witness, admissibility of Forensic reports in court, expert testimony. Fundamental Rights: Right of Equality (Articles 14 to 18) and Right of Freedom (Articles 19 to 22) as per Constitution of India

Unit - IV

Fingerprints and firearms – Introduction to fingerprints, types, classification & development methods, searching methods, collection and preservation and evaluation, AFIS (Automatic Fingerprint Identifical System). Forensic ballistics**:** introduction to evidence related to firearms, types of firearms, basic components of firearms, cartridges composition, cartridge and bullet comparison.

Suggested Reading material:
1. B.R. Sharma: Forensic Science in Criminal Investigation and Trials, Universal Law Publishing; Fourth edition 2013.
2. David R. Redsicker: The Practical Methodology of Forensic Photography, Second Edition CRC Press, 2001.
3. James, S.H and Nordby, J.J.: Forensic Science: An introduction to scientific and investigative techniques 3rd edit. CRC Press, USA.
4. Nanda, B.B. and Tewari, R.K.: Forensic Science in India: A vision for the twenty first century Select Publisher, New Delhi (2001)
5. Richard Saferstein. Criminalistics: An Introduction to Forensic Science. 10th edit. Prentice-Hall, New Jersey.
6. Upshaw Downs, Swienton A. R.: Ethics in Forensic Science, Academic press. 2012.
7. H.L. Blitzer and J.Jacobia: Forensic Digital Imaging and Photography, Academic Press (2002).

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 101

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	2	2	1
CO2	3	2	2	2	3	3
CO3	3	2	2	2	3	3
CO4	3	1	1	3	2	1
Average	3	1.75	1.5	2.25	2.5	2

CO-PSO MAPPING for M-FSC 101

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3
CO2	3	3	3	2	2	3
CO3	3	3	2	3	2	3
CO4	3	3	3	3	3	3
Average	3	3	2.5	2.5	2.5	3

Paper: M-FSC 102 (Core)	**Total Marks: 100**
Instrumental Analysis- I	**Theory Examination: 80**
Credits: 4	**Internal Assessment: 20**
	Time: 3 Hours

Objective: To familiarize students about the basic analytical techniques which are involved in analysis of evidences encountered in Forensic investigations.

Course outcomes:

CO1: The students will be able to understand about the principle and working of optical and electronic microscope used for characterisation of micro evidences.

CO2: Students will be able to gain knowledge about the concept of different chromatographic techniques which are used to separate chemical compounds.

CO3: students will be aware about the basics of Spectroscopy, sources of radiation, their utility and limitations.

CO4: Student will able to recognize the best suited techniques to be employed for examination of evidence.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

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

Unit - II

Chromatography: Basic principles, types of chromatography. Thin Layer Chromatography-Theory and Instrumentation of TLC, HPTLC, stationary phases, visualization methods, densitometer, applications.

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

High Performance liquid chromatography: Principle and Instrumentation of HPLC, injection system, column structure, detectors for HPLC, advantage and limitations of HPLC; applications.

Unit - III

Spectroscopy: Basic concept, property of EMR, interaction of radiation with matters, components of optical spectroscopy, source of radiations, wavelength selector, optical detectors. UV-Visible, IR and Raman spectroscopy: Principles, instrumentation, single beam and double beam spectrophotometer, interpretation of spectra, qualitative and quantitative analysis. Atomic absorption/ emission spectroscopy: Principle, Instrumentation; types of AAS, ICP-AES, quantitative and qualitative analysis, advantage and limitations of AAS and AES, their Forensic applications.

Unit - IV

Mass Spectroscopy: Principle, instrumentation, ion sources, type of mass anlyser- quadrupole, time of flight, double focusing, tandem mass spectroscopy, detectors for mass spectroscopy ; their applications.

NMR Spectroscopy, Neutron Activation Analysis: Principle, techniques and Forensic application. **X-rays spectroscopy:** Principles of X ray diffraction and X ray florescence technique, their forensic applications.

Suggested Reading material:
1. Barbara Wheeler and Lori J. Wilson. Practical Forensic Microscopy: A Laboratory Manual, Wiley
2. Lee and Caensstem. Advances in Forensic Science, Vol. 2. Instrumental Analysis.
3. B. K. Sharma. Instrumental Methods of Chemical Analysis, Goel Publishing House, 26th Edition (2007).
4. D. A. Skoog, D. M. West, F. James Holler and S. R. Crouch, Fundamentals of Analytical Chemistry, 8th Edition, Thomson, 2004.
5. G.Chatwal and S. Anand, Instrumental Methods of Chemical Analysis, 7th Edition Himalaya Publishing House.
6. Hobart H. Willard, Instrumental Methods of Analysis (Chemistry) Wadsworth Publishing Company.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test, online quiz & ST's.

CO-PO MAPPING for M-FSC 102

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	-	3
CO2	3	2	3	2	2	3
CO3	3	-	2	2	2	2
CO4	3	2	2	2	2	3
Average	3	2.33	2.5	2.25	2	2.75

CO-PSO MAPPING for M-FSC 102

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	3	3	2	2	3
CO3	3	3	2	3	2	3
CO4	3	3	3	3	3	3
Average	3	3	2.75	2.5	2.75	3

Paper: M-FSC 103 (Core)
Forensic Biology
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objective: To make students understand the basics of biological material and its properties to aid in forensic investigations. The subject will also provide information to learners regarding the analysis procedures of various evidences of related to animal or plant origin.

Course Outcomes:

CO1: Students will able to understand microscopic and macroscopic examination of biological samples like hair, fibers, diatoms recovered from crime scene.

CO2: It will explicate the insect development and geographical distribution for assistance in estimating the time since death and locating the probable crime scene.

CO3: It will also provide the information about poaching and hunting of protected animal species and trade in international market.

CO4: Student will be skilled forensic biologists so as to gain the knowledge of forensic analysis of biological evidences to help investigating agencies.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Forensic Biology: Types of biological evidences, identification, collection, preservation and significance of biological evidence. Hair-morphology of hair, hair growth cycle, human and animal hair, and its microscopic examination, determination of origin race, sex, body site. Fibers: classification, characteristics, Forensic anyslsis of animal and plant originat fibers. Blood-Composition and identification, species identification, blood grouping. Composistion and Examination of semen evidences. Sex chromatin.

Biological characterisation of saliva-visual examination, salivary amylase test. Identification of other body fluids like sweat, urine milk, and fecal matter.

Unit - II

Microbial forensic and Entomology:

Forensic Microbiology: Definition, Types and identification of Bacteria and Viruses in Forensic Science, Microbial profiles as identification tools, use of microorganisms in bioterrorism, Anthrax, transmission of HIV as a criminal act, role of microbes in food poisoning**.**

Forensic Entomology: Introduction, general entomology and arthropod biology, insects / invertebrates of Forensic importance, collection of entomological evidence, their life cycle, the role of aquatic insects in Forensic investigations. Insect succession on carrion and its relationship to determine time since death, Insect applications to Medico-legal Entomology

Unit - III

Forensic Botany: Introduction, types, significance, location, collection and Forensic evaluation of botanical evidences such as pollen grains, leaves, seeds etc. Wood- types of wood, soft and hard wood. Identification and comparison. Diatoms: types, lifev cycle, morphology, methods of extraction from tissue and bones, their identification and significance.

Unit - IV

Wild life Forensic: Scope, different protected and endangered species of animals. Wild life crime investigation- procedure, tools and techniques. Wild Life Protection Act-1972 and their schedules & appendix of CITES, animal poaching, animal abuse, wild life trading. Identification of pug marks. Identification of wild life clue materials such as hair, skin, fur, bones, nails, horn, teeth etc by conventional and modern methods. Case studies related to wild life crime.

Suggested Reading Material:
1. Richard Li. Forensic Biology: Identification and DNA Analysis of Biological Evidence, CRC Press.
2. Alan Gunn: Essential Forensic Biology, 2nd Edition, John Wiley and Sons. 2009
3. Eckert, W. G. & James, S.H.: Interpretation of Blood Stain, Evidence, Elsevier, New York (1989).
4. Bruce Budowle, et al.: Microbial Forensics 2nd Edition, Academic Press, Wiley-Blackwell, 2012.
5. Robertson, J. Forensic Examination of Hair. Taylor and Francis, USA. 1996.
6. Heather Miller Coyle, Forensic Botany: Principles and Applications to Criminal Casework. 1st edition, CRC Press; 2004.
7. Jane E. Huffman, and John R. Wallace, Wildlife Forensics: Methods and Applications, Wiley Blackwell. 2011
8. Chowdhari, S., Forensic Biology B.P.R. &D, Govt. of India

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test, online quiz & ST's.

CO-PO MAPPING for M-FSC 103

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	3	3
CO2	3	2	2	3	3	3
CO3	3	2	2	3	3	3
CO4	3	3	3	3	3	3
Average	3	2.5	2.25	3	3	3

CO-PSO MAPPING for M-FSC 103

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	3
CO2	3	2	3	2	2	3
CO3	3	2	3	3	3	3
CO4	3	3	3	3	3	3
Average	3	2.5	2.75	2.5	2.5	3

Paper: M-FSC 104 (Core)   **Total Marks: 100**
Forensic Psychology and Statistics   **Theory Examination: 80**
Credits: 4   **Internal Assessment: 20**
                                                   Time: 3 Hours

Objective: To study the human behavior and importance of psychological analysis in criminal trials and implementation of statistics for veritable reporting of findings.
Course Outcomes:
CO1: The students will be able to undersatand about the role of psychology and psychiatry to resolve the Forensic cases, preparing written psychological reports, interview of criminal.
CO2: The students will aquire skill in scientific methods of interogations like polygraph test and brain mapping etc.
CO3: The study of statistics will aid the students in verifying the laboratory findings, thus establishing the variability of the outcome of any analysis so conducted in Forensic investigations.
CO4: To learn about the research methodology, sampling methods, statistical analysis of data
Note:
1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I
Forensic Psychology: Introduction to Forensic Psychology; scope & ethics; distinction between Forensic and therapeutic evaluation. Genetic basis of Psychology. Legal aspect of Forensic psychology practice.
Forensic Psychiatry: Introduction, classification of mental disorders, Forensic psychiatric examination. Scope of psychiatric examination in criminal and civil cases.

Unit - II
Crime investigation- Types and classification of crimes and criminals, criminal profiling, and modus operandi. Brain Fingerprinting, Polygraph, Hypnosis, Narco Analysis- Principle, technique and their role in criminal justice system. Brain Electrical Oscillation Signature (BEOS), Layered Voice Analysis (LVA), Suspect Detection System (SDS).

Unit - III
Measures of central value: Arithmetic mean, mode and median Definition, calculation and its properties.
Measures of Dispersion:
      a. Range, Interquartile range, Quartile deviation.
      b. Mean deviation and standard deviation.
Correlation: Methods studying correlation – Scatter diagram method, Graphic method, Karl Pearson coefficient of correlation, Rank correlation.
Regression analysis (Regression lines and regression equation.)

Unit - IV

Concept of sampling and sampling methods: Definition and law of sampling, judgment sampling, Random sampling, stratified sampling, systematic sampling, multi-stages sampling and quota sampling.

Test of significance for large samples and small samples.

Chi-square analysis

Analysis of variance

Probability: Law of probability, Theoretical probability distribution: Binomial distribution, Poison distribution, Normal distribution.

Computer in Forensic statistics: MS excel, Data library, Statistical softwares

Suggested Reading material:
1. Bruce A. Arrigo: Introduction to Forensic Psychology, Academic press London.
2. CR Kothari: Research methodology, Methods and Techniques, 2nd edt. New age International Publishers.
3. Daniel, Wayne W. Bio-statistics: A Foundation for Analysis in the Health Sciences, 7th edition. John Wiley, 2000.
4. David L. Shapiro: Forensic Psychology Assessment and Investigative Approach, Allyn and Bacon Publisher.
5. Goon, A.M, Gupta, M.K and Dasgupta: B Fundamental of Statistics Vol. I.
6. Hess, A. K. and Weiner, I. B.: Handbook of Forensic Psychology, John Wiley & Sons.
7. Smoller: Biostatistics and Epidemiology: A Primer for Health and Biomedical Professionals, Sylvia Wassertheil.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 104

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	2	3	2
CO2	2	3	-	2	3	2
CO3	3	2	3	2	-	3
CO4	3	2	3	2	-	3
Average	2.5	2.25	2.66	2	3	2.5

CO-PSO MAPPING for M-FSC 104

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	3
CO2	3	3	2	2	2	3
CO3	3	2	3	2	3	3
CO4	3	2	3	3	3	3
Average	3	2.5	2.75	2.5	2.5	3

Paper: M-FSC 105 (Core)   **Total Marks: 100**
Practical (Based on Papers M-FSC 101 & M-FSC 102)   **External Examination: 80**
Credits: 4   **Internal Assessment: 20**
                                                          Time: 4 Hours

Objectives: The course aims to give practical knowledge to students about the crime scene reconstruction, polygraph test and chromatographic techniques.

Course outcomes:
CO1: Students will be able to understand about the recording methods of crime scene.
CO2: Students will be able to understand the crime scene managements and knowledge about the handling of crime exhibits.
CO3: Students will be gained experimental knowledge on handling of various types of microscopes of Forensic significance.
CO4: Students will be gained experimental knowledge on chromatographic and spectroscopic techniques.

1. Sketching and photography of mock crime scene.

2. Collection, preservation and packing of physical evidences.

3. Reconstruction and evaluation of various mock crime scene e.g. accident, theft etc

4. Report Writing in respect of crime scene.

5. Searching of evidence by Polylight.

6. Evaluation of bloodstain patterns

7. Various types of microscopes – their components and working.

8. To demonstrate polygraph test.

9. Thin layer chromatography

10. Visit to Forensic Science laboratory and preparation of report

11. Estimation of macromolecules by spectrophotometry.

12. Recoding of fingerprints

13. Development of latent fingerprints.

Suggested Reading material:
1. Chemistry Working Manual Directorate of Forensic Science MHA, Government of India.
2. Online manuals contain details of each experiments

Teaching –Learning Process
1. Experimentation
2. Preparing experimentation report
3. Critical analysis by Internal and external assessment System
4. A Forensic Guide for Crime Investigator Nation Institute of Forensic Science, Government of India.
5. Crime Scene Investigation: A Guide for Law Inforcement National Forensic Science Technology Centre (NIST. Gov.)

CO-PO MAPPING for M-FSC 105

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	2	3	2
CO2	3	-	2	2	3	2
CO3	3	3	2	1	2	2
CO4	3	3	2	1	2	2
Average	3	3	2	1.5	2.5	2

CO-PSO MAPPING for M-FSC 105

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	-	2	2
CO2	3	3	3	2	2	2
CO3	3	2	2	2	2	3
CO4	3	2	3	2	-	3
Average	3	2.5	2.75	2	2	2.5

Paper: M-FSC 106 (Core)	**Total Marks: 100**
Practical (Based on Papers M-FSC 103 & M-FSC 104)	**External Examination: 80**
Credits: 4	**Internal Assessment: 20**
	Time: 4 Hours

Objective: The objective of this lab is to make students understand the analysis procedures of different evidences of biological origin.

Course Outcomes:

CO1: Students will be gained practical knowledge on Forensic analysis of biological samples like hair, fibers etc. for personal identification.

CO2: Students will gain practical skills to identify botanical evidences of Forensic interest.

CO3: students will gain practical knowledge of analysis of blood and semen.

CO4: Student will be skilled Forensic Biologists which have the knowledge of Forensic analysis of biological evidences to help investigating agencies.

1. Morphological examination of human and animal hairs

2. Preparation of slide for scale pattern study of hairs

3. Identification of blood by chemical, micro-chemical test and UV-Visible spectrophotometer.

4. Identification of sex from blood samples

5. Detection of species of origin by immune double diffusion method.

6. ABO typing from dried blood stains.

7. Identification of spermatozoa from dried seminal stains

8. Microscopic study of fur and feathers of various birds

9. Pug marks collection and identification

10. Identification of various body fluids e.g. urine, semen, saliva, milk etc

11. Microscopic and chemical examination of different plants, animals fibers

12. Microscopic examination of soft and hard woods

13. Extraction and morphological study of various diatom genera.

Suggested Reading material:
1. Forensic Biology, Working Manual of Directorate of Forensic Science Services MHA, Government of India.
2. Online manuals contain details of each experiments

Teaching –Learning Process
1. Experimentation
2. Preparing experimentation report
3. Critical analysis by Internal and external assessment System

CO-PO MAPPING for M-FSC 106

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	3	3
CO2	3	2	2	2	3	3
CO3	3	3	2	3	3	3
CO4	3	3	2	3	3	3
Average	3	2.5	2	2.5	3	3

CO-PSO MAPPING for M-FSC 106

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	3
CO2	3	3	3	2	2	3
CO3	3	3	3	2	2	3
CO4	3	3	3	3	3	3
Average	3	2.75	3	2.25	2	3

SEMESTER-II

Paper: M-FSC 201 (Core)
Forensic Chemistry and Toxicology
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

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Objective: The objective of this course is to introduce the basics of Forensic Chemistry and Toxicology with special focus on details of adulterants in petroleum products and analytical methods for examination of alcoholic and non-alcoholic beverages and poison analysis from crime exhibits.

Course Outcomes:

CO1: The students will understand about the chemical tests that used in Forensic Chemistry.

CO2: It will also provide information about the general chemistry and analysis of legal and illegal alcoholic substances, evidences related to petroleum products and drugs of abuse.

CO3: The students will learn about the medico legal aspects of different types of toxic substances.

CO4: The students will be skilled in collection, preservation of samples and identification of poisons from different types of biological and non biological materials.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Forensic Chemistry: Introduction, Colour & Spot test, microcrystal tests, inorganic and organic analysis. Analysis of Beverages: alcoholic and nonalcoholic beverages, country made liquor, illicit liquors, detection and estimation of ethanol. Breathe alcohol analyzer. Analysis of trace evidence – cosmetics dyes, pigments, clues of trap cases.

Drug of Abuse: classification of drugs, drugs of abuse in sports. Narcotic drugs and psychotropic substances such as cocaine, cannabis, barbiturates, benzodiazepines, amphetamine, opium, designers drugs. NDPS act.

Unit - II

Analysis of Petroleum Products: Analysis of petrol, kerosene, diesel, lubricants by BIS methods and ASTM methods. Detection of adulterants of Gasoline, Diesel and Engine oils - including parameters like-Flash point, distillation range, density, kinematic -viscosity, smoke point, aniline point. Commodity Act & Petroleum Act. Arson Investigation**:** chemistry of fire, fire pattern, Extraction of fire accelerants from fire debris - Analysis of fire accelerants by UV visible spectrophotometry, TLC, Head Space GC. Analysis of oils and fats, analysis of gold in cheated cases.

Unit - III

Forensic Toxicology: Introduction and scope of Forensic Toxicology, classification of poisons, legal aspects of poisoning, types of poisoning. Antidotes, factors modifying action of poisons, LD-50, ED50, sign and symptoms of common poisons. Collection, preservation of postmortem material for poison analysis; Extraction and isolation methods of poisons from postmortem material.

Unit - IV

General studies and Analysis of vegetable poisons: Abrus, Dhatura, Marking nuts, Nux-vomica, Oleander and Aconite. Snake venoms and insect poisons, Irrespirable gases, food poisoning.

Insecticides and Metallic Poisons: Types of agriculture posions, organo-phosphorous compound, organocholorinated compound, carbamats, pyrethroids, aluminium phosphite and zinc phosphite. Arsenic, mercury, phosphorous: poisoning charecteristics and analysis.

Suggested reading material:
1. C.K. Parikh. Parikh's test book of medical jurisprudence Forensic medicine and toxicology,
2. Dettean J. D. Kirk's Fire Investigation, 5th Ed., Prentice Hall, Eaglewood Cliffs, N.J (2002)
3. EGC Clarke, Analysis of drugs and poisons. 3rd edition. Vol. 1 and 2, pharmaceutical press.
4. Maudham Bassett et al. Vogel's Textbook of Quantitative Chemical Analysis, 6th Ed., Longman Essex (2004).
5. Modi: Textbook of Medical jurisprudence &Toxicology, M.M. Tripathi Publication.
6. R.T. Morrison, R.N. Boyd; Organic Chemistry, 6th Ed., Prentice Hall, New Delhi (2003)
7. S.N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
8. Saferstein, R: Forensic Science Hand Book, Vol I, II and III, Pretince Hall, NI, 1982.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 201

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	3	2
CO2	2	2	2	2	2	2
CO3	3	2	3	2	3	2
CO4	3	-	3	2	3	2
Average	2.75	2	2.5	2	2.75	2

CO-PSO MAPPING for M-FSC 201

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	3	2	2	2	3
CO3	3	3	2	2	3	3
CO4	3	3	3	3	3	3
Average	3	3	2.5	2.25	2.5	3

Paper: M-FSC 202 (Core)   Total Marks: 100
Instrumental Analysis- II   Theory Examination: 80
Credits: 4   Internal Assessment: 20
                    Time: 3 Hours

Objective: To study the basics of biochemical techniques related to Forensic analysis such as DNA amplification, centrifugation, elctrophoresis and immunological techniques used for the analysis of chemical evidences.

Course Outcomes:

CO1: Students will gain knowledge of the basics of DNA extraction and amplification methods.

CO2: To understand basic principles and theory of centrifugation and electrophoresis techniques and their applications.

CO3: The learners will understand the principles and techniques of assay techniques and radio chemical techniques.

CO4: The students will get knowledge of the different immunological techniques and their assistance in Forensic investigations.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Molecular Biology Techniques: Isolation of DNA, RNA, purification, restriction enzymes, PCR –DNA amplification, autoradiography, blotting techniques and Forensic utility.

Cell and tissue culture techniques: pH and buffers, culture media preparations, sterilization techniques.

Unit - II

Centrifugation Techniques: Centrifugation, cold and ultracentrifuges basic principle, instrumentation, G-value & relationship between RPM., applications of analytical centrifugation.

Electrophoresis: Introduction, principles, factors affecting electrophoresis, types of electrophoresis. High and low voltage electrophoresis, capillary electrophoresis. immuno-electrophoresis, SDS-PAGE and iso- electric focusing; their application.

Unit - III

Enzyme Techniques: Enzyme kinetics, enzyme assay techniques such as visible UV spectrophotometric methods, Luminescence method, Radioisotope methods and Immuno-chemical methods.

Radio-chemical Techniques: Radioisotope, nature of radioactivity, detection and measurements of radioactivity and applications.

Unit - IV

Immunochemical Techniques: Introduction, Antigen - antibody reactions - theory and principles, Production of antibodies. Immunoprecipitation and agglutination based techniques such as immunodiffusion, cross over electrophoresis etc. Labeling of Antibodies and their detection methods: ELISA, RIA- their basic principle, techniques and their Forensic applications

Suggested Reading material:
1. Thomas J. Kindt, et al. Kuby Immunology, 6th edition 2001
2. David. L.Nelson & Michael M, Cox Lenninges; Principles of Biochemistry, 4th edition, Freeman Pub. 2005.
3. Keith Wilson & John Walker; Practical Biochemistry- Principles & Techniques, 5th Edition, Cambridge University Press 2000.
4. Peterson: Clinical and Forensic Application of Capillary Electrophoresis, 2001.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 202

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	3
CO2	3	2	2	2	3	2
CO3	3	3	2	2	3	2
CO4	3	3	3	2	3	2
Average	3	2.75	2.5	2.25	3	2.25

CO-PSO MAPPING for M-FSC 202

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	2	3	2	2	3
CO3	3	2	2	2	3	3
CO4	3	3	3	2	3	3
Average	3	2.5	2.75	2	2.5	3

Paper: M-FSC 203 (Core)
Questioned Document Examination
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objective: To familiarize the students, to natures and examination of different questioned documents submitted to the court of Law.

Course Outcomes:

CO1: Student will able to identify the types of questioned documents and their handling processes.

CO2: It will provide information about the principles and of handwriting examination procedure.

CO3: Student will able to recognize the method of examination to be applied in forgeries, printing or other manipulation done to the document

CO4: Student will be skilled in evaluating parameters required to prove or disapprove the authenticity of the document.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Document Examination: Introduction and classification of documents, genuine and forged document, and holographic document. Preliminary examination of documents, ways of procurement, handling and marking of document. Basic tools for Forensic document examination. Ink and paper examination- their types, composition and forensic examination. Various types of writing instruments-ball pen, gel pen, fountain pen, fiber tip pen, Dating documents.

Unit - II

Handwriting: Principle, class and individual characteristics, natural variations, master pattern, Handwriting form. Handwriting forgery, disguise writing, anonimus letter, identification of signature-characteristic of genuine and forged signature, standards for comparison.

Unit - III

Examination of various printing devices and printed document. Photostat, scanned and faxed document examination. Examination of typewriters and typed documents, inkjet printers, laserjet printers, thermaljet printer, dot matrix printer. Identification of printed materials and ink and toner. Working and examination of electronic and daisywheel printer, Cheque writers. Steganography.

Printing processes- introduction and characteristisc -Letterpress, Screen Printing, Intaglio Printing, Digital printing Process.

Unit - IV

Examination of altered documents: Methods and examination of alteration, obliterations, edtion, erasures, secret writing, sequence of strokes, restoration of intended writing and other impressions and charred document. Examination of stamps and seal impressions.

Examination of security documents, fake currency notes, passport, visa, credit cards and ATM. Study of advance techniques for examination of documents such as VSC and ESDA.

Miscellaneous: Photographic techniques to questioned document- Discovery of facts by comparison with known material. Fry test and Daubert standards**,** Report writing, reasons for opinion, presentation of expert evidence on documents case. Concept of database of currency, Passport, VISA.

Suggested Reading Meterial:
1) Ellen, D The scientific examination of Documents, Methods and techniques. 3rd ed., Taylor & Francis Ltd. (2006).
2) Hilton, O. The Scientific Examination of Questioned Document, 1982, Elsaevier North Holland Inc. New York.
3) Huber, A. R. and Headrick, A.M.: Handwriting identification: facts and fundamental CRC Press, (1999)
4) Kelly J.S. and Lindblom B.S. Scientific examination of questioned documents. 2nd edition CRC press.
5) Morris R.N. Forensic Handwriting Identification (fundamental concepts and Principals) 1st edition Academic Press Inc. (2000).
6) Osborn, A. S. Questioned Documents 1929, Boyd Printing Co. Chicago.
7) Wilson R. Harrison; Suspect Documents Their Scientific Examination, Universal Law Pub. Delhi Indian.
8) Mehta, M. K. The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi, Allahabad. 1970.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 203

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	3	-	-
CO2	3	2	2	2	3	2
CO3	2	2	2	2	2	3
CO4	3	2	3	3	2	3
Average	2.5	2	2.33	2.5	2.33	2.66

CO-PSO MAPPING for M-FSC 203

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	3	3
CO2	3	3	3	2	2	3
CO3	3	3	3	2	2	3
CO4	3	2	3	3	3	3
Average	3	2.75	2.75	2.25	2.5	3

Paper: M-FSC 204 (Core)
DNA Profiling
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objective: The objective of this course is to discuss the basics of DNA, methods and techniques involved in DNA profiling. The student would be able to understand the Forensic DNA profiling and its application in criminal and civil cases investigation.

Course Outcomes:

CO1: Students will able to understand the basic structure of human genome and DNA molecules

CO2: To understand various DNA typing methods such as RFLP, STR and SNPs with their limitations and advantages.

CO3: To understand diferent methods of extraction of DNA by conventional and recent methods.

CO4: Students will be capable of performing DNA profiling of any biological samples aiming at investigations.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Introduction of Human Genome: Human chromosomes and karyotype, human nuclear genome. Mutation-types and cause, gens and alleles, human genetics and heredity. Calculation of allele frequencies. Basic structure, types and properties of DNA and RNA, mt DNA, DNA modifying enzymes, restriction enzymes.

Unit - II

Forensic DNA Profiling: History and development of DNA finger printing. Concept of length and sequence variation- VNTRs, STRs, mini STR, SNPs. STR – markers-nomenclature of STR markers.

Methods of DNA profiling: Principle, techniques of RFLP, STR profiling their advantage and limitations. Gender identification: Y-STR and mt-DNA profiling.

DNA Amplification (PCR)- Principle, method, DNA primers, factors affecting PCR, advantage of PCR based techniques over RFLP.

Unit - III

DNA sample preparation: Sample sources for DNA, collection and preservation of samples for DNA testing, conventional and recent methods of DNA extraction (for samples blood, tissue, hair, tooth and bones), separation methods, DNA quality check, DNA Quantitation methods, DNA sequencing. DNA data base- CODIS, STRbase. NGS (New Generation Sequecing Rapid DMNA)

Unit - IV

Nucleic acid hybridization: Preparation of nucleic acid probes for DNA profiling, Single locus and multi locus probes, and cDNA probes; Methods of labeling of DNA probes; detection methods.

Forensic Issues: Degraded DNA, contamination, mixed samples and low copy number. Result interpretation, Quality assurance in DFP testing. Legal standards for admissibility of DNA profiling

Forensic Significance of DNA Profiling: Personal identification, paternity testing, wild life Forensics, veterinary, agriculture and mass disaster. Report writing and presentation of report in case of DNA profiling.

Suggested Reading material:
1. Daniel L. Hartl & Elizabeth W. Jones; Genetics- Principle & Analysis, 4th Ed., Jones & Bartlet Pub. 1998.
2. Jaiprakash G. Shewale, Ray H. Liu Forensic DNA Analysis: Current Practices and Emerging Technologies, CRC Press, 2013
3. John M Butler: Forensic DNA Typing. Elsevier Academic Press.
4. Keith Immen and Norah Rudus, 1997. An introduction to Forensic DNA Analysis. CRC Press, New York.
5. Lee M.C. and Gaenesten, R.E: DNA and other Polymorphism in Forensic Science. Year book Medical Published.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 204

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	3
CO2	3	3	2	2	3	3
CO3	3	2	2	2	3	3
CO4	3	3	3	3	3	3
Average	3	2.75	2.25	2.25	3	3

CO-PSO MAPPING for M-FSC 204

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	3
CO2	3	3	3	2	2	3
CO3	3	3	3	2	3	3
CO4	3	3	3	3	3	3
Average	3	2.75	2.75	2.25	2.5	3

Paper: M-FSC 205 (Core)   Seminar
Credits: 1   **Total Marks: 25**

Objective:

1. **To develop speaking skills in the students**
2. **To have ability to prepare and present on any topic assigned to them**

Course Outcomes:

CO1: Students will be able to speak on the topic assigned to them after going through related literature

CO2: Students will be able to prepare power point presentations

CO3: Students will have knowledge of different topics of Forensic especially current topics

CO4: Students will be able to comprehend vast topic in limited sphere

CO-PO MAPPING for M-FSC 205

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	3	1	2.5
CO2	2	2	2	2	2	2
CO3	2.5	2.5	2.5	2.5	2.5	2.5
CO4	2	2	2	2	2	2
Average	2.13	1.87	1.87	2.38	1.87	2.25

CO-PSO MAPPING for M-FSC 205

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	1	3	2.5	2.5
CO2	2	2	1	2	2.5	2.5
CO3	2.5	2.5	2	2.5	2	2.5
CO4	2.5	2.5	2	2.5	2	2.5
Average	2.5	2.5	1.5	2.5	2.25	2.5

Paper : M-FSC 206 (Open Elective)
Basics of Forensic Science
Credits: 2

Total Marks: 50
Theory Examination: 40
Internal Assessment: 10
Time: 3 Hours

Objective: To give the basic knowledge to students about the concepts of Forensic Science and introduced about various evidences like fingerprints, hair, blood, drug of abuse etc. used to solve the Forensic cases.

Course Outcomes:
CO1: The subject will introduce students with the history, development and principles of Forensic Science which will assist in efficient handling of evidences in criminal investigations.
CO2: The students will be understood about the methods of crime scene investigation
CO3: To learn about the basics of Fingerprints, their characterization and comparison methods.
CO4: Students will be aware about the evidences related to biology and chemistry used to solve the various crimes.
Note:
1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

History and Development of Forensic Science: Definition and concept of Forensic Science, Scope of Forensic Science, Basic Principles of Forensic Science. Physical evidence introduction and types. Forensic Science Laboratory.
Handling of crime scene: Definition, types of crime scene, protection and recording of crime scene, search of physical clues, collection and preservation of physical clues, chain of custody.

Unit - II

Fingerprints: Introduction, classification of Fingerprints pattern, characteristics,   development methods of Latent Finger Prints, Comparison of Finger Prints.

Unit - III

Forensic Biology: Introduction of evidences related to Biology. Charecteristics and Forensic analysis of blood, hair, semen their significance in crime investigation.
DNA Fingerprinting: Introduction, samples evidence for DNA analysis. General steps of DNA fingerprinting, importance in reconstruction of crime.

Unit - IV

Forensic Chemistry and Toxicology: Introduction of Forensic Chemistry, drugs of abuse, detection of drunken driving. Investigation of death due to poisoning.

Suggested Reading material:
1. B.R. Sharma: Forensic Science in Criminal Investigation and Trials, Universal Law Publishing; Fourth edition 2013.
2. James, S.H and Nordby, J.J.: Forensic Science: An introduction to scientific and investigative techniques 3rd edit. CRC Press, USA.
3. Nanda, B.B. and Tewari, R.K.: Forensic Science in India: A vision for the twenty first century Select Publisher, New Delhi (2001)
4. Richard Saferstein. Criminalistics: An Introduction to Forensic Science. 10th edition Prentice-Hall, New Jersey.
5. B. R. Sharma: Firearms in criminal investigation and trials. Universal Law Publishing; Fourth edition, 2012.
6. R. Saferstein: Forensic Science Handbook, Vol.-I, II, Prentice Hall, NJ, 1988.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprisetest , online quiz & ST's.

CO-PO MAPPING for M-FSC 205

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	2	2	-
CO2	3	2	2	3	2	2
CO3	3	2	2	2	3	3
CO4	3	3	3	2	3	3
Average	3	2.33	2.25	2.25	2.5	2.33

CO-PSO MAPPING for M-FSC 205

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	3	2
CO2	3	2	2	2	2	2
CO3	3	2	3	2	2	2
CO4	3	2	3	2	1	3
Average	3	2	2.5	2	2	2.25

Paper: M-FSC 207 (Core)
Practical (Based on Papers M-FSC 201 & M-FSC 202)
Credits: 4

Total Marks: 100
External Examination: 80
Internal Assessment: 20
Time: 4 Hours

Objective: The objective of this lab is to give practical knowledge to the students on analytical Forensic Chemistry and Toxicology including some biochemical techniques.
Course Outcomes:
CO1: The students will be gained experimental knowledge of various chemical tests that used in Forensic Chemistry.
CO2: Learners will be gained skill on forensic analysis of alcoholic substances, evidences related to petroleum products and drugs of abuse.
CO3: The students will be skilled on using various techniques like TLC and spectroscopy are used for differentiating toxic substances.
CO4: The students will be skilled in identification of poisons from different types of biological and non-biological materials.

1. Preparation of the Normal, Molar and Standard & buffer solutions.

2. Chemical and spectrophotometric analysis of phenolphthalein in trap cases.

3. Tests for metallic poisons- Preliminary and Confirmatory

4. Estimation of ethanol and methanol from blood/ urine samples.

5. Extraction and identification of drugs from blood and urine sample

6. Extraction and identification of insecticides from biological materials.

7. Identification of phosphine by colour tests

8. Determine the density of alcohol by using pyknometer

9. Practical demonstration of petroleum analysis by GLC

10. Screening of common drugs by UV – Vis spectrometry

11. Separation and identification of plant poisons and cometics dyes by TLC

12. To perform chemical tests for plant poisons

13. Demonstration of electrophoresis technique.

14. Preparation of media sterilization techniques maintenance of microbial culture and standard plate count.

Suggested Reading material:
1. Working Manual Forensic chemistry, Directorate of Forensic Science MHA, Government of India.
2. Working Manual Forensic Toxicology. Directorate of Forensic Science MHA, Government of India.
3. Online manuals contain details of each experiments

Teaching –Learning Process
1. Experimentation
2. Preparing experimentation report
3. Critical analysis by Internal and external assessment System

CO-PO MAPPING for M-FSC 207

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	2	-	2
CO2	2	3	-	2	2	2
CO3	3	2	3	2	2	2
CO4	3	2	3	2	2	3
Average	2.5	2.25	2.66	2	2	2.25

CO-PSO MAPPING for M-FSC 207

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	2
CO2	3	3	2	2	2	2
CO3	3	3	3	2	3	2
CO4	3	2	3	3	3	3
Average	3	2.75	2.75	2.5	2.5	2.25

Paper: M-FSC 208 (Core)
Practical (Based on papers M-FSC 203 & M-FSC 204)
Credits: 4

Total Marks: 100
External Examination: 80
Internal Assessment: 20
Time: 4 Hours

Objective: To give practical knowledge of examination of different questioned documents submitted to the court of Law and DNA extraction and quantitation from biological evidences.
Course Outcomes:
CO1: Student will be gained practically skill of analysis of evidence related to questioned handwriting.
CO2: Students will be capable of performing analysis of security documents
CO3: Students will be capable of performing examination different forged documents
CO4: Student will be research oriented and ability to innovate students in the sub domains of document analysis and DNA profiling.

1. Study the general characteristics of handwriting

2. Examination of disgues handwriting.

3. Examination of alteration and obliteration in documents.

4. Detection of simulated and traced forgeries.

5. Examination of security documents.

6. Examination of mechanical and chemical erasure in documents.

7. To examine printed document.

8. To examine intended writing.

9. To examine counterfeit currency.

10. Examination of rubber stamp impressions

11. Examination of typescripts

12. Extraction of DNA from blood etc.

13. DNA Quality check: Agarose gel electrophoresis.

14. DNA Quantitation by UV Spectrophotometry.

Suggested Reading material:
1. Working Manual. Questioned Documents Examination, Directorate of Forensic Science MHA, Government of India.
2. Working Manual. DNA Fingerprinting, Directorate of Forensic Science MHA, Government of India.
3. Online manuals contain details of each experiments

Teaching –Learning Process
1. Experimentation
2. Preparing experimentation report
3. Critical analysis by internal and external assessment System

CO-PO MAPPING for M-FSC 208

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	-	-	2
CO2	3	-	2	-	-	2
CO3	3	2	2	2	3	3
CO4	3	2	2	2	3	3
Average	3	2	2	2	3	2.5

CO-PSO MAPPING for M-FSC 208

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	-	2	3
CO2	3	3	2	-	2	3
CO3	3	2	3	2	2	3
CO4	3	2	3	2	2	3
Average	3	2.5	3	2	2	3

SEMESTER-III

Paper: M-FSC 301 (Core)
Forensic Ballistics and Explosives
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objective: To familiarize students about the nature of evidences concerned with the firearms and ammunition, to identify, handle & examine the evidence and reconstruct the incident of shooting cases.

Course Outcomes:

CO1: To introduce with the classification and characteristics of firearms involved in various crimes.

CO2: To understand the ballistics phenomena use to reconstruction of shooting incidents.

CO3: Student will able to conduct Forensic analysis of firearm evidences such as bullets, cartridges, barrels, GSR etc.

CO4: Students will get know the types, chemistry and examination of evidences related to explosive substances.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

History and Background of Firearms, classification and characteristics of firearms, components of firearms, firing mechanism, smooth bore and rifled bore firearms. Country made firearms: Introduction, constructional features and identification. Ammunition: Classification and composition of cartridges, propellents, cartride case, wads, compositional aspects of various types of bullets and shotgun projectile. Firearms, Data base, Cartirdge & bullet Database.

Unit - II

Forensic Ballistics: Definition and back ground, internal and external ballistics, factors affecting internal and external ballistics such as size, shape and ignition of propellants, barrel length, pressure curve, recoil, ballistics coefficient, air resistance, rifling and bullet stability, measurements of trajectory parameters, ricochet phenomenon.

Terminal Ballistics: Factors affecting wound ballistics, Bullet penetration phenomena, energy concept, stopping power, cavitational effect, characteristics of rifled firearm injury, and smooth bore firearm injury, Forensic evaluation of firearms injury.

Unit – III

Firearms and Ammunition Linkage: Principles, comparison of fired cartridge case and bullets, automated bullet-cartridge identification system – IBIS and NIBIN. Gunshot residues: Introduction, composition and its Forensic evaluation, chemical and instrumental methods of GSR analysis.

Reconstruction of Shooting Incidence: Theory of shooting reconstruction, mathametics of shooting reconstruction, accidental discharge, determination of range and time of fire. Shot pattern testing, laboratory examination of firearms. Law related to examination of firearms in Indian arms act.

<h2 align="center">Unit - IV</h2>

Explosive: Classification, types, firearms database, composition and characteristic of low explosives, primary and secondary high explosive. Black powder, NC, NG, TNT, RDX, PETN, HMX, Dynamite, ANFO, Flexible Sheet Explosives, etc. Detonators, blasting cap, Boosters, Blasting Accessories, explosive train, IEDs and pyrotechniques, explosion process and effects, effects of blast wave on structures and human. Specific approach to scene of explosion, reconstruction of sequence of events, post blast residues, collection, analysis of explosion residues.

Suggested Reading material:
1. B. R. Sharma: Firearms in criminal investigation and trials. Universal Law Publishing; Fourth edition, 2012.
2. J. Schwoeble and David L. Exline: Current methods in Forensic gunshot residue analysis CRC Press, 2000.
3. Karl G. Sellier et al; Wound Ballistics and The Scientific Background, Elsevier Pub. Co.London, 1994.
4. Yinon Jitrin. Modern Methods & Application in Analysis of Explosives, John Wiley & Sons, England, 1993.
5. Exlopsive analysis manual, Directorate of Forensic Science, MHA, Govt. of India
6. Hueske E. E., Practical Analysis and Reconstruction of Shooting Incidents, 2006, CRC Press.
7. Vincent J. M., Di Maio, Gunshot wounds Practical Aspects of Firearms, Ballistics, and Forensic Techniques Second Edit. 1999, CRC Press .

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprisetest , online quiz & ST's.

CO-PO MAPPING for M-FSC 301

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	3	-	2
CO2	3	2	2	3	2	2
CO3	3	2	2	3	2	3
CO4	3	2	2	3	3	3
Average	3	2	2	3	2.33	2.5

CO-PSO MAPPING for M-FSC 301

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	3	2	2	3	3
CO3	3	3	3	2	3	3
CO4	3	3	2	3	3	3
Average	3	3	2.5	2.25	2.75	3

Paper: M-FSC 302 (Core)　　　　　　　　　　Total Marks: 100
Computer Forensics and Recent Advances　　Theory Examination: 80
Credits: 4　　　　　　　　　　　　　　　　Internal Assessment: 20
　　　　　　　　　　　　　　　　　　　　　　Time: 3 Hours

Objective:. The objective of this course is to familiarize the students with various types of computer & cyber crimes, to handle, investigate and to prevent the computer and cyber crime cases, and the laws governing them.

Course Outcomes:

CO1: Student will be able to identify hardware and type of software tools used for commiting crime and other related evidences.

CO2: Students will be aware about numerous methods used for revealing the information needed in cyber crime case such as the recovery of deleted, encrypted or damaged files to reveal information stored in a computer.

CO3: Students will able to understand about requirments for good practices and quality management of Forensic Science Laboratory.

CO4: The distribution and security of intellectual property enlightens the students about the legal guidelines on access and distribution of information.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Computer Crime: Basics of computers, hardware accessories, operating systems (window, Mac, Linux), Computer languages, Knowledge of LAN, MAN, WAN and Fiber optics, IP address, VOIP, File formats, Memory and its types. Methods of data storage, hash function calculation and its importance, Meta data and its relevance in Forensics, server architecture, artificial intelligence.

Computer crimes: Types of computer crime, unauthorized access, program manipulation, software piracy.

Cyber Crime: Definition and classification of cybercrimes. Hacking, virus, obscenity and pornography, encryption and description methods, Investigation of cybercrime: Search and seizure of computer system, computer based evidences. Data recovery, Forensic analysis of electronic data, Tools for analysis, Repot writing.

Unit - II

Fundamental of Computer Security: Risk assessment and mitigation developing secure system, security models, damage control, assessment and auditing, and network security.

Recent advances in Computer Forensics: Computer simulation, stenography and cryptography, Forensic linguistics, e- documents, digital signature. IT act 2000 - Introduction to offences and penalties related to cybercrime..

Unit - III

Image Processing: - Imaging Softwares (Photoshop, Paint etc.), steps of image Processing, Image Enhancement and restoration, The investigation of erased tapes, analysis of signals (Analog video image Processing), Compression, encryption methods.

Cell phone/ Mobile Forensic – Seizing and preserving mobile devices., drones, Robots etc. Methods of acquisition of evidence from mobile devices.

Unit - IV

Quality Management (ISO/ IEC-17025, NABL): Introduction, general requirement for competence of testing, standardization and calibration of Forensic laboratories- Test and calibration methods and their validation, measurements, standards and reference material, traceability, sampling, Proficiency Testing and Review Program, Management and technical requirements for quality assurance.

Forensic nanotechnology, Forensic sensing.

Intellectual property right: Copyright, Patent and trademarks.

Suggested Reading material:

1. Tewari, R.K., et al.: Computer Crime & Computer Forensics selects Publisher, New Delhi, 2003.
2. John R. Vacca: Biometric technologies and verification system, 2007.
3. Anil K. Jain, Rund Bolle, Sharath Rankanli: Biometrics - Personal Identification in networked society, 1999.
4. Vacca John R: Computer Forensics, Computer Crime Scene Investigation, Firewall Medial, An imprint of Laxmi Pub.
5. Casey Eoghan: Handbook of Computer Crime Investigation, Forensic Tools & Technology, Academic Press.
6. L C Jain, H Hallic, I Hayaush, S. B Lee & S Tulsui: Intelligent Biometric Techniques in fingerprint and Face Recognition, CRC Press .

Teaching-Learning Process

- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprisetest , online quiz & ST's.

CO-PO MAPPING for M-FSC 302

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	3	1	2
CO2	3	1	1	2	1	1
CO3	3	2	3	3	2	1
CO4	3	2	3	3	3	3
Average	3	1.5	2	2.75	1.75	1.75

CO-PSO MAPPING for M-FSC 302

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	3
CO2	3	3	3	2	2	3
CO3	3	2	2	3	3	3
CO4	3	2	2	3	3	3
Average	3	2.25	2.5	2.5	2.5	3

Paper: M-FSC 303 (Core)   Total Marks: 100
Forensic Medicine   Theory Examination: 80
Credits: 4   Internal Assessment: 20
                                                               Time: 3 Hours

Objective: The objective of this course is to study the Medico-Legal aspects of death, particularly in establishing the causes of death, establish time since death, legal aspect of injury and sexual offences.

Course Outcomes:

CO1: Student will able to understand cause of death and medico-legal aspects of death in various crimes.

CO2: Student will able to understand about establish time since death, and post-mortem examination.

CO3: To understand various sexual offences and law related to sexual offences, and methods of personal identification in crime cases.

CO4: Student will able to observe and make inference in order to initiate enquiries in criminal matter and medico legal problems.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Forensic Medicine: Cause of death; Aphyxial death- Introduction, characteristics and types of asphyxia death. Machenical asphysia-Hanging, strangulation, suffocation and drowning - starvation: Charecteristics and legal aspects.

Unit - II

Thermal Death: Charecteristics, type, rule of nine, antimortem and post-mortem burn, scald and burn and their medico-legal aspects. Lightning – Electrocution.

Estimation of time since death: Somatic, cellular and brain-death, Suspended animation. Immediate changes- cooling of body, lividity, rigor mortis, cadaveric spasm, cold stiffening and heat stiffening. Late change-purtifaction, adipocere, decomposition, skeletinization. Post-mortem examination, Exhumation.

Unit - III

Injuries: Classification, types and characteristics of mechanical injuries, age of injury, antimortem and post mortem injury, artificial injury, grievous injury, suicidal/accidental/homicidal injuries; causes of death by mechanical, law related to injury and their medicolegal aspects.

Unit - IV

Sexual offences: rape Investigation, unnatural sexual offences, its medicolegal importance, section of IPC related to sexual offences, Amendments in law related to sexual offences. criminal abortion and infanticides. Database of Sexual offenders.

Identification of living and dead person: Living persons- Identification through race and religen, sex, age, stature, complexion and features. External peculariti- mole, birthmarks, occupation marks, scars, tattoo marks and deformities; handwriting and mannerisms, speach and voice. Genetic traits of Forensic significance: Colour blindness, ear lobe, brachydactyly, polydachtyly, eye colour, hair colour etc. Identification of the recently dead and decomposed bodies. Portrait parley/ Bertillon system, superimposition techniques- photographic and video superimposition. Legal aspects.

Suggested Reading material:

1. J. P. Modi: Textbook of Medical jurisprudence &Toxicology, M.M. Tripathi Pub.

2. K. Parikh: Parikh's test book of medical jurisprudence Forensic medicine and toxicology

3. K.S. Narayan Reddy, The Essentials of Forensic Medicine & Toxicology 34th Edition.

4. Anil Aggrawal Forensic Medicine And Toxicology.

5. Simpson's Forensic Medicine 14th Edition, Taylor & Francis

Teaching-Learning Process

- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprisetest , online quiz & ST's.

CO-PO MAPPING for M-FSC 303

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	1	3	2
CO2	3	3	2	1	3	2
CO3	3	3	2	2	3	2
CO4	3	2	3	3	3	3
Average	3	2.75	2.25	1.75	3	2.25

CO-PSO MAPPING for M-FSC 303

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	3	2	2	2	3
CO3	3	3	2	3	3	3
CO4	3	2	2	3	3	3
Average	3	2.75	2.25	2.5	2.5	3

Paper: M-FSC 304 (Core)
Forensic Anthropology and Biometrics
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objectives:
The objective of the course is to explain the basics of human bone growth and structure with focus on methods of assessing age, gender-using teeth and bone relevance of personal identification. The course would also highlight the Forensic morphometric of skeletal remains, and biometric techniques.

Course outcomes:
CO1: Learner will be capable to characterize the human bone and animal bones.
CO2: Student will able to understand techniques for recovering skeletonized human remains and their laboratory analysis
CO3: Student will able to understand the procedure of bone examination to identify the age sex and stature.
CO4: Student will learn methods of personal identification from odontological evidences and various biometric tools and their applications.

Note:
1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Forensic Anthropology: Development of Forensic Anthropology, scope and problems, development and structure of bones, morphological study of human skeleton, comparative study of human and animal skeleton. Techniques for recovering skeletonised human remains.

Osteometry, Craniometry: Introduction, methods and their importance in personal identification, Statistics.

Unit - II

Personal identification from skeleton remain: Determination of race from skull and other bones, determination of race, age, determination of gender and reconstruction of stature from skeleton remains. Assessing Trauma and Time Since Death.

Unit - III

Forensic Odontology: Definition, scope, structural variation and types of teeth. Determination of age and sex from teeth, Gustafson's method, dental anomalies and their significance
Bite Marks: Methods of collection, preservation, recording, comparison and their significance.

Unit - IV

Biometrics: Scopes, biometric characteristics, biometric techniques- data collection, transmission, signal processing, storage, identification. Fingerprint, face, Iris and retina imaging, ear, speech recognition, pattern comparison, termination of human gait pattern in living people. Application of biometric tool.

Facial Reconstruction: Introduction, theory and methods, importance of tissue depth to reconstruct various facial futures, genital and congenital anomalies. Facial Restoration to identify the victims and human bombs in blast cases.

Suggested Reading material:
1. Linda L. Klepinger: Fundamentals of Forensic Anthropology, Wiley-LISS.
2. Bradley J. Adam: Forensic Anthropology. Infobase Publishing
3. B.C. Smith, et al.: DNA & Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA, 1995.
4. L.C. Jain: Intelligent Biometric Techniques in Fingerprint and face recognition, CRC Press Ohio, 1999.
5. S. Hillison: Dental Anthropology, Cambridge Univ. Press, UK 1996.
6. Taylor: Forensic Art and Illustration, CRC Press. 2000
7. James Wayman, Anil Jain, Davide Maltoni Dario Maio. Biometric SystemsTechnology, Design and Performance Evaluation. Springer.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 304

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	2	3	2
CO2	3	2	2	2	3	2
CO3	3	3	2	-	3	2
CO4	3	2	2	2	3	3
Average	3	2.5	2	2	3	2.25

CO-PSO MAPPING for M-FSC 304

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	3	3	2	2	3
CO3	3	3	3	3	2	3
CO4	3	2	2	3	3	3
Average	3	2.75	2.75	2.5	2.25	3

Paper: M-FSC 305 (Core)   Seminar
Credits: 1   **Total Marks: 25**

Objective:
1. **To develop speaking skills in the students**
2. **To have ability to prepare and present on any topic assigned to them**

Course Outcomes:
CO1: Students will be able to speak on the topic assigned to them after going through related Literature
CO2: Students will be able to prepare power point presentations
CO3: Students will have knowledge of different topics of Zoology especially current topics
CO4: Students will be able to comprehend vast topic in limited sphere

CO-PO MAPPING for M-FSC 305

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	3	1	2.5
CO2	2	2	2	2	2	2
CO3	2.5	2.5	2.5	2.5	2.5	2.5
CO4	2	2	2	2	2	2
Average	2.13	1.87	1.87	2.38	1.87	2.25

CO-PSO MAPPING for M-FSC 305

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	1	3	2.5	2.5
CO2	2	2	1	2	2.5	2.5
CO3	2.5	2.5	2	2.5	2	2.5
CO4	2.5	2.5	2	2.5	2	2.5
Average	2.5	2.5	1.5	2.5	2.25	2.5

Paper: M-FSC 306 (Open Elevtive)
Methods of Solving Forensic Cases
Credits: 2

Total Marks: 50
Theory Examination: 40
Internal Assessment: 10
Time: 3 Hours

Objective: The Course aims to provide students with brief overview of the various methods that are involved during Forensic Investigations.

Course Outcomes:
CO1: Student will be able to understand the scientific methods of interrogations like polygraph, narco-analysis etc.
CO2: The student will be able to understand the voice analysis and signification of tool marks in crime investigation.
CO3: The student will able to apply various methods used in personal identification of person.
CO4: The students will able to understand identification of handwriting and signatures.

Note:
1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Methods of Interrogation: Principle, Importance as an investigative tool, methods of Polygraphy, Narco Analysis, Brain Fingerprinting.

Unit - II

Voice Analysis: Voice production, Characteristics of voice, voice comparison methods, Significance of voice nalysis. Case study.

Tool Marks: Types of tool marks, Examination and comparison of tool marks. Bullet and cartridge comparison. Case study.

Unit - III

Methods of Personal Identification: Anthropometry, DNA fingerprinting, facial superimposition, biometrics tools for identification.

Forensic Odontology: Structure and growth of tooth, types of teeth, age determination from tooth. Bite marks analysis.

Unit - IV

Handwriting Examination: Handwriting features, principles of handwriting analysis, type of forgery (simulated and trace forgery), their identification method.

Suggested Reading material:

1. Sharma B.R. (2003) Forensic Science in Criminal Investigation and Trials, Universal Law Publishing Company
2. Smith, B.C. DNA & Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA, 1995.
3. BS Nabar: Forensic Science in Crime Investigation
4. Gaensselen R., Harris H. and Lee H. (2007), Introduction to Forensic Science and Criminalistics, McGraw-Hill Education.
5. Wentworth and Wilder (1948), Personal Identification, R. G. Badger, Boston.

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 306

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	3	-	2
CO2	3	2	2	3	2	2
CO3	3	2	3	3	3	3
CO4	3	3	3	3	2	3
Average	3	2.33	2.5	3	2.33	2.5

CO-PSO MAPPING for M-FSC 306

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	3	2
CO2	3	2	2	2	2	2
CO3	3	2	2	2	2	2
CO4	3	2	3	2	2	2
Average	3	2	2.25	2	2.25	2

Paper: M-FSC 307 (Core)   **Total Marks: 100**
Practical (Based on Papers M-FSC 301 & M-FSC 302)   **External Examination: 80**
Credits: 4   **Internal Assessment: 20**
                                               Time: 4 Hours

Objective: This course will provide practical knowledge of identification and analysis of evidences concerned with the firearms and ammunition, and computer crimes.

Course Outcomes:

CO1: The students will gain practical knowledge of identification of firearms and ammunition involved in various crimes.

CO2: The student will be able to conduct Forensic analysis of evidences related to shooting incidents such as bullets, cartridges, barrels,

CO3: Student will be able to analyze explosive substances.

CO4: Student will able to identify and track suspicious criminal activities going through Email or computer related devices.

1. Examination and Comparison of fired bullets

2. Examination of characteristics of Firearms – Calibre, Choke etc.

3. Examination and Comparison of fired Cartridges/cases.

4. Determination of shot number from size and weight of shots.

5. To perform chemical tests for powder residues and Barrel wash.

6. To determine range of firing.

7. Examination of Firearms injuries

8. Identification of explosives by chemical color test.

9. Identification of explosives by TLC methods

10. Image processing using tools like photoshop, photopaints etc .

11. Email Investigation

12. Phishing case report

13. Creation & verification of Digital Signature

14. Virus attack case report

Suggested Reading material:

1. Working Manual, Forensic ballistic. Directorate of Forensic Science MHA, Government of India.
2. Online manuals contain details of each experiment.

Teaching –Learning Process
1. Experimentation
2. Preparing experimentation report
3. Critical analysis by Internal and external assessment System

CO-PO MAPPING for M-FSC 307

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	2	2	3	1
CO2	2	-	2	2	3	1
CO3	2	2	2	2	-	2
CO4	2	2	2	2	-	2
Average	2	2	2	2	3	1.5

CO-PSO MAPPING for M-FSC 307

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	3
CO2	3	3	3	2	2	3
CO3	3	2	3	2	3	3
CO4	3	2	3	3	3	3
Average	3	2.5	3	2.5	2.5	3

Paper: M-FSC 308 (Core)
Practical (Based on Papers M-FSC 303 & M-FSC 304)
Credits: 4

Total Marks: 100
External Examination: 80
Internal Assessment: 20
Time: 4 Hours

Objectives:
The objective of the course is to explain the basics of human bone relevance of personal identification.

Course outcomes:
CO1: The students will be capable to identify human bone and animal bones.
CO2: Student will able to understand the analysis methods for bone for recovering skeletonized human remains.
CO3: Students will be skilled in bone examination to identify the age, sex and stature of person.
CO4: Student will be gained practical skill on anthropometric measurement of human for personal identification.

1. Morphological identification of Human and animal bones

2. Estimation of stature from long bones

3. To perform craniometric measurements on skull.

4. Lifting identification and comparison of bite marks.

5. Determination of age from skull sutures.

6. Determination of age from Teeth.

7. Determination of sex from skull.

8. Determination of sex from Pelvis.

9. To Perform osteometric measurements on Long bones.

10. To Perform craniometric measurements on skull.

11. To perform somatometric measurement on living.

(a)	Height vertex,	(b)	Head length
(c)	Head breadth	(d)	Foot length
(e)	Foot breadth	(f)	Nasal height
(g)	Nasal breadth	(h)	External biorbital breadth
(i)	Internal bi-orbital breadth	(j)	Bigonial breadth
(k)	Bizygomatic breadth.		

Suggested Reading material:

1. Working Manual Forensic Biology. Directorate of Forensic Science MHA, Government of India.
2. Online manuals contain details of each experiments

Teaching –Learning Process

1. Experimentation
2. Preparing experimentation report
3. Critical analysis by Internal and external assessment System

CO-PO MAPPING for M-FSC 308

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	-	2	3	2
CO2	2	3	-	2	3	2
CO3	3	2	3	2	2	2
CO4	3	2	3	2	2	2
Average	2.5	2.25	3	2	2.5	2

CO-PSO MAPPING for M-FSC 308

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	2
CO2	3	3	2	2	2	2
CO3	2	3	3	2	3	3
CO4	2	3	3	2	3	3
Average	2.5	3	2.75	2	2.5	2.5

SEMESTER IV

Paper: M-FSC 401 (Core)
Forensic Physics
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objective: The students provided with through knowledge of characteristics and analysis of evidence of Forensic importance using basics principles of physics.
Course Outcomes:
CO1: Student will able to conduct Forensic analysis of various evidences related to hit and run cases.

CO2: Student will able to understand detailed Forensic analysis of Glass, paint, fiber and other clues of Forensic significance

CO3: To identify types and composition of building materials and to elucidate the use of tool marks their restorations

CO4: Student will able to understand basics of voice production and comparison methods of voice evidences.

Note:
1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I
Forensic Physics: Introduction and scope, tools and techniques, examination of vehicle in case of road traffic accident, Reconstruction and proactive measures, skid marks evaluation, Collision Investigation and Reconstruction.
Glass: Types of glass and their composition-soda-lime, boro-silicate, safety glass, laminated, light-sensitive, tampered/ toughened, wire glass, coloured glass. Matching and comparison. Forensic examinations of glass fractures- rib marks, hackle marks, cone fracture, wavy, backward fragmentation, concentric and radial fractures. Colour, fluorescence, physical measurements, refractive index, density gradient, becke-line, specific gravity examination and elemental analysis of glass evidence.

Unit - II
Paint: Types of paint and their composition, macroscopic and microscopic analysis of paint pigments, pigment distribution, micro-chemical analysis-solubility test, pyrolysis gas chromatography, TLC, colorimetric analysis, IR spectroscopy and X-ray diffraction, elemental analysis, mass spectrometer, interpretation of paint evidence.
Fibre: Types of fibres, forensic aspects of fibre examination- fluorescence, optical properties, refractive index, birefringence, dye analysis. Physical fit and chemical testing. TLC, IR-micro spectroscopy, Py-MS. Difference between natural and man-made fibres.
Miscellaneous Evidences: Wire, broken bangles, seals, counterfeit coins, ropes/ strings, synthetic fibers etc their introduction & forensic examination.

Unit - III

Building Materials: Cement- composition, types, Forensic Analysis- bromoform test, fineness test, ignition-loss test, Identification of adulterated cement. Mortar and concrete analysis.

Soil: Types and composition of soil, sample preparation, removal of contaminants, colour, molecular particle size distribution, turbidity test, pH measurements, microscopic examination, density gradient analysis, ignition-loss test, elemental analysis, interpretation of soil evidence.

Tool Marks: Theory, types of tool marks, and themselves of forensic examination, Restoration methods of obliterated marks. Methods of Lifting tool marks.

Unit - IV

Voice Analysis and Tape Authentication: Theory of voice production, Anatomy of Vocal tract, theory of voice identification- Resonance and overtones, synthesis of complex waves, Vocal Formants, analysis and recording of voice samples in trap/sting investigation, sound spectrograph, voice comparison -standards and methods of voice comparison.

Suggested reading material:

1. B.R. Sharma, Forensic Science in Criminal Investigation and Trials, Universal Law Publishing; Fourth edition 2013.
2. David A. Crown, The Forensic Examination of Paints and Pigments, Toylor & Francis, NY, 2001.
3. N. Gilbert: Criminal Investigation; Third edition, Macmillan Publishing Company.
4. Noon: Forensic Engineering Investigation, 2000.
5. Saferstein : Forensic Science Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
6. Richard Saferstein. Criminalistics: An Introduction to Forensic Science. 10th edit. Prentice-Hall, New Jersey.

Teaching-Learning Process

- **Lectures :** Supported by power point presentations and related videos
- **Assignments, related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test, online quiz & ST's.

CO-PO MAPPING for M-FSC 401

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	3	3	3
CO2	3	2	2	2	2	3
CO3	2	-	-	2	-	2
CO4	3	2	2	2	3	3
Average	2.75	2	2	2.25	2.66	2.75

CO-PSO MAPPING for M-FSC 401

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	3
CO2	3	3	3	2	2	3
CO3	3	3	3	2	2	3
CO4	3	3	3	2	3	3
Average	3	3	2.75	2	2.25	3

Paper: M-FSC 402 (Core)   **Total Marks: 100**
Forensic Dactylography and other Impressions   **Theory Examination: 80**
Credits: 4   **Internal Assessment: 20**
                                                    Time: 3 Hours

Objective: The objective of this course is to explain the concept of Dactylography and other impression of Forensic significance. The course also aims to discuss the footwear, tyre impressions, lip prints, ear prints and their significance in Forensic investigations

Course Outcomes:

CO1: The student will understand history of dactylography and various classification methods of fingerprints.

CO2: The students will learn the conventional and recent techniques of latent finger prints development.

CO3: Student will be acquainted with the comparison, identification and retrieving fingerprints data which can help in future.

CO4: The students will able to handling and retrieving information from available foot/ tyre impression evidences from different surfaces.

Note:

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

History and development of finger prints: Development of dermal ridges in intra-uterine life. Finger, palm and sole prints, palmer lines and creases. morphology of ridged skin, types, and variations in finger prints: Causes and genetics, population variations. Finger Prints Bureau.

Sample collection: Basics of taking inked prints, collection of prints, samples of living and deads, devices and material for recording prints. Classification of finger Prints, pattern types, pattern area.

Classification systems: Henry system of classification (Primary to tertiary and key classification) extension of Henry system searching of finger prints, , single finger print.

Unit - II

Chance Finger Prints: Latent prints, plastic prints, causes, composition of sweat. Development of latent finger prints on porous and non porous surfaces. Powder methods: such as fluorescent powder, magnetic powder. Fuming methods: Iodine and cynoacrylate methods. Chemical methods: Ninhydrin and its analogue silver nitrate, physical developer, application of laser technologies, metal deposition method. Methods of development of latent prints on skin.

Unit - III

Latent print processing: Systematic approach to latent print processing, preserving and lifting of finger prints. Photography of Finger Prints, comparison of finger prints: Basis of comparison, class characteristics, individual characteristics, various types of ridge characteristics.

Automatic Finger Print Identification system (AFIS) and its variants, digital Image processing of finger prints and their enhancement. Presentation of expert evidence on finger prints in court.

Unit - IV

Foot / footwear/ tyre impressions: Introduction, class and individual characteristics, types, collection, preservation and forensic examination and evaluation of impressions, Gait pattern.

Lip Prints and Ear Prints: Nature, location, collection, Forensic examination, and significance.

Suggested Reading material:

1. B.R. Sharma, Forensic Science in Criminal Investigation and Trials, Universal Law Publishing, 2013.
2. Bridges BC: Criminal Investigation, Practical Finger Printing, Thumb Impressions, Hand writing Expert testimony opinion Evidence, University Book Agency, Allahabad.
3. Cowger, James F: Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, 1993.
4. William J. Bodziak: Footwear Impression Evidence Elsevier Science Publishing Co. New York.
5. R. Saferstein: Forensic Science Handbook, Vol.-I, II, Prentice Hall, NJ, 1988.
6. C. Champod et al. Ridge skin impression, CRC Press, London, 2004.
7. Richard Saferstein. Criminalistics: An Introduction to Forensic Science. 10th edit. Prentice-Hall, New Jersey.

Teaching-Learning Process

- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 402

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	2
CO2	2	-	2	2	2	2
CO3	3	2	2	2	3	3
CO4	3	-	2	3	3	3
Average	2.75	2.5	2.25	2.5	2.75	2.5

CO-PSO MAPPING for M-FSC 402

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	3
CO2	3	3	3	2	2	3
CO3	3	3	3	2	3	3
CO4	3	3	3	2	3	3
Average	3	2.75	2.75	2	2.5	3

Paper: M-FSC 403
Forensic Genetics, Serology and Bioinformatics
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objective: To introduce students about basics of serology and genetics use to solve the Forensic cases. It provide the detailed knowledge of bioinformatics and techniques of various of Forensic significance.

Course Outcomes:
CO1: The students will able to understand genetics use in solving of paternity test and other issue.
CO2: Students will gain knowledge of serological analysis of blood, semen and other biological materials.
CO3: The students will able to understand the blood protein polymorphism and their profiling methods.
CO4: The students will learn about bioinformatics tools for Foresic analysis of various biological materials.
Note:
1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Human Genetics: Human genetic variations. Mendelian Inheritance. Hardy-Weinberg Equilibrium. Mutation- their types and causes. Relevance of population genetics. Allele frequency, genotype frequency. Polymorphism and heterozygosity. Measures of genetic variations.

Unit - II

Forensic Serology: Blood groups – history, biochemistry, biosynthesis of ABO antigen. Genetics of ABO, Rh, MN and other blood group systems. Secretors and non-secretors, rare alleles. Bombay blood group. Blood identification –presumptive and confirmatory assays. Methods of ABO blood grouping from dried blood stains and other body fluids (absorption elusion method, absorption inhibition method and mix-agglutination method), species identification from blood- Double Immunodiffusion Assays, Crossed-Over Electrophoresis.

Unit - III

Forensic Protein Profiling: Erythrocyte Isoenzymes (PGM, GLO-I, ESD, EAP, AK, ADA etc), hemoglobin polymorphism. HLA typing. Role of sero-genetic markers in individualization, paternity disputes, and their limitations.

Identification of Vaginal Secretions and Menstrual Blood: Identification of Vaginal Stratified squamous epithelial cells, vaginal acid phosphatase, and vaginal bacteria

Semen- composition, spermatozoa morphology, presumptive and confirmatory tests for semen-acid phosphatase, prosthetic antigen test (P30), vesicle specific antigen test, RNA based assay.

Unit - IV

Bioinformatics: Introduction to bioinformatics and its application in Forensics Science. Integrated information retrieval. Major databases in bioinformatics. Sequence alignment, Phylogenetic analysis and related tools. Gene identification and prediction. Bioinformatics analysis of DNA Microarray, Bioinformatics tools of Forensic applications, Protein structure prediction and visualization tools. Tools used in proteomics, In-silico simulation for molecular biology experiments. Basic theory of probability and statistics. Bayesian analysis. Likelihood ratio. Statistical evaluation of DNA profiles using Bioinformatics tools.

Suggested study material:

1. Richard Li. Forensic Biology: Identification and DNA Analysis of Biological Evidence, CRC Press.
2. Alan Gunn: Essential Forensic Biology, 2nd Edition, John Wiley and Sons. 2009.
3. Chowdhari, S., Forensic Biology B.P.R. &D, Govt. of India
4. Prakash, M. Physicology of Blood, Anmol Publications, 1998.
5. Gupta, S.K. "Essentials of Immunology", Arya Publications, 2008.
6. Goodwin, William; "An Introduction to Forensic Genetics", John Wiley & Sons Ltd. 2007.
7. Kapur, V. "Basic Human Genetics", Jaypee Brothers, 1991.
8. Kothari, Manu L. "Essentials of Human Genetics", University Press (India) Pvt. Ltd. 2009.

Teaching-Learning Process

- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 403

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	2	2
CO2	3	3	3	2	2	2
CO3	3	3	2	2	2	3
CO4	3	2	3	3	3	3
Average	3	2.75	2.75	2.25	2.25	2.5

CO-PSO MAPPING for M-FSC 403

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	2
CO2	3	3	2	2	2	2
CO3	3	3	2	2	2	3
CO4	3	2	3	3	3	3
Average	3	2.75	2.25	2.5	2.5	2.5

Paper: M-FSC 404 (Core)
Forensic Pharmacology and Drug Analysis
Credits: 4

Total Marks: 100
Theory Examination: 80
Internal Assessment: 20
Time: 3 Hours

Objective: To introduce students about pharmacology of drugs, and also provide the detailed knowledge of chemistry and analysis of various drugs of Forensic significance from various biological and non-biological samples.

Course Outcomes:
CO1: The students will able to understand pharmacokinetics and metabolism of drugs and their metabolic fates of Forensic interest.
CO2: To understand detailed chemistry and analysis methods of narcotics and barbiturates and benzodiazepines.
CO3: The students will able to understand characteristics of stimulants and hallucinogen compounds, and their analysis by spectroscopy and GC- MS.
CO4: The students will learn classical and automated methods of drug analysis from various biological materials.

Note:
1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more selecting one questions from each unit.
3. As far as possible the questions should be divided into sub-parts and marks indicated part wise.

Unit - I

Forensic Pharmacology: Concept of pharmacology, Basic concepts of pharmacokinetics, absorption- First-pass metabolism, bioavailability, Distribution, elimination of drug- drug half life, excretion.

Drug Metabolism- Phase-1 and Phase-2 (conjugation) reactions. Metabolism of ethanol, methanol, Benzodiazepines barbiturates, Amphetamines, heroin, codeine, morphine, detection of metabolits. Factors affecting the pharmacokinetics of drugs. Pharmacodynamics and pharmacogenesis.

Unit - II

Narcotic Drugs and Psychotropic Substances: Classification of narcotic substances, NDPS act. Drugs of abuse. Opiate: extraction of alkaloids from plant materials, analysis of opium alkaloids, datura alkaloids- using spot tests, microcrystal tests, TLC, spectroscopy, GC-MS.

Barbiturates and Benzodiazepines: Chemistry, types, extraction and isolation, characterization by spot tests, TLC, and IR spectrometry, HPLC – MS.

Unit - III

Stimulants and Hallucinogen Compounds: Stimulants - Amphetamines, cocaine, nicotine, caffeine, chemistry and identification. Hallucinogens – cannabis, LSD, psilocybine and mescaline: Introduction, analysis: spot tests, TLC, and IR spectrometry, HPLC – MS, GC- MS.

Unit - IV

Extraction and Purification of Drugs/Poisons from Biological Samples:
Extraction of volatile compounds (distillation methods, head space-GC). Principle of solvent extraction method, extraction and isolation of Neutral nonvolatile compounds, acidic and basic nonvolatile compounds from viscera, blood, urine and hairs - Stas-otto method, Dovbriey Nickolls (Ammonium sulphate) method, acid digest and Valov (Tungstate) methods.

Advanced Methods of Sample Purification: Solid phase extraction, Solid phase micro extraction techniques, liquid phase micro extraction method, Supercritical fluid extraction (SFE) method.

Suggested Reading material:
1. John Joseph Fenton, TOXICOLOGY A Case-Oriented Approach
2. Javed I. Khan • Thomas J. Kennedy: Donnell R. Christian, Jr. Basic Principles of Forensic Chemistry, Humana Press.
3. Lawrence Kobilinsky: Forensic Chemistry Handbook, A John Wiley & Sons, Inc., Publication.
4. Beth E. Zedeck,Forensic Pharmacolog, Chelsea House publisher.
5. EGC Clarke, Analysis of drugs and poisons. 3rd edition. pharmaceutical press
6. Toxicology Manual, Directorate of Forensic Science, New delhi.
7. THE NARCOTIC DRUGS AND PSYCHOTROPIC SUBSTANCES, ACT, 1985.
8. Toxicology Manual Directorate of Forensic Science, MHA Government of India, Scientific and Selective, New Delhi.
9. Recommended Methods for the Identification and Analysis of Barbiturates and Benzodiazepines,United Nations Office on Drugs and Crime Vienna

Teaching-Learning Process
- **Lectures :** Supported by power point presentations and related videos
- **Assignments , related case studies, Minor projects & Mock exercise**
- **Test:** Knowledge of the students is tested through surprise test , online quiz & ST's.

CO-PO MAPPING for M-FSC 404

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	-	2
CO2	3	3	-	2	2	2
CO3	3	3	2	2	2	2
CO4	2	2	3	3	3	3
Average	2.75	2.5	2.66	2.25	2.66	2.25

CO-PSO MAPPING for M-FSC 404

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	3	3
CO2	3	3	3	2	2	3
CO3	3	3	3	2	2	3
CO4	3	3	3	3	3	3
Average	3	2.75	3	2.5	2.5	3

Paper: M-FSC 405 (Core)   **Total Marks: 100**
Practical (Based on Papers M-FSC 401, M-FSC 402 & M-FSC 403)   **External Examination: 80**
Credits: 4   **Internal Assessment: 20**
                                               Time: 4 Hours

Objective: The objective of course is provided a through experimental knowledge of characteristics and analysis of physics evidences of Forensic importance.
Course Outcomes:
CO1: Student will able to conduct Forensic analysis of various evidences related to hit and run cases.

CO2: Student will able to conduct Forensic analysis of Glass, paint, fiber and other clues of Forensic significance

CO3: Student will be research oriented and ability to innovate students in the sub domains of Forensic physics, and pattern analysis.

CO4: The students will be acquainted with the comparison, identification and retrieving data which can help in evaluation of evidences.

1. Physical examination of glass fragments.

2. Density measurement of paints, glass by density gradients methods.

3. Comparison of soil samples using microscopic and density-gradient distribution of particles method.

4. Comparison of tool marks with comparison microscope.

5. Physical and chemical examination of paints.

6. Collection of plain and rolled inked fingerprints and to identify patterns and ridge characteristics.

7. Analyse the finger prints- 1st, 2nd and 3rd level details.

8. Developing and comparison of latent fingerprints with powder, fuming and chemical methods.

9. To prepare cast of foot wear/ tyre impression mark and their comparison.

10. To record foot marks by tracing method.

11. Forensic analysis of blood

12. Forensic analysis of semen

Suggested Reading material:

1. Working Manual Directorate of Forensic Science MHA, Government of India.
2. Online manuals contain details of each experiments

Teaching –Learning Process
1. Experimentation
2. Preparing experimentation report
3. Critical analysis by Internal and external assessment System

CO-PO MAPPING for M-FSC 405

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	2	-	1	2
CO2	1	-	2	2	1	2
CO3	3	3	3	2	3	2
CO4	3	2	3	2	3	2
Average	3	2.5	2.5	2	2.5	2

CO-PSO MAPPING for M-FSC 405

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	2	2
CO2	3	2	3	3	2	2
CO3	3	2	3	3	2	2
CO4	3	2	3	3	3	2
Average	3	3	3	3	2	2

Paper: M-FSC 406 (Core)   **Total Marks: 100**
Practical (Based on Papers M-FSC 404 & Viva of Training Report)   **External Examination: 40**
Credits: 4   **Internal Assessment: 10**
                                                 Viva-Training Report : 50
                                                 Time: 4 Hours

Objective: To give practical knowledge of drugs analysis in cases of drugs of abuse of Forensic significance.

Course Outcomes:

CO1: The students will be able to understand basics of drugs identification according to NDPS act.

CO2: The students will be skilled Forensic chemist which could be handle modern techniques use for analysis of narcotics and psychotropic substances.

CO3: The students will be learned classical and automated methods of drug analysis from various biological materials

CO4: Student will be research oriented in the various area of Forensic Science.

1. Systematic identification of Narcotic Drugs and Psychotropic substances (opiates, cannabis and barbiturates, benzodiazepines and amphetamines) by spot colour tests.
2. Thin layer chromatographic analysis of NDPS substances.
3. U.V/Vis spectrophotometric analysis of barbiturates, benzodiazepine and amphetamines.
4. IR/FTIR analysis of drug of abuses.
5. Identification of vegetable poisons through microscopy.
6. Systematic analysis of plant alkaloids (Opium, Datura, Nicotine).

Suggested Reading material:

1. Working Manual, Directorate of Forensic Science Servies, MHA, Government of India.
2. Online manuals contain details of each experiments

Teaching –Learning Process

1. Experimentation
2. Preparing experimentation report
3. Critical analysis by Internal and external assessment System

CO-PO MAPPING for M-FSC 406

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	-	1	2
CO2	2	2	2	-	1	2
CO3	2	2	3	2	2	2
CO4	2	2	3	2	2	2
Average	2	2	2.5	2	1.5	2

CO-PSO MAPPING for M-FSC 406

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	2
CO2	3	3	3	2	2	3
CO3	3	3	3	2	2	3
CO4	3	3	3	3	2	3
Average	3	3	3	2.25	2	2.75

CO-PO-PSO mapping matrix for all the courses of M.Sc. Forensic Science

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
M-FSC 101	3	1.75	1.5	2.25	2.5	2	3	3	2.5	2.5	2.5	3
M-FSC 102	3	2.33	2.5	2.25	2	2.75	3	3	2.75	2.5	2.75	3
M-FSC 103	3	2.5	2.25	3	3	3	3	2.5	2.75	2.5	2.5	3
M-FSC 104	2.5	2.25	2.66	2	3	2.5	3	2.5	2.75	2.5	2.5	3
M-FSC 105	3	3	2	1.5	2.5	2	3	2.5	2.75	2	2	2.5
M-FSC 106	3	2.5	2	2.5	3	3	3	2.75	3	2.25	2	3
M-FSC 201	2.75	2	2.5	2	2.75	2	3	3	2.5	2.25	2.5	3
M-FSC 202	3	2.75	2.5	2.25	3	2.25	3	2.5	2.75	2	2.5	3
M-FSC 203	2.5	2	2.33	2.5	2.33	2.66	3	2.75	2.75	2.25	2.5	3
M-FSC 204	3	2.75	2.25	2.25	3	3	3	2.75	2.75	2.25	2.5	3
M-FSC 205	2.13	1.87	1.87	2.38	1.87	2.25	2.5	2.5	1.5	2.5	2.25	2.5
M-FSC 206	3	2.33	2.25	2.25	2.5	2.33	3	2	2.5	2	2	2.25
M-FSC 207	2.5	2.25	2.66	2	2	2.25	3	2.75	2.75	2.5	2.5	2.25
M-FSC 208	3	2	2	2	3	2.5	3	2.5	3	2	2	3
M-FSC 301	3	2	2	3	2.33	2.5	3	3	2.5	2.25	2.75	3
M-FSC 302	3	1.5	2	2.75	1.75	1.75	3	2.25	2.5	2.5	2.5	3
M-FSC 303	3	2.75	2.25	1.75	3	2.25	3	2.75	2.25	2.5	2.5	3
M-FSC 304	3	2.5	2	2	3	2.25	3	2.75	2.75	2.5	2.25	3
M-FSC 305	2.13	1.87	1.87	2.38	1.87	2.25	2.5	2.5	1.5	2.5	2.25	2.5
M-FSC 306	3	2.33	2.5	3	2.33	2.5	3	2	2.25	2	2.25	2
M-FSC 307	2	2	2	2	3	1.5	3	2.5	3	2.5	2.5	3
M-FSC 308	2.5	2.25	3	2	2.5	2	2.5	3	2.75	2	2.5	2.5
M-FSC 401	2.75	2	2	2.25	2.66	2.75	3	3	2.75	2	2.25	3
M-FSC 402	2.75	2.5	2.25	2.5	2.75	2.5	3	2.75	2.75	2	2.5	3
M-FSC 403	3	2.75	2.75	2.25	2.25	2.5	3	2.75	2.25	2.5	2.5	2.5
M-FSC 404	2.75	2.5	2.66	2.25	2.66	2.25	3	2.75	3	2.5	2.5	3
M-FSC 405	3	2.5	2.5	2	2.5	2	3	3	3	3	2	2
M-FSC 406	2	2	2.5	2	1.5	2	3	3	3	2.25	2	2.75