INSTITUTE OF FORENSIC SCIENCE & CRIMINOLOGY

SEMESTER III

(Credits = 24, Marks = 600)

Course	Paper	Credits	Marks	Teaching Hrs/week
Compulsory Core Courses				
MFS-T3-C1	Forensic Toxicology and Drugs of Abuse	4	100	4
MFS-T3-C2	Ballistics	4	100	4
MFS-T3-C3	Forensic Biology	4	100	4
MFS-T3-C4	Forensic Anthropology, Osteology and Odontology	4	100	4
MFS-P3-C1	Forensic Toxicology and Drugs of Abuse (Pr)	1	25	2
MFS-P3-C2				

SEMESTER IV

(Credits = 20, Marks = 500)

Course	Paper	Credits	Marks	Teaching Hrs/week
Compulsory Core Courses				
MFS-T4-C1	Questioned Documents	4	100	4
MFS-T4-C2	Digital Forensics and Cyber Security	4	100	4
MFS-P4-C1	Questioned Documents (Pr)	1	25	2
MFS-P4-C2	Digital Forensics and Cyber Security (Pr)	1	25	2
Discipline Specific Elective (DSE) Courses (Select any Two Courses)				
MFS				

Evaluation

EVALUATION

1. To qualify for the award of the Post–graduate degree of the Faculty of Science in Forensic Science & Criminology i.e. M.Sc. (Forensic Science & Criminology) a candidate has to successfully complete the course and obtain at least 50% in aggregate (including the internal continuous assessment) & 40 % in each paper separately in theory (including the internal continuous assessment)and practical/Assignment. The students who fail to pass any paper(s) in first attempt will be allowed to take up immediately next two consecutive chances. In other words those failing to pass in the reappear chances or unable to avail of the chances will not be entitled for the award of the degree.

2. There shall be one Mid-Semester Examination of 20% Marks for Theory papers in each semester. End-semester examination will be of 80% of total marks.

3. Pattern of end-semester question paper

   i)

7. Evaluation of Courses based on Thesis Work/Dissertation-

(i) In the third semester the evaluation (50 marks) of DSE paper MFS-T3-TW1-P/C/B will be done on the basis of Research Problem Identification, Review of Literature, Objectives and work done so far. The student needs to give a brief synopsis (20 marks) and a presentation (20 marks) in this regard. The Internal assessment (10 marks) will be based on attendance, regularity and daily performance.

(ii) In the fourth semester (MFS-T4-TW2) the evaluation (125 marks) will be done on the basis of the final thesis submission and viva-voice (conducted by the external expert duly approved by the Vice Chancellor/COE).

M.Sc. Forensic Science

Syllabus-Semester I

3.	Comparison of fingerprints, basis of comparison, class characteristic, individual characteristic, various types of ridge characteristics
4.	Automatic fingerprint identification system, Expert Opinion Writing

	(with Illustrations, Sketches, Diagrams, Photos etc.) Law Book Co. Allahabad (1995)
15.	Menzel, E. Roland; Fingerprint detection with lasers. Marcel Dekker, NY (1990)
16.	Maltoni, Davide; Handbook of fingerprint recognition Springer Verlag. NY(2003)

MFS-T1-C2: Human Genetics
THEORY

Credits: 4
Marks:100
Semester Exam 80
Internal Assessment 20

This paper consists of basic genetics-blood grouping of various types, serum protein

UNIT-III

1.	Human Genome Project: Introduction, History, Goals
2.	Benefits, Social, Ethical and Legal Issues
3.	DNA Forensic Databases, Ethical, Legal, and Social Issues Associated with DNA Databanking, Potential Benefits of DNA Databanking
4.	Human Genome Diversity Project: Introduction, History, Goals, Benefits
5.	Genetic Discrimination, Behavioral genetics, Genetics and Violence

MFS-T1-C3: Instrumentation
THEORY

Credits: 4
Marks:100
Semester Exam 80
Internal Assessment 20

This paper includes all the various types of instrumental techniques which can be employed in forensic examination. It comprises of various microscopic techniques, spectroscopic techniques like UV-Vis, FTIR spectrophotometer, Raman Spectroscopy AAS, Atomic Emission Spectroscopy, XRD, XRF, Chromatographic techniques like TLC, GC, LC, HPTLC etc.

UNIT-I

1.	Principle of Microscopy, Abbe's Equation and its significance, working of compound microscope, stereomicroscope, polarized microscope and comparison microscope. Forensic applications and limitations.
2.	Electron microscopy: Principle and working of scanning electron microscopy (SEM), field emission scanning electron microscope (FE-SEM), transmission electron microscopy (TEM), Advantages/disadvantages as compared to optical microscopy and their forensic applications.

UNIT-II

1.	Introduction to spectroscopy, electromagnetic spectrum, Method of Calibration and sample preparation, Atomic and Molecular Spectroscopy, Optical system used in spectroscopy, Limit of detection and Quantification.
2	UV-Vis spectroscopy, Fourier transforms infrared spectroscopy (FTIR), and Raman Spectroscopy: Their instrumentation, Analytical and Forensic applications, Near-Mid-Far ranges of spectroscopy, spectra of some common Organic molecules
3.	Atomic Spectroscopy: Atomic Absorption Spectrometry (AAS) and Atomic Emission Spectrometry (AES): Instrumentation, Atomization process, Analytical and Forensic applications.

UNIT-III

1.	X-Ray Spectroscopy: X-ray Diffraction, X-ray Fluorescence; Origin of X-ray spectra, Instrumentation, differences between soft and hard X-rays, Analytical and Forensic Applications
2.	Nuclear Magnetic Resonance (NMR): Basic principle, theory of Chemical Shifting, instrumentation, and Forensic applications
3.	Basic principles, Working and Instrumentation of Neutron activation analysis (NAA). Thermogravimetry analysis (TGA): Instrumentation, Working and Applications

UNIT-IV

1. Chromatography: Principle, Working and Instrumentation of Thin-layer

	techniques i.e. Time of flight (ToF), *Matrix-assisted laser desorption/ionization* MALDI, Inductive coupled plasma (ICP).

Recommended Books	
1.	Undergraduate Instrumental Analysis, 7th Edition, James W. Robinson, Eileen M.S. Frame, GM Frame II. (2014)
2.	Principles of Instrumental Analysis- Skoog, Holler & Crouch 7th Edition
3.	Instrumentation Methods of Analysis – Willard Merritt & Dean Settle, 7th Edition, 2004
4.	

MFS-T1-C4: Criminology, Criminal Law and Forensic Psychology
THEORY

Credits: 4
Marks:100
Semester Exam 80
Internal Assessment 20

The realm of criminology takes up its scope and development, causes, control, criminal behavior and its theories. In criminal law the detailed description is provided regarding Indian penal code, criminal procedure code and the Indian evidence act.

Forensic psychology includes the ethical issues, profile typing, psychological assessment, aspects of polygraph, brain signature profiling, hypnosis and related legal and ethical aspects. The evolutionary paradigm of psychology will be also studied in this paper.

UNIT-I

1.	Criminology: Nature and Scope
2.	Schools of criminology: Pre-classical, Classical, Neo-classical, Positive School
3.	Causes of Crime: Biological, Psychological, Sociological, Geographic and Economic.

UNIT-II

1.	**I. Indian Penal Code** (i) *Actus non facitreum nisi mens site rea* Elements of crime: *Actusreus&mensrea* (ii) Definitions: Dishonestly (S. 24), Fraudulently (S. 25), Reason to believe (S. 26), Document (S.29), Electronic record (S.29A), Valuable Security (S. 30) A will (S.31), Voluntarily (S. 39), Illegal(S.43), Injury (S. 44), Good Faith (S. 52), Criminal Liability : Joint liability (S. 34,S. 35, S.149) General Exceptions : Mistake of fact (S. 76, 79), Accident (S. 80),Infancy (S.82, 83), Unsoundness of mind (S. 84),Intoxication (S.85,86) Compulsion (S. 94), Private defense (S. 96- 106)
2.	**II. The criminal procedure code 1973** (i) Definitions: Bailable and non-bailable offence (S. 2(a),Charge (2b) Cognizable offence 2(c), Complaint 2(d), Inquiry 2(g) Investigation 2(h), Local jurisdiction (2j), Non Cognizable offence 2(l), Summon case 2(w), Warrant case 2(x) (ii) Information in cognizable case : FIR (S. 154) (iii) Arrest of person without warrant and rights of arrested person (S.41 to 60 A) (iv) Process to compel appearance: (a) Summons (Section- 61,62,64,65,69) (b) Warrant of arrest (Section-70 to 81) (v) Search and seizure (Sections-92, 93,100,101,102,165,167) (vi) Evidence of officers of Mint and Scientific Experts (Sections-292,293)
3.	**III. The Indian Evidence Act 1872** (i) Definition: Section (3),(4) (ii) Examination of witness: Sections-135, 137, 141, 142, 143 (iii) Confession by accused: Sections-24, 25, 26, 30 (iv) Expert Evidence : Sections-45, 45-A, 46, 47, 47-A

UNIT-III

1	Forensic Psychology and the Law
2	Ethical Issues in Forensic Psychology

3	Assessing mental competency
4	Psychological Assessment
5	Genetics and Crime
6	Introduction to Evolutionary Psychology
7	Social Organization, Aggression, and Mating in primates/Apes
8	Biological Constraints on Human Social Organization and Mating
9	Behavioral similarity and differences between human and apes

10

	Press
13.	The Selfish Gene, ***Richard Dawkins*** Oxford University Press, 4th Ed. 2016
14.	The Moral Animal: Why We Are the Way We Are: The New Science of Evolutionary **Psychology,** *Robert Wright (1995) Vintage Books*

M.Sc. Forensic Science

Syllabus-Semester II

FS-T2-C1: Molecular Biology and Biochemistry

THEORY

Credits: 4
Marks:100
Semester Exam 80
Internal Assessment 20

This paper will be a melting pot of knowledge just like forensic science. It will bring together all the main streams of biology that hold a place of their own now. The knowledge imparted by these individual sciences will lead to a wholesome view of the biomolecules and their basic units along with an insight into forensic microbiology. In the coming times wars will not be fought with guns and tanks, they will be fought will strategies involving microbes.

UNIT-I

1	Chemistry of Nucleotides, Structure of DNA/RNA
2	DNA Replication: Eukaryotic and Prokaryotic
	Helicases, Topoisomerases and other DNA replicating Enzymes
3	DNA Denaturation, Cot-Rot curves,
4	DNA Repair mechanisms
5	DNA Epigenetics
6	Eukaryotic and Prokaryotic Transcription.
7	RNA Processing and Editing
8	

	investigate Bioterrorism, Database for infectious microorganisms
11	Biocrimes, Microbial Forensics, and the Physician

Recommended Books	
1.	Molecular Biology of the Cell by Bruce Albert*set*. *al*. (Garland Science; 2nd edition)
2.	GENES VII by Benjamin Lewin (Published by Jones and Bartlett Publishers)
3.	Principles of Genetics by D. Peter Snustad, Michael J. Simmons, John B. Jenkins (Published by John Wiley & Sons)
4.	Physical Biochemistry by David Freifelder (Published by W. H. Freeman and Company)
5.	Molecular Biology by David Freifelder (Published by Jones & Bartlett Pub)
6.	Lehringer's Principles of Biochemistry by David L. Nelson, Michael M. Cox (Published by W. H. Freeman; 4th edition)
7.	Biochemistry by LubertStryer (Published by W. H. Freeman and Company)
8.	Basic Principles in Nucleic Acid Chemistry Vol I and II by Paul OPO Tso (Publishedby Academic Press)
9.	Population Genetics by John H Gillespie (Published by The Johns Hopkins University Press)
10.	Progress in Forensic Genetics 9: Proceedings from the 19th International ISFG Congress Held in Munster, Germany by Bernd Brinkmann and Angel (Published by Elsievers Health Sciences)
11.	Human and Molecular Genetics by Peter Sudbery (Published by Pearson Education Limited)
12.	An Introduction to Forensic Genetics by William Goodwin, Adrian Linacre, SibteHadi (Published by Wiley)
13.	Human Variations by Stephen Molnar (Published by Prentice Hall)
14.	Genomic Diversity: Applications in Human Population Genetics bySurinder Singh Papiha, RanjanDeka, Ranajit (Published by Springer)
15	Basic ImmunologyAuthor: Abul K. Abbas, Andrew H. Lichtman Publisher: WB Saunders; 2nd edition
16	Cellular and Molecular ImmunologyAuthor: Abul K. Abbas, Andrew H. LichtmanPublisher: W.B. Saunders Company; 5th edition
17	Sourcebook in Forensic Serology, Immunology, and Biochemistry Author: R. E. Gaensslen Publisher: NatlInst of Justice/Ncjrs

Suggested Reading	
1.	Forensic Science International; Forensic Science International: Reports - Elsevier
2.	Science & Justice – Elsevier
3.	Journal of Forensic and legal Medicine: Elsevier
4.	Australian Journal of Forensic Sciences - Taylor & Francis
5.	Journal of Forensic Science- Wiley Online Library

FSC-P2-C1: Molecular Biology and Biochemistry (Pr)

PRACTICAL

Credits: 1
Marks: 25

1.	Detection, Isolation and Staining methods for different microorganisms of forensic application

2.	Isolation of Plasmid DNA, Restriction enzyme digestion – ligation of plasmid DNA
3.	Study (observation) of some pathogenic Fungi and bacteria, (permanent slides)
4.	Microbiological examination of water (Coli form test Microbiological examination of milk
5.	Study of general Morphology and cultural characteristics of staphylococeusStreptococcus, Darmatophytes etc.
6.	Study of normal flora of human body
7.	Observation some spoiled food materials
8.	Biochemical test for the identification of Soli bacteria (**IMVIC** test)
9.	Amino acid detections paper chromatography
10.	Comparative evaluation of different methods of protein analysis, Lowry, Biuret, Kjeldahl,UV
11.	Specific reactions for carbohydrates and estimation
12.	Isolation of amino acids and proteins
13.	Estimation of DNA and RNA

MFS-T2-

UNIT-III

Recommended Books	
1.	Vogel's Qualitative Inorganic Analysis (7th Edition) revised by G.Svehia (2nd Impression-2006).
2.	Petroleum Laws and Essential Commodities Act (E.C. Act) 1955
3.	IS:3752; 2005 Indian Standard Alcoholic Drinks – Methods of Test, Second Revision (2005)
4.	The ISI Specification for Kerosene (IS: 1459/1974), Second Revision (2006)
5.	The ISI Specification for Motor Gasoline (IS: 2796/2008), Fourth Revision
6.	The ISI Specification for Diesel (IS: 1460/2005), Fifth Revision
7.	The Indian Standard Methods of Test for Petroleum Products IS:1448[P:2]:2007 Second Revision
8.	An Introduction to Forensic Science by Saferstein, R., (8th edition 2003)
9.	Forensic Science Hand Book, by Saferstein, R., Printice Hall : N. Jersey, 3rd edition 2020
10.	

MFS-P2-C2: Forensic Chemistry (Pr)

PRACTICAL

		Credits: 1 **Marks: 25**
1	Acids: (a) Analysis of individual acids (HCl, H_2SO_4 and HNO_3) (b) Mixture of acids (c) Effect on fabric and analysis	
2	Chemical test and TLC of Phenolphthalein, Anthracene, Alta, Rhodamine B, Carbonate, Bicarbonate, Bleaching powder	
3	Study of effect of different concentration of Sod. Carbonate, Sod. Bicarbonate, NaOH, Bleaching powder on Phenolphthalein	
4	Collection of different bribery samples and extraction of Phenolphthalein (ether method)	
5	Minimum detection limit of Phenolphthalein using TLC and UV method	
6	Restoration of erased numbers of different surfaces	
7	Identification of alcohol (ethanol, methanol) in given (a) known sample (b) unknown sample	
8		

	Differential solubility and TLC, Infra-red spectroscopy, Pyrolysis Gas Chromatography, Mass Spectrometer, Elemental analysis of the pigments

UNIT-II

1.	Fiber: Fiber as Physical Evidence, fiber recovery, FiberIdentification: Physical matching, Microscopic Examination, solubility test, Chromatographic and Spectroscopic analysis (UV-Vis & FTIR) of Fibre.
2.	Paper: Physical examination, Watermark Examination, Chemical Analysis, Analysis by FTIR.

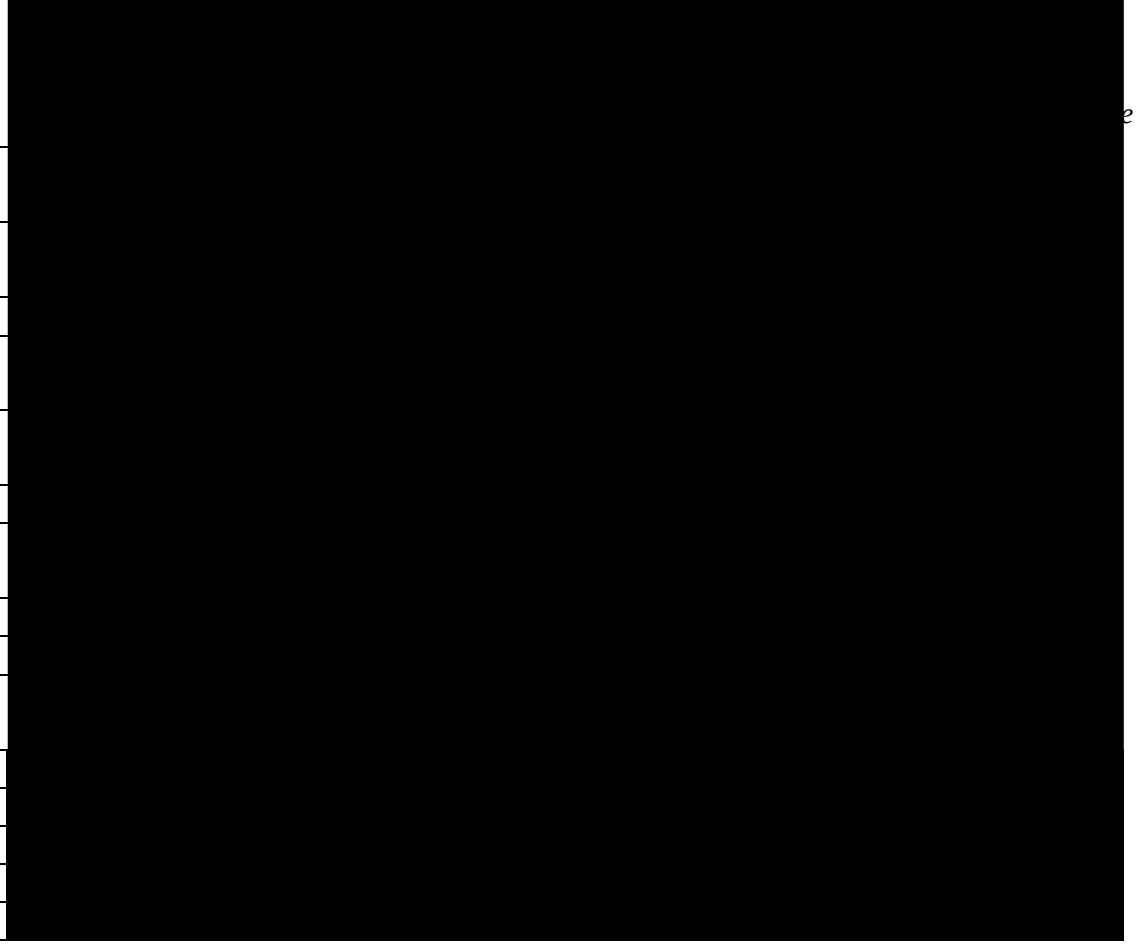
UNIT-III

1.	Soil: Sample preparation, Removal of contamination, Microscopic Examination, Particle Size Distribution, Ignition Test, Density distribution, pH Measurement, UV and TGA Analysis of soil.

2. Cement: Bromoform Test, Fineness Test, ph57941.4 red11 0 0 1590.747ineness 4(pe

4.	Australian Journal of Forensic Sciences - Taylor & Francis

5. Journal of Forensic Science-



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6. Guide of assessors to formulate recommendations for NABL

MFS-T3-

Recommended Books	
1.	Leikin, J. B., &Paloucek, F. P. (2008). *Poisoning and toxicology handbook*. Informa Healthcare.
2.	Minty, P. S. B. (1986). Drug analyses in a Department of Forensic Medicine and Toxicology. In Analytical Methods in Human Toxicology (pp. 161-239).
3.	Lappas, N. T., &Lappas, C. M. (2015). *Forensic toxicology: Principles and concepts*. Academic press.
4.	Mule, S. J., Sunshine, I., Braude, M. C., &Willette, R. E. (2019). Immunoassays for drugs subject to abuse. CRC Press.
5.	Grant, G. (1964). Poison detection in human organs. Journal of Clinical Pathology, 17(2), 204.
6.	Connors, K. A. (2007). A textbook of pharmaceutical analysis. John Wiley & Sons.
7.	Gleason, M. N., Gosselin, R. E., Hodge, H. C., & Smith, R. P. (1969). Aliphatic thiocyanates and cyanide. In Clinical Toxicology of Commercial Products. Acute Poisoning (p. 74). Williams & Wilkins Baltimore, MD.
8.	Modi, R. B. J. P. (2013). *A textbook of medical jurisprudence and toxicology*. Elsevier.
9.	Drummer, O. H. (2010). Forensic toxicology. Molecular, Clinical and Environmental Toxicology, 579-603.
10.	Working Procedure Manual – Toxicology, DFS Publications (2005)
11.	Clarke, E. G. (1970). Isolation and Identification of Drugs in Pharmaceuticals. '9 Bont

	(b) Pesticides (OPs Insecticides, Pesticides and Carbamates: (i) Malathion, chlorpyrifos, monochrotophos, dimethoate (ii) Lindane, DDT (iii) Propoxure, Seven) (c) Plant Poisons (Cannabis, Opiates, Calotropis, Dhatura, Ricimus etc.)
2.	TLC (a) Drugs (Benzodiazepines, Barbiturates: Phenobarbital, Secobarbital, Paracetamol, Diazepam, Lorazepam, Aplrazolam etc.) (b) Pesticides (OPs Insecticides, Pesticides and Carbamates: (i) Malathion, chlorpyrifos, monochrotophos, dimethoate (ii) Lindane, DDT (iii) Propoxure, Seven) (c) Plant Poisons (Cannabis, Opiates, Calotropis, Dhatura, Ricimus etc.)
3.	

UNIT-II

1	Internal Ballistics: Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting
2	External Ballistics: Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity,
3	Measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistic data
4	Terminal Ballistics: Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, Tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range, Ricochet and its effects, stopping power

UNIT-III

1	Principles of identification of firearms, different types of marks produced during firing process on cartridge-firing pin marks, breech face marks, chamber marks, extractor and ejector marks
2	Different types of marks produced during firing process on bullet, number of lands and grooves, direction of twist, depth of grooves and width of land/grooves, class and individual characteristics
3	Techniques for obtaining test material from various types of weapons, basic methodology used in comparison microscopy, linkage of fired bullets/cartridge cases with firearms
4	Automated examination and comparison of fired bullets/cartridge cases and ballistics imaging database of the markings of fired bullets/cartridge cases
5	Determination of range of fire/ bullet hole identification: Burning, scorching, blackening, tattooing and metal fouling, shots dispersion and GSR distribution, bullet hole identification, bullet penetration and trajectory through glass

UNIT-IV

1	Analysis of Gunshot Residues: Mechanism of formation of GSR, source and collection, spot test, chemical test, identification of shooter and instrumental methods of GSR Analysis, Management and reconstruction of crime scene; suicide, murder and accidental and self-defense cases
2	Firearm injuries: Threshold velocity for penetration of skin/flesh/bones, cavitations – temporary and permanent cav

4.	Cordell G. Brown, (Oct, 1981), Non-Destructive Rust Removal From Ferrous Objects, AFTE Journal, Vol 13, no. 4; pp. 85-89.
5.	Cowgill, J.P., (1975) The Newest Look of Handgun Ballistics, The American Rifleman, Vol. 123, No. 10.
6.	Davis, J.E., (1958) An Introduction to Toolmarks, Firearms and the Striagraph, Charles C Thomas, Springfield, Illinois, USA.
7.	DiMaio, J.M., (1985) Gunshot Wounds, Elseveir, USA.
8.	Feigl, F., (1962) Spot Tests in Inorganic Analysis, Elsevier Publishing Co., Netherlands.
9.	Hatcher, J.S., Jury, F.J.& Weller, J., (1957) Firearms Investigation, Identification and Evidence Handcover, October 2, 2006.
10.	J.S. Bates, (Feb, 1973) Cleaning of Rusted Firearms, AFTE Journal, Vol 5, no. 1, p.11.
11.	Jauhari, M., (1980) Identification of Firearms, Ammunition and Firearm Injuries, Bureau of Police Research and Development, Govt. of India, New Delhi, India.
12.	Kumar, K., (1987) Forensic Ballistics in Criminal Justice, Eastern Book Co., Lucknow, India.
13.	Maiti, P.C., (1973) Powder Pattern around Bullet Hole in Blood Stained Articles, Journal of Forensic Science Society, p 147.
14.	Saferstein, R., Criminalistics – An Introduction to Forensic Science, 12th edition
15.	Handbook of Firearms and Ballistics Examining and Interpreting Forensic Evidence Second Edition Brian J. Heard

Suggested Reading	
1.	Forensic Science International; Forensic Science International: Reports - Elsevier
2.	Science & Justice - Elsevier
3.	Journal of Forensic and legal Medicine: Elsevier
4.	Australian Journal of Forensic Sciences - Taylor & Francis
5.	Journal of Forensic Science- Wiley Online Library
6.	Forensic Chemistry: Elsevier

MFS-P3-C2: Ballistics (Pr)

PRACTICAL

		Credits: 1 **Marks: 25**
1.	Report writing in forensic ballistic case.	
2.	To study the classification of bullets.	
3.	Hierarchical classification of firearms.	
4.	Classification of ammunition.	
5.	Identification of firearm injuries.	
6.	Identification of cartridge case and its comparison.	
7.	To perform comparison of different types of bullets.	
8.	Chemical tests for the examination of gunshot residue (GSR).	

5.	Wild Life Forensics: Introduction & importance
6	Introduction to conservation genetics
7	Species or subspecies? Resolving taxonomic uncertainty
8	Wild populations, captive populations and conservation management units
9	Genetics and Reproduction, Cloning, Genetic selection
10	Using molecular biology for species preservation

UNIT-IV

1.	Body Fluids: The nature of blood
2.	Chemical and Microscopic Analysis of Biological Stains
3.	Screening Evidence for Biological Stains in Forensic Casework
4.	Species of Origin and Serology Separation Techniques

5. ABO Grouping and Secretor Status, List of ABO antigens and antibodies in blood

Press

experience in the field. Ancient DNA typing along with procedures involved for optimization of these techniques is also a part of this paper.

UNIT-I

1	Introduction to subject, Forensic anthropology, History, Scope and methods, Introduction to forensic Archaeology
2	Investigation of death, determination of time since death and age of the dead. Injuries: classification and type of injuries, nature of injuries – ante mortem/postmortem.
3	Burn injuries due to fire, acid, crackers& electricity. Mechanical Violence, fire arm injuries, blast & projectile injuries, injuries in sexual offence, suicide & homicide.
4	Field and laboratory management of skeletal remains
5	Dental anatomy and forensic dentistry

UNIT-II

1	Introduction to subject of human osteology, its over-view, ethics and handling of bones. Anthropometric and osteometric variation in human population
2	Biological profiling of skeletal remains: Demography, sex, age, stature and race estimation. Bio-distances and divergences
3	Trauma and Paleopathology as means of personal identity
4	Micro-skeletal markers of activity and life history
5	Body modifications and identification in living person
6	Chemistry of bones
7	Time elapsed since death. Decomposition stages and forensic entomology and Thanatology
8	Non metric skeletal variation

UNIT-III

1	Forensic facial reconstruction Human facial anatomy including bones and muscles, anatomy of the facial features, facial tissue thicknesses with MRI and other methods, three dimensional method of facial reconstruction with clay method as well as with computerized technique.
2	Facial restoration
3	

methods, ancient DNA yield, ancient DNA preservation, ancient DNA degradation patterns, the age of ancient

M.Sc. Forensic Science
Syllabus-Semester IV

MFS-T4-DES-P: Forensic Audio-Video Analysis

THEORY

Credits: 4
Marks:100
Semester Exam 80
Internal Assessment 20

Forensic Audio Video analysis is the scientific examination, comparison and /or evaluation of audio-video in legal matters. This paper includes Audio Level measurement; noise characteristics sound recording play back devices, authentication of recorded audio, introduction to video technology component of Digital Image processing, Image enhancement, restoration, Forensic analysis of audio/Video in Video recording Basic Factors of sound in speech, Acoustic speech production, Phonetic aspects of speech speaker identification etc.

UNIT-I

1.	Audio Level Measurement: Voltage, Decibels, Audio line levels, Frequency measurements, range, Spectrum Analysis, Basic Electric Circuits
2.	Noise Characteristics: Noise Model, Properties of Noise, Additive Noise, Convolution Noise, Acoustic Characteristics of Environments, Conventional Filters, Digital Filters, Adaptive noise cancellation, Audio- enhancement
3.	Sound Recording/Playback Devices: Analog Tape recorders, Digital recorder, Microphone Types & Advantages/disadvantages, Digital audio formats.

	Vowel, Consonant and Glides, IPA (The International Phonetic Alphabets) Forensic Phonetics, Phonetics in Speaker Identification, Co-articulation, Effect of context,Supra segmental (Prosodic features)-Stress, Tone, Intonation, Duration, Syllables, Nasalisation, Accent features, Psychological Stress.

4. Speaker Recognition: Principles of speaker recognition/ identification, Methods on Speaker Recognition, Aural, Sound Spectrographic,

2.	Properties of explosives: Strength or power of explosives, Brisance, Sensitivity or specificity of explosives, Relative effectiveness factor, Stability, Density, Volatility, Hygroscopicity, Oxygen balance, Toxicity, Melt cast
3.	Shock wave/blast wave: Generation of the shock wave, Characteristic, Effect of mach reflections, Effect of confinement, Channelling of blast wave
4.	Explosion effects-types: Blast pressure: Positive and Negative, Thermal, Fragmentation, Ancillary

5. Physics of explosion hazards; Thermo-

7.	Spectrometric Identification of organic Compounds (8th Edition), by Robert M. Silverstein and Francis X. Webster, published John Wiley & Sons, Inc. New York.2014.
8.	Instrumental Methods of Analysis(7th Edition) by Hobart H. Willard, Lynne L. Merritt, Jr., John A. Dean and , Frank A. Settle, Jr., CBS Publishers & Distributors, Delhi.(Ist Indian Edition-1988).
9.	Yallop, H. J. (1980). Explosion investigation. Forensic Science Society.
10.	McLafferty, F. W., Tureček, F., &Turecek, F. (1993). Interpretation of mass spectra. University science books.
11.	Beveridge, A. (Ed.). (2011). Forensic investigation of explosions.
12.	Elsayed, N. M., & Atkins, J. L. (2010). Explosion and blast-related injuries: effects of explosion and blast from military operations and acts of terrorism.
13.	Yinon, J. (Ed.). (2020). Forensic Applications of Mass Spectrometry. CRC Press.
14.	Watson, J. T., & Sparkman, O. D. (2013). Introduction to Mass Spectrometry: Instrumentation, Applications, and Strategies for Data Interpretation. John Wiley & Sons.

Suggested Reading	
1.	Science & Justice - Elsevier
2.	Talanta - Elsevier
3.	Journal of Forensic Sciences- American Academy of Forensic Sciences
4.	Forensic science International - Elsevier
5.	Analytical letters - Taylor & Francis
6.	Journal of Energetic Materials - Taylor & Francis

MFS-P4-DES-C: Forensic Explosives (Pr)

PRACTICAL

learn DNA fingerprinting for individual level identification as well as DNA barcoding for species level identification. You will also learn about upcoming trends/developments in field like Next Generation Sequencing techniques of DNA and their applications in forensics. Automation and miniaturization in the field of DNA forensics will also be discussed. Protein Biomarkers for identification of biological fluids will be discussed, specifically their serological techniques like immunochromatography. The basics of serological techniques like antigen-antibody reaction as well as the upcoming replacements of antibodies like aptamers

7.	Aptamers and affibody: forensic applications
8.	Protein engineering and invitro evolution for making proteins for forensic application
9.	Concept of antigen- antibody reaction and application to species identification
10.	Monoclonal and polyclonal antibodies

UNIT-IV

1.	NGS (next generation sequencing techniques of DNA): principles
2.	Protocols in NGS
3.	Application of NGS in forensics
4.	Automation in DNA profilling: robotics
5.	Miniaturisation in DNA profilling: microfluidics
6.	Recent developments in DNA profilling and databases

	Recommended Books
1	Fundamentals of Forensic DNA Typing John M. Butler · 2009
2	Inman, K. & N. Rudin. 1998. Introduction to Forensic DNA Analysis. CRC Press
3	

MFS-T4-DES-B: Forensic Molecular Biology (Pr)

PRACTICAL

Credits: 1
Marks: 25