

REVISED SYLLABUS

Approved vied Emergent BPGS meeting held on 18-07-2019 Effective from session 2019-2020

Master of Science

in

M.Sc. Forensic Science & Criminology

Department of Biotechnology



Babasaheb Bhimrao Ambedkar University
(A Central University)
Vidya Vihar, Raebareli Road
Lucknow-226025

**COURSE STRUCTURE FOR POST GRADUATION PROGRAMME
(M.Sc. Forensic Science & Criminology)**

1st Semester

Course Code	Course Title	Course Type	Maximum Marks		Total Maximum	
			End Sem	Sessional	Marks	Credit
MFSC-101	Instrumentation & Techniques	Open Elective(CBCS)	70	30	100	4
MFSC-102	Quality Management	Core	70	30	100	6
MFSC-103	General Forensic Science and Criminology	Core	70	30	100	6
MFSC-104a	Biostatistics in Forensic sciences	Elective	35	15	50	2
MFSC-104b	Survey of Biochemistry	Elective	35	15	50	2
MFSC-105	Laboratory Course-I	Core	70	30	100	6
MPDC-105	Remedial Language Course	Foundation-Compulsory			25	1

2nd Semester

Course Code	Course Title	Course Type	Maximum Marks		Total Maximum	
			End Sem	Sessional	Marks	Credit
MFSC-201	Forensic Chemical Science	Open Elective(CBCS)	70	30	100	4
MFSC-202	Forensic Biological Science and Psychology	Core	70	30	100	6
MFSC-203	Forensic Physical Science	Core	70	30	100	6
MFSC-204a	Diagnostics in Forensic Sciences	Elective	35	15	50	2
MFSC-204b	Introductory Molecular Biology	Elective	35	15	50	2
MFSC-205	Laboratory Course-II	Core	70	30	100	6
MPDC-205	Moral Studies	Foundation-Compulsory				1

3rd Semester

Course Code	Course Title	Course Type	Maximum Marks		Total Maximum	
			End Sem	Sessional	Marks	Credit
MFSC-301	Chemistry of Explosives	Core	70	30	100	4
MFSC-302	Forensic Anthropology and Forensic Medicine	Core	70	30	100	6
MFSC-303	Forensic Toxicology	Core	70	30	100	6
MFSC-304a	Fundamentals of Bioinformatics	Elective	35	15	50	2
MFSC-304b	Forensic & Homicide Investigation	Elective	35	15	50	2
MFSC-305	Laboratory Course-III	Core	70	30	100	6
MPDC-305	Community Service	Foundation-Compulsory				1

4th Semester

Course Code	Course Title	Course Type	Maximum Marks		Total Maximum	
			End Sem	Sessional	Marks	Credit
MFSC-401	Question Document, Handwriting and Fingerprint Examination	Core	70	30	100	6
MFSC-402a	Forensic Biology and DNA methods (Biological Sciences)	Core	70	30	100	6
MFSC-402b	Instrumental Analysis in Chemical Sciences (Chemical Sciences)	Core	70	30	100	6
MFSC-402c	Computer Forensic and audio video analysis (Physical Sciences)	Core	70	30	100	6
MFSC-403	Forensic Ballistics	Core	70	30	100	6
MFSC-404	Dissertation / Project Work	Core	70	30	100	6
MFSC-405	Seminars	Core	35	15	100	2
MPDC-405	Ambedkar Studies	Foundation Compulsory			25	1

Note:

- MFSC students can choose any other course equal or higher credits from any other department of the university in lieu of non-core and elective courses under the CBCS programme. However, all of these courses are available to students of other departments under the CBCS programme.
- Only one elective can be taken by MFSC students in a given semester.
- Dissertation may be based on in house Training/Project Work/Scientific Review/Research Training outside.
- Students have to opt any one of the specialization among **402a, 402 b and 403c**.

SEMESTER-I

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-101	Instrumentation & Techniques	70	30	100	4

This paper includes all the various types of instrumental techniques which can be employed in different laboratories for forensic examination. It comprises of various microscopic techniques different spectroscopic techniques like UV-Vis, Fluorescence and phosphorescence, spectrophotometer AAS, Atomic emission spectroscopy, XRD, XRF, FTIR, Raman Spectroscopy NAA like Column Chromatography, TLC, GC, LC, HPTLC and Electrophoresis GRIM, SEMEDAX, polygraph, and Ballistic data measurement system.

Section-A

Microscope Basic concepts- principle-source- instrumentation- working- sampling limitations: Simple Microscope, Koehler illumination, Polarizing Microscope Transmission Electron Microscope, Scanning Electron Microscope, Integrated Ballistic Identification System

Section-B

Basic concepts- principle- source- instrumentation-working- sampling-limitations: Ultra violet and visible spectrophotometer, Fluorescence and phosphorescence spectrophotometer. Atomic absorption spectrometry, atomic absorption spectrometry (AAS) Atomic emission spectrometry: ICP, X-ray spectrometry: XRD and XRF, infrared spectrophotometer (FTIR) Raman spectroscopy. Radiochemical techniques, neutron Activation Analysis (NAA), Thermal analysis methods, Nuclear Magnetic Resonance, Mass spectrometry.

Section-C

Chromatography basic concepts- concepts- principle- source- instrumentation-working sampling-limitations: Column chromatography, Thin-layer Chromatography (TLC) Gas chromatography (GC). Liquid Chromatography (LC), HPTLC, High performance liquid Chromatography (HPLC), Electrophoresis.

Section-D

Forensic Instruments Basic concepts-principle-source- instrumentation-working sampling-limitations: Glass refractive index measurement (GRIM) Voice print spectrograph (CSL) nonlinear editing, SEM-EDAX, Electrostatic lifting equipment. Polarograph, DNA sequence, Polygraph, Ballistic data measurement system.

Recommended Books

1. Forensic Science in Criminal Investigation & Trials- B.R. Sharma.
2. Instrumental analysis Skoog, Holler & Crouch Cengage Lear.
3. Instrumentation Methods of analysis- Willard Merritt & Dean Settle.
4. Forensic Science Hand book- R. Saferstain
5. Introduction to spectroscopy, Donald L Pavia

SEMESTER-I

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-102	Quality Management	70	30	100	6

Quality management can be considered to have three main components: quality control, quality assurance and quality improvement. The paper covers up the scope and management of quality control and assurance, document control, internal audits and its technical requirements, sampling, role of assessor, assessor assignment procedure and processes of onsite assessment.

Section -A

1. Scope, Quality, Quality Assurance, Quality Control
2. Management Requirements-organization, management system
3. Document control
4. Review of requests
5. Tenders and contracts
6. Subcontracting of tests and calibrations
7. Purchasing of services and supplies
8. Service to customer
9. Complaints
10. Improvement
11. Corrective action
12. Preventive action
13. Control of records
14. Management Review- Objectives, organization of management review, planning implementation, records

Section -B

1. Technical requirements-General
2. Personnel
3. Accommodation and environmental conditions
4. Test and calibration methods and methods validation
5. Equipment
6. Measurement traceability
7. Sampling
8. Handling of test and calibration items
9. Assuring the quality of test and calibration results
10. Reporting the results

Section -C

1. Internal Audits
2. Terminology
3. Objectives
4. Organization of internal audits
5. Planning of audit
6. Implementation internal audits
7. Follow up of corrective action
8. Records and reports of internal audits
9. Additional unscheduled audits

Section -D

1. Assessor guide- assessor's role
2. Assessor assignment procedure
3. Procedure of assessment of new applicant laboratories
4. Pre-assessment audits
5. On-site assessment
6. Guide of assessors to formulate recommendations for NABL
7. Procedure for conducting closing meeting

Recommended Books & Material

1. NABL-113 Issue No.01 Issue Dt.8.6.1998
2. IS/ISO/IEC 17025: 2005 General Requirements for the competence of testing and calibration laboratories.
3. NABL-161 Guide for Internal audit and Management Review for Laboratories
4. NABL-210, Assessor Guide Issue No.3, 1.5.2002.
5. NABL- 141, Guidelines for Estimation and Expression of Uncertainty in Measurement.
6. Juran's Quality Control Handbook, Fourth Edition, J.M. Juran, Frank M. Gryna, McGraw-Hill International Editions, Industrial Engineering Series (1998)
7. Total Quality Control Essentials- Key Elements Methodologies and Managing for Success, Sarv Singh Soni, Gryna, McGraw-Hill International Editions Industrial Engineering Series (1993)
8. Quality Control & Application, Bertrand L. Hansen, Prabhakar M. Ghare, Prentice- Hall of India Pvt. Ltd. New Delhi-110001(1993)

SEMESTER-I

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-103	General Forensic Science and Criminology	70	30	100	6

Forensic science is the application of a broad spectrum of sciences to answer question of interest to a legal system. This may be in relation to a crime or a civil action. The paper covers all general aspects of forensic science introduction to the techniques of measurements and an introduction to the crime scene measurements have also been provided.

Section-A

1. Nature
2. Need- social changes, anonymity, technical knowledge, wide field, better evidence.
3. Alternatives – Eye witnesses, confessions, approvers, stock witnesses.
4. Merits and Demerits of Oral and Material evidence.
5. Functions & Development
6. Laws and principles
7. Forensic Science set-up
8. Frye case & Dauber Standard

Section-B

1. Tools and techniques, Requirements: Sensitivity, specificity, rapidity, economy
2. Measurements: Microscopy, Photography, Invisible rays, Chromatography Electrophoresis, Spectrography , Mass Spectrometry, Spectrophotometry , AAS, NAA, AES, XRD,SEM-EDX, Electro- chemical techniques.
3. Problems of proof: General, Scientific evidence and proof, investigative problems, Scientific aspects, legal problems.
4. Expert Testimony: Expert, Report, Illustrations, Language, Prosecuting Counsel, Defines Counsel, Eye witness testimony, testimony, memory recovery, statement verification.
5. Court: Fallacies about expert evidence

The realm of criminology takes up its cope and development, causes, criminal behaviour and its theories. In criminal law the detailed description is provided regarding Indian penal code, criminal procedure code and the Indian evidence act. Finger prints Section includes history, development, classification and all the scientific aspects regarding preserving and the examination.

Section-C

- 1 **Criminology:** Definition, Scope and Development, Causes, Effects, Control, Prevention
- 2 **Criminal Behaviour**
- 3 **Crime:** Its elements, nature and causes, prevention
- 4 **Theories of Criminal Behaviour:** Classic, Positivist, Sociological
- 5 **Alcoholism, Drug Addiction and Crime:** Main causes of drug addiction, illicit Drug trafficking, on-line Drug trafficking, Classification of Drugs, Drug addicts and crime, Remedial measures.

Section-D

1. **Criminal Law:**
 - a. Indian Penal Code
 - i) Definitions-Dishonestly Sec.23, 24: Fraudulently Sec.25: Good Faith Sec.52: Inquiry Sec. 44: Voluntarily Sec.39.
 - ii) Defence of Mistakes of fact Sec. 76 to 79
 - iii) Defence of Unsound Mind Sec.84
 - iv) Defence of intoxication Sec. 85,86

2. **Criminal Procedure Code**
 - a. Criminal Procedure Code
 - i) Definition–Sec. 2 Charge: Complaint: Bailable or Non bailable offences: Summon Case & Warrant Case.
 - ii) F.I.R. and powers of police to investigate Sec. 154 to 176
 - iii) Arrest of person without warrant and rights of arrested person Sec. 41 to 60.
 - iv) Process to compel the appearance of person Sec. 61 to 90.

3. **Indian Evidence Act**
 - i) Definition: Sec. 3 Evidence: Fact Proved, disproved and not proved: May Presume, shall presume and conclusive proof.
 - ii) Confession by the Accused Sec. 24-30.
 - iii) Examination of Witness Sec.135-138: Leading Question Sec.141 expert Evidences Sec.45-47.

Recommended Books

1. David R. Ashbaugh, Quantitative and Qualitative Friction Ridge Analysis, CRC Press (1990).
2. E. Roland Menzel: Fingerprint Detection with Lasers, 2nd Ed. Marcel Dekker, Inc. USA (1999).
3. James F, Cowger Friction Ridge Skin, CRC Press London (1993).
4. Mehta, M.K.: Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay (1980)
5. Moenssens; Finger Prints Techniques, Chirton Books Co; Philadelphia NY (1975).
6. Chatterjee S.K. Speculation in Finger Print Identification. Jantralekha Printing Works, Kolkata (1981)
7. Cowger, James F; Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY (1993).
8. Cook Nancy; Classifying Finger Prints, Innovative learning Pub. Mento Park (1995).
9. Cossidy, M.J.; Footwear identification, Royal Canadian Mounted Police, Ontario, Canada (1980).
10. J.A. Seigel, R.J. Saukoo and G.C. Knupfer; Encyclopaedia of Forensic Sciences Vol. I, II, and III. Acad. Press (2000).
11. Smith B.C. Holland M.M. Sweel D.L. & Dizinno. A; DNA & Forensic Odontology – Manual of Forensic Odontology Colorado Springs, USA (1996).
12. Hillison. S; Dental Anthropology, Cambridge Univ. Press, UK (1996).
13. Ksgpezak I; Possibilities of Cheiloscopy in Forensic Science (1980)
14. Jannarelli, A.V. Ear Identification. Forensic Identification Series, Paramount (1989).
15. Henry C. Lee & R.E. Ganesslen; Advances in Finger Print Technology, CRC Press, London (1991).
16. Saxena, B.L.; Law and techniques relating to identification of handwriting, disputed documents, fingerprints, foots and detection of forgeries. Central Law Agency Allahabad (19990).
17. Hardless, H.R. Disputed documents Examination and Fingerprints Identification (with IIIustration, Sketches, Diagrams, Photos etc.) Law Book Co. Allahabad (1995).
18. Menzel, E. Roland; Fingerprint detection with lasers. Marcel Dekker, NY (1990).
19. Jain L.C. Intelligent Biometric Techniques in Fingerprint and face recognition. CRC Press Ohio (1999).
20. Bridges B.C. Criminal Investigation Practical Fingerprinting Thumb Impressions, Handwriting expert testimony opinion Evidence, University Book Agency. Allahabad (2000).
21. Maltoni, Davide; Handbook of fingerprint recognition Springer Verlag. NY (2003).
22. Ratha Nalini; Automatic Fingerprint recognition system, Springer Pub. NY (2004).
23. Champod, Christophe; Fingerprints and other ridge skin Impression, CRC Press London (2004).

SEMESTER-I

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-104a	Biostatistics in Forensic sciences	35	15	50	2

1.	Biostatistics its meaning and objectives, Levels of measurements, Nominal Ordinal interval & ratio scales. Scales. Fundamental concept of population, variables, parameters and statistics, frequency, proportion percentages and ratios. Graphical representation of data frequency curves.
2.	Measures of central tendency, mean median and mode. Measures of dispersion: range, interquartile range. 10-90 percentile range, range, standard deviation and variance. Moments- moment coefficient of skewness and kurtosis.
3.	Concept of probability-properties and uses. Bayes' theorem, normal, binomial and poisson distribution
4.	Sampling methods and sampling theory. Confidence limit, level of significance and critical region Type I and Type II errors. Standard error of a statistic.
5.	Testing of statistical hypothesis, single sample tests involving means proportions. Two sample tests. Difference between means and proportion. Student's t-test, chi-square test and F-test.
6.	Introduction to non- parametric statistics. Wilcoxon- Mann-Whitney test. Kolomogrov- Smirnov one sample and two sample test.
7.	Linear correlation and regression. Standard error of estimate. Test of significance involving coefficients of linear correlation coefficient.
8.	Random Variables and Distributions. Binomial, Poisson, Exponential and Normal Distributions and their applications.
9.	Samples and Sampling Distribution, Standard Error, significance level, Degrees of freedom.
10.	Tests of significance, tests for proportion, t and F tests Confidence Intervals Unit V Contingency tables of Z (Chi square) tests of goodness of fit and homogeneity.

SEMESTER-I

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-104b	Survey of Biochemistry	35	15	50	2

I. Biomolecules-Structure and Function

1.	Introduction; Cells and functional groups.
2.	Water, acids, bases, buffers.
3.	Amino acids and peptide bonds.
4.	Three-dimensional structure of proteins.
5.	Enzymes, enzyme kinetics, and mechanisms.
6.	Coenzymes and vitamins.
7.	Carbohydrates.
8.	Lipids and biological membranes.

II. Energetics and Metabolism

1.	Introduction to metabolism.
2.	Glycolysis.
3.	Krebs Cycle.
4.	Glycogen metabolism and gluconeogenesis.
5.	Electron Transport and Oxidative Phosphorylation.
6.	Lipid Metabolism.
7.	Amino acid and nucleotide metabolism.

III. Genetic Information

1.	A. Nucleic acids.
2.	B. DNA Replication and repair.
3.	C. Transcription.
4.	D. Translation.
5.	E. Recombinant DNA technology.

SEMESTER-I

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-105	Laboratory Course-I	70	30	100	6

Section-A

1.	To take plain and rolled inked finger prints.
2.	Taking of palm Prints
3.	To identify the finger print patterns
4.	To identify core and delta
5.	To perform ridge tracing and ridge counting
6.	To identify ridge characteristics
7.	Development of latent prints by mechanical methods, fuming and chemical methods on various surfaces
8.	Lifting of finger prints and photography
9.	Ten digit fingerprint classifications
10.	To compare the finger prints

Section-B

1.	SPSS practicals on computers: To cover those techniques of data preparation needed prior to data analyses, practical implementation of statistical analyses methods.
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Section-C

1.	To measure the various physical parameters of a fiber using microscope
2.	To find out the unknown concentration of the given sample using (UV/Vis Spectrophotometer).
3.	To study the Beer's Lambert's law.
4.	To study the refractive index of the mixture of solution.
5.	To find out the refractive index of mixture of solution.
6.	To study to TLC of different inks of the writing pen.
7.	To analyze the given compound using FTIR spectra.
8.	To record a voice print spectrograph.
9.	To perform the HPTLC of the given compound.
10.	To determine the refractive index of different glass sample recovered from crime scene.
11.	To measure the refractive index of the mixture of liquid.
12.	To analyse the given sample using XRF technique.

SEMESTER-I

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MPDC-105*	Remedial Language Course	15	10	25	1

SEMESTER-II

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-201	Forensic Chemical Science	70	30	100	4

This paper is exclusive in including the basics of forensic chemical science which are helpful in exploring the minute of the subject. It takes up the detective dyes; restoration erased numbers alcohols and it all related aspects, fire and arson, Indian standard specifications along with analysis of petroleum products.

Section-A

1.	Analysis of corrosive chemicals- acids and alkalis.
2.	Detective dyes: bribery- definition under Indian penal code, motives, chemistry of detective dyes, importance, method
3.	Sample collection of suspect, demonstration samples, mistakes, dyes as substituent's of phenolphthalein
4.	Case studies, precautions, laboratory examination of tap cases
5.	Restoration of erased numbers- Importance of numbers, marking of numbers on different articles, restoration of erased numbers on different surfaces

Section-B

1.	Alcohol- Forensic significance, problems of prohibition, nature, production of different types of alcohols including wines, liquors, IMFS, rectified spirit and absolute alcohol (liquors)
2.	Terminologies- proof spirit, analysis of alcohol-colour, smell, determination of percentage of alcohol by specific gravity method, acidity, ester, methyl alcohol.
3.	Alcohol- properties, absorption, elimination, effects, fatal dose, intoxication medical examination, physical tests, Blood alcohol analysis by chemical methods.
4.	Significance of blood alcohol, Breath Screening devices.

Section-C

1.	Arson- Definition under Indian penal code, difficulty in investigation of fires, nature of fire.
2.	Progress, control, burnt bodies, seat of fire, time of fire, natural causes of fires, suspected arson, motives, and person responsible.
3.	Search and collection of evidence, sample selection for extraction of accelerants, isolation and extraction of accelerants, analysis by GC/GC-MS method.
4.	Case studies.

Section-D

1.	Petroleum products- production
2.	ISS of Gasoline
3.	ISS of Kerosene
4.	ISS of HSD& LDO
5.	ISS of lubricating oil
6.	Analysis of gasoline as per ISI methods
7.	Analysis of kerosene as per ISI methods
8.	Analysis of HSD & LDO as per ISI Methods
9.	Analysis of lubricating oils as per ISI methods

Recommended Books	
1.	Forensic Science in Criminal Investigation & Trials by Dr. B.R. Sharma, Universal Law Publishing Co. Pvt. Ltd. Delhi (4 th edition 2005).
2.	Vogel's Qualitative Inorganic Analysis (7 th Edition) revised by G. Svehia (2 nd Impression-2006)
3.	Petroleum Laws and Essential Commodities Act (E.C .Act) 1955.
4.	IS: 3752-1988, Indian Standard Alcoholic Drinks – Methods of Test, First Revision (1988).
5.	IS: 323-1959, Indian Standard Specification for rectified spirit, revised, 9 th reprint, December (1989).
6.	The ISI Specification for Kerosene (IS: 1459/1974)
7.	The ISI Specification for Motor Gasoline (IS:2796/2000)
8.	The ISI Specification for Diesel (IS;1460/2000)
9.	The Indian Standard Methods of Test for petroleum Products IS: 1448
10.	The ISI Specification for Gear Lubricants (IS:2297/1997)
11.	The ISI Specification for Petroleum Hydrocarbon Solvents (SI: 1745/1978)
12.	Fire and Arson Investigation, J. Kennedy, Chicago (1962)
13.	An Introduction to Forensic Science by Safer stein, R, (1976)
14.	Forensic Science Hand Book, by Safer stein R, Print ice Hall: N Jersey, 1982
15.	Crime Investigation, by Thonton, J.I. Interscience Publishers, Inc. New York, 1974
16.	Fire investigation, P.L. Kirk, New York (1960)
17.	Arson Investigation, Robert E. Carter, Glencoe, Fire Science Series, Glencoe Publishing Co. Inc, Encino, California, London (1978)
18.	Forensic Issues in Alcohol Testing by Steven B Karch, Edition: illustrated, Published by CRC Press (2007)
19	Clark, E.G.C. Isolation and identification Drugs, Vol. And Vol. II, (1986)

SEMESTER-II

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-202	Forensic Biological Science and Psychology	70	30	100	6

Forensic biology is introduced with all its components i.e. forensic entomology, serology, botany, wildlife, limnology etc. The first Section emphasize on the tools and techniques of rim importance in forensic biology- microscopy (light and electron both, terminology and properties associated with it) and electrophoresis (special reference to application of capillary electrophoresis). The second Section touches upon the various neglected but worthwhile fields of forensic science. It deals with forensic entomology, forensic wildlife, and forensic botany. This unit gives the students an insight into the life of other living organisms, which the thereby producing meaningful and substantial evidence. Unit there is dedicated to another neglected but nearly ubiquitous type of evidence- hair and fibers. It includes the study of various properties useful in forensic comparisons along with the collection procedures. Last unit covers the mot encountered body fluids at a crime scene along with their nature, forensic characterization and collection.

Section –A

1.	Forensic Biology: History and nature
2.	General Definitions and concepts
3.	Historical developments
4.	Animals. Plants and Microorganisms in legal investigation
5.	Basic Principles, Tools and Techniques
6.	The Microscope: Applications of Polarized light method to hair analysis
7.	Forensic biological applications of scanning electron microscope
8.	Electrophoresis General overview, Principles and modes of electrophoresis
9.	Application of capillary electrophoresis in DNA typing

Section –B

1.	Forensic Entomology: General entomology and arthropod biology
2.	Insects of forensic importance
3.	Collection of entomological evidence during death investigations,
4.	The role of aquatic insects in forensic investigations,
5.	Insect succession on carrion and its relationship to determine time since death, its application to Forensic Entomology.
6.	Wild Life Forensics: Introduction & importance
7.	Protected and endangered species of animals and plants,
8.	Identification of wild life materials such as skin, fur bones, nails, horn and teeth by conventional and modern methods, identification of pug marks of various animals.
9.	Forensic Botany: introduction, types, location, collection evaluation and forensic significance
10.	Wood: Type of wood and their identification and comparison
11.	Leaves: Identification of various types of leaves and their anatomy, methods of comparison
12.	Pollen: structure, function, methods of identification and comparison
13.	Diatoms: Nature, location structure, extraction from various body tissues, including bone marrow,

	preparation of slides, methods of identification and comparison, forensic significance.
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Section-C

1.	Hair: Morphology of hair cuticle cortex and medulla area of hair
2.	Three phases of hair growth
3.	Distinction between animal and human hair
4.	Hair features useful for microscopic comparison of human hair
5.	Collection of forensic hair evidence

Section-D

1.	Body Fluid: 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.	AVO Grouping and Secretor Status, List of ABO antigens and antibodies in blood
6.	Principles of heredity
7.	Biological Markers of Forensic Significance
8.	Forensic characterization of blood
9.	Concept of antigen- antibody reaction and application to species identification
10.	Monoclonal and polyclonal antibodies
11.	The nature of semen Forensic characterization of semen
12.	Collection of physical evidence of a rape investigation, preservation of suspected blood and semen stains for laboratory examination
13.	The nature of saliva, Forensic characterization of saliva.

Recommended Books

1.	An introductions to Forensic Science by Richard Safer stein (Prentice Hall College Div; 8 th edition)
2.	Essential Forensic Biology: Animals, Plants and Microorganisms in Legal Investigation by Allen Gunn.
3.	The biochemistry of semen and male reproductive tract Thaddeus Mann Methuen & Co. Ltd. London 1964.
4.	Biology methods manual Metropolitan Police Forensic Science Laboratory Herbert R. Robertson (Editor).
5.	Mathew's textile fibers their physical microscopic and chemical properties Herbert R. Mauersberger John Wiley New York 1954.
6.	Plant Anatomy B.P. Pandey .
7.	Forensic Examination of Hair (Taylor & Francis Forensic Science Series)
8.	Forensic entomology: the utility of arthropods in legal investigations By Jason H. Byrd. James L. Castner Published by CRC Press, 2001.
9.	Forensic botany: principles and applications to criminal casework by Heather Miller Coyle Published by CRC Press, 2004.

Forensic psychology includes the ethical issues, profile typing, psychological assessment, aspects of polygraph brain signature profiling, hypnosis and related legal and ethical aspects.

Section –A

1.	Forensic psychology and the Law.
2.	Ethical Issues in Forensic Psychology, Civil and criminal case assessment.
3.	Assessing mental competency, Mental disorders and Forensic Psychology
4.	Crime and psychopathology, Genetics and Crime.
5.	Psychological Assessment.
6.	Personal History, Mental Status Examination, Psychological Assessment Tools Purpose of Psychological Assessment.
7.	Detection of deception, Various methods for detection of deception
8.	Interview, Non-verbal detection, statement assessment, Hypnosis', Psychological assessment, adoptive profiling system, voice stress analyze, polygraph thermal imaging, Brain Electrical Oscillation Signature Profiling, functional magnetic resonance study .
9.	Current research in detection of deception/ truth finding mechanisms.

Section –B

1.	Historical aspects of polygraph, Principles of polygraph
2.	Psycho physiological aspects, operational aspects
3.	Question formulation techniques, Interviewing technique procedure
4.	Chart recording, chart analysis methodology, chart interpretation skills
5.	The Art- Polygraph, Legal and Ethical aspects, Human rights of individual
6.	Historical aspects of brain signature profiling
7.	Principles of brain Signature profiling, Neuro psychological aspects, operational aspects, probe preparation EEG-ER recording, analysis methodology and interpretation skills
8.	Legal and Ethical aspects, Human rights of individual
9.	Hypnosis, Requirements of hypnosis
10.	Applications of Hypnosis Sense of Hypnosis
11.	Forensic Hypnosis Artificial Hypnosis/ Narco analysis , General Procedure, Legal and Ethical aspects, Human rights of individual

Recommended Books

1.	Forensic science in Criminal Investigation & Trials , B.R. Sharma
2.	The Hand Book of Forensic Psychology, Weiner Hass
3.	Hand Book of Forensic Psychology, O' Donohue Levensky
4.	Brain Experience- C.R. Mukundan
5.	Criminal Profiling-B. Turvey
6.	Investigative Forensic Hypnosis- J. Niehans
7.	Art & Science of the Polygraph Techniques –J.A. Matte
8.	Hand Book of Polygraph Testing- M. Kloinen
9.	Detecting lies & Deceit-A vrij

SEMESTER-II

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-203	Forensic Physical Science	70	30	100	6

This paper includes the various basic principles of physics based techniques which can be applied to solve the various forensically relevant cases. It comprises of analysis of foot/ footwear/ type impression, Tool marks, properties, analysis of Fiber through UV visible spectroscopy, papers examination, soil, cement and its analysis, Glass its types and measurement of physical parameters glass for its comparison with suspect, and gem stone analysis.

Section-A

1.	Foot/ Footwear/ Tyre Impression: Collection, Tracing, Lifting, Casting of impression characteristics.
2.	Tool Marks: Compression Marks, Striated Marks, Combination of compression and striated marks. Repetitive marks, Comparison of tool marks. Features: Class characteristics, Sub class characteristics, Individual characteristics.
3.	Identification of cameras forms film negatives: Principle of camera identification, Photomicrography recording.
4.	Paint: Microscopic examination, Micro chemical tests, Differential solubility and TLC, Infra- red spectroscopy, Pyrolysis Gas Chromatography Mass Spectrometer, Elemental analysis of the pigments.

Section-B

1.	FIBER: Determination of physical and chemical properties of fibers, physical matching, Crystallography of fibers
2.	Analysis of Textile Fibers: UV Visible Spectroscopic properties examination of Textile Fibers, Identification of Non-reactive Dyes using TLC, Analysis of fibers using IR spectroscopy.
3.	PAPERS: Physical examination, Watermark Examination Chemical Analysis Trace Elemental.

Section-C

1.	SOIC: Sample preparation, Removal of contamination Microscopic Examination, particle Size Distribution, Ignition Test, Density distribution PH Measurement.
2.	CEMENT: Bromoform Test, Fineness Test, Loss on Ignition Test.
3.	Cement analysis (Gravimetric method): insoluble Residue, SiO ₂ . Combined Alumina and Ferric Oxide, Cao.
4.	Physical Method: Determination of compressive strength Setting Times, Initial and final Setting Time, Standard Consistency, Preparation of Cube
5.	X-Ray Power Diffraction: Identification of adulterated cement and adulterant,
6.	Mortar and Concrete: Analysis of Mortar and concrete.

Section-D

1.	Glass: Types of Glass- Soda lime glass, borosilicate glass, safety glass Laminated, light sensitive glass, Tampered / toughened glass, Wire glass, Coloured glass, Matching
2.	Physical parameters: Fluorescence under UV radiation density or specific gravity, Density measurements for bigger fragments of glass, Density comparison by flotation and density gradient tubes.
3.	Refractive index Measurement (RI): immersion method, Becker line concept, RI using the mixture of miscible liquids and hot stage microscope, elemental analysis, Glass fracture identification.
4.	Gem Stones: Analysis of crystalline substances.

Recommended Books	
1.	forensic science hand book by Richard Safer stein
2.	Forensic examination of glass and paint, Brian Caddy, Taylor & Francis.
3.	Forensic Science Progress, A. Maehly et all, Vol. 1.to 5.
4.	Crime investigation by P.L. Kirk.
5.	Forensic Science Hand Book, Vo1- III Chapter-3 (1993), R Saferstein Prentice Hall international, London.
6.	Methods of chemical Analysis of Hydraulic Cement, Bureau of Indian Standard, IS: 4032-1985.
7.	Elements of X ray Diffraction B.D. Cullity, Addison – Weseley Publ. Comp Inc.
8.	ASTM standards, B.W. Anderson.
9.	Forensic examination of fibers, James Robertson.
10.	Gem Testing, B.W. Anderson
11.	Annual Book of ASTM standard, Vo104.01:1985
12.	Precious stones, Max Bauer (Vo1.I.and II)
13.	The chemistry of cement and concerts, Lea, F.M.1971, Chemical Publication. Comp. Inc. New York (USA)

SEMESTER-II

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-204a	Diagnostics in Forensic Sciences	35	15	50	2

SECTION-A

Serology- Presumptive and confirmatory tests for blood, saliva, semen, feces, vaginal secretion, urine, menstrual blood.

ABO blood group system, Rh Blood group system.

SECTION- B

Species origin- ouchterlony test or precipitin test

Adulteration, drugs testing and classification

SECTION- C

Asphyxia-Types and Causes of Asphyxia, Stages and Signs of Asphyxia, Hanging, Strangulation, Ligature Strangulation, Throttling (Manual Strangulation), Hyoid Bone Fracture, Suffocation, Smothering, Gagging Choking, traumatic Asphyxia, Drowning.

Road traffic accidents- Injuries to Pedestrian, Injuries Sustained by Motorcyclist, Injuries Sustained to Occupant of Vehicle

Recommended Books

1.	Principles of Forensic medicine and Toxicology- Rajesh Bardale
2.	Forensic science hand book by Richard Safer stein
3.	Textbook of forensic medicine and toxicology- N.G. Rao
4.	The essentials of forensic medicine and toxicology- Dr. K.S. Narayan Reddy and Dr. O.P. Murty

SEMESTER-II

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-204b	Introductory Molecular Biology	35	15	50	2

Section-A

DNA Replication: Prokaryotic and eukaryotic DNA replication, Mechanics of DNA replication, enzymes and accessory proteins involved in DNA replication and DNA repair. **Transcription:** Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements in mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing **Modifications in RNA:** 5'-Cap formation, Transcription termination, 3'-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA, mRNA stability.

Section-B

Translation: Prokaryotic and eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination, Regulation of translation, co- and post translational modifications of proteins. **Protein Localization:** Synthesis of secretory and membrane protein, Import into nucleus, mitochondria, chloroplast and peroxisomes, Receptor mediated endocytosis **Oncogenes and Tumor Suppressor Genes:** Viral and cellular oncogenes, tumor suppressor genes from humans, Structure, Function and mechanism of action of pRB and p53 tumor suppressor proteins.

Section-C

Antisense and Ribozyme Technology: Molecular mechanism of antisense molecules, inhibition of splicing, polyadenylation and translation, disruption of RNA structure and capping, Biochemistry of ribozyme; hammer head, hairpin and other ribozymes, strategies for designing ribozymes, Applications of Antisense and ribozyme technologies **Homologous Recombination:** Holliday junction, gene targeting, gene disruption, FLP/FRT and Cre/Lox recombination, RecA and other recombinases **Molecular Mapping of Genome:** Genetic and physical maps, physical mapping and map-based cloning, choice of mapping population, Simple sequence repeat loci, Southern and fluorescence in situ hybridization for genome analysis, Chromosome micro dissection and micro cloning.

Section-D

Molecular markers in genome analysis: RFLP, RAPD and AFLP analysis, Molecular markers linked to disease resistance genes, Application of RFLP in forensic, disease. prognosis, genetic counseling, Pedigree, varietal etc. Animal trafficking and poaching; Germplasm maintenance, taxonomy and Bio-diversity.

SEMESTER-II

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-205	Laboratory Course	70	30	100	6

Section-A (Biological Science Practical)

1.	Sample preparation of hairs, human and animal hair morphology, measurements (diameter, medullary ratio, ellipticity ratio, scale count from casts).
2.	Human hair comparison, color, treatment, pigment shape and distribution, damage, disease, medulla, root, tip- Animal hair diameter medulla, colour banding, scale casts
3.	Vegetable fiber characterization
4.	Unknowns and sample handling
5.	Presumptive tests for Blood and semen
6.	Confirmatory tests for blood and semen
7.	P30 by ELISA
8.	Tests for saliva

Section-B (Physical Science Practical)

1.	Radial, Concentric, hackle and Rib Marks identification on Glass fracture
2.	Measurement of physical parameters (colour, density, refractive index) on glass samples.
3.	Calculation of unit cell parameters(a, b, c) and d values certain elements from using Bragg's law
4.	Peak determination of Quartz, Beryl, Anthracite etc. Stones using XRD
5.	Comparison of Compression, striated and combination of both marks.
6.	Comparison of paint chips under microscope
7.	Microscopic examination of various fibres
8.	Measurements of physical parameters of fibers (Number of strands, Diameter of strand, Dye marks, Twist, Colour, thickness)
9.	Soil comparison using density gradient tubes

Section-C (Chemical Science Practical)

1.	Analysis of Hydrochloric Acid, Sulphuric Acid, Nitric Acid & Aqua- Regia
2.	Study of effect of different concentration of Sodium bicarbonate, Sodium carbonate & sodium hydroxide on phenolphthalein and their subsequent analysis.
3.	Collection of different samples in bribery cases and their chemical analysis for the detection of dye and base.
4.	TLC analysis of phenolphthalein, Rhodamine B, Alta and Mercurochrome
5.	Restoration of erased number on metallic surfaces
6.	Restoration of registration numbers on plates
7.	Determination of percentage of proof spirit of ethyl alcohol in alcoholic beverages.
8.	Chemical test for methanol, ethanol, acetone, copper and iron in liquors
9.	Analysis of petrol, Kerosene and HSD by GC method with temperature programming

SEMESTER-II

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-205	Moral Studies	15	10	25	1

Unit-1 Concept of Moral education

4 hours

- Meaning, Nature of Moral education
- Nature and source of Values-biological. Psychological, social, economical and ecological determinants
- Role of education in dealing with human values

Unit-2 Indian Culture and human values

4 hours

- Indian culture reverence for life: unity of life, socio-cultural traditions and values, unity in diversity, spirit of tolerance, assimilation and synthesis
- Character formation towards positive personality: truthfulness, sacrifice, sincerity, self control, constructively, tolerance, altruism, scientific vision
- Personal development: self analysis and introspection, sensitization towards gender equality, physical challenged, intellectually challenged, respect to –aged, experienced, neighbours, co-workers etc.

Unit-3 Education for National Development

2 hours

- Role of education in national development, economic development and human resource development
- Education for peace, cooperation and value-violence

Practical Work (Any One)

1. Conducting literacy programmes like adult literacy, women literacy, remedial coaching for educationally poor children and special coaching for bright and disabled children.
2. Organizing Community based intensive vocational training for economic empowerment through self employment.
3. Sanitization of human value working with old age home, leprosy home, orphanage home, physical and mental disabled association etc.
4. Utilization of human resources like unemployed youth, adolescents, illiterate women, retired persons in community development programmes.
5. Training on time management, waste management, space management and resource management through community development programme.
6. Establishment of cooperatives in the community.
7. Training of community in First Aid.
8. Training to marketing local agricultural products, dairy product, home product.
9. Conducting awareness programmes in the community.
 - Environmental conservation, sanitation and cleanliness
 - Tree plantation and water shed management.

- Domestic animal care.
- Health programmes like vaccination, polio drop, AIDS awareness, anti-alcohol/ drug addiction awareness, family planning, mobile health van, mother child care, healthy food habits etc.
- Human right, child right, women right.
- Educational provisions, policies, schemes and benefits.

SEMESTER-III

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-301	Forensic Explosives	70	30	100	6

An explosive is a substance that contains a great amount of stored energy that can produce a sudden expansion of the material after initiation, usually accompanied by the production of light, heat, sound and pressure. This paper covers up all the essentials of different explosive material and further includes the explosive devices, assessment of properties. Effects of explosives, assessment of damage, explosive detection and laboratory examination of post blast debris.

Section-A

1.	History of Explosives, Applications/uses of explosives.
2.	Definition of Explosive Substance, Constitution of Explosives: Chemical instability, Oxygen, Fuel.
3.	Classification: Inorganic and Organic Condensed and Dispersed Deflagrating and Detonating Low and High primary (initiators) secondary Legal
4.	Nuclear explosions Energetic compounds: Polynitropocycloalkanes, nit amines, N- Heterocycles Non- explosive explosions: Mechanical, Thermal, Electrical, Aerosol.
5.	Explosive Devices: Casing Explosive substance Initiation and delay: Time-Burning Corrosive, Electrical, Mechanical; Motion Booby Traps Remote- Electronic Mechanical Electrical Types: safety fuses, Detonating Cord fuse Cord, Primers Military detonators, Commercial detonators, Explosive train, Grenade, Military bombs and shells Improvised Explosive devices- importance, container, explosive initiating device, missiles. Throw- down bombs, Fuse bombs Car bombs, Time bombs Letter bombs Transistor bombs, Magnetic bombs, Human Bomb Pyrotechniques.

Section-B

1.	Assessment of explosive properties: Sensitivity to Impact, friction, static discharge, heat and shock Stability – Chemical and Physical
2.	Explosion effects: Basics – Detonation velocity, Brisance, Power of strength Effect of ignition communication.
3.	Explosion effects-types: Blast pressure: Positive and Negative Fragmentation Ancillary

4.	Blast injuries: Primary- (Direct) blast wave exposure Secondary- blast energized bomb fragments and other debris (shrapnel) Tertiary- abrupt deceleration of the body indirect blast wave effect Quaternary- Collapses of building.
5.	Assessment of Damage: Importance of damage, Types of explosive and explosion damage, Value to be attached to damage observations, Importance of the site of the Explosion centre, Determination of the site of the explosion centre, Significance of pressures, Application of pressure observations, Phenomenon of Fragmentation, Information form fragments..

Section-C

1.	Explosion site- Location Scene of explosion – Planning Precautions; Observations; search for the clues Collection of Clues; Despatch of clues ;Handling live devices, Evidence on the culprit, Evidence in the vehicle, Evidence at the factory or factory or residence Disposal Packaging and Documentation.
2.	Explosive Detection- Issue, threat problems Detection technologies. Vapour detection Trained animal dogs, GC-ECD Mass spectrometry Ion Mobility Spectrometry TOFMS Bioluminescence.
3.	Detection of Hidden Explosives: X-ray imaging, X-ray Computed Tomography; Nuclear Technologies Taggants- Tagging of Explosives.
4.	Laboratory support in crime investigation related to explosions
5.	Reading the Bomber's signatures: study of modus operandi similarity between several bombings' association of two or more incidents feedback of detailed forensic examinations: evaluation.

Section-D

1.	Laboratory examination of post blast Debris; Physical examination, Microscopic search Sorting of debris for selection of the samples, Extraction schemes Colour tests, thin Layer chromatography.
2.	Laboratory examination of explosive substances: Physical examination –Burning Flame test, solubility Chemical tests Test for acidic and basic radicals crystal tests Thin Layer Chromatography.
3.	Laboratory examination of crystalline explosives by XRD
4.	Analysis and detection of explosives by FT-IR spectroscopy
5.	Analysis and detection of explosives by mass spectrometry: Aromatic nitro compounds TNT, DNT, Picric Acid

Nitrate Esters- NG,EGDN Nit amines-RDX, HMX Organic Peroxides-TATP
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Recommended Books	
1.	Forensic Science in Criminal investigation & Trials by Dr. B.R. Sharma Universal Law Publishing Co. Pvt. Ltd. Delhi(4 th edition 2005).
2.	Forensic and environmental Detection of Explosives by Jehuda yinon John Wiley & Sons Ltd. England (1990)
3.	Modern Methods and application n Analysis of Explosives, JehudaYinon Shmuel zitrin, John Wiley & Sons Ltd. England (1993)
4.	Practical Bomb scene investigation, James T Thurman Taylor & francis New York (2006)
5.	Aspects of Explosive Detection edited by Maurice Marshall & Jimmie Coxlely, Elsevier –UK(2009)
6.	Explosives by Josef Kohler, Rudolf Mayer, VCH, Germany(4 th edition-1993)
7.	Vogel's Qualitative Inorganic analysis(7 th edition) revised by G. Sverhia (2 nd impression-2006)
8.	Vogel's Textbook of Quantitative chemical analysis by J Mendham, RC Denney, JD Barnes, MJK Thomas Pearson Education Dorling Kindersley (India) Pvt. Ltd. Delhi 6 th edition 2007.
9.	Spectrometric identification of organic compound (6 th Edition), by Robert M. Silverstein and Francis X. Webster, Published John Wiley & S Sons Inc. New York 1998.
10.	Instrumental Methods of Analysis (6 th Edition) by Hobart H. Willard, Lynne L Merritt. Jr, Jon A Dean and Frank A settle Jr. CBS publishers & Distributors Delhi (Ist Indian Edition-1986).
11.	Explosion Investigation by H.J. Yallop the forensic and Scottish Academic press, UK (1980)
12.	Interpretation of Mass Spectra by Fred W. McLafferty and franfisek Turecek university Science Books California (4 th Edition -1993)
13.	Forensic investigation of explosions edited by Alexander Beveridge Taylor & Francis Ltd. UK 1998.
14.	Application of absorption spectroscopy of organic compounds by John R Dyer Prentice Hall of India of India Pve.Ltd New Delhi (3 rd reprint 1974)
15.	Basic liquid chromatography by H.M. Mc Nair and E.J. Boneal-consolidate Varian 1978.
16.	Basic gas chromatography by H.M. Mc Nair and E.J. Boneal Consolidated printers California Varian (5 th edition 1969)
17.	Explosion and Blast related Injuries by Nabil M, E.L. sayed James L Atkins Elsevier Academic Press & USA (2008)
18.	Forensic Application of Mass spectrometry Jehuda Yinon CRC Press Florida 1995.
19.	Practical Organic Mass Spectrometry by J.R. Chapman John Wiley & sons Ltd. England (1994)
20.	Organic Chemistry of explosives by J.P. Agrawal R,D, Hodgson John Wiley & sons Ltd England (2007)
21.	Introduction to Mass spectrometry by J Throck Watson and O David Sparkman John Wiley & sons Ltd England (2007)
22.	Analytical methods in Forensic chemistry by Mat B. Ho Ellis Horwood Limited England (1990)
23.	March's advanced Organic chemistry by Michael B. Smith and jerry March, Wille Interscience A John Wiley & sons INC publication New Jersy (6 th edition(1943)
24.	Military pyrotechniques and chemical Warfare Agents, J Bebie New York (1943).

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-302	Forensic Anthropology and Forensic Medicine	70	30	100	6

Section-A

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/post-mortem.
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.

Section-B

1.	Introduction to subject of human osteology, its over-view, ethics and handling of bones. Anthropometric and ostemetric variation in human population.
2.	Biological profiling of skeletal remains: Demography, Sex, age, stature and race estimation. Bio distances and divergences.
3.	Trauma and Pale pathology 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

Section-C

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.	Facial superimposition: Anthropological study of skull, Photography of the skull in the same pose as the ante mortem photography, enlargement of the ante mortem photograph, comparison of the facial features of the human skull and the ante mortem photograph. Still photographic method and computerized technique of superimposition.
4.	Forensic art: 2D facial reconstruction by drawing method form the facial features, ‘rule of the thumb’ principles for facial reconstruction, age progression on the face, relation.

Section-D

1.	Forensic anthropologist and mass disasters.
2.	Forensic Archaeology introduction, Recovery of Forensic Evidence from individual graves, Forensic Geophysical survey, Legal matters.
3.	Molecular anthropology: Progress and Perspectives Genetic Anthropology Human migration, modern human ancestry, Benefits and Controversies of Genetic Anthropology.
4.	Ancient DNA Typing: Introduction, Methods, strategies and applications, ancient DNA markers, CCR5 F508 Ancient DNA extraction: comparison of extraction methods, ancient DNA yield, ancient DNA preservation, ancient DNA degradation patterns, the age of ancient DNA, Fragment Lengths of ancient DNA storage of ancient DNA extracts.

Recommended Books

1.	Forensic Anthropology Laboratory manual Steve Byers and Susan, Myster.
2.	Allyn and Bacon Publishers.
3.	Human osteology: A laboratory and field manual William M. Bass: Missouri Archaeological Society.
4.	The human bone manual Tim White and Pieter Folkens Academic Press Forensic Archaeology: Advance in Theory and Practice by John Hunter, Margaret Cox (Routledge Taylor and Francis Group).
5.	Ancient DNA Typing: Methods, Strategies, and Applications by Susanne Hummel (Published by Springer)
6.	Human Osteology in Archaeology and Forensic Science: In Archaeology and forensic Science Margaret Cox, Simon Mays Cambridge University Press, 2000.

SEMESTER-III

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-303	Forensic Toxicology	70	30	100	4

Toxicology is the study of the adverse effects of chemicals precisely the poisons on living organisms. The paper comprises of characteristics and spectrum of exposure, metabolism of poison and the drugs, extraction *viz.* solvent extraction, solid phase extraction and micellar extraction, isolation and analysis of various poisons.

Section- A

1.	Introduction to Toxicology– Concept and Scope Detailed classification of poisons
2.	Characteristics of exposure- Acute and Chronic Exposure–Route,Site, Duration and Frequency of Exposure;
3.	Spectrum of Toxic Effects, Dose and Response, Absorption, Distribution and Excretion and Influencing Factors;
4.	Dose– Response Relationship –Lethal dose 50, Effective dose 50.

Section-B

1.	Metabolism of poisons- Pharmacokinetics, Pharmacodynamics, Types of Metabolic reactions- Hydrolysis, Oxidation, Reduction, Conjugation, Acylation and Methylation.
2.	Factors influencing Metabolism, Factors modifying actions of poisons
3.	Metabolism of drugs – Analgesics, narcotic analgesics, tranquilizers, barbiturates and benzodiazepines.
4.	Pesticides Metabolism (intricacies to body functions) - herbicides, Organophosphate insecticides, carbamates.

Section-C

1.	Extraction, Isolation and Identification of Poisons Factors influencing choice of method.
2.	Distillation Solvent Extraction – Stas Otto method, Sodium Tungstate method, Ammonium sulphate method and Acid Digestion method.
3.	Solid Phase Extraction Micellar extractions.
4.	Modified method for clean-up and separation using Alumina/Silica gel Cleanup using Solid Phase Extraction Cartridges. Lethal dose examination.

Section-D

1.	Alcoholism and Drug Dependency, Medico-legal Aspects, Analysis and Identification of Ethyl Alcohol-Chemical Tests, Kozelka-Hine method. Conflict Poisoning- Chemical and Biological Warfare Agents of Mass destruction
2.	Agro-Chemical Poisoning- Toxicology and Identification of Organophosphorousinsecticides,Organochloro,CarbamateInsecticidesand Herbicides – Colour Tests, Thin Layer Chromatography.
3.	Identification of basic and acidic drugs of abuse-Colour Tests, Thin Layer Chromatography Identification and Toxicology of Metallic Poisons.
4.	Toxicology and Identification of common poisons of plant and animal origin of forensic relevance.Technical killings. Toxicology of hydrocarbon,petroleum distillates

Recommended Books	
1.	Toxicology-The Basic Science of Poisons by Louis J. Casarett & John Doull, Macmillan Publishing Co., Inc., New York-1975
2.	Curry A.S. : Analytical Methods in Human Toxicology, Part-II, (1986).
3.	Clark, E.G.C. : Isolation and identification of Drugs, Vol. I and Vol. II, (1986).
4.	Curry, A.S. : Poison Detection in Human Organs, (1976).
5.	Sunshine, I: Guidelines for Analytical Toxicology Programme, Vol. I, CRC Press, (1950).
6.	Sunshine, I: Handbook of Analytical Toxicology, Press, (1969).
7.	Sunshine: Methods for Analytical Toxicology, Press USA, (1975).
8.	Mule, S.J. et al. : Immunoassays for Drugs subjects to abuse, CRC Press, (1974).
9.	Curry, A.S.: Poison Detection in Human Organs, C. Thomas Springfield, Illinois USA, (1963).
10.	Connors. : A textbook of Pharmaceuticals analysis, Interscience, New York, (1975).
11.	Gleason, M.N. et al : Clinical Toxicology of Commercial products, Williams and Williams, Baltimore, USA, (1969)
12.	Modi, Jaisingh P: Textbook of Medical jurisprudence & Toxicology, M.M. Tripathi Pub. (2001).
13.	Cravey, R.H., Baelt, R.C. : Introduction to Forensic Toxicology, Biochemical publications, Davis CA (1981).
14.	A. Stolmen : Progress in Chemical Toxicology: Acad, Press, New York (1963).
15.	Working Procedure Manual – Toxicology, DFS Publications (2005)

SEMESTER-III

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-304a	Fundamentals of Bioinformatics (Elective-I)*	35	15	50	2

Section-A

Computers -An overview of computers, microcomputers, VDUs and printer. What is programming? Algorithms. Languages and packages: Introduction to MS Office, MS Access, Front Page and introduction to C, Java and SQL (structured query language) Handling arrays, procedures. Colour, sound and graphics. Use of standard packages.

Section-B

Introduction to PERL: Scalar variables, strings and numbers, Assignment statements, Arrays, Hashes, Operators, Input from file, Standard Input, Conditional and logical operators, loops, I/O, Input from file named in command line, Regular expression, Pattern matching, Meta symbols, Pattern modifiers, Subroutines. Applications of PERL in Bioinformatics: Storing DNA sequence, DNA to RNA transcription, Finding motifs, Counting nucleotides, Generating random numbers, simulating DNA mutation, generating random DNA, Analyzing DNA.

Section-C

Biological Sequence Databases: Overview of various primary and secondary databases that deal with protein and nucleic acid sequences. Databases to be covered in detail are GenBank, EMBL, DDBJ, Swiss Prot, PIR, and MIPS for primary sequences. Various specialized databases like TIGR, Hovergen, TAIR, PlasmoDB, ECDC etc., will also be discussed. Preliminary ideas of query and analysis of sequence information.

Section-D

Sequence Comparison Methods: Method for the comparison of two sequences viz., Dot matrix plots, NeedlemanWusch & SmithWaterman algorithms. Analysis of computational complexities and the relative merits and demerits of each method. Theory of scoring matrices and their use for sequence comparison.

Section-E

Database Search Algorithms: Methods for searching sequence databases like FASTA and BLAST algorithms. Statistical analysis and evaluation of BLAST results. Pattern Recognition Methods in **Sequence Analysis:** Concept of a sequence pattern, regular expression based patterns. The use of pattern databases like PROSITE and PRINTS. Concept of position specific weight matrices and their use in sequence analysis. Theory of profiles and their use with special reference to PSIBLAs. Markov chains and Markov models and their use in gene finding. Concept of HMMS, the Forward backward and the Viterbi algorithm. The Baum Welch algorithm for training a HMM. Use of profile HMM for protein family classification.

Recommended Books: Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (3rd Edition). Edited by Adreas D. Baxevanis and B.F. Francis Oullette published by WileyInterscience (2005). ISBN: 978-0-471-478-2.

SEMESTER-III

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-304b	Forensic & Homicide Investigation	35	15	50	2

SEMESTER-III

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-305	Laboratory Course-III	105	45	150	6

Section-A

1.	Barrel Wash Examination.
2.	Examination For Serviceability/Working Condition of Firearm.
3.	Identification of Firearm for Type , Make and Model.
4.	Identification of Ammunition/Parts Thereof for Type make and Calibre. Bullet/Pellets/wads Whether Fired or not.
5.	Standard Ion analysis for the presence of various radicals from explosive debris.
6.	Colour test for nitrate explosives (Griess, DPA, Brucine sulphite).
7.	Colour test for TNT & Tetryl (Alcoholic KOH,Sodium Sulphite).
8.	Colour test and analysis of Black powder (Griess, DPA Sodium cobalinitrate, NaoH sodium nitroprusside, Flame test).
9.	TLC for TNT & Tetryl.
10.	TLC for RDX & HMX.
11.	TLC for NG&PETN.
12.	Analysis of Pyrotechnique mixtures.
13.	Analysis of components of crackers.

Section-B

1.	Test for ethyl alcohol and associated impurities
2.	Colour test for Parathion-Palladium Chloride
3.	Colour test for Barbiturates-Zwikkertest
4.	TLC for Barbiturates (Phenobarbitone, Secobarbital)
5.	TLC for Benzodiazepines (Diazepam, Lorazepam, Alprazolam)
6.	TLC for Organophosphorus insecticides (Fenthion, Parathion, Malathion)
7.	TLC for Organochloro pesticides (Lindane, DDT, Endosulphan)
8.	TLC for Carbamates (Propoxur, Sevin)
9.	Colour test for Dhatura, Callotropis
10.	Colour test for Cannabis and Identification of cannabis alkaloids by TLC.
11.	Reinsch test for Metallic Poisons (Arsenic, Mercury, Antimony, Bismuth)
12.	Extraction of non volatile organic poison from viscera by ammonium sulphate method.
13.	Test for the presence of Aluminium/Zinc phosphide in given exhibit.

Section-C

1.	Osteology: Human skeleton Axial and appendicular skeleton; Descriptive terminology used in osteology; Different classes of bones and their functions features of bones; Bone identification anatomical layout and skeletal recording.
2.	Crematorium field trip Demonstration of bone injuries, Demonstration of bone and dental pathology.
3.	The Skull, Clavicle scapula and ribs, Vertebral column, Humerus radius ulna.

4.	Carpals metacarpals and phalanges, Pelvis, Femur tibia, fibula, patella, Tarsal's, metatarsals, phalanges.
5.	Human and non human bones case study.
6.	Age and sex determination of Human skeleton.
7.	Osteometry, Scapula measurements, angles, indices Humerus Measurements.
8.	Angles and indices Humerus and femur Torsion angles, Craniometry.
9.	Measurements on cranium and face.
10.	Somatometry : Landmarks on body: projective height measurements of the body in standing position measurements in sitting positic linear and breadth measurements of upper and lower extremities, Measurements of head and face; Indices:
11.	Somatoscopy: Morphological observations of different body characters.

Section-D

DNA Isolation, STR PCR.
Post PCR sample preparation.
310 Setup, Operation for STR Cleanup.
Matrix construction, Clean up.
STR Analysis, Genescan, Genotypes, Genemapper.
mtDNA: Sample collection, extraction.
Polymerase Chain Reaction, Contamination Control.
Gel purification of PCR Product.
Big Dye Sequencing PCR.
PCR cleanup, Set up, Sample loading Sequencing on Genetic Analyzer.
Sequence analysis, BLAST Search, troubleshooting
Independent sequencing project.
Profiling of characteristics of modern printing devices attached to computers.
Characteristic features of reproduction and their relation with original.
Display of parameters of identification of writing characteristics of a genuine writer and their individual qualities.
Sequence of different colour strokes.
Handling and preserving of charred documents.
Identification of class characteristics of a writer from five writing.
Display of characteristic features of forgery in a signature on a chart.
Identification of movements in a piece of writing.
Relation of speed and forms of letters in a chart.
Display of type writing with its elements of analysis i.e. letter design, vertical and horizontal alignments, alignments, wear and tear marks.
To take plain and rolled inked finger prints.
Taking of palm Prints.
To identify the finger print patterns.
To identify core and delta.
To perform ridge tracing and ridge counting.
To identify ridge characteristics.

Development of latent prints by mechanical methods, fuming and chemical methods on various surfaces.
Lifting of finger prints and photography.
Ten digit fingerprint classifications.
To compare the finger prints.

SEMESTER-III

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-305	Community Service	15	10	25	1

UNIT I: First Aid and their application

- Meaning and Definition of First Aid and First Aid kits
- Poisoning by snake bite and insect bite and other animal bites
- First Aid in burning, First Aid giving to drowning patients
- First Aid to patient having injuries and fractures

UNIT II: Care of the elderly, needs and responsibility of society towards old people

- Definition of old age, concept of ageing and problems: Social, Medical, Psychological problem and Occupational problem
- Responsibility of society towards old age people services and programmes for the aged
- Categories of services (Housing, Health, Institution for the aged day care centres, Investment and Taxation and Property etc.)

UNIT III: Programmes & Policies of Government & Non-Government organization for vulnerable group

- Children (Early childhood, Middle Childhood)
- Adolescent
- Women (Adult & Elderly)

UNIT IV: Nutritional requirement for vulnerable group

- Malnutrition in mothers and children and their management
- Policies and Programmes for promoting maternal and child nutrition and health programme
- Pregnant and lactating women

UNIT V: Study of family prevailing in the society

- Contemporary issues & concerns (Family violence, Battered women, Child maltreatment and Sexual abuse)
- Dowry, Domestic Violence and Divorce
- Awareness about legal aspect.

4th Semester
Forensic Biological Sciences

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-401	Question Document Handwriting and Fingerprint Examination	105	45	150	6

Section-A

1.	Nature and problems of document examination, classification of documents, procurement of standard admitted/specimen writings handling and marking of documents, preliminary examination of documents.
2.	Basis of handwriting identification- individuality of handwriting, natural various process of comparison.
3.	Various types of documents- genuine and forged documents, holographic documents.
4.	Various writing features and their estimation, general characteristics of handwriting, individual characteristic of handwriting.
5.	Basic tools needed for forensic documents examination and their uses.

Section-B

1.	Disguised writing and anonymous letters
2.	Identification of a writer, Examination of signatures – characteristics of genuine and forged signature,
3.	Examination of alteration, erasers, overwriting, additions and obliterations,
4.	Decipherment of secret, indented and charred document
5.	Examination of seal impression and the mechanical impressions.

Section-C

1.	History and development of fingerprint Science, formation of ridges, pattern types, pattern areas
2.	Classification of fingerprints- Henry system of ten digit classification, Extension of Henry system, search of fingerprints, fingerprint Bureau
3.	Composition of sweat, chance fingerprints: latent& visible fingerprints, plastic fingerprints,
4.	Development of latent fingerprints: conventional methods of development of fingerprints- fluorescent method, magnetic powder method, fuming method chemical method etc.
5.	Application of laser and other radiations to develop latent fingerprints, metal deposition method and development of latent prints on skin.

Section-D

1.	Taking of finger prints from living and dead persons.
2.	Preserving and lifting of fingerprints, photography of fingerprints,
3.	Digital imaging and enhancement
4.	Comparison of fingerprints, basis of comparison, class characteristic, individual characteristic, various types of ridge characteristics
5.	Automatic fingerprint identification system

Recommended Books:

1.	Hubber, A.R. and Headride, A.M. (1999) : Handwriting identification : facts and fundamental CRC LLC.
2.	Ellen, D. (1997) : The scientific examination of Documents, Methods and techniques. 2 nd ed., Taylor & Francis Ltd.
3.	Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
4.	Manning, C.A (1999) : Financial Investigations and Forensic Accounting CRC Press.
5.	Harrison, W.R. : Suspect Documents & their Scientific Examination, 1966, Sweet & Maxwell Ltd., London.
6.	Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsaevier North Holland Inc., New York.
7.	Brewster, F. : Contested Documents and Foregeries, The Eastern Law House, Calcutta. 1932.
8.	Ames : Ames on Foregery, 1900, Ames Rellingson Co., New York.
9.	Conway, J.V.P. : Evidential Documents, 1959, Charles C. Thomas, Illinois.
10.	Mehta, M.K. : The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi, Allahabad. 1970.
11.	Sulner, H.F. : Dispatad Document, 1966 Oceana Publications Inc., New York.
12.	Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabad (Ed. A.K. Singla).

4th Semester
Forensic Biological Sciences

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-402a	Forensic Biology and DNA methods	105	45	150	6

Section-A

1.	Introduction, Methods, strategies and applications DNA markers.
2.	Mitochondrial, DNA, the hypervariable regions and control region V.
3.	Cytochrome b, chloroplast DNA.
4.	Chromosomal DNA amelogenin, Autosomal STRs Y chromosomal STRs).
5.	Variable Number Tandem Repeat (VNTR's) and Short Tandem Repeat (STR's) markers.
6.	Single Nucleotide polymorphism(SNP's)

Section-B

1.	DNA Extraction, Organic and Inorganic extraction, Comparison of Extraction Agarose methods, commercial kits.
2.	DNA Quantitation, Importance of Quantitation Spectrophotometric analysis, Agarose Gel Electrophoresis, Slot Blot Hybridization, Real Time PCR.
3.	Polymerase Chain Reaction.
4.	Basic PCR mechanism, Real time PCR, Primer designing.
5.	Primer dimmer and Hairpins, Mismatch primers,
6.	Software's packages, Multiplex PCR, PCR failures,
7.	DNA degradation, inhibition, DNA overload and Cycling.

Section-C

1.	Introduction to fragment analysis, Automated fragment Length Determination, Sequence analysis.
2.	Automated Genetic Analyzer Operation theory.
3.	Biology of STRs Forensic Issues.
4.	mtDNA Biology and Analysis.
5.	DNA Sequencing application in forensics.

Section-D

1.	Eukaryotic genome structure and concepts of genomic analysis.
2.	Public sequence databases: DNA, RNA, proteins, whole genomes.
3.	Data mining for homologous sequences.
4.	Multiple sequence alignment algorithms.
5.	Phylogenetic trees and molecular evolution.
6.	Microarrays and transcriptome analysis.
7.	The proteome, metabolome, glycome, lipidome, and interactome.
8.	Human genes and genetic disorders.
9.	Ethics in human bioinformatics and genomics.
10.	Y Chromosome testing.
11.	Non-Human, medical, and research applications.

Recommended Books:	
1.	Butler, John M. 2005. <i>Forensic DNA Typing</i> , 2 nd Ed. Academic Press, San Diego. ABI Prism 310 Genetic Analyzer User's Manual 2001 Applied Biosystems.
2.	Inman, K. & N. Rudin. 1998. <i>Introduction to Forensic DNA Analysis</i> , CRC Press.
3.	Boca Raton Griffith, H. & M. Annette eds. 1994. <i>PCR Technology: Current Innovation</i> , CRC Press, Boca Raton.
4.	Kirby, L.T. 1990. <i>DNA Fingerprinting: An Introduction</i> . W.H. Freeman New York.
5.	Krawczak M. & J. Schmidtke. 1994 DNA Fingerprinting Bios Scientific Publishers, Oxford
6.	Landweber, L.F. & A.P. Dobson. 1999. <i>Genetics and the Extinction of Species: DNA and the Conservation of Biodiversity</i> .
7.	Walls, H.J. 1968 at the bench: A laboratory navigator. Cold Spring Harbor Investigation. Praeger, New York.
8.	Barker, K. 1998. At the bench: A laboratory navigator. Cold Spring Harbor Laboratory Press, New York.
9.	Butler, John M. 2001 Forensic DNA Typing. Academic Press, San Diego. ISBN 0 -12-147951-x. 322 Pages.
10.	Forensic DNA Typing Protocols.
11.	Baxevanis, A. D. & Ouellette. B.F.F. (2004) Bioinformatics: A practical Guide to the Analysis of Genes and Proteins. 3 rd ed New York: Chichester Wiley.
12.	Barnes, M.R. (2007) Bioinformatics for geneticists A Bioinformatics Primer for the Analysis of Genetic data., 2 nd ed. New York; Chichester: Wiley.
13.	Bergeron, B. (2002) Bioinformatics Computing. 1 st ed. Upper Saddle River, NJ: Prentice Hall/Professional Technical Reference.
14.	Campbell, A.M. & Heyer, L.J. (2006) Discovering Genomics, Proteomics and Bioinformatics. 2 nd ed. San Francisco, CA: CSHL Press: Pearson/Benjamin Cummings.
15.	Gibson, G., & Muse, S.V. (2004). <i>A Primer of Genome Science</i> . 2 nd Ed., Sunderland, MA: Sinauer Associates.
16.	Higgins, D, & Taylor, W (2000). <i>Bioinformatics: Sequence, Structure and Databanks: A Practical Approach</i> . 1 st Ed. Oxford; New York Oxford University Press, USA.
17.	Kohane, I.S. kho, A & Butte, A.J. (2005): Microarrays for an Integrative Genomics. 1 st ed. Cambridge, MA: the MIT Press.
18.	Lesk, A (2008). Introduction to Bioinformatics. 3 rd ed. Oxford; New York: Oxford University Press.
19.	Letovsky, S.I. (1999). Bioinformatics: Databases and systems. 1 st ed. Boston, MA: Kluwer Academic publishers.

4th Semester
Forensic Chemical Science

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-402b	Instrumental Analysis in Chemical Sciences	105	45	150	6

Section-A

1.	Chromatography –TLC/HPTLC technique, stationary phases, solvent systems, analysis, visualization, application.
2.	GLC- technique. Instrument and its parts, column efficiency, solvent efficiency, resolution, isothermal and temperature programming, detectors Qualitative analysis- chromatographic identification- retention data, identification by log plotting of homologous series, GC retention index (Kovats) Identification by relative detector response (dual channe).
3.	Quantitative analysis area normalizations, correction factors, absolute calibration (external standard method), internal standardization, Temperature programming.
4.	HPLC- Technique, Liquid Solid Chromatography, Partition Chromatography, Ion Exchange Chromatography, Exclusion Chromatography, Column efficiency, solvent efficiency, resolution Isocratic and gradient elution.
5.	Qualitative analysis- chromatographic identifications- retention data identification by log plotting of homologous, series, HPLC retention index, identification by relative detector response (dual channel) Detectors.
6.	Qualitative analysis- area normalization, correction factors , absolute calibration (external standard method), internal standardization.

Section-B

1.	UV Spectroscopy- mechanics of measurement, electronic excitations, simple chromophoric groups, conjugated systems, aromatic systems.
2.	Beer Lambert law, deviation from law, spectrophotometric accuracy- instrumental parameters, sample handling Applications- quantitative analysis.
3.	IR Spectroscopy- molecular vibration/theory, overtones, combination and difference bands, sample handling, mechanics of measurements, Polystyrene film for calibrating IR spectrum.
4.	Characteristic group absorptions of organic compounds (common functional groups). Normal, branched chain and cyclic alkanes, alkenes aromatic hydrocarbons, alcohols and phenols. Ethers and peroxides , ketones, aldehydes, carboxylic acids, esters and lactones, acid halides, amides, amines, covalent compounds containing N-O bonds, halogen compounds, sulphur compounds.

Section-C

1.	Mass Spectrometry: Mass spectrum and its formation, mass analysis of ions, ion abundance measurement, sample introduction, mixture analysis, molecular structure information, standard interpretation procedure.
2.	Elemental composition:- stable isotopes classification, A+2, A+1 and A elements, rings plus double bonds, deducing elemental compositions- base peak, molecular ion peak Molecular ion-requirements, odd-electron ions even electron ions, nitrogen rule relative importance of peaks, logical neutral losses.
3.	Fragmentation- general rules- unimolecular ion decomposition factors influencing ion abundance, reaction initiation at radical site, reaction type's sigma bond dissociation, radical site initiation charge site initiation.
4.	Decomposition of cyclic structures radical site rearrangements, charge site rearrangements.

Section-D

1.	Sample differentiation by stable- isotope ratio mass spectrometry sample differentiation in forensic science differentiation of samples based on stable isotope variations in natural occurring level, stable isotope coding as a tracing mechanism. Fast atom bombardment mass spectrometry-methodology and application Resolution of mass spectrometers for structure elucidation– unit and high flight, ion cyclotron resonance.
2.	Postulation of molecular structures- general appearance of mass spectrum, low mass series, small neutral losses, characteristic ions, postulating possible structures. Auxiliary techniques-soft ionization methods, ionization of large molecules, exact mass measurements, tandem mass spectrometry, combined techniques, shift techniques, chemical derivatives.
3.	Mass spectra of common compounds, Interpretation of mass spectra: Hydrocarbons- saturated hydrocarbons and olefins, Hydroxy compounds-alcohols and phenols, Ethers- aliphatic and aromatic, Ketones- aliphatic, cyclic and aromatic, Aldehydes-aliphatic and aromatic, Carboxylic acids-aliphatic and aromatic, Carboxylic esters-aliphatic benzyl, phenyl and aromatic.
4.	Interpretation of mass spectra; Lactones, Amines-aliphatic, cyclic and aromatic, Aliphatic and aromatic, Nitro compounds aliphatic and aromatic, Aliphatic Nitriles, Aliphatic Nitriles, Sulphur compounds-Thiols sulphides, Disulphides, Halogen compounds- Chlorides, Bromides, Fluorides, Iodides, Heteroaromatic compounds, Natural Products -Triglycerides

Recommended Books	
1.	Forensic Science in Criminal Investigation & Trials by Dr. B.R. Sharma, Universal Law Publishing Co. Pvt. Ltd. Delhi (4 th edition 2005).
2.	Basic liquid chromatography by Edward L. Johnson and Robert Stevenson-Varian -1978.
3.	Basic gas chromatography by H.M. Mc Nair and E.J. Boneal – Consolidated Printers, California Varian (5 th edition-1969).
4.	Application of absorption spectroscopy of organic compounds by John R Dyer Prentice Hall of India Pvt. Ltd. New 3 rd reprint-1974)
5.	Interpretation of Mass Spectra by Fred W. McLafferty and Frantisek Turecek University Science Books, Clifornia (4 th Edition 1993)
6.	Sectrometric Identification of organic Compounds (6 th Frantisek Turecek, M. Silverstein and Francis X. Webster, Wwebstr, Published John Wiley & Sons Inc. New York 1998)
7.	Instrumental Methods of Analysis (6 th Edition) by Hobart H. Willard, Lynne L Merritt. Jr., John A. Dean and, Frank A. Settle, Jr., CBS Publishers & Distributors, Delhi (Ist Indian edition-1986).
8.	Forensic and Environmental Detection of Explosives by Jehuda Yinon, John Wiley & Sons Ltd. England (1999).
9.	Modern methods and application in analysis f Explosives, Jehuda yinon, Shmuel Zitrin, John Wiley & Sons Ltd. England (1993).
10.	Forensic Mass Sepctrometry by Jehuda Yinon CRC Press Florida 1987.
11.	Forensic Application of Mass Sectrmentry by J.R. Chapman, John Wiley & Sons Ltd. 1995)
12.	Practical Organic Mass Sectrometry by J.R. Chapman John Sons Ltd. England (1994)
13.	Introduction to Mass Sectrometry by J. Throck Watson and O.David Separkman.

4th Semester
Forensic Physical Sciences

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-402c	Computer Forensic and Audio Video Analysis	105	45	150	6

Section-A

1.	Principles of computer: Memory and processor, address and data buses, stored program concept. Basic electrical safety, Motherboards, start of boot sequence, Power on Self Test (POST) BIOS and CMOS, MSDOS, windows 95/98/ME, windows NT/2000/XP and Mac operating systems.
2.	Methods of storing data: Number systems, character codes, record structures, file formats and file signatures.
3.	Hardware: Development of the hard disk, Physical construction CHS and LBA addressing, Encoding methods and formats , IDE and ATA specification, overcoming the 528 MB 8 GB and 127 GB limitation Dynamic drive overlays. Boot sector, partition table, slack space and free space, Disk mapping.

Section-B

1.	The logical structures of the Microsoft operating system FAT file system. The DOS and windows boot process. How to recover deleted files. The significance and determination of the creation date and time. Passwords and encryption techniques: Importance of keeping a log, Explanation of passwords keys and hashes.
2.	Seizure of computers: Preparations to be made before seizure, Actions at the scene, Treatment of exhibits. How to make bit stream (exact copies) of the original media.
3.	Investigation: Investigating on various imaging methods. Lay down the image provided onto a hard disk and provide a disk map of the suspect drive. Extraction of all relevant information from a hard disk
4.	Instruction on the acquisition, collection and seizure of magnetic media. How to best acquire, collect or seize the various operating systems. Legal and privacy issues.
5.	Forensic examination procedures. Preparing and verifying forensically sterile storage media.

Section-C

1.	Definition and type of Cyber crimes.
2.	HTML and other Internet protocols, Internet History and Topology, Internet services and access, Internet Protocols and Addressing. E-Mail and Header Interpretation, E-Mail Attachments, FTP, Telnet and IRC, Internet Chat, HTTP.
3.	Outlook express, Virus and Trojan infection Different types of attacks, Internet Research & Investigative Tools.

Section-D

1.	Overview of several operating systems including: Windows NT/2000/XP, Linux, DOS, Windows 95/98.
2.	Registries: Use of registry viewers, use of Regedit and winHex; Typed URLs; understanding of User Assist; Mounted Devices, Event Log; extracting USB related artifacts; understanding and examination of protected storage.

3.	Linux Basics: File system layout, system management and security concepts. Accessing devices, partitions and file systems. Using a desktop (GUI) environment, and introducing common desktop applications. The shell and common command–line utilities, Understanding Linux Kernels, distributions graphical environments and available options, Installing and configuring Linux and Linux applications.
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Recommended Books	
1.	Hand book of computer crime investigation, Eoghan Casey, Elsevier.
2.	Computer crime-A crime fighter’s hand book, David Icove, K. Seger and W. Vonstorch, O’reily& Alseriates, Inc.
3.	Digital evidence and computer crime-Forensic science, computers and the internet Casey, Academic press.
4.	Computer forensics-computer crime scene investigation, John R. Vacca, Firewall Media, New Delhi.
5.	Computer evidence-Collection and preservation Christopher L.T. Brown, Fire Wall Media New Delhi.
6.	Cyber forensics-A field manual for collecting, examining and preserving of computer crimes, A.J. Marcella, Robert S. Greenfield, Auerbach publication.
7.	Cyber crime, Doughless Thomas and Brian D. Loader.
9.	A practical guide to LINUX, Sober.
10.	Computer forensics- Incident response essentials, Warren G. Kruse II and Jay G. Heiser; Addison Wesley.
11.	Cyber crime investigation field guide, Bruce Middleton, Auerbach publication.

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.

Section-A

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 cancelation, Audio enhancement.
3.	Sound recording /Playback Devices: Analogy Tape recorders, Digital recorder, Microphone Types & Advantages/disadvantages, Digital audio formats.
4.	Authentication of recorded audio: Type of alterations Auditory examination by critical Listening. Waveform analysis, speech Spectrographic analysis. Magnetic developing optical method.

Section-B

1.	Introduction to video technology: Video standards, Recording formats-Analog and Digital, Introduction to Video devices, Linear and Non-linear Editing, Concept of Video film Production Graphics and animation technique.
2.	Introduction to component of Digital Image processing: Introduction to Image processing & Computer Graphic, Image perception, Colour space & representation Storage, Image Processing Application.
3.	Introduction to image enhancement, Image restoration, Integrity of Images, Concept of Digital

	Water marking, Facial Image Recognition, Image Compression.
4.	Forensic analysis of audio/video in video recording: Falsification in Video Recording Visual Examination technique on Video frame sequence, Instrumental Method- Waveform-Vectorscope, Cross-pulse Monitor, Videogramtry and Photogramtry technique, Video image analysis-Object, costumes, Facial Image recognition form video frame image.

Section-C

1.	Basic Factors of Sound in speech: Physics of sound Components of speech sound Speech Signal-Analogue & Digital, Fourier Analysis, Fourier transforms.
2.	Acoustic Speech Production: Speech Anatomy-Animal Vs Human Organs of speech Respiratory System Phonatory System, Articulaotry System, Mechanism of speech Production - Vibration Mechanism of Vocal Folds, Acoustic Properties of Vocal Tract,
3.	Phonetic Aspects of speech: Articulators-Active/Passive, Articulation-Manner & Place of Articulation Phonemes Segmental & Supra-segmental, Sound of 61 speech-Vowel, Consonant and Glides, IPA (The International Phonetic Alphabets) Forensic Phonetics, Phonetics in Speaker Identification, Coarticulation Effect of context, Supra segmental (Prosodic features)-Stress, Tone, Intonation, Duration, Syllables, Nasalisation Accent features, Pyschological Stress.
4.	Speaker recognition: Principles of speaker recognition/identification, Methods on Speaker Recognition, Aural, Sound Spectrographic, Automatic Method, Various approaches in Forensic Speaker Identification, Interpretation of result, Statistics interpretation of probability scale, Objective/Subjective methods, Concept of test and error in Speaker Identification, Present Scenario.

Section-D

1.	Introduction to Digital Signal Processing: Digital/Analogy signals, Signal Processing, Types of processing, Signal Processing Applications, Signal Processing Systems,
2.	A/D Signal Processing Model, Computer Representation of Speech, A to D Conversion-Sampling, Quantization, Digital Audio Formats, Pulse Code Modulation Coding and Decoding.
3.	Introduction to Pattern recognition Application in Automatic Speaker Identification and Verification System.
4.	Legal status in India and Abroad: Historical Background on Speaker Identification in USA European countries and India. Judgment of Supreme Court of India on report of Speaker Identification. Court presentation of report based on speaker Identification Ear witness-Speaker Profiling, Speaker Line-up.

Recommended Books

1.	Forensic Voice Identification, Harry Holien, Academic Press, London
2.	The Physics of Speech D.B. Fry, Cambridge University Press.
3.	Speech Science Primer (Physiology, Acoustics and perception of Speech), Third Edition Gloria J. Boren Kaherine S. Harris and Lawrence J. Rephael, Lippincott Williams &Wilkins a wolters Kluwer company USA.
4.	Aspects of Language, Third Edition, Dwight Bolinger and Donald A. Sears, Harcourt Brace Jovanovich college publishers, USA.
5.	The Acoustics of Crime- The New Science of Forensic Phonetics, Harry Hollien, Plenum Press, New York and London.
6.	Speech Sounds, Patricia Ashby, Routledge, London and New York
7.	The Complete Book of Video Techniques Subjects Equipment, David Cheshire, Dorling Kindersley, London.
8.	Desktop Video Studio, Andrew Soderberg and Tom Hudson, Random House Electronic

	Publishing.
9.	Newnes Guide to Digital TV, Second Edition, Richard Brice, Newnes Oxford Daystar Publications ¾, Raisina Road New Delhi.
10.	Video Editing and Post-Production, A Guide, Fourth Edition, Gary H. Anderson, Focal Press, Daystar Publication ¾ , Raisina Road, New Delhi.
11.	Digital Audio Restoration, Simon J. Godsill and Peter J.W. Rayner, Springer.
12.	Illustrated Dictionary of Moving Image Technology, Fourth Edition, Martin Uren, Focal Press, Daystar Publication ¾, Raisina Road, New Delhi.
13.	A Laboratory Manual on Biological Anthropology and Anthropometry, Indera P. Singh and M.K. Bhasin, Kamla Raj Enterprises, 2273 Delhi.

SEMESTER-III

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-403	Forensic Ballistics	70	30	100	6

Ballistics is the science of mechanics that deals with the flight, behaviour, and effects of projectiles, especially bullets, gravity bombs, rockets et. It also deals with the art of designing and accelerating projectiles so as to achieve a desired performance. This paper includes history of fire arms, Ammunition in their components, Internal and External Ballistics, terminal ballistics, fire arm examination, Gunshot residue analysis and fire arm injuries.

Section – A

1.	History of Firearms, classification and characteristics of firearms, components of small arm firearms, smooth bore and rifled firearm, bore calibre, choke, different systems and their functions, arms Act.
2.	Purpose of rifling, types of rifled and methods of producing rifling trigger and firing mechanism, Theory of recoil, identification of origin, improvised /country/ made/ imitative firearms and their constructional features.
3.	Ammunition and their components, classification and constructional features of different types of cartridges, head stamp markings, various types of bullets and compositional aspects, latest trends in their manufacturing and desing.
4.	Types of primers and priming composition, propellants propellants and their compositions, Velocity and pressure characteristics under different conditions, Explosives Act.

Section –B

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, influence of range, Ricochet and its effects, stopping power

Section-C

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 individual characteristics.

4.	Automated examination and comparison of fire 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 GRS distribution, bullet hole identification, bullet penetration and trajectory through glass.

Section-D

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 defence cases.
2.	Firearm injuries: Threshold velocity for penetration of skin/flesh/bones, cavitations temporary and permanent cavities, with various types of projectiles, explosive wounds
3.	Evaluation of injuries caused due to shot- gun, rifle, handguns and country made firearms, methods of measurements of wound ballistics parameters, preparation of gel block penetration of projectiles in gel block and other targets, post- mortem and anti mortem firearm injuries.
4.	Report writing and expert's evidence.

Recommended Books	
1.	Arms Act, 1959 and Arms Rule, 1962.
2.	Beyer, J. (Ed) (1962) Wound Ballistics, Office of surgeon General, Dept, of Army Washington DC.
3.	Bhattacharyya C.N.(2000) Particle Analysis for Detection of Gunshot Residues A State- of the Art Technique, The Indian Police Journal, BPR&D, Vol. XLVII NO.4, pp.113-127.
4.	Burred G, (1951) The Identification of Firearm and Forensic Ballistics, Herbiest Jenkins, London.
5.	Cordell G. Brown, (Oct, 1981), Non-Destructive Rust Removal From Ferrous Objects, AFTE Journal Vol13 no 4; pp 85-89.
6.	Cow gill, J.P. (1975) The Newest Look of Handgun Ballistics, The American Rifleman Vol. 123 No 10.
7.	Davis, J.E. (1958) An Introduction to tool marks, Firearms and the striagraph Charles C Thomas, spring field Illinois, USA.
8.	DiMaio J.M. (1985) Gunshot Wounds, Elseveir, USA.
9.	Dominic Denio, (July 1981) Making a Rusted Barrel Functional, AFTE Journal Vol. 13.pa3 pp.29-30.
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4th Semester
Forensic Biological Sciences

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-404	Dissertation/ Project Work	70	30	100	6

- In house Training/ Project Work/Scientific Review/Research Training outside.
- To be under taken by the students under the guidance of advisor allotted.

4th Semester
Forensic Biological Sciences

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MFSC-405	Seminars	35	15	50	2

4th Semester
Forensic Biological Sciences

Course Code	Course Title	Max Marks		Total Maximum	
		End Sem	Sessional	Marks	Credit
MPDC-405	Ambedkar Studies	15	10	25	1

Unit 1. Ambedkar as Multifaceted Personality: Life sketch, Education, Concept of Sudras and Ati-Sudras and History of his mission and struggle (2 Lectures by Prof. S. Victor Babu)

Unit 2. Social Philosophy: Understanding about Indian Society, Critic of Hindu Social Order, Annihilation of Caste, untouchability, Religion and Affirmative Action (2 Lectures by Prof. K. Choudhary)

Unit 3. Political Philosophy and Concept of Social Justice: Concept of State Socialism, Constitutional Democracy, Governance, Nationalisation of bank and LIC, Social Justice (2 Lectures By DR. Sartik Bagh)

Unit 4. Economic ideas of Dr. Ambedkar: The Problem of Rupee, Devaluation of Rupee, Caste and Indian Economy, Indian Agriculture and Land Distribution (2 Lectures by Prof. N. M. P. Verma)

Unit 5. Ambedkar's Vision of Modern India: Reasons, Rights and Identity, Cultural alternative and Buddhism (2 Lectures by Dr. B.B. Malik)

Essential Readings

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 - (1946), *Who were Sudras?* Bombay: Thacker and Co.
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