Annexure-C

GENERAL INSTRUCTIONS
and
COURSE CURRICULUM

FOR

(PG Teaching Program in Forensic Science)

M.Sc. Forensic Science
(CBCS)

(Effective from July, 2023)

DEPARTMENT OF FORENSIC SCIENCE
HIMACHAL PRADESH UNIVERSITY
(NAAC Accredited "A" Grade University)

SUMMERHILL – SHIMLA – 171005 (HP) – India

www.hpuniv.ac.in/forensic

M.Sc. Forensic Science Programme

GENERAL INSTRUCTIONS/GUIDELINES FOR EXECUTION OF CURRICULUM

1. **The M.Sc. Forensic Science program will be of two years duration spread over four semesters.**

2. There will be seventeen (17) courses in *M.Sc. Forensic Science Programme*. In the first three semesters, there will be four courses each, while in 4th semester, there will be two courses, Elective and Dissertation/ research work. Course **MFSC-403-EL- 1-4** will contain four subjects and student may select any one out of these. Course **MFSC-404** will consist of Dissertation, Seminar and viva-voce. Additionally, course **MFSC-405** will be for internship in any SFL/ FPB/ Industry/ Research institute/ Medical institute for duration of 2-4 weeks during the winter vacations but evaluation will be done in 4th semester only.

   The distribution of marks in each course for theory, practical and internal assessment will be as per details given in the *OUTLINE OF COURSES FOR M.Sc. Forensic Science*.

3. The split for internal assessment except Elective course MFSC-403-EL-1-4 will be: i) Two internal assessment tests of 15 marks each (30 Multiple choice questions, each question shall carry 0.5 marks in each test) in each course. Remaining 10 marks will include class seminar (5 marks) and class attendance (5 marks). The criteria to be followed shall be: i) up to 75% lectures including condonation of lectures as per ordinances: zero mark, ii) without condonation of lectures upto 75%: zero mark; iii) 76-80% lectures: 2 marks, iv) 81-85% lectures: 3 marks; v) 86-90% lectures: 4 marks; vi) 91% and above lectures: 5 marks. However, for the Course - Elective course MFSC-403-EL-1-4, the internal assessment will be of 20 marks. A total of two Internal Assessment tests of 10 marks each (20 MCQs, each question will carry 0.5 marks in each Internal Assessment test) will be held in a semester.

4. For internal assessment, the concerned teacher will examine the students in his/ her subject by giving multiple choice questions (MCQ of 0.5 marks each) covering the syllabus/ topics taught in the classes. The Chairman of the Department will notify the date sheet for Internal Assessment test(s) at the beginning of semester/ academic calendar. In case a student is absent in the internal assessment test, the student will explain in writing the reason for his/her absence to the Chairman of the Department. Such case(s), if any will be discussed in the Departmental Council/ Staff Council and if it finds the reason given by the student valid, it will recommend to the Chairman to allow the student to sit in such test separately.

5. The candidate who regularly attends teaching/ practical classes and maintains 75% attendance in each of the courses/ practicals shall be permitted to sit in the semester examinations.

6. Any candidate who intends to participate in intra-university or inter-university cultural/ sports/ extracurricular function(s) shall get her/ his name recommended by the Chairperson Forensic Science Programme for being considered for any such participation(s) and benefit(s) if any, thereof.

7. The project work will be in the specialized area of the Forensic Science. The students may be allowed to complete their dissertation work in any external laboratories/ FSL. The students will submit the dissertation by the due date as fixed by the Examination Branch. The Departmental Council will evaluate the dissertation and will conduct seminar and viva-voce examination of the students. If the Chairman of the department feels, he/ she may invite an External Expert for evaluation of the dissertations. The evaluation of the dissertation and seminar/ viva-voce will be of 150 and 100 marks, respectively on the basis of scientific content, presentation and response in Question & Answer session.

8. The evaluation of internship report will be of 50 marks on the basis of scientific content, presentation and response in Question & Answer session.

9. The admission to M.Sc. Forensic Science Programme of Himachal Pradesh University will be through a Merit of Qualifying Examination/ or through Combined Entrance Examination conducted by Himachal Pradesh University, Shimla or as decided by Himachal Pradesh University from time to time.

10. Eligibility for admission will be bachelor's degree under 10+2+3 pattern of Education in Sciences with any of the subjects i.e., Forensic Science, Biochemistry, Biotechnology, Genetics and Molecular Biology, Botany or Zoology or MBBS/ B.Sc. from any Institute/ University recognized by the Himachal Pradesh University, Shimla/ University Grant Commission, New Delhi with at least 50% marks or a Degree of a University recognized as equivalent by the Vice-Chancellor for the purpose.

11. The tuition fee and other monthly/ annual charges will be as per University rules.

OUTLINE OF COURSES FOR M.Sc. FORENSIC SCIENCE (CBCS)

COURSE CODE	TITLE OF COURSE	MARKS				CREDITS
		Theory	Practical	Internal assessment	Total	L+T+P
SEMESTER – 1						
MFSC-101	General Forensic Science, Criminology and Criminal Law	70	40	40	150	4+1+1
MFSC-102	Fundamentals of Dactylography and Crime Scene Management	70	40	40	150	4+1+1
MFSC-103	Forensic Biology and Elements of Forensic Medicine	70	40	40	150	4+1+1
MFSC-104	Forensic Instrumentation Methods and Techniques-1	70	40	40	150	4+1+1
	Total Credits	280	160	160	600	24
SEMESTER – 2						
MFSC-201	Forensic Chemistry and Explosives	70	40	40	150	4+1+1
MFSC-202	Forensic Physics, Voice and Ballistics	70	40	40	150	4+1+1
MFSC-203	Handwriting Forensics and Electronic Documents	70	40	40	150	4+1+1
MFSC-204	Genetics and DNA Forensics	70	40	40	150	4+1+1
	Total Credits	280	160	160	600	24
SEMESTER - 3						
MFSC-301	Fundamentals of Digital Forensics and Cyber Security	70	40	40	150	4+1+1
MFSC-302	Forensic Toxicology and NDPS	70	40	40	150	4+1+1
MFSC-303	Forensic Instrumentation Methods and Techniques-2	70	40	40	150	4+1+1
MFSC-304	Basics of Research Methodology and Statistics in Forensic Science	70	---	30	100	4+1+0
	Total Credits	280	120	150	550	23
SEMESTER – 4						
MFSC-401	Forensic Quality Management System	70	40	40	150	4+1+1
MFSC-402	Fundamentals of Forensic Psychology	70	40	40	150	4+1+1
MFSC-403-EL	**Elective** (only one out of the discipline specific courses approved)	70	-----	30	100	4+1+0
MFSC-404	**Dissertation Work:** Dissertation Viva Voce		150 100		150 100	20
MFSC-405	Internship in any FSL/FPB				50	2
	Total credits	210	330	110	700	39
	Grand Total				2450	110
* The External Examiner / the Departmental Council will evaluate the dissertation and will conduct seminar and viva-voce examination of the students.						

Semester- 1

COURSE No.: MFSC-101	General Forensic Science, Criminology and Criminal Law
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**
Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit-1 **8**

Forensic Science: Definition, Forensic Sciences in ancient India,development of Forensic Sciences in India and abroad, Nature and functions of Forensic Sciences, Principles of Forensic Sciences. Qualification and duties of forensic expert, Tele forensics, Forensic Intelligence, Ethics in Forensic Science.Good lab practices, Frye and Daubert standards.

Unit-2 **15**

Police and allied Organizations: Police, BPR&D, DFSS, CFSL, SFSL, RFSL, DFU, FPBs, NFSU, CDTS, NCRB, CBI, NIA, ED, NCB. Interpol,Federal Bureau of Investigation (FBI), MI-6, Mossad,Federal Security Services (FSB),Ministry of State Security (MSS),Inter-Services Intelligence (ISI),Directorate General for External Security (DGSE), Australian Secret Intelligence Service (ASIS) and BND.

Academic centres of education and research: Indian academy of forensic sciences, American academy of forensic sciences, Australian academy of forensic sciences, IAFS, ASCLD, AFSN.

Unit-3 **7**

Criminology: Introduction to Criminology, Definition of Crime, Schools of criminology: Pre-classical, Classical, Neo-classical, Positive School. Causes of Crime: Biological, Psychological, Sociological, Geographic and Economic.

Unit-4 **15**

Courts and adjudication, Expert testimony, Pre-court preparation and court evidence Examination-in- chief, Cross- Examination and Re-examination. Human Right Commission, Lokayukta and Juvenile courts.

Constitution of India- Fundamental Rights, Article: 20, 21 and 22.

Indian Evidence Act 1872: Definition: Section (3), Facts in issue, evidence proved, not proved, disproved. Section 32, 45, 46, 47, 57, 58, 60 to 80.

Criminal Procedure Code 1973: Definitions, Bailable, non-bailable offence (S. 2(a)), Cognizable offence (2c), complaint (2d), Inquiry (2g), investigation (2h), non-

cognizable offence (2i), summon case (2w), warrant case (2x), information in cognizable case: FIR (S. 154), Evidence of Government experts: 291, 292, 293.

Indian Penal Code: Sections: 279, 302, 304B, 306, 307, 309, 323, 324, 326, 376, 377, 420, 436, 437, 438, 498.

Briefs about IT Act 2000, Narcotic Drugs & Psychotropic Substances Act, 1985, Dowry Prohibition Act, 1986, Arms Act,1959,Wild Life Protection Act, 1972 and POSCO Act, 2012.

Suggested books:

1. Nanda, B.B. &Tiwari, R.K. (2001) ; Forensic science in India- A vision for the twenty first century, Select Publisher, New Delhi.
2. James, S.H. and Nordby, J.J. (2003); Forensic science: An Introduction to Scientific and Investigative Techniques, CRC press, USA.
3. Saferstein R (2015); Criminalistics An introduction to Forensic Science, Pearson.
4. Barry, A.J. Fisher (2003); Techniques of Crime Scene Investigation, 7th ed. R.C. Press, New York.
5. Eckett W.G and James S.H (1989); Interpretation of Blood Stains, Evidence of Crime Scene; Elseiver Pub. New York.
6. James S.H (1998); Scientific and Legal Application of Blood Stain Pattern, Identification; Boca Raton FL CRC Press.
7. Sharma B.R. (2018); Forensic Science in Criminal Investigation and Trails; Universal Pub. Co.
8. The Indian Evidence Act (1872), Amendment Act (2002),Universal Law Pub. Co. (2003)
9. Swansan C.R, Terrib L and Taylor R.W (1998); Police Administration; Prentice Hall USA.
10. Meguire M, Morgan R and Reiner R (1997); Oxford Handbook of Criminology, 2nd ed. Biddles Ltd. Lyon.
11. Beg R.K. (1999); Supreme Court on Criminal justice; Asia Law House.
12. Seigel J.A., Sukoo R.J and Knupfer G.C (2000); Encyclopaedia of Forensic Science Vol. I, II &III, Academic Press.
13. Bennet, Waynew (2000); Criminal Investigation, Wordsworth Pub. Co.
14. Lyman M.D (2002); Criminal Investigation- The art and the Science, Prentice Hall.
15. Bevel, T and Gardner, M. R.(2009); Practical Crime Scene Analysis and Reconstruction. CRC Press.
16. Turvey B. E (2008). Criminal Profiling- An Introduction to Behavioral Analysis. Academic Press

Practicals

MFSC-101: Crime file and Forensics

Crime file includes collection of important cases published in print media/research journals and in electronic media. The collection should be aimed to highlight the role of associated physical and/digital evidence in examination of a case.

COURSE No.: MFSC-102	Fundamentals of Dactylography and Crime Scene Management
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**

Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.

Unit-1 **10**

Fingerprints: History and Development of Fingerprints, formation of ridges, pattern types, pattern areas, Principles of fingerprint science, Classification of fingerprints: Henry system of 10-digit classification, Battley's single digit classification, Methods of recording fingerprints, Methods of development of Fingerprints from crime scene, Photography of Fingerprints.

Unit-2 **8**

Development of Fingerprints from living and dead persons, Comparison of fingerprints: class characteristics, individual characteristics. Digital transmission of fingerprints, National Automatic fingerprint identification system (NAFIS), Fingerprint Report and Expert testimony. Biometrics in personal identification: Introduction, concepts of biometric authentication, role in personnel identification, techniques and technology (face recognition, iris, retina and hand geometry).

Unit-3 **12**

Scene of Occurrence: Physical, digital evidence and trace evidence, Scope of forensic investigation, Role of forensic scientist, Types of crime scene, elements of crime scene examination: secure and record crime scene (sketch, photography and videography of crime scene), 3-D crime scene recording and its advantages. Search for evidence with modern tools: collection, preservation, packing, chain of custody, preparation of docket and forwarding of evidence to forensic laboratory.

Unit-4 **15**

Crime Scene Reconstruction (CSR): Importance of crime scene reconstruction, Data collection, conjuncture, hypothesis formulation, testing and theory formulation, writing a crime scene reconstruction report and expert testimony. Blood strain pattern analysis: Biological and physical properties of blood, droplet formation and directionality from blood strain pattern, determination of point of convergence and point of origin, impact spatter and mechanism. Reconstruction of road accident: skid mark, determination of speed. Evidence from victim, vehicle and crime scene.Importance of glass, soil, paint and impact analysis.

Suggested books

1. Huber 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 techniuqes. 2nd ed., Taylor & Francis Ltd.
3. Morris (2000); Forensic Handwriting Identification (fundamental concepts and Principals)
4. Sharma B.R. (2003); Forensic Science in Criminal Investigation and Trails; Universal Pub. Co.
5. Mehta M. K. (1970); The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi, Allahabad.
6. Sulner H.F. (1966); Dispated Documents, Oceana Publications Inc., New York.
7. Cherril F.R. (1954); The Finger Prints. System at Scotland Yard, Her Majesty's office, London.
8. Mehta M. K. (1980); Identification of Thumb Impression & Cross Examination of Finger Prints, N. M. Tripathi (P) Ltd. Bombay.
9. Moenssens (1975); Finger Prints Techniques, Chitton Book Co., Philadelphia, New York.
10. Bridges (1942; Practical Finger Printing, Funk and Washalls Co. New York.
11. Saferstein R (1990); Criminalistics, Prentice Hall, New York.

Practicals

MFSC-102: Fundamentals of Dactylography and Crime Scene Management

1. To obtain Plain and rolled inked finger prints.
2. To identify the finger Print Patterns.
3. To perform ridge tracing and ridge counting.
4. To identify the ridge characteristics.
5. To perform Henrys Classification (Primary, Secondary, Single digit and AFIS classifications).
6. To study Poroscopy and Edgeoscopy.
7. Examination of Fingerprints using various light sources.
8. To compare the finger Prints.
9. To develop latent finger Prints with powder, fuming method and chemical.
10. Securing and documentation of crime scene.
11. Sketching and photography of scene of crime.
12. Methods used for collection of biological, physical and chemical evidences from scene of crime.
13. Packing, sealing and forwarding of evidences from the scene of crime.
14. Evaluation, sketching and reconstruction of indoor crime scene (murder, sexual assault, hanging etc).
15. Evaluation, sketching and reconstruction of outdoor crime scene (hit and run, shooting etc.).
16. Collection and Packaging of various Physical evidences.

COURSE No.: MFSC-103	Forensic Biology and Elements of Forensic Medicine
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**
Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit-1 **12**

Biological evidence: Composition and identification of blood and body fluid(s) with physical, chemical and instrumental methods and their forensic importance. Hair and fiber: Importance, nature, location, collection, examination and evaluation. Botanical evidence-Pollen grains, wood, leaves and seeds of forensic importance: nature, location, collection, examination and evaluation.

Forensic odontology: Development and scope, role in mass disaster and anthropology, structural variation in human and non-human teeth.Determination of age from teeth (eruption sequence of milk and permanent teeth), Gustafson's method. Bite marks:location, collection, preservation, analysis of bite marks and forensic significance.

Unit-2 **12**

Forensic Anthropology: Human and non-human skeletal remains. Personal identification: Portrait Parle, Bertillon system. Somatoscopy and somatometry.

Forensic Entomology: Introduction, Definition, insects of forensic importance, collection of entomological evidence during death investigation, role of insects in forensic investigation. Insect life cycle and relationship to determine time since death.

Forensic diatomology: Introduction, structure, and classification of diatoms. D-mapping, diatom as forensic evidence in antemortem/ post-mortem drowning.Extraction of diatoms from body tissues, microscopy, comparison and its limitations.

Wild Life Forensics: Introduction and importance: Protected and endangered species of animals and plants. Identification of wild life materials such as skin, fur, bones, nail, horn and teeth by conventional and modern methods. Identification of pug marks of various animals.

Unit-3 **10**

Forensic Medicine: Brief history of forensic medicine. **Death:** Signs of death and changes after death. Somatic death, molecular death. Early changes after death: Algor mortis, rigor mortis, cadaveric spasm, heat stiffening, cold stiffening, changes

in blood, Time since death by post mortem lividity. Late changes: putrefaction-external and internal changes. Adipocere, mummification. Medico legal aspects of death: Asphyxia, syncope, coma, suspended animation, drowning, hanging and strangulation.

Unit-4 **11**

Injuries: Legal definition and medical definition. Types of Injuries: Mechanical Injuries - Blunt weapon: Abrasions, Bruises, Sharp weapon: Lacerations, Incised wounds, Stab wounds. Defence injuries, Fabricated injuries. Thermal injuries: Burn and scalds, Lightning, Electricity, Explosions. Injuries- Accidental, self-inflicted, or inflicted by others. Transportation injuries: vehicular injuries, railway injuries and aircraft injuries, Ante -mortem and post-mortem, artificial injuries and aging of injuries, collection of evidence.

Suggested books:

1. Robertson J. (1996); Forensic Examination of Hair. Taylor and Francis, USA.
2. Modi J.K. (1988); Medical Jurisprudence and Toxicology, N.M. Tripathi Pvt. Ltd.
3. Boorman K. E; Blood Group Serology, Churchill, and Lincolin, P. J. (1988)
4. Saferstein R. (1982); Science Handbook, Vol. I, II and III, Prentice Hall, New Jersey.
5. Culliford B. E. (1971); The examination and Typing of Blood Stains, US Deptt. of Justice, Washington.
6. Chowdhuri S. (1971); Forensic Biology, B P R & D, Govt. of India.
7. Eckert W. G. & James S.H. (1989); Interpretation of Blood Stain, Evidence, Elsevaier, New York.
8. Pillay, V.V (2013); Modern Medical Toxicology. Jaypee Brothers Medical Publishers (P) Ltd.
9. Saferstein R (2015); Criminalistics. An introduction to Forensic Science. Pearson.

Practicals

MFSC-103: Forensic Biology and Elements of Forensic Medicine

1. Identification of blood, semen, saliva stains.
2. To determine species of origin from blood.
3. To determine blood group from fresh blood and blood stains.
4. To examine human and animal hair morphologically and microscopically.
5. Determination of age from skull sutures and Teeth.
6. Determination of sex from skull and pelvis.
7. To study the life cycle of fly.
8. Identification of diatoms.

COURSE No.: MFSC-104	Forensic Instrumentation Methods and Techniques-1
Maximum marks: 70	Teaching hours: 45 Credits : 4+1+1
Note: The Examiner will set a total of nine (9) questionscovering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit-1 **7**

Light Microscopy: Introduction, theory, principle and application of Simple, Compound, Comparison, Fluorescence, Polarized, Stereo and infra-red microscope.

Unit -2 **15**

Molecular spectroscopy: Introduction, theory, principle and application of UV, VIS-Spectroscopy, IR-Spectroscopy, Fourier Transform Infrared spectroscopy (FTIR) and Raman spectroscopy.

Unit -3 **8**

Electrophoresis: Introduction, theory, principle and application of Cross over electrophoresis, Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, Sodium dodecyl sulphate (SDS) polyacrylamide gel electrophoresis, Pulse field gel electrophoresis, Capillary electrophoresis, Immuno electrophoresis, Iso-electric focussing.

Unit- 4 **15**

Chromatography: Introduction, theory, principle and application of Thin Layer Chromatography (TLC), HPTLC, Paper and Column chromatography, High performance liquid chromatography, LC-MS, Ion chromatography.

Gas chromatography: Pyrolysis GC, GC-MS.

Suggested Books:

1. Peterson J.R and Mohammad A.A (2001); Clinical and Forensic Application of Capillary Electrophoresis. Springer.
2. Lurie B.J and Wittwer J.D (1983); High Performance Liquid chromatography in Forensic Chemistry.Taylor and Francis.
3. Newman R, Gilbert M, Gilbert M.W and Lothridge K (1997); GC-MS guide to Ignitable Liquids. CRC Press.
4. Brown P.R (2004); Advance in chromatography.
5. Grahm D. (1973); The use of X-ray Techniques in Forensic Investigation.
6. Settle F.A (1997); Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.
7. Skoog D.A, Holler F.J & Crouch S.R (2021); Principles of Instrumental analysis: CengageLearning Inc.

8. Hofmann A and Clokie S (2018); Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology.

Practicals

MFSC-104 : Forensic Instrumentation Methods and Techniques-1

1. Identification of natural and synthetic fibres 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 Hypochromic and Bathochromic shift using UV/Vis Spectrophotometer.
5. To study the TLC of different inks of the writing pen.
6. To peform gel electrophoresis of DNA samples
7. To analyse the given compound using FTIR spectra.
8. To perform TLC of phenolphthalein.
9. Quantitative and qualitative analysis of soils from different source of origin.
10. Differentiation of various toxic textile dyes using FTIR analysis.

Semester- II

COURSE No.: MFSC-201	Forensic Chemistry and Explosives
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**
Note: The Examiner will set a total of nine (9) questionscovering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit-1 **15**

Forensic Chemistry: Introduction, preliminary and confirmatory methods used in Forensic chemistry. Schemes of identification of unknown solids, Volumetric/Titrimetric methods of analysis, Theory of indicators, Gravimetric methods of analysis, Process of precipitation, Saturated and supersaturated solution, Methods of sample preparation in organic and inorganic analytical chemistry. Phenolphthalein in trap case: Chemistry and Forensic examination of Phenolphthalein used in Bribe trap cases and related legal issues. Corrosive chemicals: Hydrochloric acid, sulphuric acid, and nitric acid and alkalis in crime exhibits of acid/alkali throwing cases.

Unit -2 **12**

Arson: Introduction, chemistry of fire, scientific investigation and evaluation of clue materials, collection and preservation, analysis of flammable residues. Documenting of the fire crime scene.

Petroleum Products: Introduction to Petroleum Products, Properties and Testing of Petroleum and Petroleum Products, Adulteration of petroleum products as per Prevention of Malpractices in Supply and Distribution, Analysis of common petroleum products including, Petrol, Kerosene, Diesel, Lubricating Oil, Furnace Oil and Grease as per BIS specifications. Analysis of Dyes used in petroleum products, Chemical fingerprinting of petroleum products.

Unit -3 **7**

Alcohol: Different types of liquor: country made liquor, illicit liquor, rectified spirit, proof spirit, absolute alcohol, sign and symptoms of alcohol intoxication, their effects on the body, Methanol poisoning. Sample collection, Analysis of alcohol: Percentage of alcohol by specific gravity method, Breath-alcohol instrumentation, Alcohol measurement using blood, breath, urine, saliva and oral fluid.

Unit- 4 **11**

Explosives: Classification, composition and properties of explosives, explosive devices, improvised explosive devices (IEDs), bomb disposal and handling of explosives, explosion mechanism, effects and evaluation of scene of explosion, evidence collection and examination of explosives and explosive residues in laboratory using chemical and instrumental techniques.

Suggested books

1. Modi J.P (1988); Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabad.
2. S.N. Tiwari (1987); Analytical Toxicology, Govt. of India Publications, New Delhi.
3. Saferstein R (1982); Forensic Science Hand Book, Vol I, II and III, Pretince Hall.
4. Saferstein R (2002); Criminalistics.
5. Sharma B.R (2003); Forensic Science in Criminal Investigation & Trials. Universal Law Publishing Co.
6. Klaassen C, Doull J and Casarett L.J (2013); Toxicology: The Basic Science of poisons. McGraw Hill Publication.
7. Curry A.S (1976); Poison Detection in Human Organs. Thomas.

Practicals

MFSC-201: Forensic Chemistry and Explosives

1. Analysis of corrosive chemicals (acids and alkalis).
2. Distillation characteristics of gasoline, kerosene, and diesel oil.
3. Analysis of adulteration of petrol and diesel with kerosene by TLC and instrumental methods.
4. Analysis of phenolphthalein in trap cases.
5. Minimum detection limit of Phenolphthalein using TLC and UV method.
6. Alcohol estimation in blood using volumetric methods.
7. Chemical analysis of alcohol for the presence or absence of all possible impurities.
8. Forensic analysis of arson related evidences.

COURSE No.: MFSC-202	Forensic Physics, Voice and Ballistics
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**
Note: The Examiner will set a total of nine (9) questionscovering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit-1 **10**

Nature, collection and evaluation of Foot/Footwear/Tyre Impression.
Nature, collection and evaluation of Tool Marks (Compression and Striated marks).
Examination of paint, soil, cement, building and road material, glass and resuscitation (chassis number and serial number of fire arms).

Unit-2 **12**

Voice analysis: Voice production theory, speech signal and pattern recognition, analysis of audio and video signal for authenticity, introduction to the techniques of recognition and comparison of voice, representation of speech signal, analogue to digital signal and conversion.

Unit -3 **12**

Ballistics: Introduction to Forensic Ballistics, Definition and scope of Forensic Ballistics.
History of firearms, Classification of firearms. Firearms and ammunition.
Internal Ballistics: Size and shapes of propellant, process of firing, internal pressure and muzzle velocity.

Unit -4 **11**

External Ballistics: Trajectory of projectiles, effects on the projectiles.Ricochet and its effects.
Wound Ballistics: Ballistics aspects of fire arm injuries, entry and exit holes study and evaluation of homicidal, suicidal and accidental injuries. Study of bullet and cartridge cases comparison and gunshot residues analysis.

Suggested books

1. Mathews H.J (1973); Firearms identification, vols. 1,2& 3; Charles C. Thomas Publisher.
2. Sharma B.R (2003); Forensic Science in Criminal Investigation and Trails; Universal Pub. Co.
3. Heard B.J (2011); Handbook of Firearms and Ballistics. Willey.
4. Warlow T (2012); Firearms, The Law and Forensic Ballistics. CRC Press.
5. M. Johari (1980); Identification of Firearms, Ammunition and Firearms Injuries; BPR& D, New Delhi.
6. Working Procedures Manual: Ballistics, BPR & D pub. (2000)

7. Yinon, J (1999); Forensic and environmental Detection of Explosives. Wiley.
8. Yallop H.J (1980); Explosion Investigation. Forensic Science Society.
9. Thurman J.T (2006); Practical Bomb scene investigation. CRC Press.

Practicals

MFSC-202: Forensic Physics, Voice and Ballistics

1. Measurement of physical parameters (colour, density, refractive index) on glass samples
2. Development of footwear impressions.
3. Comparison of paint chips under microscope
4. FTIR analysis of paint samples
5. Lifting of Footwear impressions by photographic film.
6. Restoration of erased serial numbers using physical / chemical methods.
7. Examination of glass by using vernier calliper and spherometer.
8. Discrimination of soil samples by using FTIR.
9. Characterization and discrimination of paper samples using FTIR.
10. Gunshot residue analysis: (i) Barrel wash (ii) Hand swab.
11. Examination for serviceability/working condition of firearm.
12. Identification of Firearm for Type, Make and Model.
13. Bullet/Pellets/Wads whether Fired or Not.
14. To study proof mark of firearm.
15. To study the working mechanism of firearm(s).
16. Identification of bullet marks and its Comparison.
17. Identification of cartridge case and its comparison.

COURSE No.: MFSC-203	Handwriting Forensics and Electronic Documents
Maximum marks: 70	Teaching hours: 45 Credits : 4+1+1
Note: The Examiner will set a total of nine (9) questionscovering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit- 1 **10**

Questioned Documents: Nature and problems of document examination, Importance, Classification and Preliminary Examination. Preservation of Documents, procurement of standard admitted/specimen writings, handling and marking of documents.

Handwriting Characteristics: General Characteristics, Individual Characteristics, Development of Individuality in Comparison of Handwriting: Natural Variations, Fundamental Divergences. Genuine and forged documents, holographic documents.Basic tools needed for forensic documents examination and their uses.

Unit- 2 **13**

Forgeries: Forgery and its types and characteristics, identification and examination of forgeries. Decipherment of secret indented and charred documents: Preservation of documents, Examination of seal and other mechanical impressions, examination of sequence of intersecting of strokes. Disguised writing and anonymous letters. Identification of a writer, Examination of signatures – characteristics of genuine and forged signature, Examination of alteration, erasers, overwriting, additions and obliterations, Various types of inks and paper, their chemical compositions, characterization and elemental analysis. Advanced methods of examination of alterations by video- spectral comparator (VSC) and ESDA, their working principles and uses. Forensic accounting.

Unit-3 **10**

Examination of black & white Xeroxed copies and colour Xeroxed copies, carbon copies, fax messages. Identification of type writings – Identification of typist, Identification of printed matter. Various type of typewriting devices- electronic typewriter and proportional spacing typewriter. Printing and Machine Defects. Various types of printing of security documents, printing of currency notes, latest security feature of new Indian currency note of Rs 500 &Rs 2000, examination of counterfeit currency notes, passports, visa, stamp papers, postal stamps.

Unit -4 **12**

Age of document: Absolute/relative age, determination of age of documents by Examination of signatures – paper ink and writing/signatures etc., by spectroscopic and chromatographic methods and statistical technique, Report Writing & Court Room Testimony: Evidence and testimony in court, Information required by the

Forensic expert, Components of Forensic Reports, Preparation of Report, Presenting findings in a Report format.

Suggested books

1. Hilton O(1982); Scientific Examination of Questioned Documents, Elsevier, New York.
2. Osborn A.S (1998); Questioned Documents, Second Ed. Universal Law Publishing, Delhi.
3. Bates B.P (1970); Identification System for Questioned Documents I.S.Q.D. Charles C. Thomas
4. Harrison W.R (1997); Suspect Documents – Their Scientific Examination, Universal Law Publishing.
5. Hardless, H.R (1983); Disputed Documents, Handwriting and Thumbprint Identification. Law Book Co., Allahabad.
6. Morri R.N (2000); Forensic Handwriting Identification: Fundamental Concepts an Principles. Acad. Press.
7. Levinson J (2000); Questioned Documents: A Lawyer's Handbook. Academic Press.

Practicals

MFSC- 203: Handwriting Forensics and Electronic Documents

1. Identification of Handwriting Individual and general Characteristics.
2. Study of natural variations and fundamental divergences in handwriting.
3. Comparison of handwritings.
4. Detection of Simulated forgery and traced forgery.
5. Study of Disguise in handwriting.
6. Differentiation by UV-Vis & FTIR spectrophotometer.
7. Identification of alteration, addition, and subtraction in a piece of writing
8. Examination of counterfeit currency by using microscopy and UV light.
9. Decipherment and detection of indentations in a document.
10. Examination of forged documents using VSC.
11. Study of Natural variations in Handwriting
12. Examination of creases and folds and determination of sequence of strokes

COURSE No.: MFSC-204	Genetics and DNA Forensics
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**
Note: The Examiner will set a total of nine (9) questionscovering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit -1 **13**

Human Genetics, Heredity, Chromosome structure and cell division, Alleles, Mutations and Population Genetics, The concept of Genetics polymorphism, Hardy-Weinberg Law. Measure of genetic variations.

Nucleic acids: DNA and RNA, their types, basic biochemistry and importance in forensic science.

DNA profiling: Introduction and history of DNA typing, DNA markers, Mitochondrial DNA, hypervariable regions and control region, Biology of STRs, Forensic Issues, Chromosomal DNA, Amelogenin, Autosomal STRs, Y Chromosomal STRs, X chromosomal STRs. Variable Number Tandem Repeats (VNTRs) and RFLP. Single Nucleotide Polymorphism (SNP).Ancient DNA typing.

Unit -2 **13**

DNA Extraction, Organic and Inorganic extraction, Comparison of Extraction methods, Commercial kits, DNA Quantitation, Importance of quantitation, Spectrophotometric analysis, Agarose Gel Electrophoresis, Slot Blot Hybridization, Real Time PCR, Polymerase Chain Reaction, Multiplex PCR, PCR failures, capillary electrophoresis. Primer designing. Primer, dimmer and Hairpins, Mismatch primers. Software's packages, evaluation of results in terms of statistical analysis.

Unit -3 **10**

Forensic significance of DNA profiling: applications in disputed paternity cases, child swapping, missing person's identity, civil immigration, wildlife etc. Legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad.Challenges in DNA barcoding of forensic samples and their solution. Databases of DNA barcodes. International missions/facilities/projects on DNA barcoding.

Unit-4 **9**

NGS (next generation sequencing techniques of DNA): principle, Protocols in NGS, application of NGS in forensics. Automation in DNA profiling: robotics. Miniaturisation in DNA profiling: microfluidics. Recent developments in DNA profiling and DNA forensic databases. Ethical, legal and social issues associated with DNA data banking, potential benefits of DNA data banking.

Suggested books

1. Butler J.M (2001); Forensic DNA Typing: Biology and Technology Behind STR Markers. Academic Press.
2. Butler J.M (2005); Forensic DNA Typing, Biology, Technology and Genetics of STR Markers. Academic Press.
3. Butler J.M (2009); Fundamentals Forensic DNA Typing. Academic Press.
4. Butler J.M (2011); Advanced Topics in Forensic DNA Typing: Methodology Academic Press.
5. Butler J.M (2014); Advanced Topics in Forensic DNA Typing: Interpretation. Academic Press.
6. Sharma B.R (2003); Forensic Science in Criminal Investigation and Trails; Universal Pub. Co.
7. Rudin N and Inman K (2002); Introduction to Forensic DNA Analysis. CRC Press.
8. Kirby LT (1993); DNA Fingerprinting: An Introduction. Oxford University Press.
9. Hummel S (2013); Ancient DNA Typing: Methods, Strategies, and Applications. Springer.
10. Cox M and Mays S (2000); Human Osteology in Archaeology and Forensic Science. Cambridge University Press.
11. Byers S.N (2017); Forensic Anthropology Laboratory Manual. Routledge.

Practicals

MFSC-204 : Genetics and DNA Forensics

1. DNA Isolation from human blood.
2. Differential extraction of DNA from semen and vaginal epithelial cells.
3. STR Analysis, Genescan, Genotyper, Genemapper.
4. mtDNA: Sample collection and extraction.
5. Polymerase Chain Reaction and Contamination Control.
6. Gel purification of PCR Product.
7. Big Dye Sequencing of PCR product.
8. Sequence analysis, BLAST Search, troubleshooting.
9. STR typing using vertical poly-acrylamide gel electrophoresis and silver Staining.
10. DNA Extraction from biological samples using commercially available kits.

Semester- III

COURSE No.: MFSC-301	Fundamentals of Digital Forensics and Cyber Security
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**
Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit-1 **10**

Definition of digital forensics, need, scope, principles, relevant laws (IEA 45A, 65B, 66, 67, and 79A of IT Act, 2000), Intermediaries Rules 2011, search and seizure of digital evidences, concept of hashing, methods of live and dead acquisition, write blockers and their usage, open source software for data acquisition and authentication, cloning, imaging, wiping.

Unit- 2 **15**

Basics of computer, input and output devices, computer hardware and software, history of computers, generation of mobile phones, storage and its types (RAM, ROM, cache), computer operating systems (Window, Linux, MacOS), Mobile operating system, file system, types of file system, process of writing data on hard drive, concept of bit locker encryption system, knowledge of LAN, WAN, Wi-Fi, Li-fi, Internet protocol, IP address, analysis of digital data from storage devices (hard disk, DVR, cell phone, memory card, SIM card, drone, etc.), using open source tools.

Unit -3 **10**

Definition of cybercrime, history, classification and types of cybercrimes (spoofing, phishing, vishing, spamming, SMS bombing, stalking, pornography, etc.), virus, worms, ransomware, malware logic/salami attacks, concept of Ponzi scheme, social media platforms and related crimes, forensic investigation of social media crime, cyber terrorism, financial frauds, portals for reporting cybercrimes in India.

Unit- 4 **10**

Cyber security- concept of cyber security, incidence response management, cyber security, TRIAD (CIA), cyber attack on cyber security principles, risk assessment, security audit, best security practices, web application security, network application security.

Suggested Books:

1. Casey E (2001); Handbook of Computer Crime Investigation: Forensic Tools and Technology. Academic Press.
2. Icove D.J, Seger K.A and Vonstorch W (1995); Computer crime-A crime fighter's handbook. O'Reilly &Associates.
3. Casey E (2011); Digital evidence and computer crime-Forensic science, Computers and Internet. Academic Press.
4. VaccaJ.R (2009); Computer Forensics-Computer Crime Scene Investigation, Laxmi Publications Pvt. Ltd.
5. Brown C.L.T (2010); Computer Evidence-Collection and Preservation. Charles River Medai/Cengage Learning.
6. MarcellaA.J and Menendez D Jr (2010);Cyber forensics-A Field Manual for Collecting, Examining and Preserving of Computer Crime.AuerbachPublications.
7. Loader B.D and Thomas D (2012); Cyber crime: Law Enforcement, Security and Surveillance in the Information Age.Taylor and Francis.
8. Kruse II W.G and Heiser J.G (2001); Computer forensics-Incident Response Essentials.Pearson Education.
9. Middleton B (2022); Cyber Crime Investigator'sField Guide. Auerbach publications.
10. Johansen G (2020); Digital Forensics and Incident Response: Incident Response Techniques and Procedures to Respond to Modern Cyber Threats. Packt Publishing Ltd.
11. DunhamM.H (2006); Data Mining: Introductory And Advanced Topics. Pearson Education.

Practicals

MFSC-301: Fundamentals of Digital Forensics and Cyber Security

1. Preparation of Bootable drive. System preparation for forensic work.
2. Processing of Digital scene of crime.
3. Lifting and packing of storage devices and preparation of docket.
4. Calculation of HASH value of storage media, and word, pdf, and jpeg files.
5. Image acquisition using open source tool from hard drive, flash drive, etc.
6. Authentication of acquired image using hash function.
7. RAM capture using open source tools.
8. Calculation and verification of time stamp of DVR.
9. To study disc partition of the acquired image.
10. Analysis of image hard drive and study of registry file.
11. To prepare clone of DVR drive and its analysis.

COURSE No.: MFSC-302	Forensic Toxicology and NDPS
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**
Note: The Examiner will set a total of nine (9) questionscovering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit-1 **13**

Definition of forensic toxicology, scope, poison and their classification, pharmacokinetics, metabolism, lethal dose, antidotes, sampling of viscera, gastric lavage, blood, urine, and hair fordetection of poison/alcohol/drugs, and vitreous humor for detection of alcohol and their preservation.

Unit-2 **8**

Extraction method (solvent extraction, Stas-Otto method, ammonium sulphate method, solid phase extraction method, etc.), isolation and identification of poisons using colour tests, chromatographic (TLC, HPTLC, LCMS, HPLC, GCHS, GCMS, etc.) and spectroscopic methods (UV-Vis, FTIR, Raman etc.), Immunoassay (Biochip array technology).

Unit-3 **18**

Introduction to Narcotic drugs and Psychotropic substances, classification of drugs of abuse, Cannabis & Synthetic cannabinoid receptor agonists (SCRAs), Opium (Opium products: Raw Opium, Prepared Opium, Medicinal Opium, Poppy Straw & Poppy Straw Concentrate), Opiates (Morphine, Codeine & Heroin), Opioids (Fentanyl, Buprenorphine etc.), Coca & Cocaine, Amphetamine Type Stimulants (Amphetamines, Methamphetamine & Ecstasy group substance), CNS Depressants (Benzodiazepines, Barbiturates & Methaqualone), Hallucinogens, (LSD, Tryptamines, Plant based hallucinogens, Phencyclidines), designer drugs, dope drugs, date rape drugs, rave drugs, new psychotropic substances (NPS), adulteration in drugs, counterfeit drugs, drug antidotes and withdrawal symptoms.

Unit- 4 **6**

Sampling of drugs (representative and homogenous), field test for drugs detection, screening, and quantification of drugs by using physical, chemical, instrumental methods and report writing.

Suggested Books

1. Casarett L.J &Doull J (1975); Toxicology- The Basic Science of Poisons by, Macmillan Publishing Co., Inc., New York .
2. Clark E.G.C (1986); Isolation and identification Drugs, Vol. I and Vol.II.
3. Sunshine I (1950); Guidelines for Analytical Toxicology Programme, Vol. I,CRC Press.
4. Mule, S.J. et.al (1994); Immunoassays for Drugs, CRC Press.
5. Curry A.S (1963); Poison Detection in Human Organs, C. Thomas Springfield, Illinois USA.
6. Connor (1975); A textbook of Pharmaceuticals analysis, Interscience, New York.
7. Gleason, M.N. et.al (1969); Clinical Toxicology of Commercial products, Williams and Williams, Baltimore, USA.
8. Modi J.P (2001); Textbook of Medical jurisprudence & Toxicology, M.M. Tripathi Pub. (2001).
9. Cravey R.H and Baelt R.C (1981); Introduction to Forensic Toxicology, Biochemical publications, Davis C A.
10. StolmenA (1963); Progress in Chemical Toxicology : Academic Press, New York.
11. Working Procedure Manual – Toxicology, DFS Publications (2005)
12. Sharma B.R. (2005); Forensic Science in Criminal Investigation & Trials Universal Law Publishing Co. Pvt. Ltd., Delhi (4th edition).
13. Rapid testing methods for testing Drugs of Abuse, United Nations Office on Drugs and Crime, (UNODC), Vienna, Austria.
14. Clark, E.G.C (1986); Isolation and identification Drugs, Vol. I and Vol.II.
15. Svehla G (2009); Vogel's Qualitative Inorganic Analysis. Pearson Education.
16. Mat H.Ho Ellis (1990); Analytical Methods in Forensic Chemistry E. Horwood.
17. Smith M.B and March J (2007); March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure. A John Wiley & sons, Inc; Publication.
18. Mendham J, Denney R.C and BarnesJ.D (2009); Vogel's Textbook of Quantitative Chemical Analysis. Pearson.

Practicals

MFSC-302: Forensic Toxicology and NDPS

1.To perform colour test and TLC separation for common drugs of abuse.

2.To perform colour test and TLC separation for common insecticides.

3.To perform colour test and TLC separation for common pesticides.

4.To perform colour test and TLC separation for common plant poisons.

5.To perform colour test and TLC separation for cannabis.

6.To perform qualitative analysis of cannabis employing microscopic, chromatographic and FTIR spectroscopic techniques.

7.To perform Reinsch test for metallic poisons (lead, arsenic, mercury, antimony, bismuth).

8.Quantitative estimation of ethyl alcohol/ methyl alcohol in blood and urine samples using titrimetric and GCHS method.

9.Qualitative estimation of various drugs of abuse in blood and urine samples using Immunoassay method.

10. GCMS, FTIR, HPTLC analysis of various drugs of abuse.

COURSE No.: MFSC-303	Forensic Instrumentation Methods and Techniques-2
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**
Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit- 1 **15**

Microscopy: Introduction, theory, principles, sample preparation, and applications of electron microscope including Scanning Electron Microscope, Field Emission Scanning Electron Microscope, Transmission Electron Microscope, Scanning Electron Microscope, Energy Dispersive X Ray, Scanning Probe Microscope, Scanning, Tunnelling Electron Microscope (STEM), Atomic Force Microscope, Quantum 3D Microscope, and Confocal Microscopy.

Unit -2 **12**

Atomic Spectroscopy: Introduction, theory, principles, sample preparation, and applications of Atomic Absorption Spectroscopy, Graphite Furnace Atomic Absorption Spectroscopy, Atomic Emission Spectroscopy, Inductively Coupled Plasma Atomic Emission Spectroscopy, Inductively Coupled Plasma Mass Spectroscopy.

X-Ray Techniques: Introduction, theory, principles, sample preparation, and applications of X Ray Diffraction, X Ray Fluorescence (Energy and Wavelength Dispersion), Auger Electron Spectroscopy (ESCA)

Unit -3 **9**

Introduction, theory, principles, sample preparation, and applications of Nuclear Magnetic Resonance Spectroscopy, Neutron Activation Analysis, Thermo Gravimetric Analysis, Differential Thermal Analysis

Unit- 4 **9**

Introduction, theory, principles, sample preparation, and applications of Abbey's Refractrometer, Glass Refractive Index Measurement (GRIM), Densitometer, Universal Tensile Strength testing equipment (UTM), Immunoassay and Centrifugation techniques.

Suggested Books

1. Robinson J.W, Frame E.M.K and Frame II G.M (2005); Undergraduate Instrumental Analysis. M. Dekker.
2. Skoog D.A, Holler F.J & Crouch S.R (2021); Principles of Instrumental analysis: Cengage Learning Inc.
3. Merrit W and Settle D (1981); Instrumental Methods of Analysis. Van Nostrand.
4. Saferstein R (2015); Criminalistics An introduction to Forensic Science, Pearson.
5. Pavia D.L, Lapman G.L, Kriz G.S and Vyvyan J.R(2015); Introduction to Spectroscopy. Cengage Learning.
6. Chapmen J.R (1993); Practical Organic Mass Spectrometry- A Guide for Chemical and Biochemical Analysis. Wiley & Sons.
7. Chatwal, G.R and Anand S.K. (1984); Instrumental Methods Of Chemical Analysis. Himalaya Publishing House.

Practicals

MFSC-303: Forensic Instrumentation Methods and techniques-2

1. To analyse biological samples for the detection of trace elements using AAS.
2. To prepare soil, water, and biological samples for the detection of trace elements using AES.
3. To perform centrifugation of biological samples.
4. To analyze petroleum samples by using Densitometer.
5. To calculate refractive index of glass by using GRIM.
6. To calculate refractive index of glass by using Refractrometer.
7. To separate biological samples by using centrifugation methods.
8. To analyse the given sample by using XRD.
9. To analyse the given sample by using XRF.
10. To analyse the given sample by using Thermograviometry (TGA).
11. To analyse the given sample by using Raman Spectroscopy.
12. To analyse the given sample by using Mass Spectrosopy.

COURSE No.: MFSC-304	Basics of Research Methodology and Statistics in Forensic Science
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+0**
Note: The Examiner will set a total of nine (9) questionscovering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit- 1 **9**

Definition of research, research objectives, importance of research, research methodology, types and methods of research,research design, research plan, writing of research problem, attributes of a good research, writing research proposal, literature survey, and report writing.

Unit- 2 **10**

Sampling, procedure of sampling, types of sampling, problems in sampling, sampling and non sampling errors, measurement and scaling. Data definition, need, collection of primary and secondary data, data preparation process.

Unit -3 **13**

Hypothesis, types of research hypothesis:null hypothesis and alternate hypothesis, testing of hypothesis, procedure for hypothesis testing, Type I and Type II errors,level of significance, and limitations for hypothesis testing.

Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Measures of skewness, Kurtosis, Covariance, Karl Pearson's coefficient ofcorrelation, Spearman's rank correlation, z-test

Unit -4 **13**

Parameter and statistics, student t-test, chi square distribution, F-test, degree of freedom. ANOVA (one way and two way), ANOCOVA, sign test, multivariate analysis techniques, SPSS, factor analysis (R type and Q type), cluster analysis, likelihood ratio, role of statistics in forensic sciences.

Suggested Books

1. Daniel W.W and Cross C.L (2018); Bio-statistics:A Foundation for Analysis in the Health Sciences. Wiley.
2. Gun A.M, Gupta M.K and Dasgupta B (2008); Fundamental of Statistics World Pres.
3. Bancroft H (1970); Introduction to Bio-Statistics. Harper and Row.
4. Agresti A (2013); Categorical data Analysis. Wiley.
5. Smoller S.W (2013); Biostatistics and Epidemiology: A Primer for Health Professionals. Springer.

6. Daniel W.W (1999); Bio-statistics: A Foundation for Analysis in the Health Sciences. Wiley.
7. Rao, C.R (1970); Advanced Statistical Methods in Biometric Research. Hafner Press.
8. Singh Y.K (2006); Fundamentals of Research Methodology and Statistics. New Age International Publishers.
9. Kothari C.R (2004); Research Methodology: Methods and Techniques. New Age International Publishers.

Semester-IV

COURSE No.: MFSC-401	Forensic Quality Management System
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+1**

Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.

Unit-1 **12**

History and development of ISO, ISO 9001, ISO/IEC 17025:2017, need and importance of accreditation system. Global scenario of accreditation bodies-Asia, Europe, Africa, America etc. Benefits of accreditation, scope of accreditation, accreditation vis-a-vis certification, concept of quality, quality control, quality assurance, impartiality, confidentiality and risk assessment for laboratory analysis.

Unit -2 **10**

Types of documents in laboratory management system, document control, proficiency testing, inter and intra laboratory comparison, validation of method, validation of results (blind testing, replicate testing, re-testing etc.) Measurement of uncertainty, meteorological traceability, decision rule, sampling, sampling plan, calibration, calibration plan.

Unit -3 **11**

Accreditation process, filing of application for accreditation, pre-assessment, final assessment, non-conformities (major and minor), root cause analysis, corrective actions, complaint feedback, process of handling of complaints and feedback.

Unit -4 **12**

Audit techniques, internal audit, external audit, preparation of agenda for management review meeting, essentials of a test report, use of NABL symbol, NABL 100, 217, 219, 133, 142, 143 and 163.

Suggested Books

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 J.M and Gryna F.M (1988); Juran's Quality Comtrol Handbook. McGraw-Hill International Editions.
7. Soin S.S (1992); Total Quality Control Essentials - Key Elements Methodologies and

Managing for Success.McGraw-Hill International Editions.
8. Hansen B.L and Ghare P.M (1987); Quality Control & Application, Prentice-Hall.
9. Daniel W.W and Cross C.L (2018); Bio-statistics: A Foundation for Analysis in the Health Sciences.Wiley.
10. Gun A.M, Gupta M.K and Dasgupta B (2008); Fundamental of Statistics. World Press.
11. Bancroft H (1970); Bancroft's Introduction to Bio-Statistics. Harper and Row.
12. Agresti A (2013); Categorical data Analysis. Wiley.
13. Smoller S.W (2013); Biostatistics and Epidemiology: A Primer for Health and Biomedical Professionals.Springer.
14. Daniel W.W (2006); Bio-statistics: A Foundation for Analysis in the Health Sciences. Wiley.

Practicals

MFSC-401: Forensic Quality Management System

1. Adequacy of audit.
2. In house calibration and elements of calibration certificate.
3. Calculation of Z score value.
4. Writing of conformity statement.
5. Calculation of LOD and LOQ of test sample.

COURSE No.: MFSC-402	Fundamentals of Forensic Psychology
Maximum marks: 70	Teaching hours: 45 Credits : 4+1+1
Note: The Examiner will set a total of nine (9) questionscovering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

Unit -1: Forensic Psychology **12**

Introduction to Forensic Psychology, Tests used in Forensic Psychology Assessment: Intelligence Tests, Achievement and Aptitude Tests, Personality Tests, MMPI Test, Rorschach Test, Thematic Apperception Test, Neuropsychological tests, Mensrea, competency evaluation.

Psychopathology & Abnormal Behaviour, Theories of Offending, Gender & Crime, Ethnicity & Crime.Effect of Media. Psychometric Assessment tools used in Forensic Psychology. Nature of Crime (Organized, Disorganized, Planned, Spontaneous)

Unit -2: Forensic Psychiatry **10**

Introduction to different types of mental illnesses Delirium, Dementia, Anxiety Disorders, Mood Disorders (Affective Disorders), Schizophrenia, Somatoform Disorders, Fictitious Disorders, Personality Disorders, Sexual Disorders, Mental Retardation, Psycho Somatic Disorders, Disorders of Childhood and Adolescents.

Unit -3: Interviewing and Interrogation Techniques **15**

Interviewing Techniques: Importance of investigative interviewing, influence of **Interviewing and Interrogation Techniques:** Interviewing Techniques: Importance of investigative interviewing, influence of psychology, P.E.A.C.E. model of interviewing, cognitive interviewing, ethical interviewing and other interview techniques. Interrogation Techniques: Assessment of verbal and non-verbal behavior, Micro expressions, Latent behaviors and analysis of hidden motive. Polygraph/Lie Detector Test: Objectives, theoretical basis, stages of examination, Questioning techniques, Stimulation tests and limitations.Brain Fingerprinting/Brain-Mapping: History, Principle, Importance, procedure, brain waves, and limitations.Brain Electrical Oscillation Signature Profiling (BEOS), Voice-Stress Analysis/ Layered Voice Analysis, reliability and limitations. Narco-analysis: Principle, History, drugs used, procedure, reliability, admissibility and limitations.

Unit -4: Legal & Correctional Aspects **8**

Indian scenario.NHRC Guidelines, Admissibility of interviewing and interrogating techniques in the court of law, Forensic Psychologists as an Expert. Functions and role of forensic psychologist.

The mentally ill in court, Competency to stand trial, Mental Health Act, 1987, Human Rights of Mentally ill persons, Penalties, Rehabilitation and Correctional Treatment of Offender(s) / Victim(s), Techniques, Strategies and Types of Treatments and Report writing.

Suggested Books

1. Sharma B.R. (2018); Forensic Science in Criminal Investigation and Trails; Universal Pub.Co.
2. Weiner I.B and Otto R.K (2013); The Hand Book of Forensic Psychology. Wiley.
3. O' Donohue W.T and Levensky E.R (2004); Hand Book of Forensic Psychology: Resource for Mental Health and Legal Professionals. Academic Press.
4. MukundanC.R(2007); Brain Experience : Neuroexperimental Perspectives of Brain –Mind. Atlantic Publishers & Distributors Pvt. Ltd.
5. Turvey B.E (2022); Criminal Profilling: An Introduction to Bahavioral Analysis. Academic Press.
6. Niehaus J (1998);Investigative Forensic Hypnosis. Taylor & Francis.
7. Matte J.P (1980); Art & Science of the Polygraph Techniques. Charles C Thomas Publisher Ltd.
8. Kleiner M (2002); Hand Book of Polygraph Testing. Academic Press.
9. Vrij A (2008); Detecting Lies &Deceit : Pitfalls and Opportunities. Wiley.
10. Pinker S. (2011); The Better Angels of our Nature. New York, NY: Viking
11. Pinker, S. (2007); The Stuff of Thought: Language as a Window Into Human Nature . New York, NY: Viking.
12. Barkow H, Cosmides L and Tooby J (1992); The Adapted Mind: Evolutionary Psychology and the Generation of Culture. Oxford University Press.
13. Dawkins R (1989); The Selfish Gene. Oxford University Press.
14. Wright R (1994); The Moral Animal: Why We Are the Way We Are: The New Science of Evolutionary Psychology. Pantheon Books.

Practicals

MFSC-402: Fundamentals of Forensic Psychology

1. Case history and mental status examination.
2. PGI memory scale.
3. Raven's Standard Progressive Matrices.
4. Bhatia's Performance Scale of Intelligence.
5. Demonstration of hypnotism.
6. Demonstration of Polygraph administration and recording.

COURSE No.: MFSC-403-EL-1	Environmental Forensics
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+0**

Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.

UNIT- 1 **5**

Introduction to Environmental forensics, Definition, Application of environmental forensics- Environmental site assessment, Epidemiology, Environmental Forensic Microscopy,

UNIT- 2 **10**

Forensic Palynology – introduction and importance in forensic science, Fundamentals of microbial forensics, definition and importance, Geological analysis of soil and anthropogenic material, pesticides in soil, environmental impact of pesticides. Micro/nano plastic pollutants in water and its impact on human health.

UNIT- 3 **15**

Environmental Pollutants and its types (soil, water and air), toxicity of environment contaminants, fate of chemicals in environment, industrial effluents into water and soil and its detection.Stable isotopes and Radioisotopes in environmental forensics.Marine Oil pollution, Natural Source Damage Assessment, Forensic Characterization of Gasoline Releases Impacting the Environment.

UNIT-4 **15**

Remote Sensing Technology- definition, basic principle of remote sensing application of remote sensing, Geographic Information System (GIS) and GPS technology-definition, scope, components, Geographical Data types, Use of GIS in environmental disasters.

Suggested Books

1. Hester R.E and Harrison R.M (2008); Environment Forensics. RSC Publishing.
2. Murphy B.L and Morrison R. D (2015); Introduction to Environment Forensics. Academic Press.
3. Morrison R. D (2000); Environmental Forensics: Principles and Applications.CRC Press.
4. Petrisor I. G (2014); Environmental Forensics Fundamentals; A Practical Guide. CRC Press.

COURSE No.: MFSC-403-EL-2	Forensic Nanotechnology
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+0**

Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.

UNIT- 1 **9**

Nanotechnology: Introduction, history, classification of nanoparticles, Fundamentals of nanotechnology and Nano biotechnology, Nanotechnology in Forensic Investigation, Bio nanomaterials.

UNIT- 2 **11**

Utilization of Nanotechnology in analysis of physical evidences, selectivity of nanoparticles with compatibility and feasibility, Application of nanotechnology in forensic evidence analysis

UNIT- 3 **10**

Nano sensors, basic design and types of nano sensors. Nanotechnology in fingermark sensing in DNA fingerprinting, explosive detection and drug sensing.

UNIT- 4 **15**

Nano medicine: introduction, nanostructures in medicine, applications in medical diagnostics applications, nano pharmaceuticals, toxicological and ethical issues in nano medicine.

Nano toxicology: introduction, routes of exposure, toxicity of nano materials, interaction among nanomaterials with biological systems, methods for nano toxicity determination and nano antidotes.

Suggested Books

1. Shukla, R.K and Pandya A (2019); Introduction to Forensic Nanotechnology as Future Armour. Nova Science Publishers.
2. Rawtani D and Hussain, C.M (2020); Technology in Forensic Science. Sampling, Analysis, Data and Regulations.Wiley- VCH.
3. Hussain, C, Rawtani D, Pandey G and Tharmavaram M (2021); Handbook of Analytical Techniques for Forensic Samples. Current and Emerging Developments. Elsevier Inc.
4. Kalfoglu S and Islek, D.S (2022); Understanding Crime through Forensic Science. AbsoluteAuthor Publishing House.
5. Pandya A, Bhosale R.S and Singh V (2022); Design, Principle and Application of Self-Assembled Nano Biomaterials in Biologyand Medicine. Academic Press.
6. Farrukh, MA (2013); Nano-Forensics. KS Omniscriptum Publishing.
7. Sharma H, Gupta S, Narayan M, Prasad R and Krishnan A (2022); Engineered Nanomaterials for Innovative Therapies and Biomedicine. Springer International Publishing.

COURSE No.: MFSC-403-EL-3	Forensic Engineering
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+0**

Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.

UNIT-1 **8**

Introduction to forensic engineering, definition and applications of engineering in forensics and legal system, investigation pyramid, engineer as forensic expert.

UNIT-2 **12**

Structure failure- building collapse, causes of building collapse, review of construction theory, design and material deficiencies , Causes of deterioration in concrete and steel structures- preventive measures, maintenance and inspection.

UNIT-3 **12**

Vehicular accidents, cause of accident, investigation of accident, tools used for evaluating accidents, motor vehicle fires – causes, investigation and analysis.

UNIT-4 **13**

Industrial accidents, causes and casual mechanisms, importance of accidents, preliminary and onsite investigation, accident prevention, insurance aspects, legal and ethical issues.

Suggested Books

1. Kardon JB (2012); Guidelines for Forensic Engineering Practice. ASCE.
2. Lewis GL (2003); Guidelines for Forensic Engineering Practice. ASCE.
3. Franck H and Franck D (2013); Forensic Engineering Fundamentals. CRC Press.
4. Brown JF, Obenski KS and Osborn TR (2002); Forensic Engineering Reconstruction of Accidents. Charles C Thomas Publishers Ltd.

COURSE No.: MFSC-403-EL-4	Advanced Cyber Forensics
Maximum marks: 70	**Teaching hours: 45** **Credits : 4+1+0**
Note: The Examiner will set a total of nine (9) questions covering all topics/ units of the prescribed course by setting at least two questions from each unit. Out of the nine questions, one question containing seven (7) short-answer type questions that will cover entire course will be compulsory. The candidate will attempt a total of five questions (one from each unit) including the compulsory question. All questions will carry equal marks.	

UNIT-1 **11**

Network Forensics- introduction, scope and significance, Fundamentals of Network Security, tools and technique for acquisition and analysis of network related data, encryption and encryption types, software piracy

UNIT- 2 **10**

Block chain Technology, Crypto currency, Types of crypto currency wallet, investigation of crypto related transactions, cryptographic techniques, and financial frauds.

UNIT- 3 **12**

Malwares –introduction, types of malwares and methods to detect malwares, malware analysis lab setup, steps in malware analysis, static malware analysis, dynamic malware analysis and mobile malware analysis.

UNIT- 4 **12**

Dark web- introduction and services, introduction to Anonymizers- proxy, VPN, Tor, I2P, internet of things, concept of hacking , social media investigation, machine learning and artificial intelligence in cyber forensics.

Suggested Books:

1. Casey E (2001); Handbook of Computer Crime Investigation: Forensic Tools and Technology. Academic Press.
2. Icove D.J, Seger K.A and Vonstorch W (1995); Computer crime-A crime fighter's handbook. O'Reilly & Associates.
3. Casey E (2011); Digital evidence and computer crime-Forensic science, Computers and Internet. Academic Press.
4. Kruse II W.G and Heiser J.G (2001); Computer forensics-Incident Response Essentials. Pearson Education.
5. Middleton B (2022); Cyber Crime Investigator's Field Guide. Auerbach publications.
6. Johansen G (2020); Digital Forensics and Incident Response: Incident Response Techniques and Procedures to Respond to Modern Cyber Threats. Packt Publishing Ltd.
7. Dunham M.H (2006); Data Mining: Introductory And Advanced Topics. Pearson Education.

COURSE No.: MFSC-404	Dissertation Work
Maximum marks: 250	**Credits : 20**

Each of the candidates will carry out the project work assigned to him/ her. The candidate will submit three bound copies of the research project work performed by him/ her duly certified by the guide/supervisor. The project report should cover the abstract/ summary, introduction, materials and methods, results and discussion, and references. The references will be arranged alphabetically under the format given below:

Referred Journal Bhalla TC, Sharma NN and Sharma M (2006). Expression of alkaline protease in Rhodococcus sp. J Appl Biotechnol 32: 225-230.

Book Demartino, GN (1996). Purification of proteolytic enzyme. In: Proteolytic enzyme: a practical approach. Berjnon RJ and Bond JS eds, IRL Press NewYork.

Thesis Verma ML (2006) Production, purification and characterization of thermotolerant P. aeruginosa lipase. Ph.D. Thesis, Himachal Pradesh University, Shimla, India.

Website

www.elsevier.com

COURSE No.: MFSC-405	Internship
Maximum marks: 50	**Credits : 2**

Each student will go for internship in any SFL/ FPB/ Industry/ Research institute/ Medical institute for duration of 2-4 weeks during the winter vacations.

The evaluation will be done in 4th semester only. The students will be required to submit the hard copy of the report.

The evaluation of internship report will be on the basis of scientific content, presentation and response in Question & Answer session.