

NATIONAL EDUCATION POLICY-2020

**Common Minimum Syllabus for all
Uttarakhand State Universities and Colleges for
Five Years of Higher Education**

**PROPOSED STRUCTURE OF
PG – FORENSIC SCIENCES
SYLLABUS**

2021

Curriculum Design Committee, Uttarakhand

Sr. No.	Name & Designation
1.	Prof. N.K. Joshi Vice-Chancellor, Kumaun University Nainital Chairman
2.	Prof. O.P.S. Negi Vice-Chancellor, Uttarakhand Open University Member
3.	Prof. M S. Rawat Vice-Chancellor, Sri Dev Suman Uttarakhand University Member
4.	Prof. Jagat Singh Bisht Vice-Chancellor, Soban Singh Jeena University Almora Member
5.	Prof. Surekha Dangwal Vice-Chancellor, Doon University, Dehradun Member
6.	Prof. M.S.M. Rawat Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand Member
7.	Prof. K. D. Purohit Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand Member

Syllabus Expert Committee

S. No.	Name	Designation	Department	Affiliation
1.	Prof. N. Senthil Kumar	Professor	Department of Biotechnology	Mizoram University, Mizoram
2.	Prof. C.P Singh Bhaisora	Professor	Forensic Medicine	Government Medical College, Haldwani
3.	Prof. Rambir Singh	Professor	Department of Horticulture (Aromatic and Medicinal Plants)	Mizoram University, Mizoram
4.	Mr. Ashok Bansal	President	-	Kumaun and Garhwal Chamber of Commerce
5.	Prof. Dharmesh Silajiya	Dean and Professor	Forensic Medicine	National Forensic Science University, Gujarat
6.	Dr. Mahendra Rana	Associate Professor	Pharmaceutical Sciences	Sir J.C Bose Technical Campus, Kumaun University, Nainital

Syllabus Preparation Committee

S.No.	Name	Designation	Department	Affiliation
1.	Prof. S.P.S Bisht	Dean	Biomedical Sciences	D.S. B Campus, Kumaun University, Nainital
2.	Dr. Mahendra Rana	Associate Professor	Department of Pharmaceutical Sciences	S J.C Bose Technical Campus, Kumaun University, Nainital
3.	Dr. Rashi Miglani	Project Associate-I	Biomedical Sciences	D.S.B Campus, Kumaun University Nainital

YEAR	SEMESTER	PAPER CODE	PAPER TITLE	CREDITS TH+PR	
Master in Faculty (Forensic Sciences)					
1	I	PAPER- I	Elementary Forensic Sciences	4	
		PAPER- II	Fundamentals of Fingerprint examination	4	
		PAPER- III	Forensic Tools and Techniques	4	
		PAPER- IV	Investigation Techniques	4	
		LAB	Lab Course I	4	
		Industrial Training/ Survey/Research Project	With reference to Major Papers of Semester- I	4	
				Total	24
	II	PAPER- I	Forensic Engineering and Ballistics	4	
		PAPER- II	Instrumental Methods of Analysis	4	
		PAPER- III	Forensic Biology and Biological Techniques	4	
		PAPER- IV	Forensic Medicines	4	
		LAB	Lab Course II	4	
		Industrial Training/Survey/ Research Project	With reference to Major Papers of Semester- II	4	
		I or II	Minor Elective	Laboratory Safety Guidelines or Good Clinical and Laboratory Practices or Ethical Guidelines for medical research	4
			Total	28	
Credits I+II				52	
2	III	PAPER- I	Forensic Toxicology	4	
		PAPER- II	Biochemistry and Biochemical Techniques	4	
		PAPER- III	Statistics and Forensic Applications	4	
		PAPER- IV	Forensic Criminology and Law	4	
		LAB	Lab Course III	4	
		Industrial Training/Survey/ Research Project	With reference to Major Papers of Semester- III	4	
				Total	24
	IV	PAPER- I	Forensic Drug Analysis	4	
		PAPER- II	Fundamentals of Forensic Psychology	4	
		PAPER- III	Bioinstrumentation	4	
		PAPER- IV	Research Methodology and Intellectual Property Rights (IPR)	4	
		LAB	Lab Course IV	4	
		Industrial Training/Survey/ Research Project	With reference to Major Papers of Semester-IV	4	
				Total	24
	Credits III+IV				48
	Total Credits				100

Course Objective (CO):

1. To produce competent manpower in the field of **Forensic Sciences** to meet the challenges of crime and investigative research using recent tools and techniques of Science and Technology.
2. Provide opportunities to the science graduates towards job industry-driven professional studies.

Outcomes of the course

1. The detailed study of the subject will help to understand the basics and different branches of **Forensic Sciences** and will help to know about the working and functioning of **Forensic Science** laboratories.
2. Course will generate trained manpower for Police Science and its role in criminal investigation and Prevention of crime.
3. A **forensic scientist** increases public safety by contributing to the capture of dangerous criminals. They help to achieve justice for victims and their families by using a range of techniques like DNA analysis, psychological theories and profiling approaches. You can get jobs in various governments & private sectors.

SYLLABUS (CBCS) M.Sc. FORENSIC SCIENCE

KUMAUN UNIVERSITY, NAINITAL, UTTARAKHAND.

1.	Name of the Programme	M.Sc. Forensic Science
2.	Type of Course (U.G/P.G)	Post Graduate
3.	Duration of Course	4 Semester (2 Year course) CBCS
4.	Objectives of Course	<ul style="list-style-type: none">➤ To produce competent manpower in the field of Forensic Sciences to meet the challenges of crime and investigative research using recent tools and techniques of Science and Technology.➤ Provide opportunity to the science graduates towards job and industry driven professional studies.
5.	Outcome of Course	<p>The detail study of the subject will help to understand the basics and different branches of Forensic Sciences and will help to know about the working and functioning of Forensic Science laboratories.</p> <p>Course will generate trained manpower for Police Science its role in criminal investigation and Prevention of crime.</p> <p>A forensic scientist increases public safety by contributing to the capture of dangerous criminals. They help to achieve justice for victims and their families by using a range of techniques like DNA analysis, psychological theories and profiling approaches. You can get jobs in various governments & private sectors.</p>
	Number of Proposed seats (Intake)	20 (Twenty)

SYLLABUS (NEP) M.Sc. FORENSIC SCIENCE

M. Sc. in Forensic Science
FIRST SEMESTER (ODD SEMESTER)

Course Code	Course Type	COURSE (PAPER/SUBJECTS)	Credits	Maximum Marks		
				Internal	External	Total
FSC	CCC	Elementary Forensic Science	4	20	80	100
FSC	CCC	Fundamentals of Fingerprint examination	4	20	80	100
FSC	CCC	Forensic tools and techniques	4	20	80	100
FSC	CCC	Investigation techniques	4	20	80	100
FSC	LAB	Lab Course I	4	20	80	100
Minimum credits in complete semester would be 20			Total: 20			

The M.Sc. program will be divided into four semesters each being of six months duration. Each semester comprises of compulsory core courses (CCC) Lab course (LC) will be based on CCC. Each theoretical course will be divided into Internal Assessment of 20 marks and semester end examination of 80 marks.

Duration of Theoretical and Practical Examination Time: 03 Hours



Mahendra Kumar



M.Sc. FORENSIC SCIENCE		I SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: ELEMENTARY FORENSIC SCIENCE		
CREDIT: 04	TEACHING HOURS:90	
MARKS: 100	THEORY EXAM. : 80	CCA: 20
UNIT-1 18 Hours	Definition of Forensic Science, History, Organization of Forensic Science Laboratories and other allied institutions (FSL, CFSL, GEsQD, FPB), Development of Forensic Science in India & Abroad, Pioneers in Forensic Science, Multidisciplinary nature, Role of Forensic science in crime investigation with advanced technology, Forensic intelligence and Interviews. Concise of Forensic Physical, Biological, Chemical and Psychological evidences, Court Testimony Admissibility of expert testimony, Expert and lay witnesses, Laws and ppinciples of forensic science, branches of forensic science	
UNIT-2 18 Hours	Nature of Evidence; What is Evidence? Kind of evidence, Levels of evidence, Forensic science is History, Basis of evidence; Transfer & Persistence, contamination, Identity, class and Individualization. Known and questioned items, Relationship and context, comparison of evidence, controls, Analysis of evidence: Controls, Analysis of evidence: Some preliminary considerations.	
UNIT-3 18 Hours	Relationship between police and forensic expert, Role of Police at the Crime scene, scientific help at crime scene, handling of various types of crime scenes by police, forensic teaching of police personals, forensic case documentation by Police, Technological Advance and Police. Criminal Justice system in India, Introduction, Administration of civil and criminal justice, Hierarchy of courts, Powers of courts, Types of courts Lok Ayukta system. Forensic Report: Forensic Expert, Forensic Report, Formats of Forensic Report, Court Testimony, Pre-Court Preparations & Court appearance, Examination in chief, Cross Examination and Re-examination, Ethics in Forensic Science	

UNIT-4
18 Hours

Recent Trends in Forensic Science-Environmental Forensics: Definition, Legal processes involving environmental forensic science. Geo-forensics Global Positioning System; Basic principles and applications. Biometrics in Personal Identification: Introduction, Concepts of Biometric Authentication, Role in person Identification, Techniques and Technologies (Finger Print Technology, Face Recognition, IRIS, Retina Geometry, Hand Geometry, Speaker Recognition, Signature Verification and other forensic related techniques). Bioterrorism-Definition, Concepts of Biosecurity and microbial forensics, Weapons of mass destruction (WMD), mass-casualty weapons (MCW), NBC and CBRNE, Dirty Bombs

SUGGESTED
READINGS

- *Nanda, B.B. and Tewari, R.K. (2001) Forensic Science in India: A vision for the twenty first century Select Publisher, New Delhi.*
- *James, S.H and Nordby, J.J. (2003) Forensic Science: An introduction to scientific and investigative techniques CRC Press,*
- *Saferstein: Criminalistics (1976) Prentice Hall Inc., USA.*
- *Deforest, Gansellen & Lee: Introduction to Criminalistics.*
- *Sharma, B.R. (1974) Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad,1974.*
- *Bruce A. Arrigo (2000) Introduction to Forensic Psychology Academic Press, London*
- *J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press.*
- *Virginia A. Lynch (2011) and Janet Barber Duval: Forensic Nursing Science*

M.Sc. FORENSIC SCIENCE		I SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: FUNDAMENTALS OF FINGERPRINT EXAMINATION		
CREDIT: 04	TEACHING HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 18 Hours	Introduction: Biometrics and Forensic Science- face, Iris & retinal imaging, speech recognition, fingerprinting in India, What are friction ridges? Friction ridges pattern visualization techniques, taking of finger prints from living & dead persons, preserving prints for analysis, principles of friction Ridge analysis, Classifying Fingerprints, Comparison of finger prints, Automated Fingerprint Identification System (AFIS), Identification, How long do friction ridge prints last, Elimination prints, Lip print, ear print.	
UNIT-2 18 Hours	Chemistry of latent fingerprint residue, factor contributing to latent fingerprints, Methods of Development of latent fingerprints using conventional methods–Powdering (Black and grey, fluorescent and magnetic), Fuming method, Vacuum Metal Deposition (VMD) Method, Chemical method, Reagent chemistry and formulations, Sequential Treatment and Enhancement., Photography of fingerprints, Digital Transmission	
UNIT-3 18 Hours	Impression Evidence: Types of Impression Evidence, Significance of Impression Evidence, Footwear Impressions (General Characteristic), Footwear Impressions at the Crime Scene, casting three-Dimensional Footwear impressions, lifting imprints, Comparison of footwear impressions, Tire Impressions Evidence skid mark, Serial numbers restoration. Basic principles and techniques of black & white and colour photography. Camera and lenses, exposing, development & printing, different kinds of developers & fixers, modern developments in photography. Digital photography, Crime Scene Photography and Laboratory photography. Tape authentication techniques and their applications in forensic science.	

UNIT-4 16 Hours	<p>Forensic Document Examination and its scope & importance; Classification of documents; Care, handling, and preservation of documents; Observation tests and their application in handwriting examination; Preliminary examination of documents; examination of paper & inks, Process of comparison of handwriting; Principle of handwriting examination; Importance of natural variations and disguise in handwriting examination; Latest technological developments in the field of document examination with reference to office automation; Quality Assurance in document Examination; Document Expert in trial courts.</p>
SUGGESTED READINGS	<ol style="list-style-type: none"> 1. <i>Saferstein, R. (1990) Criminalistics, Prentice Hall, New York.</i> 2. <i>David R. Ashbaugh (1999) Quantitative and Qualitative Friction Ridge Analysis, CRC Press.</i> 3. <i>E. Roland Menzel (1999) Fingerprint Detection with Lasers, 2ndEd., Marcel Dekker, Inc. USA.</i> 4. <i>James F. Cowger (1993) Friction Ridge skin, CRC Press London.</i> 5. <i>Mehta, M.K (1980) Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay.</i> 6. <i>Moenssens (1975) Finger Prints Techniques, Chitton Book Co. Philadelphia, NY.</i> 7. <i>Chatterjee S.K. (1981) Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata.</i> 8. <i>Cowger, James F (1993) Friction ridge skin-Comparison and Identification of fingerprints, CRC Press, NY.</i> 9. <i>J A Siegel, P.J Saukko (2000) Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press.</i>

M.Sc. FORENSIC SCIENCE		I SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: FORENSIC TOOLS AND TECHNIQUES		
CREDIT: 04	THEORY HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 20 Hours	<p>Meaning and Terminology of Instrumentation: Definition, Need of Instrumentation in Forensic Science, Qualitative and quantitative methods of analysis, Destructive and Non-Destructive Methods, Separatory techniques, Hyphenated techniques, Accuracy, Precision, Signal to noise ratio, Sensitivity and detection limit, sources of noise, Instrument calibration. Scientific Calculations: Scientific volume and weight measurements, Centrifugation, Extraction, Filtration, Distillation, Density, Specific Gravity, Specific Volume, Percentage, Ratio Strength, and other Expressions of Concentration.</p>	
UNIT-2 20 Hours	<p>Schematic analysis of Chemical, Biological and Physical samples, Preliminary and Confirmatory methods of analysis, Color spot tests in Forensic Biological, Chemical and Physical analysis, Microcrystalline test. Centrifuge Techniques: Centrifugation Techniques, Basic principles of sedimentation, Various types of centrifuges, Density gradient centrifugation, Preparative centrifugation, Ultra-Centrifuge-Refrigerated Centrifuges. Introductory Chromatography: Definition, Chromatographic Techniques, History of Chromatography, Theoretical principles of Chromatography, Classification of Chromatographic Methods, Adsorption and Partition Chromatography. Thin Layer Chromatography: Basic Principle, Setup, visualization and Forensic Applications etc.</p>	
UNIT-3 15 Hours	<p>Microscopy: Theory and basic principles, setup and Forensic applications of Compound, Comparison, Fluorescence, Polarized, Stereo-zoom microscope. Introduction, Geometrical optics, Image formation, Magnification and Resolution, Lens aberrations, Distortion of image and curvature of field, Polarised Light Microscopy, Fluorescence Microscopy, Comparison Microscope. Electron Microscopy-Theory and basic principles of Electron Microscopy, Structure and Forensic applications of Scanning Electron microscope (SEM), Transmission Electron Microscope (TEM).</p>	

UNIT-4
20 Hours

Introduction to radiation biology, techniques and radiotracer technology, type, handling and applications of radioisotopes.

Indian and International Regulations on radiation. Case studies related to breach of regulatory norms.

SUGGESTED
READINGS

- *Borrow (1980) Molecular Spectroscopy.*
- *Willdard, H. H (1974) Instrumental Methods of Analysis.*
- *Moonesens A.A.(1979) Scientific Evidence in Criminal Cases.*
- *Lundquist & Curry (1963) Methods of Forensic Science.*
- *Settle, F.A. (1997) Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.*
- *E. Stahl (1969) Thin Layer Chromatography: A Laboratory Handbook.*
- *Sue Jickells and Adam Negrusz (2008) Clarke's Analytical Forensic Toxicology.*
- *Forensic Chemistry: Max M Houck (2015)*
- *Tilstone, W. J. and Lothridge, K.: Crime Laboratory Management, Taylor and Francis, 2004*
- *Clair, J. S: Crime Laboratory Management, Academic Press, 2003*
- *Siegel, J. A, Saukko, P. J and Knupfer, G. C (Eds.): Encyclopedia of Forensic Sciences, Academic Press, 2000*
- *Uma Devi, P, Satish Rao, B.S, Nagarathnam, A (2000). Introduction to radiation biology. India: N. p., 2000. Web.*
- *Radiation Biology: A Handbook for Teachers and students. Interantional Atomic Energy Agency (IAEA), Vienna, 2010*
- *Thomas, C & Woolnough, L. (2014). Understanding and using the light microscope. Milton Contact. Ltd.*

M.Sc. FORENSIC SCIENCE		I SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: INVESTIGATION TECHNIQUES		
CREDIT: 04	TEACHING HOURS: 90	
MARKS: 100	THEORY EXAM:80	CCA: 20
UNIT-1 15 Hours	Pathology: Introduction: Cause and manner of death, medico-legal examination, Postmortem examination (AUTOPSY): the external, or visual, examination, other evidence collected, determining time since death, Laboratory Analysis, consultations	
UNIT-2 15 Hours	Anthropology and Odontology, Introduction: The human skeleton, Collecting Human remains, analysis of skeleton materials, facial reproductions, Interpretations, case studies.	
UNIT-3 20 Hours	Entomology, Introduction: Insects and their Biology, Life cycles of insects, collecting insects at a crime scene, the postmortem interval, the classification of insects, rearing insects, calculating A PMI, other forensic uses for insects, case studies.	
UNIT-4 20 Hours	Serology and Bloodstain, pattern analysis, Introduction: Collection Body Fluids, the major body fluids, presumptive tests or blood, confirmatory tests or blood, species origin, semen, presumptive tests for semen, confirmatory tests for semen, saliva, urine, bloodstain pattern analysis, determining point of origin, documenting bloodstains at the scene, case studies. DNA Analysis, Introduction, the nature of DNA, DNA typing, Mitochondrial DNA (mt DNA), Interpretation of DNA typing results, DNA database the FBI Codis system, codis success stories, case studies. Forensic hair examinations, introduction: Growth of hairs, Microanatomy, human vs non-human hairs, body area determination, ancestral estimation, damage, disease and treatments, comparison of human hairs, DNA and hairs, case studies.	

1. Houck, M.M. & Siegel, JA; *Fundamentals of Forensic Science*, Academic Press, London, 2006.
2. Sharma, B.R., *Forensic Science in Criminal Investigation & Trials*, Universal Publishing Co., New Delhi, 2003
3. James, SH and Nordby, J.J., *Forensic Science- An Introduction to Scientific and investigative Techniques*, CRC Press, USA (2003)
4. Saferstein; *Criminalistics- An Introduction of Forensic Science*, Prentice Hall Inc, USA,2007.
5. Barry, A.J. Fisher; *Techniques of Crime Scene Investigation*, 7th Ed, CRC Press, NY, 2003.
6. Seigel, JA, Sukoo, R.J, &Knupfer, G.L. *Encyclopaedia of Forensic Science*, Vol I,II and III, Academic Press, 2000
7. O'Hara CE and Osterburg, JW; *An Introduction to Criminalistics*, Indiana Univ. Press,London, 1972.
8. Swansson,CR, Chamelin, NC, & Territ, L., *Criminal Investigator*, McGrawhill, NY,2000.
9. Becker; *Criminal Investigation*, ASPEN Publishing, Inc. Maryland, 2000.
10. Modi, JP, *Textbook of Medical Jurisprudence & Toxicology*, N.M. Tripathi Pub,2001
11. Chadha, PV; *Handbook of Forensic Medicine & Toxicology*, Jaypee Brothers, New Delhi,2004
12. Parikh, C.K; *Text Book of Medical Jurisprudence, Forensic Medicine & Toxicology*, CBS Pub. New Delhi,1999
13. Eckett, WG & James, SH; *Interpretation of Blood Stains Evidence of Crime Scene*, Elsevier Pub. NY,1989

M.Sc. FORENSIC SCIENCE

I SEMESTER

COURSE CODE: FSC

COURSE TYPE: PRACTICAL

COURSE TITLE: LAB (Lab Course 1)

CREDIT: 04

PRACTICAL HOURS: 90

MARKS: 100

LABORATORY WORK

1. Field test for narcotic drugs
2. TLC of drugs
3. TLC of pesticides
4. Test for ethanol and methanol
5. Preliminary test for explosives
6. Preliminary tests for: (a) identification of bloodstain (b) identification of seminal stain (c) identification of saliva stain.
7. Microscopic examination of semen
8. Sketching of Outdoor crime scene
9. Sketching of Indoor crime scene
10. Photography of crime scene
11. Collection and packing of physical evidence at the scene of crime
12. Forwarding of physical evidence
13. Reconstruction and evaluation of indoor crime scene
14. Reconstruction and evaluation of outdoor crime scene
15. Physical evidence and Locard's principle
16. Polygraphy (Demonstration only)

M. Sc. in Forensic Science

SECOND SEMESTER (EVEN SEMESTER)

Course Code	Course Type	COURSE (PAPER/SUBJECTS)	Credits	Maximum Marks		
				Internal	External	Total
FSC	CCC	Forensic Engineering & Ballistics	4	20	80	100
FSC	CCC	Instrumental Methods of Analysis	4	20	80	100
FSC	CCC	Forensic Biology & Biological Techniques	4	20	80	100
FSC	CCC	Forensic Medicine	4	20	80	100
FSC	LAB	Lab (Lab Course 2)	4	20	80	100
Minimum credits in complete semester would be 20			Total: 20			

The M.Sc. program will be divided into four semesters each being of six months duration. Each semester comprises of compulsory core courses (CCC) Lab course (LC) will be based on CCC. Each theoretical course will be divided into Internal Assessment of 20 marks and semester end examination of 80 marks.

Duration of Theoretical and Practical Examination Time: 03 Hours

M.Sc. FORENSIC SCIENCE		II SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: FORENSIC ENGINEERING & BALLISTICS		
CREDIT: 04	TEACHING HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 18 Hours	<p>Glass: Types of glass and their composition, Forensic examination of glass fractures under different conditions, Determination of direction of impact: cone, Fracture, rib marks, hackle marks, backward fragmentation, Color and fluorescence, Physical matching, Density comparison, Physical measurements, Refractive index by refractometer, Elemental analysis, Interpretation of glass evidence.</p> <p>Paint: Types of paint and their composition, Macroscopic and microscopic studies, Pigment distribution, Micro-chemical analysis, Solubility test, pyrolysis chromatographic techniques, TLC, UV-Vis and IR spectrophotometric and X-Ray diffractometric methods - Elemental analysis - Interpretation of paint evidence.</p>	
UNIT-2 18 Hours	<p>Soil: Formation and types of soil, Composition and color of soil, Particle size distribution, Turbidity test, microscopic examination, Density gradient analysis, Ignition loss, Differential thermal analysis, Elemental analysis, Interpretation of soil evidence, Discussion on important case studies of glass and soil.</p> <p>Tool Marks: Types of tool marks, Class characteristics and individual characteristics, Tracing and lifting of marks, Photographic examination of tool marks and cut marks on clothes and walls, etc. Restoration of erased/obliterated marks, Method of marking, Methods of obliteration, Method of restoration, Recording of restored marks, Restoration of marks on wood, leather, polymer, etc.</p>	
UNIT-3 18 Hours	<p>Elements of Forensic Engineering: Building materials, Cement and its composition, Determination of adulteration in cement, Reinforced Cement Concrete, Bitumen and road tar, Examination of electrical appliances and installations. Regulations regarding the Construction of commercial and residential buildings including ISO guidelines.</p>	

UNIT-4
18 Hours

Introduction, Classification of fire arms based on various parameters, Techniques of dismantling/assembling of fire arms, Identification of origin, Improvised/country made /imitative firearms and their constructional features, Ammunition and their components, Types of ammunition.

Classification and construction features of different types of cartridges, Types of primers, priming compositions, Propellants and their compositions, Velocity and pressure characteristics, Various types of bullets and compositional aspects, Improvised ammunition and safety aspects of handling firearms and ammunitions.

Internal and external ballistics, fire direction, time of fire, range of fire, post mortem and anti-mortem firearm injuries.

SUGGESTED
READINGS

1. Saferstein, R., *Criminalistics. An Introduction to Forensic Science, 5th ed., Prentice Hall, 1998*
2. Saferstein, R., *Handbook of Forensic Science (Vol. 1,2,3)*
3. Kirk, P.: *Criminal Investigation, Interscience, 1953*
4. James, S. H. and Nordby, J. J.: *Forensic Science: An Introduction to Scientific and Investigative Techniques, CRC Press, 2003 & 2005*
5. Siegel, J. A., Sukoo, R. J, and Knupfer, G. C: *Encyclopedia of Forensic Science, Vol, I, II and III, Academic Press, 2000*
6. Hara, C.E.O., & Osterburg, J.W., *An Introduction to Criminalistics Indiana University Press, (1972)*
7. *Working Procedure Manual: Physics, BPR&D Publication (2000)*
8. Caddy, B., *Forensic Examination of Glass & Paints. Analysis and Interpretation ISBN (2001)*
9. Mathews, H.J., & Thomas, C.C., *Firearms Identification (Vol1,2,3), Springfield, (1973)*
10. Hatcher, Jury & Weller, *Firearms Investigation, Identification and Evidence, Stackpole Books, (1977)*
11. Heard, B.J., *Handbook of Firearms and Ballistics, John Wiley & Sons, (1997)*
12. Warlow, T.A. *Firearms: The Law and Forensic Ballistics, Taylor & Francis, (1996)*
13. Johari, M., *Identification of Firearms, Ammunition and Firearm Injuries; BPR&D,*

(1980)

14. Sellier, K.G. et.al., *Wound ballistics and The Scientific Background*, Elsevier, (1994)

15. Jahne, B., *Digital Image Processing*, Heidelberg Springer (1996)

16. Jacobson, B.H.E., Sidney, R.G., Attridge, G., *The Manual of Photography*, focal Press, (1998)

17. Horeustein, H., *Colour Photography; A Working Manual*, Little Brown Company, (1995)

18. Red Sicker, D. R., *The Practical Methodology of Forensic Photography*, CRC Press, (1994)

19. Brain J. H., *Hand Book of Fire arms and Ballistics*, John Wiley

20. Sharma B. R., *Fire arms in Criminal Investigation and Trials*, 3rdEdn. Universal (2002)

21. Kumar K., *Forensic Ballistics in Criminal Justice*, Eastern Book Co (1987)

M.Sc. FORENSIC SCIENCE		II SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: INSTRUMENTAL METHODS OF ANALYSIS		
CREDIT: 04	TEACHING HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 18 Hours	Molecular Mass Spectrometry, Molecular mass spectra, Ion sources, Interpretation of mass spectra, Applications of mass spectrometry, atomic mass spectrometry, Inductively coupled plasma Mass spectrometry	
UNIT-2 18 Hours	Chromatographic Techniques-Principles and applications of Adsorption and Partition Chromatography, Thin Layer Chromatography. High Performance Liquid Chromatography, Instrumentation - Detectors – Columns and Stationary Phases, Applications of Liquid Chromatography, Super Critical Fluid Chromatography, Columns Detectors, Applications, Principle, instrumentation and applications of Capillary electrophoresis and CE-MS.	
UNIT-3 18 Hours	Gas Chromatography, Instrumentation – Detectors, Adsorption, Partition, Gas-Solid, Gas-Liquid, Isothermal, Linear Temperature Programming, Chiral, Pyrolysis and Derivatization Chromatography - Columns and Stationary Phases, Column Efficiency, Method Development, Forensic Applications of Gas Chromatograph. Hyphenated techniques: Principle, instrumentation, techniques and applications of GC-FTIR, GC-MS, LC-MS and MS-MS.	
UNIT-4 16 Hours	Laboratory Information Management system (LIMS): Classification of LIMS, Functions, Sub-division by functional area, Definition of LIMS, Strategic design of LIMS, System development life cycle, Review of the laboratory, Project proposal, Definition of system requirements, Specifications, Commercial or Bespoke LIMS, Evaluation, Purchase and installation, Demonstration, Validation, User training and implementation, good laboratory practices-laboratory safety and handling of hazards.	

1. Skoog, D. A., Holler, J. F., and Neiman, T. A.: *Principles of Instrumental Analysis*, Thomson, 1997.
2. Willard, H. H., Merritt, L.L. Jr., Dean, J. A. and Settle, F. A. Jr.: *Instrumental Methods of Analysis*, 7th edn., Wadsworth, 1998.
3. Kealey, D. and Haines, P. J.: *Analytical Chemistry*, Bios Scientific / Viva Books, 2002
4. Settle, F. A.: *Hand Book of Instrumental Techniques for Analytical Chemistry*, Prentice Hall, 1997.
5. Harris, D. C.: *Quantitative Chemical Analysis*, 5th edn., Freeman, 1999
6. Christian, G. D.: *Analytical Chemistry, Theory and Applications*, John Wiley, 2004
7. Chatwal, G. R. and Anand, S.: *Instrumental Methods of Chemical Analysis*
8. Sharma, B. K.: *Instrumental Methods of Chemical Analysis*
9. Gowenlock, A. H.: *Practical Clinical Biochemistry*, 6th edn., Butterworth / CBS, 1988
10. Townsends Allen (ed.): *Encyclopedia of Analytical Science*, Academic Press, 1995
11. Sane, R. T and Joshi, A. P.: *Electroanalytical Instruction*
12. Goldsby, R. A., Kindt, T. J., Osborne, B. A and Kuby, J.: *Immunology*, 5th Edn., Freeman, 2003.
13. Murray, R. K., Granner, D. K., Mayes, P. A and Rodsell, V. W: *Harper's Biochemistry*, 25th Edn., McGraw-Hill, 2000.
14. Gowenlock, A. H., Mc Murray and J. R, McLaughla, D. M: *Varley's Practical Clinical Biochemistry*, CBS Pub., 1996
15. Mukherjee, K. L (Ch. Ed): *Medical Laboratory Technology, Vol I & II*, Tata McGraw-Hill, 1988.
16. Gerstein, A.S (Ed): *Molecular Biology - Problem Solver – A Laboratory Guide*, Wiley-Liss, 2001

M.Sc. FORENSIC SCIENCE		II SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: FORENSIC BIOLOGY & BIOLOGICAL TECHNIQUES		
CREDIT: 04	THEORY HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 20 Hours	Forensic Biology, Introduction, Scope, Various forms of biological evidences like wood, timber varieties, seeds and leaves, their identification and matching Forensic Botany. Toxic principles of plants and their forensic significance - Identification of poisonous plants and mushrooms of India. Diatoms, Types, Morphology. Study and identification of pollen grains, Identification of starch grains, powder, stains of spices, Paper pulp identification.	
UNIT-2 20 Hours	Forensic Anthropology, History, Scope and Development, Role of forensic anthropologist - Collection and Preservation of evidence. Human osteology - Determination of age, sex, stature, Determination of personal identity by superimposition technique, Video image analysis, Facial reconstruction, Legal provisions and tools, Pathology of bones and its importance. Identification of burnt bones, skeletal remains in accidents, crimes and mass disasters. Forensic Odontology: Introduction, Structure and types of teeth, Dentition and dental formula, Dental diseases, Determination of age, sex and race from teeth, Role of teeth in mass disaster, Forensic significance in identification	
UNIT-3 15 Hours	Hair Examination, Structure of hair, Growth and Chemistry of Hair, Identification and Comparison of Hair through microscopic, Chemical, Biochemical and instrumental methods Identification of animal hair, Assessment of age, sex, race and site of hair. Analysis of drugs and elements in hair, Hair diseases, Hair transfer, persistence and recovery, DNA typing of hair Fibre Examination Classification of fibres, Identification and comparison of fibres by physical, Chemical, Microscopic, Spectroscopic, Chromatographic methods, Persistence and recovery of	

	<p>fibres, Forensic significance, Forensic Entomology: Analyzing crime scene for entomological evidence - Collection of climatological data and specimen before body removal, Determination of the time of death, Entomological succession in case of buried, drowned and buried bodies</p>
<p>UNIT-4 20 Hours</p>	<p>Wildlife Forensics: Importance of wildlife, Wildlife Protection Act, Endangered species, CITES, Census of wildlife population, Wildlife crime, Methods of smuggling and poaching of wildlife artefacts, Crime scene search, Criminal investigation, Determination of the time of death, Sex determination from bones, Identification of teeth, claws, Ivory, Horns, antlers, furs, skin, bite marks, pug marks, Identification of blood, excreta and bones by biochemical and immunological methods.</p>
<p>SUGGESTED READINGS</p>	<ol style="list-style-type: none"> 1. Robertson, J., ed: <i>Forensic Examination of Fibres</i>. Chichester, West Sussex, England: Ellis Horwood Ltd., (1992) 2. Saferstein, Richard: <i>Criminalistics. An Introduction to Forensic Science, 5th ed.</i>, Prentice Hall, 1998 3. Robertson, J: <i>Forensic Examination of Hair</i>. Taylor and Francis. (1999) 4. Saferstein, R: <i>Handbook of Forensic Science (Vol 1,2,3)</i>, 5. Eckert: <i>An Introduction to Forensic Science</i> 6. Kirk, P: <i>Criminal Investigation, Interscience, 1953</i> 7. James, S. H. and Nordby, J. J: <i>Forensic Science: An Introduction to Scientific and Investigative Techniques</i>, CRC Press, 2003 & 2005 8. Siegel, J. A., Sukoo, R. J, and Knupfer, G. C: <i>Encyclopedia of Forensic Science, Vol I, II and III</i>, Academic Press, 2000. 9. Becker, R. F: <i>Criminal Investigation</i>, Aspen Pub., 2000. 10. Lee, H: <i>Physical Evidence</i>, Elsevier, 2000 11. <i>The Wild Life Protection Act, 1972.</i>, Universal Law Publishing 12. Pillay, V.V: <i>Handbook of Forensic Medicine and Toxicology, 12th ed.</i>, Paras Publication 2001. 13. Smith, D.G.V: <i>A Manual of Forensic Entomology and Death: A Procedural Guide</i>, Joyce's Publications (1990) 14. Byrd, J.H. & Castner, J, L: <i>Forensic Entomology - The Utility of Arthropods in</i>

Legal Investigation, CRC Press, (2000)

15. *Biology Methods Manual, Metropolitan Police Forensic Science Laboratory, London, (1978)*

16. *Castner James L (Ed.), Forensic Entomology, CRC Press (2006)*

17. *Richard Li, Forensic Biology, CRC Press, 2008*

18. *Gunn Allen, Essentials of Forensic Biology; Animals, Plants & Microorganisms in Legal Investigations, J. Wiley (2006)*

19. *Coyle H. M. (Ed.), Forensic Botany – Principles and Applications to Criminal Case Work, CRC Press (2002)*

M.Sc. FORENSIC SCIENCE		II SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: FORENSIC MEDICINE		
CREDIT: 04	TEACHING HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 15 Hours	Human anatomy and physiology, Structural levels of organization of human body, Cardiovascular system, Structure and Functions of heart, Arterial & Venous system. Digestive system and its parts, Process of digestion and absorption of food in the alimentary canal. Respiratory system and its parts, Mechanism and regulation of respiration.	
UNIT-2 15 Hours	Nervous system, Structure and functions of neurons, Transmission of nerve impulse, Central and Peripheral Nervous systems and their functions. Endocrine system Characteristics of hormones, Endocrine glands and their hormones. Urinogenital system -Structure and functions of kidneys, Formation and composition of urine. Male and female reproductive systems and their functions.	
UNIT-3 20 Hours	Forensic Medicine, Personal identification of living and dead, Postmortem examination (autopsy), Medico-legal aspects of death, Causes of death, Postmortem changes and their importance in the determination of time after death, Mechanical injuries, Thermal injuries, Medico-legal aspects of injuries	
UNIT-4 20 Hours	Forensic pathology, Preservation of pathological evidence, Examination of decomposed, mutilated and burnt bodies, Exhumation procedure, Deaths from poisoning, Mechanical Asphyxia, Drowning, Starvation, Lightning, Electrocution. Sexual offences and medicolegal aspects, Abortion & Infanticide, Medico-legal aspects, Medical Termination of Pregnancy Act (MPT), Linkage with forensic science laboratory.	

**SUGGESTED
READINGS**

1. Pillay, V.V., *Handbook of Forensic Medicine and Toxicology*, 12th ed., Paras Publication 2001.
2. Modi, J. P., *Textbook of Medical Jurisprudence & Toxicology*, M.M. Tripathi Publication, (2001)
3. Parikh, C.K., *Textbook of Medical Jurisprudence & Toxicology*
4. Reddy Narayn, M., *Textbook of Medical Jurisprudence & Toxicology* 5. James, P.J.: *Encyclopedia of Forensic and Legal Medicine*, Elsevier, 2005

M.Sc. FORENSIC SCIENCE

II SEMESTER

COURSE CODE: FSC

COURSE TYPE: PRACTICAL

COURSE TITLE: LAB (Lab Course II)

CREDIT: 04

PRACTICAL HOURS: 90

MARKS: 100

LABORATORY WORK

1. Verification of Beer's law and calculation of molar absorption coefficients for CuSO_4
2. Verification of Beer's law and calculation of molar absorption coefficients for KMnO_4
3. Conductometric titration of strong acid vs. strong base
4. Conductometric titration of weak acid vs. strong base
5. Conductometric titration of mixture of acids vs. strong base
6. Potentiometric titration of strong acid vs. strong base
7. Potentiometric titration of weak acid vs. strong base
8. Potentiometric redox titration of potassium dichromate-ferrous ammonium sulphate
9. Separation of amino acids by Paper chromatography
10. Paper electrophoresis for separation of amino acids
11. Agarose gel electrophoresis for separation of proteins

M. Sc. in Forensic Science

THIRD SEMESTER (ODD SEMESTER)

Course Code	Course Type	COURSE (PAPER/SUBJECTS)	Credits	Maximum Marks		
				Internal	External	Total
FSC	CCC	Forensic Toxicology	4	20	80	100
FSC	CCC	Biochemistry & Biochemical Techniques	4	20	80	100
FSC	CCC	Statistics and Forensic Applications	4	20	80	100
FSC	CCC	Forensic Criminology and Law	4	20	80	100
FSC	LAB	Lab Course (Lab 3)	4	20	80	100
Minimum credits in complete semester would be 20			Total: 20			

The M.Sc. program will be divided into four semesters each being of six months duration. Each semester comprises of compulsory core courses (CCC) Lab course (LC) will be based on CCC. Each theoretical course will be divided into Internal Assessment of 20 marks and semester end examination of 80 marks.

Duration of Theoretical and Practical Examination Time: 03 Hours

M.Sc. FORENSIC SCIENCE		III SEMESTER	
COURSE CODE: FSC		COURSE TYPE: CCC	
COURSE TITLE: FORENSIC TOXICOLOGY			
CREDIT: 04		TEACHING HOURS:90	
MARKS: 100		THEORY EXAM: 80	CCA: 20
UNIT-1 18 Hours	<p>Toxicology: Introduction, History, Scope. Role of forensic toxicologist.</p> <p>Poisons: Classification of poisons, Types of poisoning, Sample collection and preservation of toxicological exhibits in fatal and survival cases, Storage of samples, Signs and symptoms of poisoning. Toxicological investigation/examination of poisoned death, Interpretation of toxicological data, Courtroom testimony in toxicological cases. Case Histories.</p>		
	UNIT-2 18 Hours	<p>Principles of Toxicology: Introduction, Pharmacokinetics, Methods of transportation of toxicant.</p> <p>Toxicokinetic one and two compartmental model, Toxicodynamic, Spectrum of undesired (toxic) effects, Interaction of chemicals, Tolerance-Dose response relationship, Developmental and reproductive toxicity, Mutagenicity, Toxicity testing.</p>	
		UNIT-3 18 Hours	<p>Toxicological Analysis: Introduction, Sample preparation, Deproteinization, Deconjugation, Isolation and Clean-up procedures in toxicological analysis, Identification and quantitation of poisons by physical, chemical, chromatographic, spectrophotometric, electrophoretic, immunoassay and other methods (Metals, anions, volatile poisons, gases, drugs, pesticides and miscellaneous poisons), Field testing in toxicological work, Therapeutic drug monitoring, Emergency hospital toxicology.</p>
	UNIT-4 18 Hours		<p>Management of acute poisoning: Introduction, Maintenance of vital functions, Measures to enhance elimination of poisons, Removal of unabsorbed poisons. Antidotes: Classification, Mechanism (cyanide, methanol, arsenic, opiate, carbon monoxide, nitrite, acetaminophen and pesticides). Identifying route of administration of poison, Estimation of time and dose after administration of poison, Recovery and after care of patients, Poison Information/Control Centre.</p>

1. *Klaassen, C. D. Casarett and Doull's Toxicology: The Basic Science of Poisons, 5th ed., McGraw-Hill, 1995.*
2. *Moffat, A.C. Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and postmortem material, 3rd ed., Pharmaceutical Press 2004*
3. *Bogusz, M. J. Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science, 2000.*
4. *Siegel, J.A., Saukko, P. J., Knupfer, G. Encyclopedia of Forensic Sciences (Vol3), Academic Press, 2000.*
5. *Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt/Churchill Livingstone, 2000.*
6. *Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed., Nirali Prakashan, 1990.*
7. *Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2nd ed., 1999.*
8. *Wiseman, H and Henry J.: Management of Poisoning, A Handbook for Healthcare workers, 1st ed., A.I.T.B.S, 2002*
9. *Hardman, J. G. and Limbird, L. E. Goodman and Gilman's The Pharmacological basis of Therapeutics, 9th edn., McGraw-Hill, 1996*
10. *Laboratory Procedure Manual, Forensic Toxicology: DFS, 2005*
11. *Sunshine, I; Methods for Analytical Toxicology, CRC Press USA (1975)*
12. *Cravey, R.H; Baselt, R.C.: Introduction to Forensic Toxicology, Biochemical Publications, Davis, C.A. (1981)*
13. *Stolmen, A.; Progress in Chemical Toxicology: Academic Press, New York (1963)*
14. *Modi, Jaisingh, P.; Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Publication (2001)*
15. *Eckert; An Introduction to Forensic Science, CRC Press*
16. *Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001*

17. Curry, A. S: *Poison Detection in Human Organs*

18. Levine Barry, *Principles of Forensic Toxicology*, 2ndEdn., (2006)

19. Hodgeon Emeet, *A Text Book of Modern Toxicology*, 3rd.Edn. (2004)

M.Sc. FORENSIC SCIENCE		III SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: BIOCHEMISTRY & BIOCHEMICAL TECHNIQUES		
CREDIT: 04	TEACHING HOURS:90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 18 Hours	Biomolecules and cells, biological fitness of organic compounds, Hierarchy of molecular organization of cells, Primordial biomolecules, Specialization and differentiation of biomolecules, The dimensions and shapes of biomolecules, Biomolecules supra molecular structures and cell organelles, Structural organization of cells. Proteins and peptides, Composition of proteins, Size of protein molecules, Confirmation of protein supra molecular assemblies of proteins, Denaturation, Estimation of proteins Functional diversity of proteins, Antibodies and immune response, The species specificity of proteins, Sequence isomerism in polypeptide chains, Genetic coding of amino acid sequences in proteins, Mutation, Structure of peptides, Optical and chemical properties of peptides, Steps in determination of amino acid sequence, Separation and analysis of peptides, Sequence analysis of peptide fragments.	
UNIT-2 18 Hours	Amino acids, Common amino acids of proteins, Rare amino acids of proteins, non-protein amino acids, Physicochemical properties of amino acids, Absorption spectra of amino acids, Chemical reactions of amino acids, Analysis of amino acid mixtures, Complete hydrolysis of polypeptide chains and determination of amino acid composition, Identification of N-terminal and C-terminal residues of peptides. Enzymes, Definition, types and classification - Biological activities, Kinetics, Inhibition, Types of inhibition, Poisoning, Micheles-Mentor's equation, Enzyme polymorphism, Purification of proteins and enzymes, Enzyme assay techniques: UV-Vis, Luminescence, Radio isotope and immunochemical methods, Automated enzyme analysis, Immobilized enzymes.	
UNIT-3 18 Hours	Nucleotides, General structure of the nucleotides, Pyrimidines and purines, Nucleosides, Nucleotides, Nucleic acids-RNA and DNA, Short hand representation of nucleic acid back bones- Hydrolysis of nucleic acids by acids and bases, Enzymatic hydrolysis of nucleic acids, Analysis of nucleotide sequence in nucleic acids, Nucleic acid, Protein supra	

	molecular complexes, DNA sequencing, PCR technique
UNIT-4 16 Hours	Electrophoretic Techniques, Principles, Factors affecting migration, Instrumentation, Techniques and Applications of: Zone Electrophoresis, Cellulose Acetate Membrane Electrophoresis, Agar Gel Electrophoresis, Acryl amide Gel Electrophoresis, Capillary electrophoresis, Isoelectric Focusing, Isotachophoresis, Biochemical techniques, General principles, pH and buffers, physiological solution, Cell and tissue culture, Cell fractionation, Centrifugation techniques.
SUGGESTED READINGS	<ol style="list-style-type: none"> 1. Nelson, D. L., and Cox, M. M.: <i>Lehninger Principles of Biochemistry</i>, 3rd edn., Macmillan Worth, 2000 2. Voet, D. and Voet, J.G.: <i>Biochemistry</i>, 2nd edn., John Wiley, 1995 3. Rao, P. Gundu, <i>Biochemistry</i>, Vallabh Prakashan, 1995 4. White, A., Handler, P. and Smith, E.: <i>Principles of Biochemistry</i> 5. Turner, P.C, McLennan, A. G., Bates, A. D., and White, M. R. H.: <i>Molecular Biology</i>, 2nd edn. Bio Scientific/Viva Books, 2001. 6. Rao, Rama. A. V. S. S.: <i>A Text Book of Biochemistry</i>, 8th edn., L. K & S Pub, 1998 7. Henry, B. J.: <i>Clinical Diagnosis and Management by Laboratory Methods</i>, 19th edn., Harcourt / Thomson, 1999. 8. Gowenlock, A. H.: <i>Practical Clinical Biochemistry</i>, 6th edn., Butterworth / CBS, 1988 9. Plummer, D. T.: <i>An Introduction to Practical Biochemistry</i>, 15th edn., Tata McGraw Hill, 1988.

M.Sc. FORENSIC SCIENCE		III SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: STATISTICS AND FORENSIC APPLICATIONS		
CREDIT: 04	THEORY HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 20 Hours	<p>Statistics: Definition, Importance of statistics in interpreting forensic data in research work and quality control, Data, Population, Distribution, Location, Random experiment, Brief introduction to sampling and data collection: Frequency distribution, Concept of measures of central tendencies, Normal distribution, Arithmetic mean, Median & Mode concept of measures of dispersion, Variance, Normal distribution-Variance, Standard Deviation, Coefficient of variation.</p>	
UNIT-2 20 Hours	<p>Concept of probability, Definitions of probability, Discrete random variables and probability distributions, Addition, multiplication and Bayer's theorem & applications. Probability in Forensic Evidence, Concept of random variable, Discrete and continuous, Concept of probability distribution, Binomial, Poisson, Normal distribution, Definitions, statements of properties of above distribution and examples, Simple linear regression and correlation, Concept of computational methodology, Concept of tests of hypothesis, Null and alternative hypothesis, Critical region, Types of errors & level of significance.</p>	
UNIT-3 15 Hours	<p>Large samples tests, Test for single mean, Difference of means, Single proportion and difference of proportion examples, Chi square test for goodness of fit and test for independence of attributes, Hypothesis testing for one or two population means, Student t-test, t-test for simple mean, Difference of means, Hypothesis testing for small sample sizes and multinomial experiments, Fisher's exact test, Analysis of variance and multiple comparison tests, F-test for equality of variance, Concept of analysis of variance, Computational procedure for ANOVA one way and two-way classification.</p>	

UNIT-4
20 Hours

Introduction to Scientific evidence and statistics, Data Bases, Type and geographical factors, Statistical approach to DNA fingerprinting, Loci and alleles, Simple case genotypic frequencies, Hardy Weinberg equilibrium, Simple case of allelic frequencies Accounting for sub-population, Paternity mother and father unrelated, Database searches and value of evidence, Blood group frequencies, Clothing fibres, Shoe types, Air weapon projectiles, Height identification from eyewitnesses, Uncertainty in scientific experimentation, Determination of uncertainty.

SUGGESTED
READINGS

1. *David Lucy: Introduction to Statistics for Forensic Scientists, Wiley, 2004*
2. *Colin Aitken & Franco Taroni: Statistics and Evaluation of Evidence for Forensic Scientists (Statics in practice)*
3. *Wing kam Fung & Yue-Quing Hu: Statistical DNA Forensics, Theory Methods & Computation, Wiley, 2008*
4. *I. W. Evett & B. S. Wier: Interpreting DNA Evidence – Statistical Genetics for Forensic Scientists, 1998*
5. *Miller, J. C. and Miller, J. N.: Statistics for Analytical Chemistry, Ellis Horwood, 1988*
6. *Fisher, R. A.: Statistical Methods for Research Workers, John Wiley, 1954*
7. *Sokal, R. R. and Rolf, F. J.: Biometry – Principles and Practices of Statistics in Biological Research, Freeman, 1981*
8. *Bhaskar Rao T.: Methods of Biostatistics, Paras, 2001*
9. *Rama Krishnan P., Biostatistics, Saras, 1995.*
10. *Meier, P. C. and Zund, R. E.: Statistical Methods in Analytical Chemistry, Wiley, 2000*
11. *Rao, V. K., Biostatistics – A Manual of Statistical methods for use in Health, Nutrition and Anthropology, Jaypee Medical Pub., 1996*

M.Sc. FORENSIC SCIENCE		III SEMESTER	
COURSE CODE: FSC		COURSE TYPE: CCC	
COURSE TITLE: FORENSIC CRIMINOLOGY AND LAW			
CREDIT: 04		THEORY HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20	
UNIT-1 20 Hours	Crime Scenario in India: Concept and Definition of Crime, Introduction to crime, Sociological aspects of crime and criminals in society. Types of crime and its causes: Property crimes, public order crimes, violent crimes, cybercrimes, juvenile delinquency, Society-Criminal interaction and various types of crimes in India.		
UNIT-2 20 Hours	Forensic Criminology: Introduction of Forensic Criminology, Control and Prevention of Crime in context with Organization, Industrialization, Family set up, Psychology. Procedures involved in detection of crime: Latest evidence-based research in detection and prevention of crime. Criminal Profiling: Definition, Need and Types, Forensic Scientific evidence, Crime and Psychopathology, Genetics and Crime, Serial murders, Modus Operandi		
UNIT-3 15 Hours	Indian Courts: Constitution of Courts-Hierarchy of Courts and their Powers. Lok Adalats, Lok Ayukts and Juvenile Courts. Constitution of India-Preamble, Fundamental Rights Article 20, 21, 22. Forensic Expert: Definition and related Laws & Issues, Expert Witness (Cr.P.C. 291-93), Indian Evidence Act – Section 45		
UNIT-4 20 Hours	Indian Penal Codes: Offences against the person, Sections: - 300, 302, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362, 375 and 377. Offences against property, Sections: - 378, 383, 390, 391, 415, 420, 441, 463, 489A, 497, 499, 503 and 511. Briefs of Information: Technology IT Act, cyber laws and cyber security, Narcotic Drugs & Psychotropic Substances Act, Dowry Prohibition Act, Arms Act, Wild Life Protection Act.		

**SUGGESTED
READINGS**

1. Constitution of India
2. Indian Evidence Act
3. Criminal Procedure code.
4. Indian Penal Code.
5. Barak, Gregg: Integrative Criminology.
6. Johnson: Crime, Correction and Society.
7. Riderman: The Manipulation of Human Behaviour

M.Sc. FORENSIC SCIENCE

III SEMESTER

COURSE CODE: FSC

COURSE TYPE: PRACTICAL

COURSE TITLE: LAB (Lab Course 3)

CREDIT: 04

PRACTICAL HOURS: 90

MARKS: 100

LABORATORY WORK

1. Preliminary tests directly on blood / urine / vomitus / tissues for heavy metals, alkaloids, pesticides, cyanide, phenolic compounds and alcohol
2. Detection and determination of ethyl alcohol in blood / urine / visceral tissue by kozelka & Hine's method
3. Detection and determination of ethyl alcohol in blood / urine / visceral tissue by gas chromatography
4. Systematic extraction of basic substances from viscera
5. Systematic extraction of neutral & acidic substances from viscera

M. Sc. in Forensic Science

FOURTH SEMESTER (EVEN SEMESTER)

Course Code	Course Type	COURSE (PAPER/SUBJECTS)	Credits	Maximum Marks		
				Internal	External	Total
FSC	Theory	Forensic Drug Analysis	4	20	80	100
FSC	Theory	Fundamentals of Forensic Psychology	4	20	80	100
FSC	Theory	Bioinstrumentation	4	20	80	100
FSC	Theory	Research Methodology and Intellectual Property Rights (IPR)	4	20	80	100
FSC	LAB	Lab Course (Lab 4)	4	20	80	100
Minimum credits in complete semester would be 20			Total: 20			

The M.Sc. program will be divided into four semesters each being of six months duration. Each semester comprises of compulsory core courses (CCC) Lab course (LC) will be based on CCC. Each theoretical course will be divided into Internal Assessment of 20 marks and semester end examination of 80 marks. Duration of Theoretical and Practical Examination Time: 03 Hours.

The Dissertation will be of 16 credits and a total of 400 marks. The students would be assessed externally as per the following criteria.

- i) Presentation and Viva-voce: 100 Marks
- ii) Dissertation Report/Thesis: 100 Marks

*Internal marks for dissertation work would be assessed as per following criteria

- i) Regularity and attendance: 50 Marks
- ii) Research concept and hypothesis: 50 Marks
- iii) Field and Lab work: 100 Marks

M.Sc. FORENSIC SCIENCE		IV SEMESTER
COURSE CODE: FSC		COURSE TYPE: CCC
COURSE TITLE: FORENSIC DRUG ANALYSIS		
CREDIT: 04	THEORY HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20
UNIT-1 20 Hours	Drug: Definition of Drug, Drug Use & Misuse, Drug Chemistry, Drug Dependence and Chemistry of Addiction, Drug Receptors and Brain Chemistry. Drugs of Abuse: Definition, Classification based on Form and Origin, Use, Effects and Schedules, Structure of NDPS Act and the definitions of each drug classification, Drugs as Evidence, Profiling Examples of Illegal Drugs, United Nations International Drug Control Programme.	
UNIT-2 20 Hours	Chemistry and Analysis of Drugs of Abuse: Origin, Pharmacology, Methods of preparation, Storage, Diluents and Adulterants, Sample Handling, Optimization of Experimental Conditions, Presumptive/Screening and Confirmatory Methods: Color/spot test, Microscopic examination, Microcrystalline tests, Thin-Layer Chromatography, Sample Preparation before TLC Specimen, Extraction Evaluation of TLC for Drug Screening, Immunoassay Methods, UV Spectrophotometry, IR/FTIR Spectrophotometry, NMR, GC-MS & HPLC/LC-MS, Legal Implications and Data Interpretation of Opium and Opioids analgesics, Stimulants (Cocaine, Amphetamine & other amphetamine derivatives), Depressants (Barbiturates and Benzodiazepines), Hallucinogens (Cannabis, LSD, Psilocybine and Mescaline), OTC, Inhalant and Volatile Substances, Drugs in sexual assault	
UNIT-3 15 Hours	Clandestine laboratory: Meaning and Definition of Clandestine, Clandestine Laboratory, Related Problems, Factors Contributing to Clandestine Drug Labs, Harms Caused by Clandestine Drug Labs, Equipment Needs: Reflux, Distillation, Hydrogenation, Bucket Chemistry, Extractions, Chemical Needs, Cooking Methods Commonly Used in Clandestine Drug Labs, Extraction Process, Conversion Process, Synthesis Process, Tableting. Designer drugs: Definition, Analogs of Fentanyl and Meperidine (both synthetic opioids), Phencyclidine (PCP), Amphetamines and	

SYLLABUS (NEP) M.Sc. FORENSIC SCIENCE

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Mahendra Kama

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	methamphetamines (which have hallucinogenic and stimulant properties). Laboratory Analysis: The Chemist, Extractions: Physical Extraction, Dry Wash/Extraction, Liquid/Liquid Extractions, Analysis: Chemical Color Tests, Microscopic Techniques, Infrared Spectroscopy, Thin-Layer Chromatography, Ultraviolet Spectroscopy, Gas Chromatography. Format of NDPS Report Writing & Court Room Testimony
UNIT-4 20 Hours	Drug Abuse in Sports: Introduction, International Olympic Committee (IOC), World Anti-Doping Agency (WADA), classification of commonly prohibited substances and Performance enhancing Drugs, Steroids, Stack and Pyramid methods, Dope test and Blood Doping, Sampling techniques, analytical approaches.
SUGGESTED READINGS	<ol style="list-style-type: none"> 1. <i>Clarke's Analysis of Drugs and Poisons, (Formerly Isolation & Identification of Drugs) 3rd Ed. 2 Vol. Set.</i> 2. <i>Clark, E.G.C: Isolation and identification of Drugs, VI and Vol. II, 1966, 1975-1986.</i> 3. <i>Modi, Text Book of Medical Jurisprudence Forensic Medicines and Toxicology (1999) CBS Pub. New Delhi</i> 4. <i>Saferstien (1982) Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.</i> 5. <i>DFS -Working Procedure Manual- Narcotics</i> 6. <i>E. Stahl (1969) Thin Layer Chromatography: A Laboratory Handbook.</i> 7. <i>Saferstein (1976) Criminalistics.</i>

M.Sc. FORENSIC SCIENCE		IV SEMESTER	
COURSE CODE: FSC		COURSE TYPE: CCC	
COURSE TITLE: FUNDAMENTALS OF FORENSIC PSYCHOLOGY			
CREDIT: 04		THEORY HOURS: 90	
MARKS: 100	THEORY EXAM: 80		CCA: 20
UNIT-1 20 Hours	Basics: Forensic Psychology and the Law, Ethical Issues in Forensic Psychology, Civil and criminal case assessment, assessing mental competency, Mental disorders and Forensic Psychology, Eye witness testimony, Criminal profiling- need and types, Forensic Scientific evidence, Crime and Psychopathology, Genetics and Crime, Serial murders, Modus Operandi		
UNIT-2 20 Hours	Psychological Assessment: Psychological Assessment Tools, Detection of deception, Various methods for detection of deception, Interview, Non-verbal detection, statement assessment, Hypnosis, Psychological assessment, voice stress analyzer, Polygraph, thermal imaging, Brain Electrical Oscillation Signature Profiling, Functional Magnetic Resonance study, Current research in detection of deception/truth finding mechanisms.		
UNIT-3 15 Hours	Polygraph: Historical aspects of Polygraph, Principles of polygraph, psycho physiological aspects, operational aspects, Question formulation techniques, Interviewing technique procedure, The Art-Polygraph, Legal and Ethical aspects, Human rights of individual.		
UNIT-4 20 Hours	Narco-Analysis: Historical aspects, Principle and Theory, General Procedure, Legal and Ethical aspects, Human rights of the Individual. Brain Electrical Oscillation Signature (BEOS) Profiling: Principle and Theory, General Procedure, Legal and Ethical aspects, Human rights of individual		

**SUGGESTED
READINGS**

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. Mukun*
5. *Criminal Profilling – 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. Vri*

M.Sc. BIOMEDICAL SCIENCE		IV SEMESTER	
COURSE CODE: BSC		COURSE TYPE: CCC	
COURSE TITLE: BIOINSTRUMENTATION			
CREDIT: 04		TEACHING HOURS: 90	
MARKS: 100		THEORY EXAM: 80 CCA: 20	
UNIT-1 18 Hours	<p>Theory of NMR: Quantum description, Classical description – Processional motion, Larmour frequency, Relaxation processes, T1 and T2 and their measurement. Fourier Transform NMR: Pulsed excitation, FID, Types of NMR Spectra – Wild line and high. - resolution spectra. NMR Spectrometers: Instrumentation.</p> <p>Introduction to 13C NMR: Proton decoupling: Broad band, off-resonance, Pulsed decoupling, NOE, application to structure determination.</p> <p>The concept of MRI, BOLD imaging, fMRI, Application in Muscle Physiology, and functional mapping of the brain. Other nuclei: 31P, 19F, 23Na, 15N, metabolomics studies using NMR</p>		
	UNIT-2 18 Hours	<p>The nature of radioactivity, detection and measurement of radioactivity: detection based on gas ionization- Geiger Muller counter- principles and applications. Detection based on excitation- Liquid Scintillation counter-principle and applications. Supply, storage and purity of radiolabelled compounds, specific activity, inherent advantages and restrictions of radiotracer experiments, safety aspects, applications of radioisotopes in biological sciences. Flow cytometry, ELISA, Immunoblotting</p>	
		UNIT-3 20 Hours	<p>Structure and operation of light microscope, phase, dark field and differential interference contrast microscopes, confocal microscope, fluorescence microscope, transmission electron microscope (TEM), scanning electron microscope (SEM), specimen collection, fixation, sectioning, basic staining and immunocytochemical methods for microscopic examination, photography and interpretation of the results, laboratory rules and regulations.</p>
	UNIT-4 20 Hours		<p>Centrifugation: Principle of centrifugation, Small bench top centrifuges, large capacity refrigerated centrifuges, High speed refrigerated centrifuges, preparative and analytical ultra centrifuge. Electrochemical techniques: Principles of electrochemical techniques, redox reactions, the pH electrode, ion-sensitive and gas-sensitive electrodes, The Clark oxygen electrode, Biosensors.</p>

**SUGGESTED
READINGS**

1. Keith Wilson and John Walker. *Practical Biochemistry- principles and techniques*; Cambridge University press, London, UK. (Fifth edition).
2. *Biophysical chemistry: Principles and Techniques*; Himalaya Publishing House, Upadhyay, Upadhyay and Nath.
3. David T Plummer, Tata McGraw- Hill publishing company limited; McGraw office, New Delhi.
4. *A Biologist's guide to principle and techniques of practical biochemistry - Brigian L. Williams.*
5. *Handbook of Biomedical Instrumentation - R.S. Khandpur, Tata McGraw Hill*
6. *Biophysics - Cotrell (Eastern Economy Edition) Clinical Biophysics –Principles and Techniques- P. Narayanan (BhalaniPub, Mumbai)*
7. *Biophysics – Pattabhi and Gautham (Narosa Publishing House)*
8. *Instrumentation measurements and analysis – Nakara, Choudhari (Tata Mc Graw Hill).*
9. *Handbook of analytical instruments – R.S. Khandpur (Tata Mc Graw Hill)*

M.Sc. FORENSIC SCIENCE		IV SEMESTER	
COURSE CODE: FSC		COURSE TYPE: CCC	
COURSE TITLE: RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS (IPR)			
CREDIT: 04		THEORY HOURS: 90	
MARKS: 100	THEORY EXAM: 80	CCA: 20	
UNIT-1 20 Hours	Understanding the language of research – Concept, Construct, Definition, Variable. Research Process, Problem Identification & Formulation – Research Question, Qualitative and Quantitative Research, Interpretation of Data and Academic Writing, Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism		
UNIT-2 20 Hours	Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance, Research Design: Exploratory Research Design, Descriptive Research Designs, Experimental Design. Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Sample types, Concept of Independent & Dependent variables, Levels of measurement – Nominal, Ordinal, Interval and Ratio. Data Analysis, Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.		
UNIT-3 15 Hours	Intellectual property rights and its types-Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of new GMOs, Basics of patents (Types, patent application and Specifications), concept of Prior Art and patent filing procedures, Process patent vs product patent.		
UNIT-4 20 Hours	Introduction to General Agreement on Tariffs and Trade (GATT), World Trade Organization (WTO), World Intellectual Property Organization (WIPO) and Trade Related Intellectual, Property Rights (TRIPS), Indian Patent Act.		

**SUGGESTED
READINGS**

1. *Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition*
2. *Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.*
3. *Research Methodology – C.R. Kothari*
4. *Intellectual Property Rights in India (2015) 2nd edition, V.K Ahuja.*
5. *Intellectual Property Rights (2014), Neeraj Pandey and Dharni Khush deep, PHI Learning Pvt Ltd.*

M.Sc. FORENSIC SCIENCE

IV SEMESTER

COURSE CODE: FSC

COURSE TYPE: PRACTICAL

COURSE TITLE: LAB (Lab Course 4)

CREDIT: 04

PRACTICAL HOURS: 90

MARKS: 100

LABORATORY WORK

1. Identification of basic drugs (from the extract) by colour tests and TLC
2. Identification of neutral and acidic drugs (from the extract) by colour tests and TLC.
3. Identification of pesticides (from the extract) by TLC
4. Determination of a drug in urine by visible / UV spectrophotometry
5. Determination of a drug / pesticide in toxicological specimen by GC
6. Determination of a drug / pesticide in toxicological specimen by HPLC
7. GC-MS / LC-MS of a poison of forensic interest (Demo only)