M.D.University,Rohtak

M.Sc. Forensic Science

The **Forensic Science** course provides students with experiences and information that will broaden their understanding of the field of Forensic Science and crime scene investigations. A concurrent goal of the course is to develop observational, organizational and cognitive skills so to be able to integrate their experiences and knowledge so to solve problems.

A series of planned activities utilizing skills such as fingerprinting, fiber analysis, crime scene preservation, teeth prints, lip prints, evidence collection and other investigations will be offered to the students. Students will also research and present a famous crime and write a paper to show their understanding of the crime and the processes used to solve it. The students will also research careers in the field and present their information to the class.

The **Forensic Science** course engages the students in experimentation, personal observation and hands on learning. Note taking, reading and attention to educational films, and at times commercially films, related to forensic science are also stressed. The course will educate the students to use facts, logic and objective thinking, as opposed to emotions, feelings and subjective assumptions in solving problems.

Students enrolled in the **Forensic Science** course will attain the goals designed for the following topics:

1. History of Forensic Science
2. Crime Scene Evaluation and Safety
3. Physical Evidence
4. Physical Properties
5. Organic and Inorganic Analysis
6. DNA as a Forensic Science Tool
7. Fingerprints
8. The Microscope and Hair and Fiber Analysis
9. Forensic Aspects of Arson and Explosion Investigations
10. Forensic Serology
11. Document Analysis
12. Firearms, Tool Marks and Other Impressions
13. Forensic Science and related professions as career choices

Eligibility

Graduation in any science subject

Career Prospect

Those who obtain M. Sc. Degree in Forensic Sciences would have excellent job opportunities in many organizations, such as Courts, Prisons, CBI, Police, Detective and Security Agencies which are under the present scenario being established more and more all over the metropolitan cities, and many associated institutions and organizations.

Scheme of Examination of M.Sc. (Forensic Science)

Paper no	**Nomenclature of Paper**	**Marks of internal assessment**	**Marks of Th. Paper/ practical**	**Total Marks**	**Duration of theory exam/ Practical exam**
First Semester					
FS101	General Forensic Science	20	80	100	3 hours
FS102	Criminology & Law	20	80	100	3 hours
FS103	Questioned Document& Finger Prints Examination	20	80	100	3 hours
FS104	Instrumental Analysis I	20	80	100	3 hours
FSP101	Practical Based on Questioned Documents & Finger Prints Examination			100	6 hours
			Total	500	
Second semester					
FS201	Criminalistics	20	80	100	3 hours
FS202	Forensic Ballistics and Photography	20	80	100	3 hours
FS203	Instrumental Analysis II	20	80	100	3 hours
FS204	Computer Forensic and Bioinformatics	20	80	100	3 hours
FSP205	Practical based on Criminalistics & Forensic Ballistics			100	6 hours
			Total	500	
Third semester					
FS301	Forensic Chemistry and Toxicology	20	80	100	3 hours
FS302	Forensic Biology and Serology	20	80	100	3 hours
FS303	Forensic Physical Anthropology and Forensic Medicine	20	80	100	3 hours
FS304	Quality Management and Research methodology	20	80	100	3 hours
FSP305	Practical based on Forensic Biology and Serology including forensic Physical Anthropology			50	6 hours
FSP306	Practical based on Forensic Chemistry and Toxicology			50	6 hours
			Total	500	
Fourth semester					
FS401	Advanced Forensic Biology	20	80	100	3 hours
FS402	Advanced Forensic serology including DNA Forensics	20	80	100	3 hours
FSP403	Practical based on Forensic Biology and Serology			100	6 hours
FSR404	Special Report/Dissertation			200	
			Total	500	
		Grand Total		2000	

M.D.University,Rohtak

SYLLABUS OF (M.SC.) FORENSIC SCIENCE

SEMESTER – I

FS 101 : General Forensic Science
FS 102 : Criminology & Law
FS 103 : Instrumental Analysis-I
FS 104 : Questioned Document& Finger Prints Examination
: FSP 105 : Practical Based on Questioned Documents & Finger Prints Examination

SEMESTER – II

FS 201 : Criminalistics
FS 202 : Forensic Ballistics and Photography
FS 203 : Instrument Analysis-II
FS 204 : Computer Forensic and Bioinformatics
FSP205 : Practical based on Criminalistics & Forensic Ballistics

SEMESTER – III

FS 301 : Forensic Chemistry and Toxicology
FS 302 : Forensic Biology and Serology
FS 303 : Forensic Physical Anthropology and Forensic Medicine
FS 304 : Quality Management and Research methodology
FSP305 : Practical based on Forensic Biology and Serology including Forensic Physical Anthropology
FSP 306 : Practical based on Forensic Chemistry and Toxicology

SEMESTER – IV

Forensic Biology and Serology (FBS)

FS 401 : Advanced Forensic Biology
FS 402 : Advanced Forensic serology including DNA Forensics
FSP 403 : Practical based on Forensic Biology and Serology
FSR 404 : Special Report

SEMESTER – I

FS101 : GENERAL FORENSIC SCIENCE

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.

Internal assessment: 20 Min. Pass Marks: 35%

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION- A

History and Development of Forensic Science, Definition of Forensic Science, Scope of Forensic Science, Need of Forensic Science, Basic Principles of Forensic Science, Tools and Techniques of Forensic Science.

SECTION- B

Organizational setup of Forensic Science Laboratories, CFSL, FSL, GEQD, FPB, NICFS, Central Detective Training School, NCRB (Maintenance of Crime Records), NPA Mobile Forensic Science Laboratory, Branch of Forensic Science, Forensic Science : its International Perspective.

SECTION- C

Modus Operandi and MOB and its role in Criminal Investigation,

Methods of Investigation : Narco analysis :History, Importance as an investigative tool, methods as use of drugs, Hypnosis etc. Limitations and legal aspects.

Brain fingerprinting : Concepts, History, Significance, method, future perspective of the technique, limitations.

Criminal Profiling : Introduction, Importance, Profile of the victim and culprit, understanding modus operandi, investigative strategy, crime scene characteristics, criminal behavior on the internet, limitations. Various Police Organisations, Organisation of Police Station, Evolution of Police as an Institution, Role & Functions of Police,

SECTION- D

Education of Forensic Science, Role of Media, Human Rights & Criminal Justice System.

Ethics in Forensic Science, Duties of Forensic Scientist, Qualification of Forensic Scientist.

Money Laundering: Concept, Conventional methods.

History and Development of Finger Print as Science for Personal Identification, Type of Finger Prints, Classification of Finger Prints, Latent Finger Print, Causes of Formation of latent Finger Prints, Comparison of Finger Prints, ridge details.

Presentation of Expert Evidence: Data, Reports, Evidence in the Court.

Suggested Readings

1. Nanda, B.B. and Tewari, 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,
3 Barnett (2001): Ethics in Forensic Science.
4. O'Hara & Osterburg : Introduction to Criminalistics, 1949, The MacMillan Co., 1964.
5. Osterburg : Crime Laboratory.
6. Saferstien : Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
7. Saferstein : Criminalistics, 1976, Prentice Hall Inc., USA.
8. Nickolas : Scientific Criminal Investigation
9. Deforest, Gansellen & Lee : Introduction to Criminalistics.
10. Sharma, B.R. : Forensic Science in Criminal Investigaion and Trials, Central Law Agency, Allahabad, 1974.
11. Kirk : Criminal Investigation, 1953, Interscience Publisher Inc. New York.

FS102 : CRIMINOLOGY & LAW

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.

Internal assessment: 20 Min. Pass Marks: 35%

Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

SECTION- A

Concept and Definition of Crime, Causes of Crime, Social Change and Crime, Control and Prevention of Crime in context with Organisation, Industrialization, Family set up, Criminal Behavior and Psychology.

SECTION- B

Criminal Procedure Code-291,292,293. Constitution of Courts-Hierarchy of Courts and their Powers, Evidence in Enquiries and Trials, Expert Witness (291-93) Lok Adalats, Lok Ayukts and Juvenile Courts.

SECTION- C

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

Indian Evidence Act - Section 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141.

Indian Penal Code sections pertaining offence against property offences against person.

Offences against the person-Sections:- 299, 300, 302, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362, 375 and 377.

Offences against property- Sections:-378, 383, 390, 391, 405, 415, 420, 441, 463, 489A, 497, 499, 503 and 511.

SECTION- D

I.T.:- Information Technology.

Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act, I.T. Act 2000- Introduction of offences and Penalities.

Suggested readings

1. Arrigo (2002) : Introduction to forensic Psychology.
2. Cooke, G. (1980) : The role of Forensic Psychologist. Chanles C. Thomas.
3. Howitt D : 2002 Forensic and Criminal Psycholgy. Prentic Hall Publications
4. Constitution of India
5. Indian Evidence Act
6. Criminal Procedure code.
7. Indian Penal Code.
8. Bare Acts with short notes on the following : Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Food Adultration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act.
9. Hess, A.K. and Weiner, I.B. (1999) Handbook of Forensic Psychology 2nd Ed. John wiley & sons.
10. Barak, Gregg : Integrative Criminology.
11. Adler, Freda : Criminology
12 Reid S.T. : Crime and Criminology.
13 Johnson : Crime, Correction and Society.
14 Riderman : The Manipulation of Human Behaviour.
15 Lionel Haward: Forensic Psychology, 1981, Batsford Academic and Education Ltd., London.

FS103: INSTRUMENTAL ANALYSIS -I

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.

Internal assessment: 20 Min. Pass Marks: 35%

Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section- A

UV/VIS-Spectroscopy

Introduction, Review of UV-Visible spectroscopy-Fundamental laws of spectrophotometry, deviation from Beer's Law, Instrumentation and techniques, qualitative and quantitative methods in UV-Visible spectroscopy, Forensic applications.

SECTION- B

IR-Spectroscopy

Introduction, Review of IR spectroscopy, Dispersive and Non-dispersive IR spectrophotometers, Fourier transform IR spectrophotometers, Instrumentation and Techniques, Interpretation of IR spectra, Microspectrophotometry, Forensic applications.

SECTION- C

Atomic Spectroscopy

Atomic Absorption Spectroscopy- Introduction, Review, Basic principles, Instrumentation and Techniques, FAAS, Interference in AAS-Background correction methods, Forensic applications.

Introduction, Review of Atomic Emission spectroscopy, Principles and Instrumentation, Interferences and background correction, techniques, Graphite electrodes spark emission, ICP-AES, Forensic applications.

SECTION- D

Mass Spectrometry

Introduction, Review of Mass spectrometry, Basic Principles and Theory, Instrumentations and technique, Ionization methods, Fragmentations in Mass spectrometry, selected ion monitoring-Atomic mass spectrometry, Fast atom Bombardment mass spectrometry, stable Isotope ratio mass spectrometry, Tandem mass spectrometry, Forensic applications

Suggested readings :

1. Yinon: Forensic Application of Mass Spectrometry 1994.
2. Borrow : Molecular Spectroscopy, 1980.
3. Willard, H. H., et al : Instrumental Methods of Analysis, 1974.
4. Moonesens A.A. et al : Scientific Evidence in Criminal Cases, 1973.
5. Lundquist & Curry : Methods of Forensic Science, 1963.
6. Curry : Analytical Methods in Human Toxicology, 1986.
7. Lee & Gaensslen : Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
8. Settle,F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997.

FS104 QUESTIONED DOCUMENTS AND FINGER PRINTS EXAMINATION

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.
Internal assessment: 20 Min. Pass Marks: 35%
Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section- A

Document in general: Importance, Classification and Preliminary Examination.

Handwriting Characteristics: General Characteristics, Individual Characteristics, Development of Individuality in Handwriting Comparison of Handwriting : Natural Variations, Fundamental Divergences. Standards for Comparison, Forgery-definitions, types and characteristics.

Section- B

Indented and Invisible Writings, Alterations in the document : erasures, additions, overwriting and obliterations.

Determination of Age of Document : Absolute/relative age, sequence of intersecting strokes.

Section- CComparison of type written matter: Working of typewriter, Printing and Machine Defects, alterations in typed text, various type of typewriting devices-check writing machines, electronic typewriter and proportional spacing typewriter

Comparison of Printed matter: Various Printing Processes.

Section- D

Photography For Documents: - Basic Principals & Techniques, Exposing, Developing and Printing.

Suggested readings

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. Madinger J. and zalopany, A.R. (1999) : Money Laundering CRC Press.
5. Manning, C.A (1999): Financial Investigations and Forensic Accounting CRC Press.
6. Harrison, W.R. : Suspect Documents & their Scintific Examination, 1966, Sweet & Maxwell Ltd., London.
7. Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsaevier North Holland Inc., New York.
8. Brewster, F, : Contested Documetns and Foregeries, The Eastern Law House, Calcutta. 1932.
9. Ames : Ames on Foregery, 1900, Ames Rellingson Co., New York.
10. Conway, J.V.P. : Evidential Documents, 1959, Charles C. Thomas, Illinois.
11. Mehta, M. K. : The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi, Allahabad. 1970.
12. Sulner, H.F. : Dispated Document, 1966 Oceana Publications Inc., Ner York.
13. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
14. Quirke, A.J. : Forged, Anonymous & Suspet Documents, 1930, Reorge Rontledge & Sons Ltd., London.
15. Osborn, A. S. : Questioned Documents 1929, Boyd Printing Co., Chicago.
16. Cummins & Midlo : Finger Prints, Palms and Soles, 1943, The Blakiston office London.
17. Cherril, F.R. : The Finger Prints. System at Scotland Yard, 1954; Her Majestuy's office, London.
18. Wentworth & Wilder : Personal Identification, 1948. R. G. Badger. Boston.
19. Mehta, M. K. : Identification of Thumb Impression & Cross Examination of Finger Prints, 1980 N. M. Tripathi (P) Ltd. Bombay.
20. Moenssens : Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.
21. Allison : Personal Identification.
22. Bridges : Practical Finger Printing, 1942, Funk and Washalls Co. New York.
23. Holt : Genetics of Dermal Ridges.
24. Saferstein, R.: Criminalistics, Prentice Hall, New York, 1990.

FSP105: PRACTICAL BASED ON QUESTIONED DOCUMENTS & FINGER PRINTS EXAMINATION

Max. Marks: - 100

1. Identification of Handwriting General Characteristics.
2. Study of natural variations in handwriting.
3. Study of fundamental divergences.
4. Identification of individual characteristics.
5. Study of Disguise in handwriting.
6. Comparison of handwriting.
7. Detection of Simulated forgery.
8. Detection of traced forgery.
9. To obtain Plain and rolled inked finger prints.
10. To identify the finger Print Patterns.
11. To perform ridge tracing and ridge counting.
12. To identify the ridge characteristics.
13. To Compare the finger Prints.
14. To develop latent finger Prints with powder methods.
15. To develop latent finger Prints with fuming methods.
16. To develop latent finger Prints with chemical methods.

SEMESTER – II

FS201: CRIMINALISTICS

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.
Internal assessment: 20 Min. Pass Marks: 35%
Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section -A

Crime Scene Investigation- Protection of crime scene, Documentation (including photography and sketching), nature, location, collection and preservation of evidences, physical evidence : their types, significance, classification and stages in physical evidence analysis.

Glass-Types of glass and their composition, Forensic examination of glass, Glass fracture analysis, Interpretation of glass evidence.

Soil- Formation and types of soil, Composition and color of soil, Forensic examination of soil, Interpretation of soil evidence.

Section -B

Paints- Types of paint and their composition, Forensic examination of paints, Interpretation of paint evidence.

Miscellaneous Clue Materials- Examination of strings/ropes, Fibers, Threads and fabrics, Wires/cables, Seals, Counterfeit coins.

Foot Prints- Importance, Gait Pattern, Casting of foot prints in different mediums, Electrostatic lifting of latent foot prints.

Section -C

Building Materials- Types of cement and their composition, Determination of adulterants, Analysis of Bitumen and road material, Analysis of cement mortar and cement concrete and stones. Forensic examination of electrical appliances/installations.

Tool Marks- Types of tool marks, Class characteristics and individual characteristics, Lifting of tool marks, Examination and comparison of tool marks.

Resuscitation of Obliterated Numbers in Metal Surfaces- Theoretical and practical aspects of resuscitation.

Section -D

Road Accidents- Examination of scene, Victim and the vehicle, Collection of the evidence, Filaments examination, Examination of skid marks, Head light bulb filaments.

Forensic Psychology-Truth & Deception, Psychology of lying, Various methods of lie detection, Principles of Polygraph, Legal aspects.

Voice Identification: Introduction, SSignificance, Theory of generation of voice, Characteristics, Voice Spectrography, Recent Development of Computerised Speech Laboratory, Legal Aspects,

Suggested readings:

1. Kleiner, Munay (2002) : Handbook of Polygraph testing. Academic Press.
2. Kirk (2000) Vehicular Accident investigation and reconstruction.
3. Noon (2000) : Forensic Engineering Investigation.
4. Carper (200) : Forensic Engineering.
5. Hess, A.K. and Weiner, I.B. (1999) Handbook of Forensic Psychology 2nd Ed. John wiley & sons.
6. Bruce A. Arrigo (2000) Introduction to Forensic Psychology Academic Press, London
7. Peter Mcdonald; (1989) Tyre Imprint evidence by Elsevier Science Publishing Co. New York.
8. David L. Shapiro; (1991) Forensic Psychological Assessment An Investigative Approach; Allyn and Bacon Publisher, 1991.

9. H. James, William G. Eckert; (1999) Interpretation of Blood stain evidence at crime scene stuart Second edition, CRC Press, 1999.
10. N. Gilbert; Criminal Investigation; Third edition, Macmillan Publishing company, 1993.
11. Joe Nicharrs; (1999) Investigative Forensic Hyponsis CRC Press LLC, 1999.
12. Bernard Robertson and G.A. Vignaur; (1995) Interpreting evidence John Wiley and Sons Ltd. 1995.
13. William J. Bodziak (1989) Footwear Impression Evidence Elsevier Science Publishing Co. New York, 1989.
14. Sharma, B.R. : Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.
15. Lundquest & Curry : Forensic Science, Vol I to IV, 1963, Charls C. Thomas, Illinosis, USA.
16. Saferstein : Forensic Science Handbook, Vol I, II & III, Prentice Hall Inc. USA.
17. Saferstein : Criminalistics, 1976, Prentice Hall Inc. USA.
18. Davis, E. : Tool Marks, Firearms and Straigraphy.
19. Kirk : Criminal Investigation, 1953, Interscience Publisher Inc. New York.
20. Nickolas : Scientific Criminal Investigation.
21. Sharma B. R. : Footprints, Tracks and Trials. 1980. Central Law Agency. Allahabad.
22. Deforest, Gaenssellen & Lee : Introduction to Criminalistics.
23. Lee & Gaensselen : Advances in Forensic Science (Vol.2) Instrumental Analysis.

FS202: FORENSIC BALLISTICS AND PHOTOGRAPHY

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.

Internal assessment: 20 Min. Pass Marks: 35%

Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section- A

1. Firearms : Early history of firearms, the earliest firearms, the fifteenth century Match lock, sixteenth & seventeenth century small arms, The age of the Flint lock, the percussion lock firearms.
2. Classification, Characteristics and firing mechanism of smooth bored firearms (M.L., B;L.) Rifled firearms (Pistol, Revolver, Rifles, Machine Guns), Classification, nomenclature and construction of country made firearms.
3. Ammunition : Types, Cartridge Components (Cartridge case primer propellant, Bullets, Pellets and wads).

Section- B

4. Internal Ballistics : Definition, Ignition of the propellent, manner of burning, Piobett's law, Shape and Size of the propellent, pressure space curve, shot

start pressure. All burnt point, Velocity, Space curve, Le Due's formula, muzzle velocity, Factors affecting muzzle velocity, theory of recoil.

5. External Ballistics : Definition-trajectory drop in the flight of the projectiles force of gravity, air resistance-base drag, Yaw, Shape of bullet (Spherical ball, Cylinder-conical, flat nose, round nose etc.) effective range, extreme range.

6. Terminal Ballistics : Definition, behavior of various type of bullets on hitting the target, remaining velocity, stopping power, Ricochet.

Section- C

7. Matching of crime & test Bullets and cartridge cases in regular firearms, Identification of Bullets, pellets & wads fired from improvised country made firearms. Automated method of cartridge case and bullet comparison.

8. Determination of Range of fire, time of fire. Visual and Chemical, instrumental methods with special reference to the applications of Neutron activation, Atomic absorptions, Scanning Electron microscopy and other miscellaneous methods.

9. Gun Shot Residues (GSR) : Mechanism of formation of GSR, modern methods of analysis of GSR from the shooting hand & target with special reference to clothings.

10. Firearm injuries : Ballistic aspect of firearm injuries, nature, Effect of target, Velocity, constructional features and range on the wounding, identification of firearm injuries. Evaluation of Firearm injuries, Reconstruction : Accident, Suicide, murder and self defence.

Section- D

11. Photography: Basic principles and techniques, Exposing, Developing and Printing, Modern Developments in Photography, Digital Photography, Videography/High speed videography, Crime scene and Laboratory photography.

Suggested Readings

1. Redsicker (2000) : The Practical Methodology of Forensic Photography.
2. Hatcher Jury & Weller, 1987 : Firearm Investigation Identification and Evidence, The University Book Agency, Allahabad.
3. Gunther & Gunther, 1935 : The Identification of Firearms, Willies, New York.
4. Jauhri, M. 1980 : Monograpnh on Forensic Ballistics, Govt. of India Publication, New Delhi.
5. Burrad, 1951 : The Identification of Firearms and Forensic Ballistics.
6. Sharma, B.R. : Firearms in Criminal Investigation and Trails, 1990.
7. Dimado : Gunshot Wounds, 1987.
8. Kumar : Forensic Ballistics in Criminal Justice, 1987.
9. Yallop : Explosion Investigation, 1980.
10. Lenz : Explosives and Bomb Diposal Guide, 1976.
11. Suceska : Test Mehods for Explosives, 1995.

FS203: Instrumental Analysis- II

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.
Internal assessment: 20 Min. Pass Marks: 35%
Total Marks: 100

Section-A

Chromatography

Introduction, Review of basic principles and types of chromatography, Thin layer chromatography, Theory and instrumentation, visualization, Densitometry, HPTLC-method, Qualitative and Quantitative, Forensic Application.

Gas chromatography, Theoretical principles, instrumentations and technique, columns, stationary phases, detectors, Pyrolysis GC, GC-MS, Forensic applications.

Liquid chromatography, HPLC, Review of theory, Instrumentation, Technique, column, detectors, LC-MS, Forensic applications.

Section-B

Electrophoresis

Theory and General Principles, Various factors affecting electrophoresis, Low and High Voltage electrophoresis, Horizontal and Vertical Electrophoresis.

Various electrophoresis techniques – Immuno-electrophoresis, Sodium dodecyl sulphate (SDS) polyacrylamide gel electrophoresis, Iso-electric focusing (IEF), Capillary electrophoresis-Theory and basic principles, Instrumentation, Forensic applications.

Section-C

Neutron Activation Analysis- Introduction, Review, Basic theory and principles, Instrumentation-Various neutron sources, Detection and measurement of Gamma-rays for qualitative and quantitative analysis, Forensic Applications.

X-ray Techniques- Introduction, Properties of X-Rays, Overview of various X-Ray techniques, X-ray Diffraction (XRD), X-ray Fluorescence (XRF), Basic theory and principles, Instrumentation, Forensic applications.

Section-D

Microscopy

Light Microscopy-Introduction, Geometrical optics, Image formation, Magnification and Resolution, Lens aberrations, Distortion of image and curvature of field, Types of microscopes- Compound, Comparison, Fluorescence, Polarized, Stereo, Their basic principles, working and Forensic Applications.

Electron Microscopy- Introduction, Historical review, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Theory and basic principles, Instrumentation, Forensic applications.

Suggested readings :

1. Peterson: Clinical and Forensic Application of Capillary Electrophoresis, 2001.
2. Lurie and Witturer : High Performance Liquid chromatography in Forensic Chemistry,1983.
3. Gilbert: GC-MS guide to ignitable liquids, 1997.
4. Brown, P.R: Advance in chromatography
5. Howard: Forensic Analysis by Gas Chromatography.
6. Grahm D.: The use of X-ray Techniques in Forensic Investigation, 1973.
7. Settle, F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997.
8. Crowle: Immuno Diffusion.

FS204: COMPUTER FORENSIC & BIOINFORMATICS

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.

Internal assessment: 20 Min. Pass Marks: 35%

Total Marks: 100

Section-A

Computer and Cyber crimes: Introduction, stand alone computer crimes-Printing of Counterfeit currency and other documents. Computer Scanners, Imaging Software (Photoshop, Photopaint etc.) Software piracy, Data recovery.

Section-B

Networked Computer Crimes: Unauthorized access and interception: Hacking, Computer Viruses, Programme manipulations Computer Security, Internet, use of Biometeric methods with special reference to personal identification.

Section -C

Image Processing:- Introduction and Process, Image Enhancement and restoration

The investigation of erased tapes and analysis of signals (Analog video image Processing), Compression, encryption methods.

Methods for digital video recording, Digitalization techniques.

Investigation of integrity of images and videos

Section -D

Bioinformatics: Introduction, Theory and practice of database searching, Integrated information retrieval, Internet access, Searching for sequence homology and alignment. Basic concepts of UNIX database and programming, Computing concepts of the UNIX operating system. Patent laws and Intellectual rights.

Suggested readings

1. Tewari, R.K., Sastry, P.K. and Ravikumar, K.V. (2003) : Computer Crime & Computer Forensics select Publisher, New Delhi.
2. Wold, G.H. : Computer Crime, Techniuques of Prevention Goyal, R.M. and Pawar, M.S. : Computer crimes.

3. Stern D.L. Preventing Computer frands.
4. Nancy L. Pruitt, Larry S. Underwood, William Surver, Bioinquiry Learning System 1.0.
5. Kenneth W. Adloph Human Genome Methods
6. C. Stan Tsai : An Introduction to Computational Biochemistry.
7. Wayne W. Daniel Biostatistics : A Foundation For Analysis in The Health Science.
8. David W. Mount Bioinformatics : Sequence and Genome Analysis
9. Christoph W. Sensen Essentials Of Genomics and Bioinformatics.
10. S.C. Rastogi, Namita Mendiratta Bioinformatics Concepts, Skills and Applications.
11. Warren J. Ewens, Gregory R. Grant Statistical Methods in Bioinformatics : An Introudction
12. Ben Hui Liu Statistical Genomics : Linkage, mapping and QTL Analysis.
13. Irfan Ali Khan, Atiya Khanum Fundamentals of Bioinformatics.
14. Mahajan T.S. and Singh, Didar (2003) : Computer Networking and HTML; Gurunanak Publication, Patiala.

FSP205: PRACTICAL BASED ON FORENSIC BALLISTICS AND CRIMINALISTICS

Max. Marks: - 100

1. Identification of firearms, cartridges, bullets, gunpowder, etc.
2. Determination of range and time of firing.
3. Matching by comparison microscope bullets and cartridge cases.
4. Preparation of report of the examination.
5. Determination of density, by density gradient tube techniques.
6. Comparison of paints, Soils and glass.
7. Miscellaneous (Cloth, Bangles, threads etc.)
8. Evaluation of Crime scene and photographs.
9. Lifting or prints and impressions by caste and replicas.
10. Sole prints comparison and their lifting from the scene of crime.

SEMESTER – III

FS301 : Forensic Chemistry & Toxicology

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.

Internal assessment: 20 Min. Pass Marks: 35%

Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section -A

Forensic Chemistry: Introduction, Types of cases which require chemical analysis, Limitations of forensic samples, conventional methods of chemical analysis, presumptive tests (colour/spot tests), Microcrystal tests, Elemental analysis (organic and inorganic).

Examination of contact Traces: Introduction to cosmetics and detective dyes, collection, sampling and analysis.

Section -B

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

Drugs of abuse: Introduction, drug addiction and its problems, classification of drugs of abuse, Depressants, stimulants, Hallucinogens, Identification, Field tests and laboratory tests.

Drug abuse in sports: Introduction, common prohibited substances, analytical approach.

Section -C

Forensic Toxicology: Introduction, Role of the toxicologist, significance of toxicological findings, poisons, definition, classification on the basis of their origin, physiological action and chemical nature, poisons and poisoning in India,

Section -D

Management of Toxicological cases in the hospital: Signs and symptoms of common poisons, antidotes.

Collection and preservation of viscera for various types of poisons: Choice of preservatives, containers and storage.

Suggested Readings

1. Ret Newman, Micheal Gilbert, Kevin Lothridge; GC-MS Guide to Ignitable Liquids, CRC Press, LLC, 1999.
2. Modi's: Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabd, 1988.
3. S.N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
4. Saferstein, R: Forensic Science Hand Book, Vol I, II and III, Pretince Hall, NI, 1982.
5. Saferstein, R: Criminalistics, 2002.
6. O Hara & Osterburg : Introduction to Criminalistics, 1949.

7. Sharma, B.R.: Forensic Science in Criminal Investigation & Trials, 2003.
8. Maehly and Stromberg : Chemical Criminalistics, 1980.
9. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
10. Casarett & Doll Toxicology : The Basic Science of poisons.
11. Curry, A.S. : Poison Detection in Human Organs, 1976.
12. Holfmann, F.G.: Handbook of Drug and Alchoho Abuse.
13. Arena Poisoning: Chemistry, Symptoms and Treatment.
14. Froede, R.C.: The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
15. Connors, K.: A text book of Pharmaceuticals analysis, Interscince, New York, 1975.
16. Gleason, M.N. et. al.: Clinical Toxicology of Commercial products, Williams and Williams, Baltimore USA, 1969.

FS302: FORENSIC BIOLOGY AND SEROLOGY

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.
Internal assessment: 20 Min. Pass Marks: 35%
Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section -A

1. Biological evidence: Importance, nature, location, collection and evaluation.
2. Hair and Fibres: Importance, nature, location, collection, evaluation and tests for their identification.
3. Importance and identification of Botanical evidence as Pollen grains, wood, leaves and seeds.

Section –B

4. Blood: Composition and functions, collection and species identification.
5. Human Blood groups: General Principles, theory of their inheritance, Blood group determination from fresh blood, titer, raulax formation and Bombay

blood group. Definition of antigen and antibody, Various Antigen-antibody reactions.

6. Blood grouping from stains of blood, semen, saliva and other body fluids by Absorption-inhibition, Absorption-elution and mixed agglutination techniques, determination of secretor/non-secretor status.

Section -C

5. Semen: Forensic significance, location, collection, evaluation and tests for identification
6. Forensic significance of other body fluids as saliva, sweat, milk etc. Their collection and identification

Section -D

7. Polymorphic enzymes: Forensic significance, identification from fresh blood and stains.
8. Paternity disputes: Causes, Various serological and biochemical methods, calculation of paternity index and probability for paternity and maternity.

Suggested readings

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. Fraser, Roberts J.A (1965): An introduction to Medical Genetics.
4. Chatterjee, C. C- (1975): Human Physiology.
5. Boorman, K. E: Blood Group Serology, Churchill, and Lincolin, P. J. (1988)

6. Race, R. R. and Sangar, R. (1975): Blood Groups in Man. Blackwell Scientific, Oxford.

7. Saferstein, R. (1982): Science Handbook, Vol. I, II and III, Prentice Hall, New Jersey.

8. Barris, H. and Hopkinson, D. A. (1976): Handbook of Enzyme, Electrophoresis, Elsevier, North, Holland, New York.

9. Gilblet, E. (1969): Marker's in Human Blood, Davis, Pennsylvania.

10. Culliford, B. E. (1971), The examination and Typing of Blood Stains, US Deptt. of Justice, Washington.

11. Chowdhuri, S. (1971): Forensic Biology, B P R & D, Govt. of India.

12. Dunsford, I. and Bowley, C. (1967): Blood Grouping Techniques, Oliver & Boyd, London.

13. Eckert, W. G. & James, S.H. (1989): Interpretation of Blood Stain, Evidence, Elsevaier, New York.

FS303 FORENSIC PHYSICAL ANTHROPOLOGY AND FORENSIC MEDICINE

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.
Internal assessment: 20 Min. Pass Marks: 35%
Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section -A

Forensic Anthropology: Definition scope and Problems, Human skeleton, comparative skeletal anatomy of human and non-human.

Identification of bones and determination of site: Age determination from skeletal remains: General considerations, classification of bones, suture closure in skull and ossification in other bones. Sex determination from skeletal remains: skull, Pelvis, and other bones. Estimation of stature from skeletal remains with special reference to long bones.

Section -B

Personal Identification techniques as somatoscopy, somatometery, osteometery and craniometery their imporfance in determination of age and sex.

Portrait Parle/Bertillon system, introduction and importance of photofit/identi kit system for facial reconstruction. Cranio facial super imposition techniques as photographic super imposition, Video-superimposition, Roentgenographic superimposition. Use of somatoscopic and craniometric methods in reconstruction. Importance of tissue depth to reconstruct various facial features/Genetic and congenital anomalies: causes, types, identification and their forensic significance.

Section -C

Forensic odontology: Development and scope, role in mass disaster and anthropology, structural variation in teeth (human and non-human), types of teeth and their functions, determination of age from teeth: eruption sequence, Gustafson's method, dental anomalies, their significance in personal identification.

Bites marks: Forensic significance, collection and preservation of bite marks, photography of bite marks, and evaluation of bite marks. Legal aspects of bite marks.

Section -D

Forensic Medicine: Medico legal aspect of Death causes of Death as asphyxial death, starvation, electrocution, Accidents.

Determination of time since death by various methods including, histopathological methods.

Determination of age of living person, medico-legal investigation of sexual offences, including examination of victim and suspect.

Injuries: Types and classification of injuries, anti-mortem and post-mortem injuries, aging of injuries, artificial injuries.

Suggested Readings:

1. Text book of Forensic Medicine by Krishan Vij; B.I. Churchill Livingstone Pvt. Ltd. 2001.
2. Forensic Dentisty by Paul G. Stimson, Curtis A. Mertz; CRC Press, LLC, 1999.
3. Craniofacial Identification in forensic Medicine, edited by John. G Clement and David. L. Ranso; Oxiford University, Press; 1998.
4. Forensic Taphonomy, edited by William D. Haglernd, Marculla H. Sorg; CRC Press, LLC, 1997.
5. Beals, R.L. and Hozier, H. (1985): An Introduction to Anthropology, Macmillan, New Delhi.
6. Krogman, W.M. And Iscan, M. (1987): Human Skeleton in Forensic Medicine, Charles & Thomas, U.S.A.
7. Gray's Anatomy (1987): Churchill Livingston, Edinburgh.
8. Glaister (Ed)-Rentoul & Smith (1973) : Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.
9. Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
10. Najjar, and Macwilliams (1978) : Forensic Anthropology.
11. Mukherjee, J.B.: Forensic Medicine & Forensic Toxicology.
12. Cummins, H. and Midlo, C. (1961) : Finger Prints, Palmsand Soles, Dover Publications, U.S.A.
13. Fraser, Roberts, J.A. (1965): An Introduction to Medical Genetics.
14. Comas, J.A. (1960): Manual of Physical Anthropology, Charles C. Thomas U.S.A.
15. Whitaker, D.K. and MacDonald, D.U. (1989): Forensic Dentistry, Wolfe Medical Publications Ltd.
16. Robert A. Jensen: Mass falality and Casulity incidents: A field guide
17. Taylor (2000) : Forensic Art and Illustrations CRC Press.
18. Singh, I.P. and Bhasin M. K. (1968): Anthropometery, Kamla-Raj Publications, Delhi.
19. Beals, R.L. and Hoizer, H. (1985): An introduction to Anthropology, Macmillan, New Delhi.
20. Hooton, E.A. (1946): Up from the Ape, Macmillan, New York.
21. Krogman, W.M. And Iscan, M. (1987): Human Skeleton in Forensic Medicine Charles & Thomas, U.S.A.
22. Gray's Anatomy (1987): Churchill Livingston, Edinburgh.
23. Glaister Anatomy (Ed)—Rentoul & Smith (1973): Forensic Medicine & Toxicology, Churchill Livingston, Edinburgh.
24. Modi, J.K. (1988): Medical Jurisprudence & Toxicology, N.M. Tripathi Pvt. Ltd.
25. Najjar, and Macwilliams (1978): Forensic Anthropology.
26. Mukherjee, J. B.: Forensic Medicine & Forensic Toxicology.
27. Cummins, H. and Midlo, C. (1961) : Finger Prints, Palms and Soles, Dover Publications, U.S.A.
28. Fraser, Roberts, J.A. (1965): An introduction to Medical Genetics.
29. Comas, J.A. (1960): Manual of Physical Anthropology, Charles C. Thomas. U.S.A.
30. Whitaker, D.K. and MacDonald, D.U. (1989): Forensic Dentistry, Wolfe Medical Publication Ltd.

FS304 Quality Management and Research methodology

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.

Internal assessment: 20 Min. Pass Marks: 35%

Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section- A

Quality Management System:- Quality, Total Quality, Quality assurance, Quality control, Quality Planning, Quality Audit: Internal and External Audit, Accreditation, NABL, ISO,IEC, BIS

Section- B

General requirements for the competence of testing and calibration laboratories-

Management Requirements:- organizational, document control, subcontracting of tests and calibrations control of Non conforming testing / calibration work, corrective and preventive actions, Management Review.

Technical Requirements: - Test and calibration methods and their validation, measurements, standards and reference material, traceability, sampling,

Section- C

Selection of research Problem: Research proposal, literature search, hypothesis, report writing. Sampling Population and sample, sampling procedures (random and non random), sampling statistics, sampling and physical state, homogenization of samples, sample size and hazards in sampling.

Section- D

Mean and standard deviation: Distribution of random errors, reliability of results, tests of significance, confidence interval, Paired t-test, Correlation and linear regression, the number of replicate determination, analysis of variance, the value of statistics in forensic science.

Suggested Readings

1. C.G.G. Aitken and D.A Stoney; The use of statistics in Forensic Science, Ellis Horwood Limited, England 1991.
2. Visweswara Rao. K: Biostatistics, A Manual of Statistical Methods for Use in Health, Nutrition & Anthropology.
3. Sokal, R.R & Rolf, F.J: Biometery, Principles & Practices of Statistics in Biological Research
4. Rao, C. R Advanced Statistical Methods in Biometric Research.

5. Saferstein R. Forensic Science Handbook I, II, III.

6. William L. Duncan: Total Quality, Key Terms and Concepts.

7. Murray S. Cooper: Quality control in the Pharmaceutical Industry.

8. John T. Rabbitt, Peter A Bergh: The ISO 9000 Book.

9. Willard Merritt, Dean & Settle: Instrumental Methods of Analysis.

10. NABL -113

11. NABL -113A

12. Quality Management systems: A Practical Guide

Howard S. Gitlow 2001 CRC Press ISBN 1-574-44261-9

13. Crime Laboratory Management: Jami St. Clair 2003. Academic Press. ISBN 12661051-3

14. ASCLD Guidelines for Forensic Science Laboratory Practics.

15. The laboratory Quality Asurance system: A manual of Quality Procedures and forms. Thomas A Ratliff. 2003 3rd ed. John Wiley & Sons ISBN. 0-471 26918-2

16. Systematic Quality Management Gary B Clark. 1995 Practical Laboratory Management Series.

17. Quality assessment of chemical Measurments John K. Taylor. CRC Press 1987. 087371-097-5.

18. Quality in the analytical chemistry laboratory E. Prichard. 1995 JohnWiley ISBN 0471 955418

FSP305.

Practical based on Forensic Biology and Serology including forensic physical anthropology.

Max. Marks: 50

1. Determination of age from skull sutures.
2. Determination of age from Teeth.
3. Determination of sex from skull.
4. Determination of sex from Pelvis.
5. To Perform osteometric measurements on Long bones.
6. To Perform craniometric measurements on skull.
7. To perform somatometric measurement on living.
   - (a) Height vertex, (b) Head length
   - (c) Head breadth (d) Foot length
   - (e) Foot breadth (f) Nasal height
   - (g) Nasal breadth
   - (h) External biorbital breadth
   - (i) Internal bi-orbital breadth (j) Bigonial breadth
   - (k) Bizygomatic breadth.
8. To prepare slides of scale patterns of human hair.
9. To examine human hair for cortex and medulla.
10. To examine Barr bodies from hair root.
11. To identify blood stains.
12. To identify semen stains.
13. To identify saliva stains.
14. To identify various type of fibers.
15. To determine species of origin from blood.
16. To determine blood group from fresh blood and blood stains.

FSP306. Practicals on Forensic Chemistry and Toxicology

Max. Marks: 50

1. M.P, B.P and flash point Determination.
2. Colour/spot tests for common drugs of abuse.
3. TLC separation of drugs of abuse.
4. TLC separation of pesticides/insecticides.
5. TLC separation of anabolic steroids.
6. Distillation characteristics of gasoline, kerosene, and diesel oil.
7. Analysis of phenolphthalein in trap cases.

SEMESTER - IV

Forensic Biology and Serology (FBS)

FS-401 Advanced Forensic Biology

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.
Internal assessment: 20 Min. Pass Marks: 35%
Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section- A

Fibre Examination: Introduction, Classification, Fibre transfer and persistence. Fibre Recovery: At the scene, in the laboratory, contamination and its prevention. Fibre Identification and comparison: Microscopical Examination, Determination of optical properties, Refractive Index, Birefringence, Intrumental analysis, dye analysis by TLC, factors affecting the strength of fibre evidence.

Hair examination: Hair structure, growth and replacement of hair.

Identification: Species of origin, variation in different major population groups, somatic origin.

Individualization: Blood grouping, enzyme typing and DNA typing

Section- B

Wild Life Forensics**:** Introduction, importance, protected and endangered species of Animals and Plants. Identification of wild life materials such as skin, fur, bones, nails, horn, teeth, flowers and plants, by conventional and modern methods, Identification of Pug marks of various animals.

Section- C

Forensic Entomology**:** Introduction, general entomology and arthropod biology, insects of forensic importance, collection of entomological evidence during death investigations, the role of aquatic insects in forensic investigations, Insect succession on carrion and its relationship to determine time since death, its application to Forensic Entomology.

Section- D

Botanical evidences: Introduction, types, location, collection evaluation and forensic significance.

1. Wood: Type of wood and their identification and comparison.
2. Leaves: Identification of various types of leaves and their anatomy, methods of comparison.
3. Pollens: Structure, function, methods of identification and comparison.

4. Diatoms: Nature, location, structure, extraction from various body tissues, including bone marrow, preparation of slides, methods of identification and comparison, forensic significance.

Forensic Microbiology: Types and identification of microbial organisms of forensic significance.

Suggested Readings

1. Richard saferstein; Forensic Science Hand book, Vol (I); Prentice Hall, Publications.
2 Jason H. Byrd and James L. Castner; Forensic entomology, CRC Press LLC, 2001.
3. Forensic Science Hand book by Richard saferstein Vol (II); Prentice Hall, Publications.
4. Robertson (1996) : Forensic examination of Hair. Francis & Taylor, USA.
5. Robertson (1999) : Forensic examination of Hair. Francis & Taylor, USA.
6. Safersstein, R. (1982) Science Handbook; Vol. III, Prentice Hall, New Jersey.
7. Curry, A. S. (1965) Methods of Forensic Science, Vol. IV, Interscience, New Youk.
8. Chowdhuri, S. (1971) : Forensic Biology, B P R & D Govt. of India.

FS-402

ADVANCED FORENSIC SEROLOGY INCLUDING DNA FORENSICS

Lectures to be delivered-60

Max. Marks: 80. Time Allowed: 3 hrs.
Internal assessment: 20 Min. Pass Marks: 35%
Total Marks: 100

INSTRUCTUION FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A, B, C and D will have two questions from the respective sections of the syllabus carrying equal marks. Section E will consist of sixteen short answer type questions which will cover the entire syllabus uniformly. Short answer type questions (not more than five lines or fifty words) shall carry two marks each.

INSTRUCTUION FOR THE CANDIDATE

Candidates are required to attempt one question each from the sections A, B, C and D of the question paper and the entire section E.

Section- A

Immunology: Immune system, immune response, innate and acquired immunity and antigens, haptenes and adjuvants.

Immunoglobulin: Types, physio-chemical properties and function, raising of antisera.

Lectins: Forensic significance, buffers and serological reagents, methods of sterilization employed for serological work.

Antigen-Antibody Reactions: Precipitation, agglutination, complement, neutralization, immunofluorescence.

HLA system: Its applications in paternity testing, pitfalls of HLA system.

Section- B

Forensic examination of Body fluids: 1) Blood:

Identification (Preliminary and confirmatory tests), species of origin (Immunodiffusion and Immunoelectrophoresis), Individualization: Blood grouping, enzyme typing,

2) Semen: Composition, functions and morphology of spermatozoa,

Identification (Preliminary and confirmatory tests including Azoospermic semen stains), Individualization (Blood Grouping, seminal fluid isozymes typing,

iii) Composition, functions and forensic significance of saliva, sweat, milk, urine, faecal matter, vaginal secretions and tests for their identification including the presence of blood group specific ABH substances.

Section- C

DNA Profiling**:** Introduction, History of DNA Typing, human genetics- heredity, alleles, mutations and population genetics, molecular biology of DNA, variations, polymorphism, DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR. Mitochondrial DNA, evaluation of results, frequency estimate calculations, interpretations, allele frequency determination, match probability- database, quality control, certification and accreditation.

Section- D

Forensic Significance of DNA profiling: Applications in disputed paternity cases, child swapping, missing person's identity- civil immigration, veterinary, wildlife

and agriculture cases, legal perspectives- legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad.

New and future technologies: DNA chips, SNPs and limitations of DNA profiling.

Suggested Readings:-

1. Medical immunology by Danniel P. Stites, Abba I. Jerr, Tristram G. Parstow, Ninth edition; Prentice Hall International Inc. 1997.
2. Stern, C. (1964) : Principles of Human Genetics, Freeman, California.
3. Chatterjee, C. C-(1975) Human Physiology.
3. Beerman, K.E.: Blood Group Serology, Churchill, and Lincoin, P.J. (1988)
4. Race, R.R, and Sanger, R. (1975) : Blood Groups in Man. Blackwell Scientific, Oxford.
5. Saferstein, R. (1982): Science Handbook, Vol. I, II, & III, Prentice Hall New Jersey.
6. Curry, A. S. (1965): Methods of Forensic Science, Vol IV, Interscience, New York.
7. Barris, H. and Hopkinson, D.A. (1976) : Handbook of Enzyme, Electrophoresis Eleavier, North, Holland, New York.
8. Gilblet, E. (1969) : Markers in Human Blood, Davis, Pensylvania
9. Culliford, B.E. (1971) The Examination and Typing of Blood Stains, US Deptt. of Justice, Washingron
10. Kirby : DNA Fingerprinting Technology.
11. Furley, M.A. & Harrington, J.J. (1991) Forensic DNA Technology
12. National Research Council (1992) : DNA Technology in Forensic Science, Washington DC National Academy Press.
13. Chowdhari, S. (1971) : Forensic Biology, B P R & D, Govt, of India.
14. Dunsford, I and Bowley, C. (1967) : Blood Grouping Techniques, Oliver & Boyd, London
15. Bokert, W. G. & James, S. H. (1989) Interpretation of Blood Stain, Evidence, Elsevaier, New York.
18. Erikson : Blood Group Serology.
19. DNA structure and functions by Richard R. Sinden; Academic Press, Inc. 1994.
20. DNA Structure and functions by Richard R. Sinden; Academic Press, Inc. 1994.
21. DNA Profiling and DNA fingerprinting; Edited by Jorg T. Epplen and Thomas Lubjuhn; Birkhauser Verlag, Switzerland, 1999.
22. Forensic DNA Profiling Protocols edited by Patrick J. Lincoln and Jim Thomson; Humana Press, Inc. 1998.
23. DNA and other Polymorphism in Forensic Science by Henry C. Lee and R.E. Gaensslen; Year book Medical Publishers, Inc. 1990.
24. DNA Technology in Forensic Science by committe on DNA Technology in Forensic Science, Board on Biology, Commission on Life Sciences, National Research council; National Academy Press, Washington, D.C. 1992
25. Keith In man and Norah Rudin; An Introduction to Forensic DNA Analysis, CRC Press; Ny. 1997.

FSP-403 Practical based on forensic biology and serology

Max. Marks: 100

1. To determine titre of antisera.
2. To prepare anti-H from seeds of Eulex.
3. To perform precipitin test for species of origin determination.
4. To perform Immunodiffusion test for species of origin.
5. To determine blood group from stains of blood and various body fluids with Absorption-inhibition, mixed agglutination and absorption-elution techniques.
6. To prepare gel plates for electrophoresis.
7. To perform electrophoresis for separation of Haptoglobins.
8. To perform electrophoresis for separation of various polymorphic enzymes.
9. Examination of diatoms.
10. Examination of hair of different animals as cat, dog, cow, horse and goat.
11. Extraction and isolation of DNA from blood and other body fluids.

Special note:

For optional papers students will be attached to a Forensic Science laboratory for about a fortnight. Fifty marks in the practical paper of the option concerned will be kept for the evaluation of the comprehensive attachment report to be submitted by each student.

FSR404 SPECIAL REPORT

Max. Marks: 200

Every student will have to submit a special report based on the option and the actual work carried out on the problem in the laboratory. The report will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and external examiners.