

Semester I

Course Code: Paper 1-Forensic Science, Photography, Crime Scene Management

Theory

Marks: 100 (I.A. =30 and Theory =70) Duration: 14 weeks (L= 4 hours per week)

Practicals=2 Credits (50 Marks)

Course Objectives:

The objective of this course is to introduce the concept of forensic science, its development and progress over time. It will also familiarize students with the organizational setting and working set up of forensic laboratories. It aims to introduce different techniques used in forensic investigations with the principles involved. The course would apprise students with the basics of forensic photography techniques with management of crime scene in different situations.

Contents:

Unit 1

Forensic Science Unit

Introduction, Need, Scope, Concepts and Significance of Forensic Science, History and Development of Forensic Science, Laws and Basic principles of Forensic Science, Branches of forensic science, Organizational set-up of a Forensic Science Laboratory. Investigative strategies. Expert testimony and eye-witness report.

Unit 2

Tools and techniques in Forensic Science

Basic principles of microscopy, spectroscopy, chromatography. Electrophoresis, EnzymeLinked Immunosorbent Assay (ELISA), Radio Immuno Assay (RIA). Measuring and optical instruments. Research methodologies. Formation of research design on a specific problem. Central tendency and Dispersion. Test of significance. Analysis of variance.

Correlation and

Regression.

Unit 3

Forensic Photography

Basic principles of Photography, Techniques of black & white and color photography,

cameras, lenses, shutters, depth of field, film; exposing, development and printing techniques; Different kinds of developers and fixers; UV, IR, fluorescence illumination guided photography; Modern development in photography- digital photography, working and basic principles of digital photography; Surveillance photography. Videography and Crime Scene & laboratory photography.

Unit 4

Crime Scene Management

Crime scene investigations, protecting and isolating the crime scene; Documentation, sketching, field notes and photography. Searching, handling and collection, preservation and transportation of physical evidences. Chain of custody and Reconstruction of scene of crime. Report writing.

Course Learning Outcomes:

CO 1 Understand the basic concept, meaning, significance and development of Forensic science.

CO 2 To elucidate research methodologies and techniques used in the formation of research design on a specific problem.

CO 3 Describe Crime scene investigations, Reconstruction of scene of crime, basic principles of photography and its relevance.

Suggested Readings:

1. Houck, M.M & Siegel, J.A; 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. Nanda B.B and Tewari, R.K; Forensic Science in India- A vision for the Twenty First Century, Select Publisher, New Delhi, 2001.
4. James, S.H and Nordby, J.J; Forensic Science- An Introduction to Scientific and Investigative Techniques, CRC Press, USA, 2003.
5. Saferstein; Criminalistics- An Introduction of Forensic Science, Prentice Hall Inc, USA, 2007.
6. Barry, A.J. Fisher; Techniques of Crime Scene Investigation, 7th Ed, CRC Press, New York, 2003.

7. Mordby, J. & Reckoning, D; The Art of Forensic Detection, CRC Press NewYork, 2003.
8. G.R. Chatwal; Analytical Spectroscopy 2nd Edn, Himalaya Publishing House New Delhi,2002.
9. Aitken and Stoney; The Use of Statistics in Forensic Science, Ellis Horwood, New York, 1991.
10. Robertson and Vignaux; Interpreting Evidence, John Wiley, New York, 1995.
11. H.L. Blitzer and J.Jacobia; Forensic Digital Imaging and Photography, Academic Press, London, 2002
12. David R.Redsicker; The Practical Methodology of Forensic Photography- 2nd Ed. CRC Press, New York, 2001.
13. R.E.Jacobson, S.F.Ray, G.G.Attridge; The Manual of Photography- Photographic and Digital Imaging , N.R. Oxford

Practical: Crime scene management and criminology : 2 Credits

1. Descriptive study of organizational structure of a forensic science laboratory.
2. To carry out photography of indoor and outdoor crime scenes
3. Crime scene photographic processing and development in different light sources and using different filters.
4. To carry out digital photography of various forensic evidences
5. Mock crime scene investigation and writing a report on evaluation of crime scene.
6. Interpretation of crime scene notes, photos, sketches and reconstruction of crime scene
7. Microscopy of various physical evidences
8. Study the theories of crime

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9. Criminal profiling
10. Portrait parley
11. Expert testimony in a mock court case scenario.

Semester I

Course Code: Paper 2: Forensic Physics

Theory

Marks: 100 (I.A. =30 and Theory =70) Duration: 14 weeks (L= 4 hours per week)

Practical: 2 Credits

Course Objectives:

The objective of this course is to introduce the concept of forensic examination of various evidences like soil, cement, fiber, glass etc. at crime scene. It will also explain students with the specific techniques to be used for the examination of forensic evidences especially paint, fiber, soil, glasses and tool marks involved with the crime.

Unit 1

Soil, Cement and Concrete

Types and composition of soil, sample preparation, removal of contaminants, colour, molecular particle size distribution, turbidity test, pH measurements, microscopic examination, density gradient analysis, ignition-loss test, elemental analysis, interpretation of soil evidence. Spectroscopic methods for organic materials of soil, XRD analysis. Cement bromoform test, fineness test, ignition-loss test. Identification of adulterated cement. Mortar and concrete analysis.

Unit 2

Paint and Fibre

Types of paint and their composition, macroscopic and microscopic analysis of paint pigments, pigment distribution, micro-chemical analysis- solubility test, pyrolysis gas chromatography, TLC, colorimetric analysis, IR spectroscopy and X-ray diffraction, elemental analysis, mass spectrometer, interpretation of paint evidence.

Types of fibres, forensic aspects of fibre examination- fluorescence, optical properties, refractive index, birefringence, dye analysis. Physical fit and chemical testing. TLC, IR-micro spectroscopy, Py-GCMS. Difference between natural and man-made fibres. chemical compositions of papers, examination of wood and paper fibers, elemental analysis.

Unit 3

Glass

Types of glass and their composition- soda-lime, boro-silicate, safety glass, laminated, lightsensitive, tempered/ toughened, wire glass, coloured glass. Matching and comparison. Forensic examinations of glass fractures- rib marks, hackle marks, cone fracture, wavy, backward fragmentation, concentric and radial fractures. Colour, fluorescence, physical measurements, refractive index, density gradient, becke-line, specific gravity examination

and elemental analysis of glass evidence.

Unit 4

Toolmarks

Types of toolmarks- compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks, skid marks and their analysis, Photographic examination of tool marks and

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cut marks on clothes and wall etc. Restoration of erased / obliterated marks- Method of making-cast, punch, engrave; methods of obliteration, method of restoration- etching (etchings for different metals), magnetic, electrolytic etc., recording of restored marks – restoration of marks on wood, leather, polymer etc.

Course Learning Outcome

CO 1 To identify types and composition of soil, microscopic examination, Mortar and concrete analysis.

CO 2 To analyse types of paint and fibres, their composition, their macroscopic and microscopic analysis.

CO 3 To learn about the different types of glass and their composition.

CO 4 To elucidate the use of tool marks their restoration and method of recording those restored marks.

Suggested Readings 2 Credits

1. Caddy, B; Forensic Examination of Glass and Paint Analysis and Interpretation, CRC Press, New York, 2001.
2. Shaw, D; Physics in the Prevention and Detection of Crime, Contem Phys. Vol.17, 1976.
3. Saferstein, R; Forensic Science Handbook. Vol. I,II, (Ed.), Prentice Hall, New Jersey, 1988.
4. Working Procedure Manual; Physics BPR&D Publication, 2000.
5. Sharma, B.R; Forensic Science in Criminal Investigation and Trials (3rd Ed.), Universal Law Publishing Co., New Delhi, 2001.
6. Working Procedure Manual- Physics, BPR&D Publication. 2000
7. Hess, K.P; Textile Fibers and their Use, 6th Edn, Oxford and IBH Publishing Co., 1974.

Practical: Forensic physics and impression

1. Preliminary examination of glass, soil, fibre, paint and cloth evidences.
2. Examination of physical properties of glass, soil, fibre and paint evidences.
3. Develop latent fingerprints using different powder and chemical methods.
4. Comparison of fingerprints and palm prints by individual and class characteristics.
5. Restoration techniques of tool mark impressions and casting footprints.
6. Comparison and identification of individuals from lip print evidence.
7. Gait pattern recognition

Semester I

Course Code: Paper 3: Criminology, Criminal Law and Police Administration

Theory

Marks: 100 (I.A. =30 and Theory =70) Duration: 14 weeks (L= 4 hours per week)

Course Objectives:

The objective of this course is to introduce the concept and scope of crime. It will familiarize students with types of crime and its effects as well its prevention. The course would highlight about criminal behavior and related theories. The course aims to discuss the concept of Juvenile delinquency and Victimology. It will disseminate information to students with specific criminal Law, Indian Penal Code: sections, Criminal Procedure Code and police Administration.

Unit 1

Crime

Definition, concept and scope of crime.Types of crime.Causes, effects, control and prevention of crime.Recent developments.

Unit 2

Criminology and criminal anthropology

Aim and scope of criminology; Criminal behavior and theories of criminal behavior: classic, positivist, sociological. Organized crimes, white collar crime.Juvenile delinquency.Role of correctional institutions.Criminal profiling and modus operandi, portrait parley, voice stressanalysis.Victimology.

Unit 3

Criminal Law

Indian Penal Code: sections-23, 24, 25,39,44,52,76-79,84-86.

Criminal Procedure Code: sections-2, 6-35, 41-60, 61-90,154-176, 293, 294. Charges:
bailable/non-bailable offences, cognizable/ non-cognizable, summon case and warrant cases.

Indian Evidence Act: sections- 3, 24-30, 45, 135-138, 141. Expert testimony.

NDPS Act, Food and Adulteration Act, Drugs and Cosmetic Act, Arms Act, Explosives Act.

Unit 4

Police Administration

History and development of police administration; Police duties, responsibilities and powers. Organization and structure of police station; maintenance of crime records and accountability of police to law. People and society. Custodial deaths, Police and Human Rights.

Course Learning Outcome

CO 1 To understand concept of crime and recent development in its control and prevention.

CO 2 To study the aim and scope of criminology.

CO 3 to elucidate Criminal profiling and modus operandi, portrait parley, voice stress analysis

CO 4 To describe History and development of police administration; Police duties, responsibilities and powers.

Suggested Readings

1. Swanson, C.R, Terrbles, L & Taylor, R.W; Police Administration, Prentice Hall, USA, 1998.

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2. Gross.H; Criminal Investigation- A Practical Textbook for Magistrates, Police Officers, and Lawyers; Universal Law Publishing Co., New Delhi, 2000.

3. Lyman, M.D; Criminal Investigation – The Art & the Science, Prentice Hall, New Jersey, 2002.

4. O'Hara CE & Osterburg, JW; An Introduction to Criminalistics., Indiana University. Press, London, 1972.

5. Swansson, C.R, Chamelin, N.C, & Territ, L; Criminal Investigator, McGrawhill, New York, 2000.

6. The Indian Evidence Act, (1872), Amendment Act (2002); Universal Law Publishing Co.,

2003.

7. The Code of Criminal Procedure (1973) Amendment Act, (2001); Universal Law Publishing Co., 2002.

8. Rattan Lal&DhirajLal; The Indian Penal Code, 28th Ed. Wadhwa& Co. Nagpur, 2002.

Semester I

Course Code: Paper 4: Forensic Dermatoglyphics and other impressions

Theory

Marks: 100 (I.A. =30 and Theory =70) Duration: 14 weeks (L= 4 hours per week)

Course Objectives:

The objective of this course is to explain the concept of dermatoglyphics and other impression with their forensic implication. It will also familiarize students with the biometrics, technology involved and multibiometric systems. The course also aims to discuss the foot/ footwear/tyre impressions lip prints, ear prints and their significance in forensic investigations

Unit 1

Fingerprints and Palm prints

History and development of Dermatoglyphics , formation of ridges, pattern types, pattern area. Classification of fingerprints- Henry's system of classification, single-digit classification, Extension of Henry's classification, filing, searching and fingerprint bureau. Composition of sweat, development of chance, latent, visible and plastic prints. Conventional methods of development of latent prints- fluorescent methods, magnetic powder method, fuming method, chemical method etc. Application of laser and other radiations to develop latent fingerprints, metal deposition method and development of latent prints on skin.Taking of fingerprints from living and dead person, preserving and lifting of fingerprints, photography of fingerprints.Ridge counting and ridge tracing, class and individual characteristics, various types of ridge characteristics. Comparison of palm prints on the basis of individual ridge characteristics. Automated Fingerprint Identification System (AFIS).Modern methodologies in fingerprinting.

Unit 2

Biometrics

Biometric evidences such as finger impressions, retina, iris pattern, voice, gait pattern, face

recognition, 3D face recognition, automatic forensic dental identification, hand vascular pattern

technology, Multibiometric systems, Recent developments, biometric databases.

Unit 3

Foot/ Footwear/Tyre impressions

Importance, Gait pattern, Casting of footprints in different medium, electrostatic lifting of latent footprints. Taking of control samples. Collection, tracing, lifting, casting of impressions,

enhancement of footwear impressions, analysis and comparison of foot impressions, moulds, identification characteristics.

Unit 4

Lip prints, Ear prints and their significance

Nature, location, collection and evaluation of lip prints. Forensic Significance, photography, location, collection and evaluation, taking of control samples of footprints, lip prints and Ear prints for comparison. Modern techniques and developments.

Course Learning Outcome

CO 1 To understand the history and development of Dermatoglyphics, different classifications used and Modern methodologies in fingerprinting.

CO 2 This paper furthermore addresses the use of biometric evidences.

CO 3 To learn methods of taking footprints, their collection and identification of characteristics.

CO 4 To analyse lip prints and their forensic significance.

Suggested Readings

1. Bridges, B.C; Criminal Investigation, Practical Fingerprinting, Thumb

Impression, Handwriting expert Testimony, Opinion Evidence., Univ. Book Agency, Allhabad, 2000

2. Mehta, M.K; Identification of Thumb impression & cross examination of Fingerprints, N.M. Tripathi Pub. Bombay, 1980.

3. Chatterjee, S.K; Speculation in Fingerprint Identification, Jantralekha printing Works, Kolkata, 1981.

4. Cowger James F; Friction Ridge Skin- Comparison & Identification of Fingerprints, CRC

Press, NY, 1993

5. Cassidy, M.J; Footwear Identification, Royal Canadian, Mounted Police, 1980.

6. Iannavelli, A.V; Ear Identification, Forensic Identification Series, Paramount,1989.

7. Henry, C.L. &Ganesslen, R.E; Advances in Fingerprint Technology, CRC Press, London,1991.

8. Jain, A.K., Flynn, P.& Ross A.A., Handbook of Biometrics, Springer, New York 2008

Semester II

Course Code: Paper 5: Forensic Chemistry and Toxicology

Theory

Marks: 100 (I.A. =30 and Theory =70) Duration: 14 weeks (L= 4 hours per week)

Practicals=2 Credits (50 Marks)

Course Objectives:

The objective of this course is to introduce the forensic chemistry basics with special focus on arson chemistry, details of adulterants in petroleum products and analytical tools for examination of alcoholic and non-alcoholic beverages. It will explain types of explosives, Department of Anthropology, University of Delhi

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their synthesis and characteristics, concept of forensic toxicology and pharmacology. The students would be taught about different drugs of abuse including natural and synthetic drugs of abuse.

Unit 1

Forensic Chemistry

Introduction to Forensic chemistry, sampling of chemical evidences, presumptive, screening (colour/ spot test), inorganic analysis. Detective dyes- cases and importance in trap cases. Arson Chemistry of fire, searching of fire scene, collection, preservation and examination of arson evidences. Adulteration in Petroleum products. Examination procedures involving standard methods and instrumental techniques, analysis of beverages- alcoholic and nonalcoholic, country made liquor and medicinal preparations containing alcohol as constituents. Significance of alcohol in breath and breath screening devices. Forensic analysis of Fertilizers/ insecticides/ pesticides/ biocides.

Unit 2

Explosives

Classification of explosives, synthesis and characteristics of Tri-nitro toluene (TNT), Pentaerythritol tetranitrate (PETN) and Research and Development Explosives (RDX). Explosion process, blast waves, searching of scene of explosion. Post blast residue collection and analysis, blast injuries and detection of hidden explosives. Improvised explosive devices.

Unit 3

Forensic Toxicology and Pharmacology

Definition, classification of poisons- organic, inorganic, metallic, non-metallic etc. Acute and chronic poisoning, Accidental, homicidal and suicidal poisoning, Extraction and identification of commonly used poisons. Dosage, Frequency, Route of administration, Absorption, distribution and metabolism and factors affecting metabolism and excretion. Toxicological techniques.

Unit 4

Drugs of Abuse

Natural and synthetic drugs of abuse. Drug dependence, classification of drugs- Narcotics, Hallucinogens, Depressants, Stimulants, Anabolic steroids. Psychotropic and Psychedelic drugs of abuse. Field and laboratory tests of drugs of abuse. Instrumental methods of analysis, collection, preservation and transportation of drug evidences.

Course Learning Outcome

CO 1 This paper intends to acquaint the students with the concept of Forensic chemistry, sampling of chemical evidences and their examination procedure.

CO 2 To understand the classification of explosives.

CO 3 To know the Definition and classification of different types of poisons.

CO 4 To learn the methods of analysis, collection, preservation and transportation of drug evidences.

Suggested Readings

1. Niesink, RJM; Toxicology- Principles and Applications, CRC Press, 1996
2. Modi, JP, Textbook of Medical Jurisprudence & Toxicology, N.M. Tripathi Pub, 2001
3. Chadha, PV; Handbook of Forensic Medicine & Toxicology, Jaypee Brothers, New Delhi, 2004

4. Parikh, C.K; Text Book of Medical Jurisprudence, Forensic Medicine & Toxicology, CBS Pub. New Delhi,1999
5. Morrison R.T and Boyd R. N;Organic Chemistry 6th Ed Prentice Hall, 2003
6. Laboratory Procedure Manual : Petroleum Products ,Directorate of Forensic Science, MHA, Govt. of India, 2005
7. Working Procedure Manual on Chemistry ; Directorate of Forensic Science MHA Govt. of India
8. Bureau of Indian Standard Specifications related to Alcohols and Petroleum Products.
9. Welcher F; Standard Methods of Chemical Analysis, 6th Ed.VanNostrand Reinhold, New York, 1969
10. Watson C. A; Official and Standardised Methods of Analysis, Royal Society of Chemistry, UK,1994.
11. Central Excise Act ; Universal Law Publication.
12. Essential Commodity Act, 1955
13. Feigl, F; Spot Test in Inorganic Analysis , Elsevier Publ. New Delhi, 2005.
14. Curry A.S ; Analytical Methods in Human Toxicology : Part II ,CRC Press Ohio, 1986.
15. Curry, A.S : Poison Detection in Human Organs, C Thomas Spring field, CRC Press, Costa Rica, 1976
16. Clark E.G.C; Isolation and Identification of drugs, Academic Press, London, 1986
17. Sunshine I : Handbook of Analytical Toxicology, CRC Press, Costa Rica,1969.

Practical: Forensic Chemistry and Instrumentation

1. TLC and spot test of alkaloids of drugs of abuse and toxic substances.
2. Isolation and instrumental analysis of different toxic substances and drugs.
3. Thin layer chromatography of explosive substances
4. Examination of petroleum products as per BIS standards.
5. Detection and identification of doping drugs from- hair, blood, saliva, urine and other body fluid and estimation of alcohol from breath, urine and blood.
6. UV-Visible Spectroscopic analysis of Drugs
7. Fourier transform infrared spectroscopic (FTIR) analysis of physical evidences
8. Gas chromatography (GC) and High performance liquid chromatography (HPLC) analysis of poisons, explosives, amino acids and proteins

Semester II

Course Code: Paper 6: Forensic Ballistics

Theory

Marks: 100 (I.A. =30 and Theory =70) Duration: 14 weeks (L= 4 hours per week)

Practicals=2 Credits (50 Marks)

Course Objectives:

The objective of this course is to explain the history and background of firearms, their classification and characteristics. The course also aims to discuss different types of ammunitions, their identification, origin etc. with focus on improvised/ country made/ imitative firearms and their constructional features. It also highlight the identification and examination of internal, external and terminal ballistics.

Unit 1

Forensic Ballistics-I

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History and background of Firearms, their classification and characteristics, various components of small arms, smooth bore and rifled firearm, different systems and their functions, rifling – various class characteristics, types of rifling and methods to produce rifling. Trigger and firing mechanism, cartridge-firing mechanism. Projectile velocity determination, Theory of recoil, methods for measurement of recoil. Techniques of dismantling/assembling of firearm. Types of ammunitions, classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, velocity and pressure characteristics under different conditions, various types of bullets and compositional aspects, latest trends in their manufacturing and design, smooth bore firearm projectile, identification of origin, improvised ammunition and safety. Identification of origin, improvised/ countrymade/ imitative firearms and their constructional features.

Unit 2

Internal and External Ballistics

Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion

and gas cutting, equation of motion of projectile, principal problems of exterior ballistics, vacuum trajectory, effect of air resistance on trajectory, base drag, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Ballistics tables, measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistics data.

Unit 3

Terminal Ballistics

Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, Tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range, Cavitation – temporary and permanent cavities, Ricochet and its effects, stopping power, Wound Ballistics; Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, penetration of projectiles in gel block and other targets, nature of wounds of entry, exit, initial track with various ranges and velocities with various types of projectiles, explosive wounds, evaluation of injuries caused due to shot-gun, rifle, handguns and country made firearms, methods of measurements of wound ballistics parameters, post-mortem and anti-mortem firearm injuries.

Unit 4

Examination and identification

Firearms, ammunition and their components identification and examination, different types of marks produced during firing process on cartridge-firing pin marks, breech face marks, chamber marks, extractor and ejector marks and on bullet number/direction of lands and grooves, striation marks on lands and grooves, identification of various parts of firearms, techniques for obtaining test material from various types of weapons and their linkage with fired ammunition, class and individual characteristics, determination of range of fireburning, scorching, blackening, tattooing and metal fouling, shots dispersion and GSR distribution, time of firing – different method employed, and their limitations, stereo & comparison microscopy, automatic bullet and cartridge comparison system.

GSR analysis: Mechanism of formation of GSR, source and collection, spot test, chemical test, identification of shooter and instrumental methods of GSR Analysis, Management and reconstruction of crime scene; suicide, murder and accidental and self defence cases.

Course Learning Outcome

CO 1 This paper intends to give an overview on Firearms, their classification and characteristics.

CO 2 To describe concept of propellants, their ignition, shape and size of propellants, manner of burning, various factors affecting the internal ballistics.

CO 3 To analyse Firearms, ammunition and their components identification and examination.

Suggested Readings

1. Sharma, B.R.; Firearms in Criminal Investigation & Trials, 4th Ed, Universal Law Publishing Co Pvt Ltd, New Delhi, 2011.
2. Mathews, J.H; Firearms Identification, Vol I, II and III, Charles C. Thomas, USA, 1977.
3. Hatcher, Jury and Weller; Firearms Investigation, Identification and Evidence, Stackpole Books, Harrisburg, Pennsylvania, 1997.
4. Heard, B.J; Handbook of Firearms and Ballistics, John Wiley, England, 1997.
5. Warlow, T.A.; Firearms, The Law and Forensic Ballistics, Taylor and Francis, London, 1996.
6. Schoeble, A.J. and Exline, L.D; Current methods in Forensic Gunshot Residue Analysis, CRC Press, New York, 2000.
7. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, 1977
8. Carlucci, D.E & Jacobson, S.S; Ballistics, CRC Press, London, 2008.
9. Sellier, K.G; Wound Ballistics and the Scientific Background, Elsevier Pub. Co., London, 1994.
10. Jauhari M; Identification of Firearms, Ammunition, & Firearms Injuries, BPR&D, New Delhi.
11. Ordog, G.J; Management of Gunshot wounds, Elsevier Pub. Co., New York, 1983.
12. Schoeble, A.J. and Exline, L.D; Current methods in Forensic Gunshot Residue Analysis, CRC Press, New York, 2000.
13. Beyer, J.C; Wound Ballistics, US. Printing Office, Washington, 1962.
14. Wilber; Ballistic Science for the Law Enforcement Officer, Charles C. Thomas, USA, 1977.
15. Di Maio, JM; Gunshot Wounds, CRC Press, New York, 1999.

Practical: Ballistics and Questioned Documents 2 Credits

1. Forensic identification of class and individual characteristics of handwriting
2. Analysis of signature forgery
3. Examination of anonymous letters and disguised writing
4. To detect and decipher alterations in a document
5. To decipher secret writings, indentations and charred documents
6. To study the handwriting of ethnic and population groups
7. To examine forgery in currency notes, passports and credit cards under Visual Spectral Comparator
8. Linkage of suspected bullet and cartridge case with the firearm on the basis of class and individual characteristics.
9. Classification and designation of ammunition using physical measurements
10. GSR collection and analysis of various components of GSR.
11. Estimation of Range.
12. Determination of velocity and energy of projectiles.

Semester II

Course Code: Paper 7: Instrumental Techniques (Physical, Chemical, Biological)

Theory

Marks: 100 (I.A. =30 and Theory =70) Duration: 14 weeks (L= 4 hours per week)

Course Objectives:

The objective of this course is to introduce specialized techniques and their application in forensic science. The students will be able to understand the atomic & molecular spectroscopy, physical instrumentation techniques, radiochemical and nuclear techniques, biological and biochemical techniques with their general principles involved as well as their applied aspects.

Unit 1

Atomic & Molecular Spectroscopy

Spectroscopy, electromagnetic spectrum, sources of radiation, their utility and limitations. Conventional sources for UV, visible and infrared rays, sources for shorter wavelength radiations (X-ray tubes), radioactivity, Laser (He, Ne Argon, ion, dye lasers, semi conductor lasers) a source of radiation, interaction of radiation with matter:- reflection,

absorption, transmission, fluorescence, phosphorescence and their forensic applications, radiation filters. Detection of radiations; photographic detectors, thermal detectors, photoelectric detectors etc. Atomic spectra, energy levels, quantum numbers and designation of states, selection rules, qualitative discussions of atomic spectra. Elements of X-ray spectrometry, fluorescence, energy dispersive X-ray analysis (EDX), wavelength dispersive X-ray analysis (WDX), X-ray diffraction, Auger effect. Application of these techniques in forensic science.

Unit 2

Physical instrumentation techniques

IR spectroscopy- correlation of infrared spectra with molecular structure, Fourier transform, infrared (FTIR) and Raman spectroscopy, fluorescence and phosphorescence spectrophotometry, Ultra violet and visible spectrophotometry: Types of sources, filters-cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection.

Fluorescence and phosphorescence spectrometry: Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods. Atomic absorption spectrometry: Instrumentation and techniques, interference in AAS, background correction methods, quantitative analysis. Atomic emission spectrometry: Instrumentation and techniques, arc/spark emission, ICP-AES, comparison ICP vs AAS methods, quantitative analysis, applications. Techniques -RBS (Rutherford Back Scattering spectrometry) Application of these techniques in forensic science.

Unit 3

Radiochemical and Nuclear techniques

Radiochemical techniques: Basic principles and theory, introduction about nuclear reactions and radiations, neutron sources, neutron activation analysis (NAA), Thermal analysis methods: Basic principles and theory, differential scanning calorimetry and differential analysis, thermogravimetry. Nuclear Magnetic Resonance spectroscopy: Basic principles, theory and instrument, Mass Spectrometry, GCMS, LCMS, Secondary Mass Spectrometry, Laser Mass spectrometry, Fast Atom bombardment and liquid secondary Ion Mass

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spectrometry, High performance liquid chromatography, Electrospray Ionization mass spectrometry. Application of these techniques in forensic science.

Unit 4

Biochemical techniques

Biological and biochemical techniques: General principles of Biological/ Bio-chemical Analysis, pH and buffers, Physiological solution, cell and tissue culture, Cell fractionation, Biological variations etc. Centrifugation Techniques, Immuno-chemical Technique, General principles, Production of antibodies, Precipitin reaction, Gel immune-diffusion, Immunoelectrophoresis, complement fixation, Radio Immuno Assay (RIA), Enzyme-linked ImmunoSorbent Assay (ELISA), Fluorescence immune assay. Chromatographic Techniques, Electrophoretic Technique: General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis, Sodium dodecylsulphate (SDS) polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical Electrophoresis. Application of these techniques in forensic science.

Course Learning Outcome

CO 1 To know about the concept of Spectroscopy, electromagnetic spectrum, sources of radiation, their utility and limitations.

CO 2 This paper tends to describe the different Physical instrumentation techniques.

CO 3 To understand basic principles and theory of radiochemical techniques.

CO 4 To highlight general principles of biological and biochemical techniques.

Suggested Readings

1. Robinson, J.W; Atomic Spectroscopy, 2nd Ed. Revised & Expanded, Marcel Dekkar, Inc, New York, 1996.
2. Workman, J; Art Springsteen; Applied Spectroscopy- A compact reference for Practitioners, Academic Press, London, 1997.
3. Subrahmanyam, N. & Lal B; A text Book of Optics, S. Chand & Company, New Delhi, 2004.
4. Willard, H.H. Lynne L. Merrett, J. Dean, A. Frank, A. Settle. J; Instrumental Methods of Analysis, 7th Edn. CBS pub. & Distributors, New Delhi, 1986.
5. Khandpur, R.S; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New

Delhi, 2004.

6. Thomson, K.C. & Renolds, R.J.; Atomic Absorption Fluorescence & Flame Emission Spectroscopy, A Practical Approach, 2nd Edn. Charles Griffith & Company, New SouthWales, 1978.

7. Dudley, H. Williams & Fleming, I; Spectroscopic Methods in Organic Chemistry, 4thEdn, Tata McGraw- Hill Publishing Company, New Delhi, 1994.

Semester II

Course Code: Paper 8: Questioned Documents

Theory

Marks: 100 (I.A. =30 and Theory =70) Duration: 14 weeks (L= 4 hours per week)

Course Objectives:

The objective of this course is to disseminate the knowledge about various types of forensic documents including genuine, forged and holographic documents. It also aims to discuss the Department of Anthropology, University of Delhi

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principles of handwriting, its identification, tools needed for forensic document examination & their use in forensic science. The course will explain the typewritten, printed documents and forgery detection techniques to students

Unit 1

Introduction to Document Examination

Nature and problems of document examination, classification of forensic documents, Specimen/Admitted writings/type writings etc: handling, preservation and marking of documents, importance of natural variations and disguise in writing, various types of forensic documents- genuine and forged documents, holographic documents, principles of handwriting identification, basic tools needed for Forensic Document Examination & their use, analysis of paper and inks.

Unit 2

Handwriting and Signature examination

Various writing features and their estimation, general characteristics of handwriting, individual characteristics of handwriting, ethnic and gender variability of handwriting, various types of forgeries and their detection, examination of signatures – characteristics of

genuine and forged signatures, identification of forger, identification of writer of anonymous letters and application of Forensic Stylistics/Linguistics in the identification of writer, examination of built-up documents and determination of sequence of strokes.

Unit 3

Typewritten and Printed Documents

Identification of typescripts-identification of typist, various types of printing processes, identification of printed matter including printing of security documents and currency notes, identification of electronic typewriters, dot matrix, inkjet and laser jet printers, examination of black and white and color photocopies, fax messages and carbon copies.

Unit 4

Forgery Detection

Determination of age of documents by examination of signatures, paper, ink etc., Examination of alterations, erasures, over writings, additions and obliterations, decipherment of secret writings, indentations & charred documents, physical matching of documents, examination of seal, rubber and other mechanical impressions, examination of counterfeit currency notes, Indian passport/visas, stamp papers, postal stamps etc., examination of fake credit cards, e documents, digital signatures, an introduction of computer forensics, preliminary examination of documents, opinion writings and reasons for opinion.

Course Learning Outcome

CO 1 The paper tends to introduce students to document examination. Also describes classification, variation, nature and problems of document examination.

CO 2 To learn writing features, their estimation, general characteristics, individual characteristics, ethnic and gender variability of handwriting, various types of forgeries and their detection.

CO 3 To identify typescripts, various types of printing processes and their examination.

CO 4 To Determine identification of age of documents by examination of signatures, paper, ink etc.

Suggested reading:

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1. Hilton, O; Scientific Examination of Questioned Documents. Revised Edition, Elsevier, New York, 1982.
2. Osborn, A.S; Questioned Documents, 2nd Ed., Universal Law Publications, Delhi, 1998.
3. Osborn, A.S; The Problem of Proof, 2nd Ed., Universal Law Pub. Delhi, 1998.
4. Thomas, C.C; Identification System for Questioned Documents, Billy Prior Bates Springfield, Illinois, USA, 1971.
5. Harrison, W.R; Suspect Documents Their Scientific Examination, Universal Law Publication, Delhi, 2001.
6. Morris, R.N; Forensic Handwriting Identification, Academy Press, London, 2001.
7. Sheila, K; Graphotypes a new Plant on Handwriting Analysis, Crown Pub. Inc., USA, 1983.
8. Lerinson, J; Questioned Documents, Academy Press, London, 2001.
9. Katherine, M. K; CDE-Forensic Document Examination-Humana Press, New Jersey, 2007.