

Master of Science - Forensic Science

Syllabus - First Semester

FORENSIC BALLISTICS

Course Code: FCH4106

Credit Units: 02

Course Objective: - The objectives of the course:

- To understand the basics of the projectile motion, ballistics and role of ballistics in Forensic Science,
- Classification of different types of firearms and explosives.

Course Contents

Module I: Introduction to Ballistics:

Definition and scope, Firearms, Indian Arms Act, Types of evidences associated, History and mechanism of Muzzleloaders (Match lock, Wheel lock, Flint lock firearms), Briefs of Pinfire, Rimfire and Centrefire systems of firearms, Characteristic features of the firearms, various types of modern firearms, classification of firearms on different basis, bore characteristics Different parameters of classification of firearms, Introduction to Shotgun, Revolver, Pistol, Rifle and Country Made/ Improvised Firearms. Proof Marks of Weapons.

Module II: Firearm Ammunition:

Ammunition Components of Shotgun and Rifled firearm cartridges, Headstamp Markings on Ammunition. Various types of bullets and their compositional aspects, latest trends in their manufacturing and design, smooth bore and improvised ammunition.

Module III: Internal and external Ballistics:

Internal Ballistics: Definition, Shapes and manner of Propellant burning, Muzzle velocity and Factors affecting muzzle velocity.

External Ballistics: Definition- Bullet Trajectory and factors affecting bullet flight. Wound Ballistics: Definition of wound ballistics, Ballistic aspect of firearm injuries, significance of studying cavitations in body, Bullet Entry/Exit Hole Identification, Evaluation of Accident, Suicide, Homicide firearm injuries.

Module IV: Bullet linkage:

Different types of marks produced during firing process on bullet-number/direction of lands and grooves, width of lands and depth of grooves, angle and pitch of rifling, striation marks on lands and grooves, techniques for obtaining test material from various types of weapons and their linkage with fired ammunition, class and individual characteristics

Module V: Range of Firing determination:

Introduction and methods of estimation. Gunshot Residue: Introduction and methods of analysis. Bullet and Cartridges matching: Ejecta, burning, scorching, blackening, tattooing and metal fouling, shots dispersion and GSR distribution, time of firing – different methods employed, and their limitations, stereo & comparison microscopy, automatic bullet and cartridge comparison

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Brain J. Heard; Hand book of Firearms and Ballistics; John Willey, England, 1997.
- D.A. Skoog, D.M. West and F.J. Holler; Analytical Chemistry: An Introduction; Saunders College Publishing, Philadelphia, USA, (1994)
- Dettean, J D; Kirk's Fire Investigation, 5thed, Prentice Hall, Eaglewood Cliffs, N.J (2002)
- Working Procedure Manual: Chemistry, Explosives and Narcotics, BPR&D Pub (2000)
- Hatcher Jury & Weller, 1987: Firearm Investigation Identification and Evidence, The University Book Agency, Allahabad.
- Gunther & Gunther, 1935 : The Identification of Firearms, Woldies, New York
- Jauhri, M. 1980: Monograph on Forensic Ballistics, Govt. of India Publication, New Delhi.
- Burrad, 1951: The Identification of Firearms and Forensic Ballistics.

FORENSIC PHYSICS - PRACTICAL

Course Code: -FCH4107

Credit Units: 02

Course Objective: - The students will understand & perform experiments relating to: Examination of physical properties of physical evidences commonly encountered at the crime scene.

Course Contents: - Lab/Practical	
1.	Examination of physical properties of Soil by microscopy.
2.	Examination of physical properties of Glass by microscopy.
3.	Comparative analysis of paints by TLC.
4.	Solubility test for paints
5.	Comparative analysis of Glass fragments
6.	Size distribution analysis of soil particles.
7.	Mineral test for soil
8.	Casting of tyre marks
9.	Casting of footprints
10.	Comparison of bangles.

Examination Scheme:

IA				EE		
A	PR	LR	V	PR	V	V
5	10	10	5	35		35

Note: IA –Internal Assessment, EE- External Exam, A: Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text and references:

- A Glencoe Program Physics principles and problems: Forensic Laboratory Manual Student edition
- Thomas Kubic, Nicholas Petraco Forensic Science Laboratory Manual and Workbook, Third Edition 2009
- Kathy Mirakovits, Gina Londino, The Basics of Investigating Forensic Science: A Laboratory Manual 2015
- Washington state patrol Forensic Laboratory services: Crime Laboratory: Technical & Training Manuals
- G.H. Stout & L.H. Jensten, X-ray Structure Determination – A practical Guide; 2nd Edn. Wiley, New York, 1989

CRIME SCENE INVESTIGATION (CSI) – PRACTICAL

Course Code: FCH4108

Credit Units: 02

Course Objective: The course focuses on following objectives-

- Developing an understanding and application of Crime Scene Investigation.
- Develop an understanding on processing of crime scene (searching, sketching and photography of Crime scene (Indoor and Outdoor).
- Brief description on procedure adopted for collection, preservation and packaging of Physical evidences.

Course Contents: - Lab/Practical

1. Sketching of the Indoor Crime scene
2. Sketching of the outdoor Crime scene
3. Photography of the Indoor crime scene
4. Photography of the outdoor crime scene
5. Collection, packaging and forwarding of trace evidences by Druggist Fold method.
6. Collection and preservation of various physical evidences (Fingerprint, blood, saliva, fibre, hair etc.).
7. Forwarding of physical evidences.

Examination Scheme:

IA					EE		
A	PR		LR	V	PR		V
5	10		10	5	35		35

Note: IA –Internal Assessment, EE- External Exam, A: Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text and references:

- A Glencoe Program Physics principles and problems: Forensic Laboratory Manual Student edition
- Thomas Kubic, Nicholas Petraco Forensic Science Laboratory Manual and Workbook, Third Edition 2009
- Kathy Mirakovits, Gina Londino, The Basics of Investigating Forensic Science: A Laboratory Manual 2015
- Virginia Department of Forensic Science, Practical and Manuals

FORENSIC AND CRIMINAL INVESTIGATIONS

Course Code: FCH4111

Credit Units: 03

Course Objective: The course focuses on following objectives-

- Developing an understanding and appreciation of the scope of Crime Scene Investigation and Management.
- Develop an understanding on handling of different physical evidences found at the crime scene
- Develop comprehensive knowledge on various investigative techniques used in processing the crime scene.

Course Contents:
Module I: Introduction to Forensic Science Introduction and History of Forensic Science, Basic principles and significance, Utilization of Forensic Science, Forensic Scientist at the scene of crime, Structure of Forensic Labs
Module II: Crime Scene Management Definition and causation of crime, Types of crime scene, Crime scene survey, protection of crime scene, searching of physical evidences, Recording, documentation and presentation in the court, processing and reconstruction of the crime scene.
Module III: Physical Evidences Physical evidences and its types (Fingerprints, glass, fibre, blood, saliva, weapon of crime etc.), Blood spatter analysis, Characteristic blood patterns, testimonial and real evidence, admissibility of scientific evidence and importance of physical evidences, Collection, preservation, packing and forwarding of different types of evidences to the laboratories.
Module IV: Investigation and Interrogation techniques Interviewing of the criminals; methods used by the police in getting information from the criminal; the ethical issues related to the same. Criminal profiling, Portrait Parley, Polygraphy, Narcoanalysis, Brain Fingerprinting, Speech signal processing and pattern recognition – basic factors of sound in speech, acoustic characteristics of speech signal

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Nabar, B. S., Forensic Science in Crime Investigation, Asian Law House, 2001.
- Allison, R., Investigation of Crime Scene, Global vision Publishing House, 2008.
- Bodziak, W., Footwear Impression Evidence (2nd Edn.) CRC Press, Boca Raton, Florida, 2000.
- DeForest, P., Gaensslen, R., and Lee, H., Forensic Science - An Introduction to Criminalistics, McGraw Hill, New York, 1983.
- Fisher, B., Techniques of Crime Scene Investigation (6thEdn.) CRC Press, Boca Raton, Florida, 2000.
- James, S.H., and Nordby, J.J., (Eds), Forensic Science; An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.

INSTRUMENTAL ANALYSIS - CHEMICAL

Course Code: FCH4112

Credit Units: 03

Course Objective The objective of the course is to provide student with practical understanding of working and applications of various instrumentation techniques used in the forensic science laboratory for the chemical analysis of evidences.

Course Contents:
Module I: Chromatographic Techniques General principles, Paper chromatography, column chromatography, TLC, Adsorption chromatography, Partition chromatography, Gas chromatography, Gas- liquid chromatography, Ion-exchange chromatography, Exclusion (permeation) chromatography, Affinity chromatography, HPLC, HPTLC, Capillary Chromatography, Interfacing GC with IR spectrometry
Module II: Mass Spectrometry Sample flow, Ionization methods, Mass analyzer, Vacuum systems, Data handling, Correlation of mass spectra and molecular structure, Fourier transform mass spectrometry, Tandem mass spectrometry, Electrospray ionization mass spectrometry
Module III: Computer aided Analysis -Introduction, Computer organization - Hardware, Circuits for interfacing computers to Instruments, Computer Organization - software, Data representation, The Automated Laboratory.
Module IV: Measurements, Signals and Data Introduction, Signal-to-noise ratio, Sensitivity and detection limit, Sources of noise, Signal-to-noise enhancement, Evaluation and measurement, Accuracy and instrument calibration

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Lindsay S; High Performance Liquid Chromatography, Wiley & Sons NY (1992)
- Handbook of TLC, 2nd Ed, Marcel Dekker; NY (1995)
- Jarris, KE, A.L. Gray et al, Handbook of Inductively Coupled Plasma Mass Spectrometry, Glasgow Blockie, (1992)
- Maclaffrty F.W. & F. Turecek; Interpretation of Mass spectra, 4th Ed., Mill Valley, CA Univ Science Books, (1993)
- Chapman J R; Practical Organic Mass Spectrometry - A Guide for Chemical and Biochemical Analysis, Wiley & Sons, NY (1993)
- H.H Willard et al; Instrumental Methods of Analysis CBS Pub. and Distributors, Delhi (1986).
- Skoog, Holler, Crouch, principles of instrumental analysis, 6th edition, 2007.
- Mendham et al., Vogel's Quantitative Chemical Analysis, Pearson Education Ltd., 2009.
- N. Gray, Instrumental Methods of Analysis, 1st Edition, CBS Publisher, 2011.

SEMINAR

Course Code: FCH4110

Credit Units: 01

Objectives

A seminar is primarily an activity based academic event that is organized to provide the students a one to one and hands on experience on any aspect of their learning for research based activity. Prereq., graduate standing in chemistry/ biochemistry/ Forensic Sciences on consent of instructor. Seminar to acquaint new graduate students with departmental research (This one will be running through out first semesters on every Monday any Lecture, where normally Ph.D. students /internal Faculties /external speakers will give talk on their research or other topic of their specialization).

The trainer has to make sure that the aspects covered are practically practiced by the participants. The evaluation will be done by Board of examiners comprising of the faculties.

Major Themes for Seminar

The seminar may be conducted on any of the following major themes:

- Forensic Science & its related laws
- Criminal Investigations & its proceedings
- Forensic Chemistry
- Forensic Physics
- Forensic Ballistics
- Forensic Fraud Investigations
- Forensic Document Examinations
- Investigative Techniques
- Forensic Analytical Techniques
- Forensic Medicine & Odontology
- Forensic Anthropology Examinations
- Cyber & Digital Forensics
- Any other relevant topics

These themes are merely indicative and other recent and relevant topics of study may be included.

Evaluation Scheme:

Attendance	Active Participation	Multiple Choice Questions/ Quiz	Solving the case/ Assignment/ Write up	Total
10	30	30	30	100

Syllabus - Second Semester

FORENSIC PHOTOGRAPHY

Course Code: FCH4201

Credit Units: 02

Course Objective: This course is designed to:

- Provide foundation knowledge of photography
- Develop an understanding and application of Photography in Forensic Science and CSI

Course Contents:

Module I: Introduction

Introduction to forensic photography; required equipments for photography – Camera, lens, shutter, depth of field, film; Importance of Forensic photography in a crime scene investigation

Module II: Types of Photography & Photo Prints

History and Development of Photography. Basic principles and techniques of Black & White and colour photography. Developing techniques and methods of photography, Different kinds of developers and fixers, modern developments in photography, linkage of cameras and film negatives.

Module III: Photography of various crime scenes

Photography in indoor and outdoor scene of crime. Aerial photography. Surveillance photography – Cameras and accessories for surveillance photography, moving surveillance on foot, 2-person foot surveillance, surveillance with vehicles, fixed surveillance. Use of photography in reconstructing the scene of crime and its presentation in the court of law.

Module IV: Guidance Documentation

Image magnification, U. V. and I. R. illumination in Photography. Photography of Artefactual evidences (Bloodstain, fingerprint, imprints, and micro evidence).

Module V: High-tech Photography for Crime Scene

Digital photography, working principle of digital camera works and basics of digital imaging. videography/ high speed videography, High-speed photography, legal aspects of visual evidence.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Redsicker, D. R., The Practical methodology of Forensic Photography, CRC Press, London, 1994.
- Henry Horeustein; Colour Photography -A working Manual, Little Brown Co. Boston (1995)
- B.H.E. Jacobson, Ray GG Attridge; The Manual of Photography, Focal Press, London (1988)
- Jahne B; Digital Image Processing, Heidelberg Springer (1990) Photography- 2nd Ed. CRC Press LLC (2001)
- R.E. Jacobson, S.F. Ray, G.G. Attridge, N.R. Oxford; The Manual of Photography- Photographic and Digital Imaging, 9th Ed., Focal Press (2000)

ELEMENTS OF FORENSIC MEDICINE, ODONTOLOGY

Course Code: FCH4202

Credit Units: 03

Course Objectives:

During the course the student will

- Understand and appreciate the scope of forensic medicine.
- Know about different types of injuries, causes and manner of death and their medico legal significance
- Learn about the utility of the odontological studies in identification and other medico legal purposes like age, sex and population Determinations.

Course Contents:

Module I: Introduction to Forensic Medicine

Definition of forensic medicine, Cause, manner and characteristics of death. Autopsy, Post mortem changes.

Module II: Wounds and its medico legal significance:

Basic injury production and healing mechanisms, Mechanical injuries (Abrasions, Bruises, Lacerations, Incised and stab wounds) and their medico legal significance.

Module III: Causes and manner of death

Deaths due to Asphyxia, Deaths due to fire, electrocution. Various Sexual

Module IV: Forensic Odontology - I

Definition and Scope of Forensic Odontology, Types of dentition, Basic structure of human teeth, types of teeth & their morphology, and determination of age from teeth using various methods, dental anomalies and their role in Personal Identification.

Module V: Forensic Odontology - II

Bite marks: Types & forensic importance .Collection and preservation of samples, analysis of Bite marks, presentation of bite mark evidences in court of law. Role of Forensic Odontology in mass disaster victim identification.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

References:

- Modi's Medical Jurisprudence and Toxicology, 23rd Edition, by K. Mathiharan & Amrit K. Patnaik, Third reprint, 2009, LexisNexis, Butterworth, New Delhi
- Essentials of forensic medicine, Dr. K. S. Narayan Reddy.
- Forensic Medicine and toxicology, JB Mukherjee, Vol I & II.
- Forensic Dentistry, Paul. G. Stimson & Curtis. A. Mertz, CRC
- Forensic Odontology, Pramod .K. Dayal
- Keith Simpson's , Forensic Medicine
- Glister's Medical Jurisprudence and Toxicology, Churchill Livingstone Dental Anatomy Atlas, Whitaker

QUESTIONED DOCUMENTS

Course Code: FCH4205

Credit Units: 03

Course Objective: The course focuses on following objectives-

- Developing an understanding and appreciation for the scope of Questioned Documents.
- Develop an understanding on different types of questioned documents, the types of forgeries and disguise generally encountered.
- Give brief description on various methods of their detection and examination.

Course Contents:
Module I: Questioned Document: Definition, Importance, Classification and Preliminary Examination of questioned documents. Handwriting: Definition, Scripts, Development, Graphology, Systems of Writing, Instruments and Appliances of handwriting expert. Handwriting Characteristics: General Characteristics, Individual Characteristics, Development of Individuality in Handwriting Comparison of Handwriting: Natural Variations, Fundamental Divergences.
Module II: Forgeries: Forgery and its types and characteristics, identification and examination of forgeries. Decipherment of secret indented and charred documents: Preservation of documents, Examination of seal and other mechanical impressions, examination of sequence of intersecting of strokes. Standards for Comparison and Disguise etc.
Module III: Age of Document & Alterations: Determination of Age of Document- Absolute/relative Age, Indented and Invisible Writings, Alterations in the document: erasures, additions, overwriting and obliterations. Comparison of type written/printed 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.
Module IV : Instrumentation and Photography of Documents: Basic Principles & Techniques Visible and Florescence (UV and IR), Photomicrography & Microphotography, Stereo-zoom Microscopy, Video Spectral Comparator (VSC) and Electrostatic Detection Apparatus (ESDA).
Module V: Report Writing & Court Room Testimony: Evidence and testimony in court, Information required by the Forensic expert, Components of Forensic Reports, Preparation of Report, Presenting findings in a Report format

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Osborn, A. S. (1998). *Classes of Questioned Documents*. Questioned Documents, 2nd edition, First Indian reprint, Universal law publishing co. Pvt. Ltd., New Delhi.
- Kelly, J. S. Lindblom, B. S. (2006). *Science, Handwriting Examination and the Courts. Scientific Examinations of Questioned Documents*, 2nd edition, CRC Press, Taylor & Francis group.
- Huber, A. R. Headrick, A. M. (1999). *The Discrimination and Identification of writing. Handwriting Identification Facts and Fundamentals*, CRC Press, Boca Raton London.
- Saferstein, Richard, *Criminalistics, An Introduction to Forensic Science*, 6th Ed. Prentice-Hall, New Jersey, 1998.
- Sharma, B. R., *Forensic Science in Criminal Investigation and Trials (3rdEdn)* Universal Law Publishing Co. Ltd. New Delhi, 2001.
- Cassidy, M.J., *Footwear Identification*, Royal Canadian Mounted Police, Ontario, Canada, 1980.
- Charles, C. Thomas, *I.S.Q.D. Identification System for Questioned Documents*, Billy Prior Bates, Springfield, Illinois, USA, 1971.
- Charles C. Thomas, *Typewriting Identification I.S.Q.D.*; Billy Prior Bates; Springfield, Illinois, USA, 1971.
- Hard less, H.R., *Disputed Documents, handwriting and thumbs – print identification: profusely illustrated*, Low Book Co., Allahabad, 1988.
- Lerinson, Jay, *Questioned Documents*, Acad Press, London, 2001.
- Morris, Ron, N., *Forensic handwriting identification*, Acad Press, London, 2001.
- Ordway Hilton, *Scientific Examination of Questioned Documents*, Rev. ED., Elsevier, New York, 1982.
- Wilson, R., Harrison, *Suspect Documents – Their Scientific Examination*; Universal Law Publishing, Delhi, 1997.

PHOTOGRAPHY, FORENSIC MEDICINE & ODONTOLOGY - PRACTICAL

Course Code: - FCH4206

Credit Units: 02

Course Objective: Photograph crime scene and present the evidence through photographs and charts and identify individual by using dentition.

Course Contents: - Lab/Practical

1. Identification of individual teeth based on the morphological features.
2. Estimation of age from the teeth.
 1. Living subject
 2. Maxilla & mandible
3. Comparison and Identification of Individuals from bite marks
4. Autopsy observation through visits and recording the files.
5. Camera, its various parts & their importance
6. Taking Photographs
7. Photography of Outdoor Crime Scene
8. Indoor photography including the laboratory
9. Presentation of Evidence through Photograph and charts.

Examination Scheme:

IA				EE		
A	PR		LR	V	PR	V
5	10		10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, A: Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text and references:

- Laboratory Protocols CIMMYT Applied Molecular Genetics Laboratory Third Edition
- Kathy Mirakovits, Gina Londino, The Basics of Investigating Forensic Science: A Laboratory Manual 2015
- Washington state patrol Forensic Laboratory services: Crime Laboratory: Technical & Training Manuals
- G.H. Stout & L.H. Jensten, X-ray Structure Determination – A practical Guide; 2ndEdn. Wiley, New York, 1989
- Redsicker, D. R., The Practical methodology of Forensic Photography, CRC Press, London, 1994.
- R.E. Jacobson, S.F. Ray, G.G. Attridge, N.R. Oxford; The Manual of Photography- Photographic and Digital Imaging, 9th Ed., Focal Press (2000)

QUESTIONED DOCUMENTS & FINGERPRINTS – PRACTICAL

Course Code: FCH4208

Credit Units: 02

Course Objective: - The course focuses on following objectives-

- Developing an understanding and application on Practical aspects of Questioned Documents and Fingerprints.
- Develop an understanding on procedure adopted for examination of different types of questioned documents, the types of forgeries, disguise and their examination along with giving appropriate conclusion on the basis of findings.
- Brief description on identification, analysis and examinations of various kinds of fingerprints and other impressions that are encountered on crime scenes.

Course Contents: - Lab/Practical

1. Examination and comparison of security documents, fake currency and stamp papers.
2. Development of latent finger prints by Chemical methods and photography.
3. Development of latent finger prints by physical methods and photography.
4. Comparison of fingerprints, palm prints along on the basis of ridge characteristics and ridge details.
5. Comparison of forged (disputed) signature with the specimen signatures.
6. Comparison of disguised (disputed) signature with specimen signatures.
7. Examination and comparison of disputed anonymous letter with specimen of suspect/suspects.
8. Identification of altered/added/obliterated/erased/handwriting on cheques and deeds.
9. Ridge counting and ridge tracing.
10. Recording of prints on fingerprint chart.
11. Examination of other impressions and photography.

Examination Scheme:

IA				EE			
A	PR	LR	V	PR	LR	V	
5	10	10	5	35		35	

Note: IA –Internal Assessment, EE- External Exam, A: Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text and references:

- A Glencoe Program Physics principles and problems: Forensic Laboratory Manual Student edition
- Thomas Kubic, Nicholas Petraco Forensic Science Laboratory Manual and Workbook, Third Edition 2009
- Kathy Mirakovits, Gina Londino, The Basics of Investigating Forensic Science: A Laboratory Manual 2015
- Washington state patrol Forensic Laboratory services: Crime Laboratory: Technical & Training Manuals
- Bridges, B. C., Vollmar, A. Monir, M., Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting, Expert Testimony Opinion Evidence, The University Book Agency, Allahbad, 2000.

INSTRUMENTAL ANALYSIS – BIOLOGICAL

Course Code: FCH4209

Credit Units: 03

Course Objective: The objective of the course is to provide student with practical understanding of working and applications of various instrumentation techniques used in the forensic science laboratory for the analysis of biological evidences.

Course Contents:

Module I:

General Principles of Biological/ Bio-chemical Analysis

pH and buffers, Physiological solution, Cell and tissue culture, Cell fractionation.

Outline of Genetic Manipulations, Enzymes in genetic manipulation, Cloning procedures, Isolation of specific nucleic acid sequences – complementary DNA, Gene libraries, Colony hybridisation, Nick translation, Oligo nucleotide probes, Expression of genes

Module II:Centrifugation Techniques

Basic principles of sedimentation, Various types of centrifuges, Density gradient centrifugation, Preparative centrifugation, Analysis of sub-cellular fractions, Ultra-centrifuge- Refrigerated Centrifuges

Module III: Electrophoretic Technique

General principles, Factors affecting electrophoresis, Low voltage thin sheet electrophoresis, High voltage electrophoresis, Sodium dodecyl sulphate (SDS) polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical Electrophoresis

Module IV:Immuno-chemical Techniques

General principles, Production of antibodies, Precipitin reaction, Gel immuno-diffusion, Immunoelectrophoresis, complement fixation, Radio Immuno Assay (RIA), ELISA, Fluorescence immuno assay.

Module V: Microscopy

Basic principles, Simple and Compound microscope, Comparison microscope, Phase contrast Microscope, Stereoscopic microscope, Polarizing microscope, Fluorescent Microscopy, Infra-red Microscopy, Scanning Electron Microscope (SEM) & Transmission Electron Microscope (TEM)

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Baker DR.; Capillary- Electrophoresis, NY (1995)
- H.H Willard et al; Instrumental Methods of Analysis CBS Pub. and Distributors, Delhi (1986)
- Bryan L.William& Keith Wilson; Principles & Techniques of Practical Biochemistry, Edward Arnold Pub. (1975)
- Keith Wilson & John Walker; Practical Biochemistry- Principles & Techniques, 5th Ed., Cambridge University Press (2000)
- David. L.Nelson& Michael M, Cox Lenninges; Principles of Biochemistry, 4th Ed., Freeman Pub. (2005).
- LeremyM.Beig, John L. Tymoczko, LubertStryes; Biochemistry5th Ed., Freeman Pub. (2003)
- Genes VIII, Lewin International Edition, Pearson Prentice Hall,(2004)

- Watson Gillman, Witkowski, Zolles; Recombinant DNA, 2nd Ed., Scientific American Books, (1998)
- George M. Malacinski; Essentials of Molecular Biology, 4th Ed. Jones and Bartlet Pub. (2003).
- Daniel L. Nartl& Elizabeth W. Jones; Genetics- Principles and Analysis, 4th Ed., Jones & Bartlet Pub (1998)
- Gardnes&Snustd; Principles of Genetics 6th Ed., John Wiley & Sons (1981)
- D.M.Weir; Hand Book of Experimental Immunology, 2nd Ed., Blackwell Pub. (1973)
- Ivan M.Roett; Essential Immunology, 6th Ed., Blackwell Pub. (1988).

FINGERPRINT SCIENCE

Course Code: FCH4210

Credit Units: 03

Course objective:

- Developing an understanding and appreciation for the scope of Fingerprints.
- Develop comprehensive knowledge on fingerprint patterns, fingerprint classification, the various methods of fingerprint development.

Course Content:
Module I: Introduction to Fingerprints Dactylography, Dermatoglyphics, and Dactyloscopy, basis for the science of fingerprints, Friction Ridge Skin, Morphogenesis of Friction Ridge Skin, Primary Dermal Ridge Development, Definition of fingerprint, History of Fingerprint Identification, Fingerprint as forensic Evidence, Visible Fingermarks, Latent Fingermarks,
Module II: Classification of Fingerprints for Comparison purposes: Pattern area, Core, Delta, Type lines, ridge characteristics, Fingerprint Pattern Types: Essentials and its types of Loop, Arch, whorl, Composites, accidental patters etc., Ten Digit and Single Digit fingerprint classification
Module III: Methods of Taking Fingerprints: From living and dead persons, preserving and lifting of fingerprints. Comparison Protocols: Class and individual characteristics (Galton's details), different ridge characteristics, Standards of proof, Automatic Fingerprint Identification System (AFIS), Poroscopy and Edgescopy.
Module IV: Fingerprint Developing Methods: Chemistry of latent fingerprint residue, factor contributing to latent fingerprints, Methods of Development of latent fingerprints using conventional methods–Powdering (Black and grey, fluorescent and magnetic), Fuming method, Vacuum Metal Deposition (VMD) Method, Chemical method, Reagent chemistry and formulations,, Photography of fingerprints.
Module V: Report Writing & Court Room Testimony: Evidence and testimony in court, Information required by the Forensic expert, Components of Forensic Reports, Preparation of Report, Presenting findings in a Report, Expert and the rules of evidences, Daubert's challenges to fingerprints

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Nath, S., Fingerprint Identification, CRC Press, 2nd edition, 2002.
- Champhod, C., Fingerprint and other ridge skin impressions, CRC Press, 2004.
- Bridges, B. C., Vollmar, A. Monir, M., Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting, Expert Testimony Opinion Evidence, The University Book Agency, Allahabad, 2000.
- James, S. H. and Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientific and Investigation Techniques, CRC Press, London, 2003.
- Nanda, B. B., and Tiwari, R. K., Forensic Science in India. Select Publishers, New Delhi, 2001.
- Saferstein, Richard, Criminalistics, An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
- Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rdEdn) Universal Law Publishing Co. Ltd. New Delhi, 2001.

SEMINAR/WORKSHOP/TERM PAPER

Course Code: FCH4212

Credit Units: 01

Objectives

A seminar is primarily an activity based academic event that is organized to provide the students a one to one and hands on experience on any aspect of their learning for research based activity. Prereq., graduate standing in chemistry/ biochemistry/ Forensic Sciences on consent of instructor. Seminar to acquaint new graduate students with departmental research (This one was for second semester students to attained and fourth semester students had to present on one selected topic of their choice or Ph.D. students/ internal faculties /external speaker will give talk).

The trainer has to make sure that the aspects covered are practically practiced by the participants. The evaluation will be done by Board of examiners comprising of the faculties. This one will be one time event in one semester.

Major Themes for Seminar

The seminar may be conducted on any of the following major themes:

- Forensic Science & its related laws
- Criminal Investigations & its proceedings
- Forensic Chemistry
- Forensic Physics
- Forensic Ballistics
- Forensic Fraud Investigations
- Forensic Document Examinations
- Investigative Techniques
- Forensic Analytical Techniques
- Forensic Medicine & Odontology
- Forensic Anthropology Examinations
- Cyber & Digital Forensics
- Any other relevant topics

These themes are merely indicative and other recent and relevant topics of study may be included.

Evaluation Scheme:

Attendance	Active Participation	Multiple Choice Questions/ Quiz	Solving the case/ Assignment/ Write up	Total
10	30	30	30	100

Syllabus - Third Semester

FORENSIC CHEMISTRY, TOXICOLOGY & PHARMACOLOGY

Course Code: FCH4301

Credit Units: 03

Course Objectives:

During the course the student will;

- Understand the scope of forensic chemistry, toxicology and pharmacology.
- Understand and appreciate the scope, diversity and utility of a variety of chemical analysis
- Learn the principles of primary techniques used for forensic identification of various chemicals, drugs and poisons

Course Contents

Module I: Introduction to Forensic Chemistry

Forensic Chemistry: Introduction, types of cases/exhibits, preliminary screening, presumptive test (colour and spot test), inorganic analysis, micro – chemical methods of analysis, Analysis of petroleum products.

Module II: Toxicology of alcohol & Examination of Alcoholic Beverages

The fate of alcohol in the body, alcohol in the circulatory system, breath test instruments, field sobriety testing, Examination of alcoholic beverages; country made liquor, illicit liquor. Analysis of blood for alcohol.

Module III: Drugs of Abuse

Introduction, classification of drugs of abuse, drugs of abuse in sports and doping, narcotics drugs and psychotropic substances, designer drugs and their forensic examination, Drugs and Cosmetic Act, Excise Act, NDPS Act.

Module IV: Introduction to Toxicology

Definition, Law relating to poison, Classification of poisons. Action of poisons & factors modifying its action, routes of administration of poisons.

Module V: Forensic Pharmacology

Pharmacology and toxicology of Psychotropic Drugs: Sedatives, Stimulants, Opiates and drugs of abuse. Extraction, Isolation of drugs from viscera, tissues and body fluids.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

References:

- A Burger; Medicinal Chemistry, Vol. II, Wiley Interscience, New York; (1970)
- A.I Vogel; Textbook of Practical Organic Chemistry including Qualitative Organic Analysis; ELBS, Essex (1971)
- Boudreau, JE et al – Arson & Arson Investigation, Survey & Assessment National Institute of Law Enforcement, U.S Dept. of Justice, US Govt. Printing Press (1977)
- Clark, E.G.C., Isolation and identification of Drugs, Vol. I and Vol. II, Academic Press, 1986.
- Cravey, R.H., Baselt, R.C., Introduction to Forensic Toxicology, Biochemical publications, Davis C A, 1981.
- Gleason, M.N. et.al, Clinical Toxicology of Commercial products, Williams and Williams, Baltimore,

FORENSIC BIOLOGY & SEROLOGY

Course Code: FCH4302

Credit Units: 03

Course Objective: This course will cover:

- The important biological evidences commonly found at crime scene
- Significance of forensic anthropology, and forensic botany.
- Importance of serology and DNA analysis in interpretation of crime.

Course Contents:

Module-I: Hair & Fibre

Structure of hair and its biochemical properties, Phases of hair growth, types of hair. Differences between animal and human hair, Forensic examination of different types of hairs. Different Types of fibres and their identification.

Module-II: Introduction To Botanical Evidences & Diatoms

Different botanical evidences of forensic significance: seeds, pollens etc. Diatoms: Classification, basic structure and morphology, forensic significance of diatoms.

Module-III: Introduction To Forensic Anthropology

Definition and scope of forensic anthropology, Human skeletal system and Types of bones. Estimation of age from skull and long bones, site and side determination. Estimation of Stature from skeletal remains. Determination of sex from skull, mandible and pelvis.

Module-IV: Introduction To Forensic Serology

Definition and scope of forensic serology. Nature, composition and functions of blood and other fluids. Collection, preservation and packing of Biological fluids. Introduction to ABO, Rh, MN systems, Lectins – their forensic significance, Determination of secretor/ non secretor status. Antigens- Antibody reactions.

Module-V: DNA Profiling

DNA Profiling: Introduction, History of DNA Typing, molecular biology of DNA, variations, polymorphism, DNA Extraction-Organic and Inorganic extraction, Extraction methods
DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism.
Evaluation of results, analysis of STR, SNP and Mitochondrial DNA, YSTRs, PCR amplifications, FTA cards, Forensic applications of DNA profiling, limitations of DNA profiling

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text References:

- Pandey, B. P., Plant Anatomy; S. Chand, New Delhi, 1998.
- Biology Methods manual, Metropolitan Police Forensic Science Laboratory, London, 1978.
- Byrd, J. H. & Castner, J. L., Forensic Entomology, The Utility of Arthropods in legal Investigation, CRC Press, USA, 2000.
- Catts, E.P & Haskell N.H., Entomology and death: A procedural guide, Joyce's Print Shop, 1990.
- Mauersberger, Herbert R., & Mathews, Textile Fibres – Their physical, Microscopic and chemical properties, John Wiley, New York, 1954.

- Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice – Hall, Englewood Cliff, New jersey; (1982)
- Smith; DGV; A manual of Forensic Entomology Ithaca New York Camstock Univ. Press, USA, (1986)
- 00Fisher, B., Techniques of Crime Scene Investigation (6thEdn.) CRC Press, Boca Raton, Florida, 2000.

FORENSIC BIOLOGY & SEROLOGY PRACTICAL

Course Code: FCH4304

Credit Units: 02

Course Objective: This course will cover:

- The practical aspects of forensic biology, anthropology, and serology
- To collect, pack and analyse biological, anthropological, & serological evidences
- To document chain of custody, write laboratory reports pertaining to the examinations conduct presumptive and confirmatory tests for evidence

Course Contents: LAB/PRACTICAL

- Determination of species of origin from blood & other biological evidences using precipitin test
- Presumptive and Confirmatory tests for blood Examination and Identification body fluids
- Microscopic Examination of Hair for the determination of different types of medulla & scale
- Microscopic Examination of Hair for the determination of species Gel Immuno Diffusion tests for species origin
- Blood grouping from dried stains by Absorption Inhibition or Absorption Elution
- Analysis of fibre
- Extraction /Isolation of Diatoms from water/soil, tissues & Identification
- Identification of bones based on its morphology and anatomical planes
- Sex Determination from Skull, Mandible, Pelvis & long bones
- Age Estimation from Skull, Mandible, Long bones
- Sexing from Barr Bodies

Examination Scheme:

IA				EE			
A	PR		LR	V	PR		V
5	10		10	5	35		35

Note: IA –Internal Assessment, EE- External Exam, A: Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text and references:

- Lab Procedures by V Veeraraghavan, S Lukose
- Laboratory Protocols CIMMYT Applied Molecular Genetics Laboratory Third Edition
- Kathy Mirakovits, Gina Londino, The Basics of Investigating Forensic Science: A Laboratory Manual 2015
- Washington state patrol Forensic Laboratory services: Crime Laboratory: Technical & Training Manuals
- G.H. Stout & L.H. Jensten, X-ray Structure Determination – A practical Guide; 2nd Edn. Wiley, New York, 1989
- Redsicker, D. R., The Practical methodology of Forensic Photography, CRC Press, London, 1994.

FORENSIC CHEMISTRY & TOXICOLOGY - PRACTICAL

Course Code: FCH4305

Credit Units: 02

Course Objective:

The students will understand & perform experiments related to:-

- Isolation techniques for different poisons.
- Analysis of different poisons.
- Spot tests for different cations and Anions

Course Contents: - Lab/Practical

- Isolation techniques of different toxic substances.
- TLC of insecticides, Barbiturates and other drugs.
- Analysis of volatile and non-volatile poisons.
- Analysis of vegetable poisons.
- Spot test of nitrates, nitrites, carbonates, sulphates, sulphites, chlorates.
- Spot test of mercury, iron, copper, Aluminium and cadmium and zinc and other metallic poisons

Examination Scheme:

IA				EE			
A	PR		LR	V	PR		V
5	10		10	5	35		35

Note: IA –Internal Assessment, EE- External Exam, A: Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text and references:

- A Glencoe Program Physics principles and problems: Forensic Laboratory Manual Student edition
- Thomas Kubic, Nicholas Petraco Forensic Science Laboratory Manual and Workbook, Third Edition 2009
- A. I. Vogel Textbook of Practical organic Chemistry including Qualitative organic analysis
- Isolation and identification of Drugs by E.G.C. Clark
- Bryan L. William & Keith Wilson; Principles & Techniques of Practical Biochemistry, Edward Arnold Pub. (1975)
- K. Nakanishi, Infrared absorption spectroscopy - practical, Holden-Day, Inc., San Francisco and Nankodo Company Ltd., Tokyo, 1962.

STATISTICS & RESEARCH METHODOLOGY

Course Code: FCH4315

Credit Units: 03

Course Objective: This course is designed to:

- Provide foundation knowledge of quantitative and qualitative research methods used in Forensic Sciences.
- Provide understanding of the use of survey, field, and qualitative research techniques to develop practice knowledge;
- Describe distributions in terms of shape, centre, and spread including the ability to construct visual displays of data (charting, graphing);
- Provide an understanding of and ability to use the basic principles of statistical inference.

Course Contents:

Module I: Introduction to Research

Research– its definition and objectives, Types of Research, Research process, defining the research problem, research design.

Module II: Sampling

Principles, methods: census and sample survey, sample design. Types of sampling, rationale for using a particular sampling procedure.

Module III: Tools of Data Collection

Observation, interview schedule, questionnaire, Survey, case study methods

Module IV: Statistics

Introduction, Descriptive Statistics: Frequency distribution, class intervals, graphical presentation: bar diagram, histogram, pie chart; Measures of Central Tendency: mean, median, mode; measures of dispersion: variance and std. deviation.

Module V: Parametric and nonparametric statistics

Methods of correlation, skewness and Kurtosis variance, Types of correlation (Pearson r& Rho); Tests of significance. Level of significance, one sample, two samples and k-samples, Kruskal-Wallis ANOVA.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Broota, K.D., Experimental designs in psychological research, Wiley eastern, New York, 1992.
- Guilford, Statistics in Psychology and Education, McGraw hill, New York, 1986.
- Katz and Kahn, Research in Behavioural Sciences, Methuen, USA, 1979.
- Kerlinger, F., Foundations of Behavioural Research, Surjeet Publications, Delhi, 1983.
- Rajamanickam, M., Statistical Methods in Psychological and Educational Research, Concept Publishing Co. New Delhi, India, 1983.
- Smith, Jonathan, A. (Ed.), Qualitative Psychology: A Practical Guide to Research Methods, Sage Publications, 2003.
- Woodworth and Schlosberg, Experimental Psychology, Methuen and co. ltd, London, 1971.

INSTRUMENTAL ANALYSIS - PHYSICAL

Course Code: FCH4316

Credit Units: 03

Course Objective: The objective of the course is to provide student with practical understanding of working and applications of various instrumentation techniques used in the forensic science laboratory for the analysis of evidences.

Course Contents:

Module I : Basic Concepts - Atomic & Molecular Spectroscopy

Introduction to Atomic orbitals, spectra, Bohr Model. Quantum Theory, molecular orbital, types of molecular energies, vibrational and electronic spectra, IR spectroscopy- correlation of infra-red spectra with molecular structure, Raman spectroscopy, fluorescence and phosphorescence spectrophotometry FTIR Spectroscopy

Module II:

Ultra-violet and visible spectrophotometry: Types of sources and stability, wavelength selection, filters, reference cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection (Single beam and double beam)

Fluorescence spectrophotometry: 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, Applications in Forensic Science.

Atomic emission spectrometry: Instrumentation and techniques, arc/spark emission, comparison of ICP vs AAS methods, quantitative analysis, applications in forensic science.

X-ray spectroscopy: X-ray absorption and fluorescence methods, X-ray diffraction, Applications in Forensic Science.

Module III: Other Techniques

Introduction, principles, theories and basic instrumentation: Neutron Activation Analysis (NAA), differential scanning calorimetry and differential analysis thermogravimetry
Radio chemical technique, thermal Analysis along with forensic applications

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- James W. Robinson; Atomic Spectroscopy, 2nd Edn. Revised & Expanded, Marcel Dekkar, Inc, NY. (1996)
- V.B. Patania; Spectroscopy, Campus Books International, (2004)
- Jerry Workman, Jr, Art Springsteen; Applied Spectroscopy-A compact reference for Practitioners, Academic Press (1997)
- N.Subrahmanyam & Brij Lal; A text Book of Optics, S. Chand & Co. (2004).
- Gurdeep R. Chatwal & Sham K. Anand; Instrumental Methods of Chemical Analysis, Himalaya Pub. House (2004).
- Hobart H. Willard, Lynne L. Merrett Jr, John A Dean Frank A. Settle Jr; Instrumental Methods of Analysis, 7th Edn. CBS Pub. & Distributors (1986)

- R.S.Khandpur; Handbook of Analytical Instruments, Tata McGraw Hill Pub.Co. New Delhi (2004)
- John A. Dean; Analytical Chemistry Handbook, McGraw Hill Inc. (1995)
- K.C.Thompson& R.J. Renolds; Atomic Absorption Fluorescence & Flame Emission Spectroscopy, aPractical Approach, 2nd Edn. Charles Griffin & Co. (1978)
- John C. Lindon, George E. Tranter & John L. Holmes; Encyclopaedia of Spectroscopy & Spectrometry, Academic Press (2000)
- Colin N. Banwell& Elaine M, Mc. Cash; Fundamentals of Molecular Spectroscopy 4th Edn, Tata McGraw-Hill Pub. Co. New Delhi (1995)
- R.Murugesan; Optic & Spectroscopy, S.Chand& Co. (1998)
- Jack L Koeing; Spectroscopy of Polymers, 2nd Edn., Elsevier pub. Co. (1999)
- Kamlesh Bansal; Analytical Spectroscopy Campus, Books International (2000)
- D.R.Khanna& H.R. Gulati; Fundamentals of Optics Geometrical Physical & Quantum, 20th Edn., R. Chand & Co. (2002)
- Francis A.Jenkins; Fundamentals of Optics, 4th Edn., McGraw Hill Book Co. Auckland (1981)
- K.Thyagarajan; Lasers Theory & Applications, Macmilan, India Delhi (2004)
- H.D.Bist; Lasers and their applications in the Indian Context, Tata McGraw Hill Pub. Co, New Delhi (1985)
- John D.Cutnell& Kenneth W Johnson; Physics 5th Edn., John Wiley & Sons Inc., NY. (2002)
- E.R.Mengel; Laser Spectroscopy Techniques & applications, Marcel Dekker NY (1995)
- E.R.Mengel; Fluorescence in Forensic Science in Encyclopedia of Analytical Chemistry, Wiley & sons (2000)
- G.R. Chatwal; Analytical Spectroscopy 2nd Edn, Himalaya Pub. House (2002)

SEMINAR/WORKSHOP/TERM PAPER

Course Code: FCH4318

Credit Units: 1

Objectives

A workshop/seminar is primarily an activity based academic event that is organized to provide the students a one to one and hands on experience on any aspect of their learning. The communication in a workshop has to be necessarily two ways. The trainer has to make sure that the aspect covered is practically practiced by the participants. The student will choose the option of workshop from amongst their concentration electives. The evaluation will be done by Board of examiners comprising of the faculties.

Major Themes for Workshop

The workshop may be conducted on any of the following major themes:

- Crime Scene Investigation
- Forensic Toxicology
- Forensic Anthropology
- Handwriting & Typewriting Analysis
- Crime Scene Investigation
- Criminology, Criminal Law & Police Administration
- Fingerprint Science
- Forensic Serology
- DNA Fingerprinting
- Wounds & its Medico-Legal Aspects

These themes are merely indicative and other recent and relevant topics of study may be included.

Guidelines for Workshop

The procedure for earning credits from workshop consists of the following steps:

- i. Relevant study material and references will be provided by the trainer in advance.
- ii. The participants are expected to explore the topic in advance and take active part in the discussions held
- iii. Attending and Participating in all activities of the workshop
- iv. Group Activities have to be undertaken by students as guided by the trainer.
- v. Evaluation of workshop activities would be done through test and quiz at the end of the workshop.
- vi. Submitting a write up of at least 500 words about the learning outcome from the workshop.

Methodology

The methodology followed at the workshop could be based on any one or more of the following methods:

- i. Case Study
- ii. Simulation
- iii. Quiz
- iv. Quality analysis & characterization
- v. Identification and preparation of materials

Evaluation Scheme:

Attendance	Active Participation	Multiple Choice Questions/ Quiz	Solving the case/ Assignment/ Write up	Total
10	30	30	30	100

ADVANCED FORENSIC BIOLOGY & ANTHROPOLOGY

Course Code: FCH4306

Credit Units: 03

Course Objectives:

During the course the student will

- Understand and appreciate the scope of forensic biology and Forensic Anthropology.
- Understand and appreciate the scope, diversity and utility of a variety of Human, Animal and plant evidences and their examination
- Learn the primary technique used for identification of various biological evidences
- Acquire the knowledge on techniques presently being used in the forensic examination of biological evidences and skeletal remains

Course Contents

Module I: Introduction to Wild Life Forensics

Introduction to wildlife forensics, Examination of pug marks, horn, skin, fur, hair, nail and teeth. Identification of some endangered species of plants and animals. Wildlife life protection Act.

Module II: Forensic Entomology & Forensic microbiology

Collection of insects, Shipment of collected insects, Identification of insect and its stage of growth. Determination of the post-mortem interval or "time since death" in homicide investigations, forensic entomotoxicology. Introduction to forensic microbiology

Module III: Forensic Anthropology

Somatometry, osteometry&Cranimetry. Identification of individuals from skeletal remains, Collection, Handling, preservation of skeletal remains of forensic science and report writing.

Module IV: Forensic Taphonomy, Forensic Radiology

Forensic Taphonomy. Fire modification of bones, Assessment of ante mortem and post-mortem skeletal trauma. Artefacts in the skeletal remains. Application of radiology in forensic anthropology

Module V: Super Imposition & Facial Reconstruction

Superimposition techniques. Facial reconstruction; three dimensional and computer assisted facial reconstruction

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Richard Saferstein; Forensic Science Hand Book; Ed.; Prentice – Hall, Englewood Cliff, New jersey; (1982)
- Biology Methods manual, Metropolitan Police Forensic Science Laboratory, London, 1978.
- Byrd, J. H. &Castner, J. L., Forensic Entomology, The Utility of Arthropods in legal Investigation, CRC Press, USA, 2000.
- Encyclopaedia of Forensic Sciences, Volume, I, II, III & IV, Edited By Jay A. Siegel, Geoffrey
- C. Knifer & Pekka Saukko, Academic Press, 2000 A laboratory manual on Biological Anthropology, Anthropometry, Indira P. Singh, M.K. Basin,: Kamal Raj Enterprises, 1989
- Advances in Forensic Taphonomy: Method, Theory, and Archaeological Perspectives ,William D. Haglund, Marcella H. Sorg, CRC Press; 1 edition, 2001
- Brogdon's Forensic Radiology, Second Edition, Edited by Michael J. Thali, Mark D. Viner, B.G. Brogdon, Published November 22nd 2010 by CRC Press – 654 pages

CYBER FORENSIC & COMPUTER APPLICATIONS

Course Code: FCH4317

Credit Units: 03

Course Objective: The objectives of the course are to:

- Provide students with a technical skills and competencies in the field of forensic computing thus producing competent and confident graduates.
- Produce students who will have a hands-on knowledge and able to perform technical role in forensic computing field.
- Equip students with the right skills thus enabling them to adapt real working environment, while contributing positively to the society at large.

Course Contents:
Module I: Computer Fundamentals - I Computer characteristics and classifications, Concept of Computer Hardware, Concept of Computer Software
Module II: Computer Fundamentals - II Fundamentals of programming languages, Concept of Algorithm and Flow Chart, Networking and Internet Concepts
Module III: Data Storage Fundamentals Data Storage Devices, Storage Fundamentals (Sector, Cluster, FAT, etc.), File System Concepts, Data Storage and Recovery, Basics of Operating System Software
Module IV: Pattern Recognition & Biometrics Pattern Recognition & Biometrics – Face, Iris & retinal imaging, Speech recognition, finger and palm print, gait pattern, signatures, Pattern comparison, Image processing – Proactive Forensic science
Module V: Cyber Crimes, Search and Seizures of Evidence Cyber Crimes – definition, IT laws – Introduction, internet, hacking, virus, obscenity, pornography, programme manipulation, software piracy, intellectual property and computer security etc., Encryption and Decryption methods, Investigation of cyber-crimes and tools for analysis

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- James, S.H. and Nordby, J.J. Eds., Forensic Science An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
- Leshin, C.B., Internet Investigation in Criminalistics, Prentice Hall, New Jersey, 1997.
- Tessarolo, A.A. and Marignani, A., Forensic Science and the Internet. The Canadian Society of Forensic Science Journal, Vol. 29, 1996.
- BernadJahne: Digital Image processing, Springer Verlag (1993)

ADVANCED QUESTIONED DOCUMENTS EXAMINATION

Course Code: FCH4310

Credit Units: 03

Course Objective: The course focuses on following objectives-

- Developing an understanding and appreciation for the scope of Questioned Documents Examination.
- Develop an understanding on different types of cases in questioned documents and different writing conditions.
- Brief description on case presentation and report writing.
- Develop comprehensive knowledge on advanced Instrumentation techniques used for examination.

Course Contents:

Module I: Various Questioned documents cases

Disputed documents - wills, deeds, cheques, suicide letters, anonymous letters, threatening letters, stamps fraud, fake currencies, fake paintings and printing, fake rubber stamps and seals, Tampered documents, charred documents, Computer generated/ electronic documents/ typed and photocopied documents

Module II: Personality assessment and Different Writing Condition

Evaluation of personality and psychological traits from handwriting, Evolutionary phases in handwriting, effect of age factor in handwriting and variations in handwriting characteristics, effect of alcohol and drugs on handwriting characteristics/ signatures.

Module III: Report writing and case representation

Expert's opinion, examination in chief, cross examination, re-examination, oath taking, summons for evidences, report writing and case representation in court of law as Moot court.

Module IV: Instrumentation in Questioned Documents

Camera, Compound microscope, Stereo microscope, magnifying glasses, illuminated torch, Video Spectral Comparator, Docu-centre, color filters, Osborn's scale, geometrical requirements, Projectina, ESDA, Transmitted light apparatus, Oblique light, UV and IR radiations, TLC and Paper Chromatography.

Module V : Security Documents

Brief description on of security documents, security and verification features of passports, credit cards, cheques etc., Types of security documents, Salient features for identifications, Instrumentation used for their Examination

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Albert, S. Osborn, Questioned Documents, Second Ed., Universal Law Publishing, Delhi, 1998.
- Charles, C. Thomas, I.S.Q.D. Identification System for Questioned Documents, Billy Prior Bates, Springfield, Illinois, USA, 1971.
- Kelly, J. S. Lindblom, B. S. (2006). Science, Handwriting Examination and the Courts. Scientific Examinations of Questioned Documents, 2nd edition, CRC Press, Taylor & Francis group.

- Huber, A. R. Headrick, A. M. (1999). The Discrimination and Identification of writing. Handwriting Identification Facts and Fundamentals, CRC Press, Boca Raton London.
- Ordway Hilton, Scientific Examination of Questioned Documents, Rev. ED., Elsevier, New York, 1982.
- Wilson, R., Harrison, Suspect Documents – Their Scientific Examination; Universal Law Publishing, Delhi, 1997.
- Charles C. Thomas, Typewriting Identification I.S.Q.D.; Billy Prior Bates; Springfield, Illinois, USA, 1971.
- Hard less, H.R., Disputed Documents, handwriting and thumbs – print identification: profusely illustrated, Low Book Co., Allahabad, 1988.
- Kurtz, Sheila, Graphotypes a new plant on handwriting analysis, Crown Publishers Inc., USA, 1983.
- Lerinson, Jay, Questioned Documents, Acad Press, London, 2001.
- Morris, Ron, N., Forensic handwriting identification, Acad Press, London, 2001.

ADVANCED FINGERPRINTING & OTHER IMPRESSIONS

Course Code: FCH4311

Credit Units: 03

Course Objective: The course focuses on following objectives-

- Developing an understanding and appreciation for the scope of Fingerprints and Examination.
- Develop an understanding on fingerprint and its characteristics, classification and advanced methods adopted to develop fingerprints of various surfaces.
- Give brief description on various methods of their detection and examination.
- Develop comprehensive knowledge and skills on poroscopy, edgescopy and advanced instrumentation techniques adopted to examine fingerprints and other impressions.

Course Contents:

Module I: Fingerprints in Personal Identification

History of fingerprints, Significance of fingerprints in personal identification, Fingerprint ridge characteristics: class and individual, ridge counting and ridge tracing, Comparison of fingerprints on the basis of ridge characteristics and details.

Module II: Fingerprint Classification & Case representation

Fingerprint handling, collection and preservation, significance of fingerprint as evidence, Classification systems for fingerprints – Henry’s system, Batley’s system and Extension of Henry’s system, recording of fingerprints, report writing and appearing as an expert in court of law – Moot court.

Module III: Introduction to Poroscopy&Edgescopy

Introduction: Poroscopy and edgescopy, Fingerprints Examination on the basis of poroscopy and its significance, evaluation of fingerprints on the basis of edgescopy and its significance in fingerprint field.

Module IV: Advanced Methods of Recording & examination of Fingerprints

Chemical and physical methods and procedure adopted for development of fingerprints, photography of fingerprints, Digital imaging and enhancement, Automatic fingerprint identification system, application of radiations to examine latent fingerprints on various surfaces including skin.

Module V: Palmer, Plantar & Other impressions

Palm, sole and foot prints – importance, Casting of footprints, taking of control samples, different types of tyre marks and tool marks encountered, significance of tyre marks and tool marks, evaluation and its examination.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Nath, S., Fingerprint Identification, CRC Press, 2nd edition, 2002.
- Champhod, C., Fingerprint and other ridge skin impressions, CRC Press, 2004.
- Bridges, B. C., Vollmar, A. Monir, M., Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting, Expert Testimony Opinion Evidence, The University Book Agency, Allahabad, 2000.
- Komarinski, P, Automated Fingerprint Identification Systems, Elsevier Academic Press, 2005.

- James, S. H. and Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientific and Investigation Techniques, CRC Press, London, 2003.
- Nanda, B. B., and Tewari, R. K., Forensic Science in India. Select Publishers, New Delhi, 2001.
- Saferstein, Richard, Criminalistics, an Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
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- Cossidy, M.J., Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada, 1980.

Syllabus - Fourth Semester

RESEARCH PAPER/REVIEW/ SEMINAR

Course Code: FCH4407

CreditUnits: 1

Course Objective:

Students will be introducing to learning the written and oral communication of technical information. Assignments include writing and presenting proposals, reports, and documentation. Emphasis on use of rhetorical analysis, computer applications, collaborative writing, and usability testing to complete technical communication tasks in the workplace.

Course Contents:

Module I: Technical Writing Process

Technical Writing: Scientific and technical subjects; formal and informal writings; formal writings/reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes; common errors to be avoided.

Module II: Journal paper writing

Journal paper writing: Abstract for paper and poster, different kind of journal for forensic Sciences, impact factors of journals, ISBN number, Citation, H-index.

Module III: Documentation Process

Writing Skills; Selection of topic, thesis statement, developing the thesis; introductory, developmental, transitional and concluding paragraphs, linguistic unity, coherence and cohesion, descriptive, narrative, expository and argumentative writing.

Analytical report, Project Management in Technical Communication, Project writing, project proposal writing.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination;
A: Attendance

Text & References:

- M. Frank. Writing as thinking: *A guided process approach*, Englewood Cliffs, Prentice Hall Regents.
- L. Hamp-Lyons and B. Heasley: Study Writing; *A course in written English*. For academic and professional purposes, Cambridge Univ. Press.
- R. Quirk, S. Greenbaum, G. Leech and J. Svartik: *A comprehensive grammar of the English language*, Longman, London.
- Daniel G. Riordan & Steven A. Panley: *“Technical Report Writing Today”* - Biztantra.
- Daniel G. Riordan, Steven E. Pauley, Biztantra: *Technical Report Writing Today*, 8th Edition (2004).
- *Contemporary Business Communication*, Scot Ober, Biztantra, 5th Edition (2004).

QUALITY MANAGEMENT & ACCREDITATION IN FORENSIC SCIENCE

Course Code: FCH4405

CreditUnits: 02

Course Objective: The Objective of this course is to introduce the students with the Quality management system and requirements for the competence of testing and calibration, the technical requirements needed in a laboratory.

Course Contents:
Module I: Management requirements I General requirements for the competence of testing and calibration laboratories – Introduction, Scope, Management requirements: Organization, Quality System, Document Control, Review of requests
Module II: Management requirements II Internal Audits; Control of records Corrective and preventive actions, Tenders and contracts, Subcontracting of tests and calibration, Purchasing services and supplies, Service to the clients, Complaints,
Module III: Technical requirements I Technical requirements: General, Personnel, Accommodation and environmental conditions, Test and calibration methods
Module IV: Technical requirements II Equipment, measurement traceability, Sampling, Handling of test and calibration items, assuring the quality of test and calibration results and reporting the results.
Module V: Laboratory Management Laboratory information management system, validation and safety equipments

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination;
A: Attendance

Text & References:

- International standard on General requirements for the competence of testing and calibration laboratories, First Edn., 1999-12-15, ISO/IEC 1702:1999(E)
- Mario Deva RGAS, The Total Quality Management, NCC Blackwell Publication, (1995).
- Willard Merritt, Dean & settle; Instrumental Methods of Analysis, CBS Publishers & Distributors, 7thEdn. New Delhi, (1986)

ADVANCED ANALYTICAL TECHNIQUES

Course Code: FCH4406

CreditUnits: 03

Course Objective: To give the students an advanced knowledge of analytical techniques, which will provide them enough confidence to start their career in research as well as in industry with ease?

Course Content:
<p>Module-I: Mass spectrometry Mass spectrometry - high resolution mass spectrometry, linked scans, MIKES, HV scan, negative ion mass spectrometry, applications of field desorption, plasma desorption, fast atom bombardment, electrospray and tandem mass spectrometry and FTMS. Determination of biomolecules by absorption photometry, fluorimetry, biochemical applications of mass spectrometry. Manometry and respiration measurement, oxygen polarography, BOD estimation, resting cells preparation. Principles of microscopy - light, darkfield, phase contrast, fluorescence and electron microscope, fixing and preparation of samples</p>
<p>Module-II: Centrifugation and advanced chromatographic techniques Principles of centrifugation - calculation of r.c.f. values, ultracentrifuges, density gradients. Enzyme assays- Biomolecules separation by chromatography, paper, thin layer and column chromatography, ion exchangers, molecular sieves, affinity columns, Gas chromatography and HPLC. Electrophoresis - theory and practice, mobility,</p>
<p>Module III: Research based analytical techniques: Preparations of solutions of different strength and scales (molarity, molality, normality, formality, w/w, v/v ratio calculation exercises) buffers, agarose and polyacrylamide matrices, gel apparatuses, native and SDS -PAGE gels, Isoelectric focussing, Zymograms. Immunochemical methods - immunoassays, immunodiffusion, rocket immunoelectrophoresis. Use of radioisotope tracer techniques in biochemical experiments and their detection.</p>
<p>Module-IV: UV & CD spectroscopy UV-visible spectroscopy - advancements in experimental methods, analysis of mixtures, dissociation constants of acids and bases, study of enzyme catalysis, applications of ORD and CD.</p>
<p>Module V: NMR Spectroscopy- experimental aspects, FT NMR, factors influencing sensitivity and resolution, applications of chemical shift and spin-spin coupling, Karplus equation and conformational analysis; NMR of carbon-13, fluorine-19, phosphorous-31, Nitrogen- 14 and 15 and oxygen 17. EPR Spectroscopy - epr spectra of solutions, frozen solution, especially organic molecules.</p>

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Scopes R, Protein purification: Principles and practice, Springer-Verlag NY 1982.
- Plummer D.T., An introduction to practical biochemistry, 3rd edition, Tata McGraw Hill, 1988.
- P.Gerhardt (Ed.), Methods for General Bacteriology, Amer.Soc. Microbiol/ Washington, 1981.
- N.C. Price and L. Stevens, Fundamentals of Enzymology, Oxford University Press, 1989.
- C.N.R. Rao, UV and Visible spectroscopy, Butterworths, 3rd edition, London, 1972.
- K. Nakanishi, Infrared absorption spectroscopy - practical, Holden-Day, Inc., San Francisco and Nankodo Company Ltd., Tokyo, 1962.

- J.K.M. Sanders and B.K. Hunter, *Modern NRM Spectroscopy: A Guide for chemists*, Oxford University Press, London, 1987.
- W. Kemp, *NMR in Chemistry, A Multinuclear Introduction*, McMillan, London, 1986.
- W.R. Croasmun and R.M.K. Carlson (Ed), *Two-dimensional NMR spectroscopy, Applications for Chemists and Biochemists*, VCH, New York, 1987.

RESEARCH WORK BASED PROJECT

Course Code: FCH4437

Credit Units: 10

GUIDELINES FOR PROJECT FILE AND PROJECT REPORT

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critically analyzed by the faculty guide and corrected by the student at each stage.

PROJECT FILE

The Project File may be a very useful tool for undertaking an assignment along-with a normal semester, an exploratory study, sponsored projects, a project undertaken during summer period or any other period as per curricula where the researcher is working with a company/organization. The project/ assignment may also be a part of the bigger research agenda being pursued by a faculty/ institution/ department

The Project File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. This file may be considered in continuous assessment.

In general, the File should be comprehensive and include:

1. A short account of the activities that were undertaken as part of the project;
2. A statement about the extent to which the project has achieved its stated objectives;
3. A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
4. Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
5. Any problems that have arisen and may be useful to document for future reference.

PROJECT REPORT

The Project Report is the final research report that the student prepares on the project assigned to him. In case of sponsored project the layout of the project could be as prescribed by the sponsoring organization. However, in other cases the following components should be included in the project report:

Title or Cover Page

The title page should contain Project Title; Student's Name; Programme; Year and Semester and Name of the Faculty Guide.

Acknowledgement(s)

Acknowledgment to any advisory or financial assistance received in the course of work may be given. It is incomplete without student's signature.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project. It should not exceed more than 1000 words.

Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

Introduction

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Materials and Methods

This section should aim at experimental designs, materials used (wherever applicable). Methodology should be mentioned in details including modifications undertaken, if any. It includes organization site(s), sample, instruments used with its validation, procedures followed and precautions.

Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing this section, emphasis should be laid on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various sections, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary, do not write in "point" form.

While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be in congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion rather; it should lead to generalization of data on the chosen sample.

Results and its discussion should be supporting/contradicting with the previous research work in the given area. Usually one should not use more than two researches in either case of supporting or contradicting the present case of research.

Conclusion(s) & Recommendations

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

Check that your work answers the following questions:

1. Did the research project meet its aims (check back to introduction for stated aims)?
2. What are the main findings of the research?

3. Are there any recommendations?
4. Do you have any conclusion on the research process itself?

Implications for Future Research

This should bring out further prospects for the study either thrown open by the present work or with the purpose of making it more comprehensive.

Appendices

The Appendices contain material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

References

References should include papers, books etc. referred to in the body of the report. These should be written in the alphabetical order of the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples:

For research article:

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichiacoli*O157: H7. *ClinMicrobiolInfect* ,**8**(suppl 1): 116–117.

For book:

Kowalski, M. (1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

The Layout Guidelines for the Project File & Project Report:

1. A4 size Paper
2. Font: Arial (10 points) or Times New Roman (12 points)
3. Line spacing: 1.5
4. Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

ASSESSMENT OF THE PROJECT FILE AND THE PROJECT REPORT

Essentially, the assessment will be based on the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

The Project should fulfill the following *assessment objectives*:

1. Range of Research Methods used to obtain information
2. Execution of Research
3. Data Analysis (Analyze Quantitative/ Qualitative information)
4. Quality Control
5. Conclusions

Assessment Scheme:

Continuous Evaluation:

40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation:

60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

It is recommended that the Final evaluation should be carried out by a panel of evaluators.