

**SYLLABUS**  
**(Pre-Ph.D. Coursework)**  
**DEPARTMENT OF FORENSIC SCIENCE**  
**Paper-1 (DFSC-PP-01)**

**Research Methodology and Scientific Communication and Research Ethics**

*Course outcome – by the end of these course students will be able to understand the basics of research idea formulation, development and will learn about scientific communication.*

*Learning outcome-*

- 1. The student will learn about the principle of research idea conceptualization.*
- 2. They will learn about development of research methodology.*
- 3. They will learn about research proposal writing and scientific communication.*
- 4. They will learn about the importance of research ethics.*

**UNIT- I**

Elements of a Quality Management System: Quality, Total Quality, Quality assurance, Quality control Quality system. Quality Planning, Quality Audit: Internal and External Audit & MRM, History and development of ISO, Terminology of NABL. Benefits of ISO standards and Requirements, IEC-17025. PR Issues, Ethical Issues, Essential requirements for the competence of testing and calibration laboratories, LIMS, Introduction, scope, management Requirements: Organizational, Documents control, Review of requests and Calibrations, Laboratory Hazards, Good Laboratory Practices, Purchasing service and supplies, service to the clients, complaints, corrective and preventive action, control of records

**UNIT- II**

Sampling: sampling procedures (random and non-random), sampling statistics, Physical state, homogenization, size and hazards in sampling, Sampling Error, Significance of statistics in forensic science. Descriptive Statistics- Basic concepts of frequency distribution, Measure of Central Values - Mean, median and mode, Measures of Dispersion- Range, Mean deviation and Standard deviation, Standard Error. Inferential Statistics-Correlation and Regression analysis. Probability- Definition, Theory, Classical and types, Chi Square Test of Association and Independence, t-test, z-test, One-way and Two-way ANOVA, AMOVA, Relative Risk and Path Analysis.

**UNIT –III**

Meaning of research Problem: Research, definition, Objectives of research. Types of research-From the viewpoint of application, Hypothesis and its Testing, Objectives, Inquiry mode. Search for existing literature, Interpretation and Report Writing, Research Communication, Plagiarism. Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, Fabrication" and Plagiarism (FFP), Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

**UNIT –IV**

Publication ethics: definition" introduction and importance, Best practices / standards setting initiatives and guidelines: COPE, WAME, etc; Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types. Violation of publication ethics, authorship and contributor-ship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals. Open access publications and initiatives, SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies, Software tool to identify predatory publications developed by SPPU, Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester, etc.

## **UNIT –V**

Subject specific ethical issues, FFP, authorship, Conflicts of interest, complains and appeals: examples and fraud from India and abroad. Use of plagiarism software like Turnitin, Urkund and other open sources software tools. Indexing databases, 2. Citation databases: Web of Science, Scopus, etc. Impact Factor of journal as per Journal citation Report, SNIP, SJR, IPP, Cite Score. Score, 2. Metrics: h-index, g index, i10 index, altmetrics

### **Recommended Books:**

1. ISO/IEC/17025:2005, NABL -113, NABL -113A, 131, guidelines of NABL.
2. International Standard on General requirements for the competence of testing and calibration laboratories, 1st Ed., 1999-12-15, ISO/IEC 17025:1999(E). C.G.G.
3. Kothari, C.R. Research Methodology Methods and Techniques. Wiley Eastern Limited, New Delhi.
4. Saferstein R. Forensic Science Handbook I, II, III.
5. William L. Duncan: Total Quality, Key Terms and Concepts.
6. Murray S. Cooper: Quality control in the Pharmaceutical Industry.
7. John T. Rabbitt, Peter A Bergh: The ISO 9000 Book.
8. Willard Merritt, Dean & Settle: Instrumental Methods of Analysis.
9. Jami St. Clair Crime Laboratory Management: Academic Press.
10. Thomas A The laboratory Quality Assurance system: A manual of Quality Procedures and forms.
11. Ratliff. 2003 3rd ed. John Wiley & Sons.
12. Gary B Clark Systematic Quality Management. Practical Laboratory Management Series.
13. Bird, A. (2006). Philosophy of science. Routledge.
14. MacIntyre, Alasdair (1967) A Short History of Ethics. London.
15. P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:97E.9387480865

16. National Academy of Sciences National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to Responsible conduct in Research: Third Edition National Academies Press.

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## **Paper-2 (DFSC-PP-02)**

### **Analytical Approaches in Forensic Techniques (Physical, Chemical & Biological)**

*Course outcome – by the end of these course students will be able to understand the uses of various analytical techniques used in forensic research.*

*Learning outcome-*

- 1. The student will learn about the principle and working principles of various analytical techniques and fundamentals of instruments.*
- 2. They will learn about general application of these analytical techniques.*
- 3. They will learn about forensic application of these analytical techniques.*
- 4. They will learn about drawbacks of these analytical techniques.*

#### **UNIT-I**

Nature, Scope, Basic principles & Forensic Applications of Microscopy, Comparison microscope, Stereoscopic microscope, Fluorescent Microscopy, Infra Red Microscopy, Scanning Electron Microscope (SEM) & Transmission Electron Microscope (TEM). General principles of Immuno chemical technique, Antigen-Antibody binding, Precipitation, Agglutination, Complement fixation, Gel immuno diffusion, Immuno electrophoresis, Radio Immuno assay, ELISA, Fluorescent immuno assay, Fluorescent Activated Cell Sorting (FACS).

#### **UNIT-II**

Nature, Scope, Concepts, Basic Principles & Forensic Science Applications of UV-Visible spectroscopy, Infra Red (IR) Spectroscopy, Fourier transform Infra Red (FTIR) Spectrophotometer Atomic Absorption Spectrophotometry (AAS), Atomic emission Spectrometry (AES), Inductive coupled plasma (ICP), X-ray spectroscopy, Auger emission spectroscopy, Mass spectrometry.

#### **UNIT-III**

Nature, Scope, Concepts, Basic Principles & Forensic Science Applications of Chromatography, Thin Layer chromatography (TLC), High Performance Liquid Chromatography (HPLC), Gas Chromatography (GC) and High performance Thin layer Chromatography (HPTLC).

#### **UNIT-IV**

Nature, Scope, Basic principles & Forensic Applications Electrophoretic Technique, General principles, Factors affecting electrophoresis, High voltage electrophoresis, polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative, Horizontal and Vertical Electrophoresis.

#### **UNIT-V**

Molecular Biology Techniques: Genetic Manipulations, Restriction enzymes, Gene cloning, Cloning strategies, cloning vectors- Plasmids, Cosmids, phagemids, BAC, YAC, DNA extraction, Polymerase chain reaction, DNA sequencing methods and its advances, Mutagenesis, Gene Libraries, Colony Hybridization, Nick translation, Expression of Genes etc.

## Recommended Books:

1. John C. Lindon, George E. Tranter & John L. Holmes; Encyclopedia of Spectroscopy & Spectrometry, Academic Press (2000).
2. Cottrell, C.T. Irish, D, Msters V M., and Steward, J.E. (1985) Introduction to ultraviolet and visible spectrophotometry, 2<sup>nd</sup> ed. Pye Unicam, Cambridge.
3. Burgess, C., and Knowle, A. (1981) Technique in visible and Ultraviolet absorption spectroscopy, Chappman and Hall, London.
4. Claridge, T. D. W., High-Resolution NMR Techniques in Organic Chemistry. A Practical Guide to Modern NMR for Chemists, OUP, Oxford, 2000.
5. Gunther, H., NMR Spectroscopy. Basic Principles, Concepts and Applications in Chemistry, 2nd Edn, Wiley, Chichester, 1995.
6. Chapman, R (1985) Practical Organic Mass Spectrometry, Wiley & Sons, London.
7. Davis, R.and Frearson, M. (1987) Mass Spectrometry, Wiley, London.
8. McLafferty, F.W. and Turecek, F. (1993) Interpretation of Mass Spectra, 4th edn., University Science Books, Mill Valley, USA.
9. Working Procedure Manual: Physics/Chemistry DFS, Publication (2005).
10. Long, D.A. (1977) Raman spectroscopy, McGraw-Hill, Maidenhad.
11. Alan Gunn Essential forensic biology Jhon. Wiley.
12. Barbara Wheeler Lori J. Wilson, Practical Forensic Microscopy: A Laboratory Manual.
13. Bryan L. William & Keith Wilson; Principles & Techniques of Practical Biochemistry, Edward Arnold Pub. (1975).
14. Keith Wilson & John Walker; Practical Biochemistry-Principles & Techniques, 5th Ed., Cambridge University Press.
15. George M. Malacinski; Essentials of Molecular Biology, 4<sup>th</sup> Ed. Jones and Bartlet Pub. (2003).
16. Gardnes & Snustd; Principles of Genetics 6th Ed., John Wiley& Sons
17. D.M.Weir; Hand Book of Experimental Immunology, 2nd Ed., Blackwell Pub.
18. Ivan M.Roett; Essential Immunology, 6th Ed., Blackwell Pub.
19. Working Procedure Manual Biology / Serology, DFS Pub New Delhi 2005

### **Paper-3 (DFSC-PP-03)**

#### **Advance & Applied Forensic Science**

*Course outcome – By the end of this course Pre- PhD students will learn about advanced and applied forensic science which will help them to decide their future research goal.*

*Learning outcome-*

- 1. The student will learn about the basics of recent advancements in the field of forensic science.*
- 2. They will learn about application of these advance techniques.*
- 3. They will learn about emerging issues of forensic science.*
- 4. They will learn to develop the newer technique which will hel in future advancement of forensic investigation.*

#### **UNIT-I**

Nature, Scope & Definition of Forensic chemistry, Introduction to Narcotic drugs, Depressants, stimulants, and Hallucinogens their Active components and legal issues and method of analysis of Designer Drugs & Anabolic steroids. Forensic Medicine- Definition, Scope and Importance, Post-mortem examination, Death: Definition, types, and nature, time since death, Injuries-Definition and Nature, Estimation of Age of injuries from Ante-mortem and Post mortem injuries, Burns-Classification, Ante-mortem and Post mortem Burns,

#### **UNIT-II**

Toxicology, Poisons–Definition & Classification, Collection and Preservation of Viscera and other relevant material, Isolation and identification of Plant Poisons, opium and its derivatives, Benzodiazepine tranquilizers, Metallic Poison, Insecticides and Pesticides. Basic concepts of Poisonous Mushrooms, Poisonous fungi, Food Poisoning, Common vegetable abortifaciantst, Animal poison, Snake venom.

#### **UNIT-III**

Serology & Immunology, Blood: Composition and Histology, Examination & Identification of blood, blood stains & Analysis of Blood Pattern, and other body fluids/stains viz. menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail, Secretors and Non-secretors. Immunology: Cell & Organ of Immune system, Haematopoiesis, immune response, innate and acquired immunity, Antigens, Immunoglobulin: Types, Physio-chemical properties and function. Antigen-Antibody Reactions: Precipitation, agglutination, complement fixation, Compliment system, Major Histo-compatibility Complexes (MHC) and antigen presentation, Autoimmunity, Apoptosis.

#### **UNIT-IV**

An Introduction to Genetic Material, Structure of DNA, Chemical nature of DNA, Physiochemical properties of DNA, Denaturation and Renaturation kinetics of DNA, Central Dogma, DNA extraction and Quantification; Basic concept of sequence variation - VNTRs, STRs, Mini STRs, SNPs. Mitochondrial DNA Evaluation of results, frequency estimate calculations and interpretation, Allele frequency determination, STR Profiling: Structure of STR loci; The development of STR multiplexes; Detection of STR polymorphisms; Interpretation of result; Assessment of STR profiles: Stutter peaks. Sp. Pull-up; Degraded DNA; Statistical Assessment of STR profiles; estimating the frequencies of STR,profiles. History of DNA profiling applications in disputed paternity cases, child swapping, missing person's identity, civil immigration, limitations of DNA profiling.

#### **UNIT-V**

Detection techniques- RFLP, PCR amplifications, Massive parallel sequencing, Y- STR, Advance Cloning methods, Analysis of SNP, DNA chip technology- Microarrays Cell free DNA, mi-RNA and its role in forensic science, RNAseq, Chip-Seq, Match probability – Database, DNA typing from blood, semen, bone and teeth and the use of DNA typing in wildlife investigations.

#### **Recommended Books:**

1. Khan, Javed I., Ho, Mat H. Analytical Methods in Forensic Chemistry. New York: Working Procedure Manual Chemistry/Toxicology/Explosives/Narcotics, DFS Pub. New Delhi
2. Kennedy, Thomas J., Christian, Jr., Donnell Basic Principles of Forensic Chemistry, Springer
3. Saferstein, Criminalistics: An Introduction to Forensic Science. Prentice Hall
4. Maudham.B.et.al; Vogel's Textbook of Quantitative Chemical. Analysis, Longman
5. John D. DeHaan ; Kirk's Fire Investigation, Prentice Hall Eaglewood Cliffs, N.J
6. Yinon J; Modern Methods & Application in Analysis of Explosives, John Wiley.
7. C.A. Watson; Official and standardized Methods of Analysis. Royal Society of Chemistry, UK.
8. Coyle, H. (ed.) Nonhuman DNA Typing, International Forensic Science and Investigation Series, CRC Press, Boca Raton.
9. Niels Morling, Handbook of Forensic Genetics (Forensic Science and Medicine) Humana Press.

10. John M. Butle. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers Elsevier Academic Press.

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