

## PET SYLLABUS FOR FORENSIC SCIENCE STUDENTS 2020 ONWARDS

### PAPER I Research Methodology

1. **Foundation of Research:** Meaning, Objectives, Motivation, Utility, Characteristics and Types. Characteristics of scientific methods - understanding the language of research - Concept, Construct, definition, Variable. Scientific Research Process. Steps of research, methods of research, research ethics.

2. **Problem Identification & Formulation:** definition and formulating the research problem, Necessity of defining the problem, Importance of literature review in defining a problem. Literature survey: primary and secondary; web sources; critical literature review. Research Question - Investigation Question - Hypothesis testing - Qualities of a good hypothesis - Null hypothesis & Alternative Hypothesis

3. **Research Design:** Concept and Importance in Research - Features of a good research design - Exploratory Research Design - Concept, Types and uses, Descriptive Research Design - concept, types and uses. Experimental Design - Concept of Independent & Dependent variables. Biased and unbiased research design

4. **Qualitative and Quantitative Research:** Qualitative - Quantitative Research - Concept of measurement, causality, generalization, replication. Merging the two approaches. **Biological data:** Types of data - Qualitative data, Quantitative data

5. **Data Collection and analysis:** Execution of the research - Observation and Collection of data - Methods of data collection, hypothesis-testing - Generalization and Interpretation.

6. **Measurement:** Concept of measurement - what is measured? Problem in measurement in research - Validity and Reliability. Levels of measurement - Nominal, Ordinal, Interval, Ratio.

7. **Sampling, data collection and analysis:** Concept of Statistical population, Sample, Sampling Frame, Sampling Error, Sample size, Non Response. Characteristics of a good sample, sample distribution, Probability and Probability distributions. Determining size of the sample - Practical considerations in sampling and sample size. Data analysis - Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis - Cross tabulations and Chi-square test including testing hypothesis of association including Chi test, correlation and regression analysis, t-test, z-test, ANOVA- one way and two way.

8. **Interpretation of Data and Paper Writing:** Graphical interpretation of data, Layout of a Research Paper, Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

9. **IPR :** Types, Copyrights in Scientific work, Patents in scientific research, Writing a patent specification, patent filing and grant, infringement. Gene patenting,

Farmer's rights, Plant Breeder's rights, Traditional knowledge and protection.

**10. Reasoning and Mental ability:** Analogy, Logical reasoning and aptitude, Classification, Series, Coding-Decoding, Direction Sense, Representation Through Venn Diagrams, Mathematical Operations, Arithmetical Reasoning, Inserting the Missing Character, Number, Ranking and Time Sequence Test, Eligibility Test, Representation through Venn-diagrams, Number & symbols ordering, Comprehension questions, Statement & assumptions, Statement & conclusions, Statement & actions.

**Reference books:**

- 1) Garg, B. L. Karadia R. Agrawal, F. and Agrawal U. K., 2002. An Introduction to Research Methodology, RBSA Publishers
- 2) Kothari C. R., 1990. Research Methodology: Methods and Techniques New Age International 418p.
- 3) Sinha S. C. and Dhiman A. K., 2002. Research Methodology Ess Publications 2 Columes.
- 4) Trochim W. M. K., 2005. Research Methods: The Concise Knowledge Base Atomic Dog Publishing. 270P
- 5) Wadehra B. L., 2000. Law Relating to Patents, Trade Marks, Copyright Design and Geographical Indications, Universal Law Publishing
- 6) Research Methodology: An Introduction-Stuart Melville and Wayne
- 7) Practical Research Methodology-Catherine Dawson
- 8) Research Methods for Science Michael P Marder
- 9) Research Methodology: Principle, Methods and Practices-Joshua O. Miluwi and Hina Rashid
- 10) Research Methodology: A Step By Step Guide for beginners- Ranjeet Kumar
- 11) How to Write and publish a Research Paper- Seventh Edition-Robert Day And Barbara Gastle
- 12) Introduction to Biostatistics and Research Methods- P S S Sunder Rao
- 13) Research Methodology and Scientific Writings- C George Thomas

## **PAPER II CORE SUBJECT: FORENSIC SCIENCE**

### **Unit – I**

**Forensic Science:** Definition, History & Development, Scope, Ethics in Forensic Science

**Physical Evidence:** Nature, Types, Search methods, Collection, Preservation, Packing & Forwarding of Physical & Trace evidence for forensic analyses, Chain of Custody

**Crime Scene:** Nature, Types, Preservation of Scene of Crime

**Criminal Investigations:** Unnatural deaths, Criminal assaults, Sexual offences, Poisoning, Vehicular accidents

**Courts:** Types, powers and jurisdiction, Admissibility of evidence in Courts, Definition of Experts, Provisions in Cr.P.C., 1973 & Indian Evidence Act relating to experts & their reports; Court Procedures pertaining to Expert Testimony & Witness

**Organization of Forensic Science Laboratories of Centre and State,** NCRB and NICFS

**Fundamental Rights:** Right of Equality (Articles 14 to 18) and Right of Freedom (Articles 19 to 22) as per Constitution of India

**Criminal Profiling:** Profile of victim and culprit, its role in crime investigation, Lie detection (Polygraphy), Narco analysis, Brain mapping, scope and limitations

**Concept of quality control management in Forensic institutions**

## **Unit – II**

**Microscopy:** Polarizing, Comparison, Stereoscopic, Fluorescent and Electron Microscopes

**Spectrophotometry:** UV, Visible, IR, Raman, Atomic absorption, Emission

**Neutron Activation Analysis**

**X – rays and x-ray based techniques** such as XRD, XRF

**Mass Spectroscopy**

**Chromatographic Techniques:** TLC, GLC, HPLC, HPTLC

**Hyphenated Techniques:** GC-MS, LC-MS, IR-MS and ICP-MS

**Electrophoresis:** High and Low voltage electrophoresis, Immunoelectrophoresis

**Immunoassays:** Principle, Types, Techniques and applications

## **Unit – III**

**Detection and Identification of Blood stains**

**Determination of Species of Origin**

**Blood Group Systems**

## **Techniques of Determination of Blood groups of Blood Stains**

**Detection of Seminal and other body fluids and their Blood Grouping,** Red cells Enzymes, Serum Proteins of forensic significance

## **Disputed Paternity & Maternity**

**DNA:** Structure, DNA as genetic marker, DNA Extraction and Profiling Techniques

**DNA Phenotyping and RNA Profiling** & their applications

**Wild life Forensics:** Wild life (Protection) Act,1972, Scope, Evidences and Identification

## **Unit – IV**

**Analysis of Ethyl alcohol** in beverages , liquors, biological fluids and breath

**Analysis of Methanol and Denaturants**

**Illicit liquors**

**Analysis of Chemicals in Trap Cases**

**Metabolism and Chemical examination of :**

Insecticides & Pesticides, Tranquillizers & Sedatives, Hypnotics Stimulants, Narcotics, Opiates, Drugs of abuse; Analyses of above and their Toxicity

**Plant poisons**

**Metallic Poisons**

**Extraction, Isolation & Clean-up procedures, Identification of common poisons from viscera, tissues and body fluids**

## **Unit – V**

**Fire arms:** Types, Classification, Ammunition and their Compositions

**Forensic examination** of Firearms, Ammunition, Firearms' projectiles (Bullets, Shots, Slug etc.), Shell case

**Gunshot residues analysis**

**Concept of** Velocity, Penetration, Dispersion, Ricochet, Accidental Discharge, Determination of Range in firearm cases

**Examination** of Country made firearms

**Basics of Internal, External and Terminal Ballistics**

**Tool marks: Meaning, Types and Examination**

**Restoration of Erased Markings on Metal Surfaces**

## **Unit – VI**

**Fire and Arson:** Analyses of Petroleum Products and other incendiary materials

**Explosives:** Definition, Types and Analyses

**Bombs:** Country made bombs, Improvised Explosive Devices ( IEDs ) and their examination

**Investigation** in Explosion and Arson related cases

**Photography: Types, application in criminal investigation & Forensic evidence examination**

## **Unit – VII**

**Hair & Fibers:** Nature, Types, Structure and Examination

**Pollens and Diatoms:** Their application in Forensic investigation

**Dust & Soil:** Nature, Types, Forensic Examination

**Paint, Lacquer & Varnishes:** Nature, composition and forensic examination

**Glass:** Composition, Types, Fractures, Examination

**Cement, Mortar and Concrete:** General Composition, Forensic Analysis

**Computer Forensics: Introduction, Types of Computer crimes, Digital evidence- Seizure, Acquisition and Forensic examination**

**Mobile Phone Forensics**

## **Unit – VIII**

**Fingerprints:** History, Characteristics, Types, Classification, Preservation, Development, Lifting and Comparison, Examination of Chance Prints, Computerization of Fingerprints, AFIS

**Track Marks:** Foot Prints, Shoe Prints, Tire Marks, Their Preservation & Casting, Comparison, Skid marks. Gait pattern

**Biometric Systems of Identification and its relevance**

**Voice Analysis:** Introduction, Significance, Structure of Human Voice apparatus, Voice spectrography, Voice analysis, Legal aspects and limitations

**Unit – IX**

**Documents:** Definition, Types, Preliminary examination of documents

**Reproduction** of documents through photographic and mechanical means and their examination

**Examination** of Alterations such as Erasures, Obliterations & Additions

**Indentations, Secret writings and Charred documents**

**Inks, Papers** and their scientific examinations with modern methods

**Age of documents**

**Examination** of Typescripts, Printed matter including currency notes and lottery tickets. Mechanical impressions

**Hand writings:** Class and Individual characteristics of Handwritings, Factors affecting handwritings, Standard samples for comparison, Comparison of hand-written texts

**Anonymous and disguised writings**

**Identification** of hand writings, signatures, detection of forged signature and forgeries

**Examination of Credit Cards and Similar materials**

**Unit –X**

**Modes & Manner of deaths, Sexual offences and its medicolegal importance, Amendments in law related to sexual offences**

**Post – mortem examination and Post – mortem changes, Estimation of time since death**

**Injuries & Wounds: Types, Medicolegal importance, Gunshot wounds**

**Determination of Species of Origin, Sex , Age, Stature, and individual identification through skeletal remains**

**Identification through Skull superimposition and facial reconstruction**

**Human dentition, Type of teeth, determination of Age, Bite marks**

**Forensic Entomology: Introduction, Insects of forensic importance, Insects on Carrion, Forensic applications**

**REFERENCE MATERIAL:**

As prescribed for the Mumbai University MSc Forensic Science syllabus.