INTRODUCTORY FORENSIC SCIENCE
FRS 102

SYNOPSIS

1. General introduction to forensic science

2. Principles of scientific methodology in forensic science

3. Principles of scientific comparison in forensic science

4. Techniques used by forensic identification specialists to document crime scenes

5. Techniques used by forensic identification specialists to detect, recover, and analyze evidence

6. Methods used by forensic specialists to minimize impact on crime scenes and maintain continuity and integrity of evidence

7. Overview of forensic DNA analysis

8. Facial recognition and facial reconstruction as an investigative tool

9. Fingerprints in digital forensics

Forensic Science is the application of scientific principles and techniques to the investigation of crimes. It involves the collection, preservation, and analysis of evidence to support the resolution of legal cases. It encompasses various disciplines, each specializing in different types of evidence or analysis.

Key areas of forensic science:

1. **Crime Scene Investigation** - The process of collecting, documenting, and preserving physical evidence from crime scenes.

2. **Forensic Pathology** - The examination of bodies to determine the cause and manner of death.

3. **Forensic Biology** - The study and analysis of biological materials such as blood, hair, and other bodily fluids to identify individuals and other issues.

4. **Forensic Chemistry (Toxicology)**
   The analysis of substances to identify drugs, poisons, and other chemicals present in body fluids or a crime scene.

5. **Forensic Anthropology**
   The study of human skeletal remains to determine identity, cause of death, and other information about deceased individuals.

6. **Forensic Odontology**
   The examination of dental evidence to identify human remains and assess bite mark evidence.

7. **Forensic Entomology**
   The study of insects in relation to criminal investigations to estimate time of death.

8. **Forensic Ballistics**
   The analysis of firearms, bullets, and projectile impact to determine information about a shooting incident.

9. **Digital Forensics**
   The recovery and analysis of data from electronic devices to uncover

evidence related to crime investigation.

10. **Forensic Psychology and Psychiatry**
    The assessment of individual mental states and behavior in relation to criminal cases.

Principles of Scientific Methodology in Forensic Science

This follows a systematic approach to ensure that evidence is collected, analyzed, and interpreted accurately and reliably, following these steps:

Observation and Documentation

Observation refers to the initial assessment and careful examination of the crime scene or evidence.
Documentation means detailed recording of the scene, evidence, and observations through notes, photographs, sketches, and possibly videos.

Hypothesis Formation

Based on the initial observation, determining the possible cause of the crime, how it was committed, or identifying potential suspects.

Evidence Collection

It can come in the form of physical traces, preservation, labelling and packing

Analysis

Evidence analysis done through laboratory testing

Data Presentation Interpretation

Comparison of result and statistical analysis

Validation

Repeat testing, peer review

Formulation of conclusion

Reporting and presentation

Report writing and court testimony

Review and improvement

Continuous improvement procedures and adaptation

Principle of Scientific Comparison in Forensic Science

The principle of scientific comparison in forensic science involves systematic and rigorous methods to ensure that evidence is correctly compared, analyzed, and interpreted.

Some of the key principles are:

1. **Individualization**
   This principle holds that objects have unique characteristics that can be distinguished from other sources. Forensic science looks for unique features to identify or exclude potential sources of evidence.
2. **Class Characteristics and Individual Characteristics**
   - Class characteristics include traits that place evidence into a broad category, e.g., type of firearm, blood type, etc.
   - Individual characteristics are unique features that can link evidence to a specific source, e.g., a DNA profile.
3. **Known Standard or Standard Sample**
   Comparisons are made between unknown (questioned) evidence and a known sample or reference sample.
   A known standard/sample comes from a reliable source, and its origin is certain.

4. **Comparison Analysis**
   This process involves a side-by-side examination of the questioned and known samples using various techniques, including microscopy, chemical analysis, and DNA sequencing. Measurements and observations are made to identify similarities and dissimilarities.
5. **Reproducibility and Reliability**
   The methods used for comparison should be reproducible and provide consistent results under similar conditions. The techniques must be validated to ensure their reliability. Transparency is also crucial—records of the comparison process, including observations, methods used, and results obtained, must be maintained.
6. **Documentation and Transparency**
   Transparency in the methodology allows for peer review and verification by other experts.

7. **Quantitative and Qualitative Analysis**
   Quantitative analysis involves measuring and comparing numerical data such as the concentration of chemicals or the length of fibers.
   Qualitative analysis involves assessing non-numerical characteristics such as patterns, colors, or textures.

8. **Statistical Methods:**
   Statistical methods are used to interpret the significance of the comparison result to determine probability of a common or exclusion. Error rates and confidence intervals are considered to assess the strength of the evidence. No agreed-on procedures and consensus. These are done to ensure accuracy and objectivity to address discrepancies and uncertainties through further analysis and discussions. We equally have legal standards and admissibility. The methods and conclusions must meet legal standards and admissibility in court. It requires that evidence is relevant, reliable, and based on scientifically valid reasoning methodology.

Techniques Used By Forensic Identification Specialists To Document Crime Scene:
A variety of techniques are used to document a crime scene, ensuring that all relevant information is preserved for analysis and investigation. Key among these methods are:

- **Photography**, which can be overall shot, midrange, or close-up shot.
- **Videography**, taking video to explain the layout and spatial relationship between given evidence.
- **Sketching**, which could either be rough or final. It could be quick.
- **Drawing:**
  Quick Drawing or Detailed Drawing
- **Notes and Report:**
  Location
  Environmental details
- **3D Scanning and Modelling:**
  Use laser scanners or other devices to create a 3D model of the crime scene to capture precise measurements and spatial relationships in digital format.
- **Measurements and Mapping:**
  Baseline method
  Triangulation method
  Grid methods
- **Evidence Marking and Labelling:**
  Use of markers to indicate evidential materials in a crime scene. This will assist in correlating physical evidence with sketches, videos, and notes.
- **Chain of Custody Documentation:**
  Recording details about the collection, transport, and storage of evidence to maintain integrity and prevent tampering of items.
- **Environmental and Contextual Documentation:**
  Recording environmental conditions such as weather and contextual details, including circumstances that might affect the evidence or investigation.
- **Forensic Mapping Software**
  These are specialized software that integrate photographs, sketches, measurements, and other data into a cohesive and accurate live map of the crime scene.