



NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF ARTS AND SOCIAL SCIENCE

COURSE CODE: CSS455

COURSE TITLE: FORENSIC SCIENCE



CSS455
FORENSIC SCIENCE

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Introduction

You are introduced to CSS455: FORENSIC SCIENCE. FORENSIC SCIENCE is a first semester course of 3 credits and is available for first year students of the Police Science Programme. The course examines the application of scientific concepts and principles to police system, and the role of Forensic Science in relation to crime or a civil action, besides its relevance to a legal system.

FORENSIC SCIENCE consist of 23 study units. The Course Guide introduces you to what the course is all about, course materials you will require, and information on how you can work your way through the material. It also highlights assignments (tutor-marked assignments) as part of the requirement for the course.

What You Will Learn in This Course

The study of FORENSIC SCIENCE will enable you to have insight to the Police Crime Investigation, as related to forensic science. It combines the knowledge and techniques of several different disciplines, including science, mathematics, logic and law.

You will also study and commit to memory definitions of FORENSIC SCIENCE. In addition, you will acquaint yourself with the techniques of Crime Scene Investigation as related to Forensic Psychologist, as well as the use of forensic analysis in crime investigation.

You will also learn the concepts of criminology and the role of the police in community policing. You will study the criminal justice system in relation to the police and forgery.

You will also study general principles of photography in relation to light and criminal photography. The use of finger prints, questioned documents, criminal laboratories in forensic science is discussed for your understanding.

The basic rudiments of fire investigation and the use of arms and ammunitions like Ballistic, Projectiles, Explosives and Land mines are exhaustively discussed for your understanding.

Finally, you will discover through your reading and assignments, ways and methods of detecting counterfeit currencies and also acquaint yourself with the concept of jurisprudence.

Course Aims

This course encourages you to

1. Study scientific procedures that directly or indirectly deal with police work.
2. Study the techniques of crime investigation, as related to Forensic Science.
3. Learn the techniques and procedures of forensic analysis.
4. Know the role of Police in interrogations and confessions.
5. Discuss the goals and main parts of the criminal justice system.
6. Discover the importance of finger prints in crime detection.
7. Study the principles of General photography as applied to criminal photography.
8. Know the general procedures of fire investigation and methods of extinguishing fire.
9. Assess the use of Ballistics, Projectiles and Mines as ammunitions.
10. Know the methods of detecting counterfeit currencies.

Course Objectives

At the end of this course, you should be able to:

- Define FORENSIC SCIENCE.
- State the subdivisions of Forensic Science.
- Describe the techniques of crime investigations.
- Analyse data obtained from forensic analysis.
- Differentiate between crime and criminalistics.
- Describe the criminal justice system in Nigeria.
- List four types of forgery.
- Identify fingerprints in a given exhibit.
- State the roles of forensic psychologist.
- Describe the principles of criminal photography.
- Differentiate between Ballistics, Mines, Explosives and Projectiles.
- List methods of detecting counterfeit currencies.

Course Requirements

To complete this course you are required to read the study units, read suggested books and other materials that will help you achieve the objectives. Each unit contains self-assessment for assessment purposes. There will be final examination at the end of the course. The course

should take you a total of about 20 weeks to complete. Listed below are the major components of the course.

Course Materials

- Course guide
- Study Units
- Recommended textbooks
- Assignment file

Study Units

There are twenty three study units in this course. Each unit should take you about two hours to work through. The twenty three study units are divided into five modules. Three Modules contain five units each, while the last two modules contain four units.

These are arranged as follows:

Module 1 Forensic Science

- Unit 1 Definition and Scope of Science
- Unit 2 Meaning and Scope of Forensic Science
- Unit 3 Techniques of Crime Scene Investigation, as related to Forensic Science
- Unit 4 Forensic Psychologist, Roles and Responsibilities
- Unit 5 Forensic Medicals/Applications and Critique

Module 2 Police Science

- Unit 1 Criminology
- Unit 2 Community Policing
- Unit 3 Penology
- Unit 4 Criminal Justice System
- Unit 5 Jurisprudence

Module 3 Light and Criminal Photography

- Unit 1 Meaning and Principles of Photography
- Unit 2 Criminal photography
- Unit 3 Crime Scene Photography
- Unit 4 Photographic Evidence
- Unit 5 Fingerprinting

Module 4 Firearms and Ammunitions

Unit 1	Ballistics
Unit 2	Projectiles
Unit 3	Explosives
Unit 4	Landmines

Module 5 Fire investigation and counterfeiting

Unit 1	Fire Investigation Unit
2	Signature Forgeries
Unit 3	Counterfeit Currencies
Unit 4	Questioned Documents and Criminal Laboratories

Each unit includes a table of contents, introduction, specific objectives, recommended textbooks and summaries of key issues and ideas. At intervals of each unit, you will be provided with a number of exercises or self-assessment questions. These are to help you test yourself on the materials you have just covered or to apply them in some way. The value of these self-test is to help you assess your progress and to reinforce your understanding of the material. At least, one tutor-marked assignment will be provided at the end of each unit. The exercise and the tutor-marked assignments will help you in achieving the stated learning objectives of the individual units, and of the course.

Textbooks and References

- Fisher, B. A. J. (1993). *Techniques of Crime Scene Investigation*, (5th Ed.). Boca Raton, Florida: CRC Pres Inc.
- Kirk, P. L. (1974). *Crime Investigation*, (2nd Ed.). New York: John Wiley and Sons.
- Saferstein, R. (1998). *Criminalistics: An Introduction to Forensic Science*, (6th Ed.). Englewood Cliffs, N. J. Prentice Hall.
- Walker, S. “*Origins of the Contemporary Criminal Justice Paradigm: The American Bar Foundation Survey. 1953-1969*”. *Justice Quarterly* 9 (1).
- John R F. (2005). *Criminal Justice: Mainstream and Crosscurrents*. Prentice Hall. Upper saddle River. N. J.
- Lawrence S. & Wrightsmann S, M. Fuero (2005). Thomas Inc. *forensic Psychology*.
- Davis & Hull H. *Manual of Firearmship Revised Structure* (2006). HBL Printers, N. J.

Assignment File

All the details of the assignment you must submit to your tutor for marking will be found in this file. You must get a passing grade in these assignments in order to pass this course. In the assignment file itself and in the section on assessment within this Course Guide, additional information will be found.

There are fifteen (15) assignments in this course. They will cover:

- Definition and Scope of Science (Module 1)
- Techniques of Crime Scene Investigation as related to Forensic Science (Module 1, Unit 3)
- Forensic medical Analysis (Module 1, Unit 5)
- Criminology (Module 2, Unit 1)
- Criminal Justice System in relation to the Police (Module 2, Unit 5)
- Criminal Photography: General Principles (Module 3, Unit 1)
- Fingerprints Evidence (Module 3, Unit 5)
- Crime scene photography (Module 3, Unit 3)
- Photographing evidence (Module 3, Unit 4)
- Fire Investigation (Module 5, Unit 1)
- Ballistics (Module 4, Unit 1)
- Explosives (Module 4, Unit 3)
- Landmines (Module 4, Unit 5)
- Counterfeit currencies (Module 5, Unit 3)
- Forgery (Module 5, Unit 2)
- Questioned documents and Criminal laboratories (Module 5, Unit 4)

Assessment

The course will be assessed in two aspects. These are as follows:

- Tutor-marked assignments
- Written examination.

For you to do the assignments very well, it is expected of you to apply information, knowledge and techniques obtained from the course. You must endeavour to submit the assignments to your tutor for marking, before the deadlines given in the assignment file. The assignments will count for 30% of the final examination. The remaining 70% will be for written examination for the total Course work. The examination will be of three hours duration.

Tutor-Marked Assignments

This course consists of 15 tutor-marked assignments. The best three assignments with the highest marks will be counted for you. You are encouraged to submit all your assignments. Each assignment counts 10% towards your total course work.

In the Assignment File, you will find all the assignment questions for all units. To demonstrate your understanding of the course, do not depend only on information obtained from the units to answer the question. Go to the Library, read and research very well to obtain more information on the course.

After completing each assignment, send it to your tutor. Try your best to get each assignment across to your tutor on or before the dates given in the assignment file. However, if it becomes impossible for you to submit any of those assignments on time, please let your tutor know before the due date. After due consideration, you might be given an extension.

Final Examination and Grading

To prepare for this examination, revise all the areas covered in this course. Revision of all the exercises and the tutor-marked assignments before the examination will also be of help to you. The revision should start after you have finished studying the last unit. This final examination will be of three hours duration. It has a value of 70% of the total course grade.

Course Marking Scheme

This table shows how actual course marking is broken down.

Assessment	Marks
Assignments	Five assignments, best three marks of the five counts at 30% of work marks.
Final Examination	70% of overall courses marks
Total	100% of course marks

Course Overview

The Units, the number of weeks it would take you to complete them and the assignments that follow them are outlined in the table below.

Unit	Title of Work	Duration (Weeks)	Assignment
	Course Guide	1	
Module 1 Forensic Science			
1	Definition and Scope of Science	1	Assignment 1
2	Meaning and Scope of Forensic Science	1	Assignment 2
3	Techniques of Crime Scene Investigation, as related to Forensic Science	1	Assignment 3
4	Forensic Psychologist, Roles and Responsibilities	1	
5	Forensic Medicals/Applications and Critique	1	Assignment 4
Module 2 Police Science			
1	Criminology	1	
2	Community Policing	1	Assignment 5
3	Penology	1	Assignment 6
4	Criminal Justice System	1	Assignment 7
5	Jurisprudence	1	Assignment 8
Module 3 Light and Criminal Photography			
1	Meaning and Principles of Photography	1	Assignment 9
2	Criminal Photography		
3	Crime Scene Photography	1	Assignment 10
4	Photographic Evidence		Assignment 11
5	Fingerprinting	1	Assignment 12
Module 4 Firearms and Ammunitions			
1	Ballistics	1	Assignment 13
2	Projectiles	1	Assignment 14
3	Explosives	1	
4	Landmines	1	
Module 5 Fire Investigation and Counterfeiting			
1	Fire Investigation		
2	Signature Forgeries		
3	Counterfeit Currencies	1	Assignment 15
4	Questioned Documents and Criminal Laboratories	1	
	Revision		
	Examination		

Strategies for Studying the Course

In the National Open University, where open and distance learning system is fundamental in the development of course materials, the study units replaces the university lecturer. Thus you can read the course materials at your own pace, at anytime and anywhere. Exercises to test your understanding of the materials are provided in each unit. There is a common format for all the units. The first item is the introduction to what the unit will be introducing to you. The introduction also shows you how a particular unit is related to other units, and to the course as a whole. After the introduction, you will see the objectives. The objectives indicate what you are expected to achieve after studying the unit. So you should keep it handy in order to constantly check or monitor yourself in terms of achieving those objectives.

The main body of the unit guides you through the required readings from other sources. Exercises, as was mentioned before, are provided at intervals throughout the materials. Answers to those exercises are provided at the end of each unit. Don't try to skip any of the exercises. Try to do them as you meet them while reading. This will help you to do your tutor-marked assignments and also to prepare you for examinations.

The following is a practical strategy for studying the reading materials.

- If you encounter any problem, contact your tutor and he/she will be available to help out.
- Read this Course Guide thoroughly, provide a time table for yourself and take note of the time you are required to spend on each unit, and always stick to the time table.

Facilitators/Tutors and Tutorials

There are ten hours tutorials (eight hours) provided to support this course. The dates, times and locations of these tutorials will be made available to you, together with the name and address of your tutor.

Your tutor will mark the assignments. Take note of the comments he might make and remember to send your assignments before the deadline. In case you will not meet the deadline, make sure you notify your tutor. The tutor will return your assignments to you after he must have marked them.

Try your best not to skip any of the tutorials. This is because that is the only chance you have of meeting your tutor and your fellow students.

Your tutor will more easily solve problems encountered while reading the course materials.

Summary

CSS455: FORENSIC SCIENCE intends to introduce you to the application of scientific procedures to the police work, and also the implications of forensic science in the legal framework. By the time you complete this course, you would have known the relationship between FORENSIC SCIENCE, General Principles of photography and firearms and ammunitions.

Therefore, the successful completion of this course will aid you to answer these questions without much difficulty:

- i. What is Forensic Science?
- ii. What is the relationship between Forensic Science and Police Science?
- iii. How are Police Investigations and Confessions conducted?
- iv. What is the difference between Crime and Criminalistics?
- v. How can you apply the general principles of photography to criminal photography?
- vi. The role of fingerprints in evidential law.
- vii. What are the ways of detecting forgery?
- viii. How are Landmines laid?
- ix. What are the basic components of explosives?

The questions are quite numerous. There are more you can answer.

We wish you success with the course and hope that you will find it both rewarding and interesting.

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MODULE 1 FORENSIC SCIENCE

Unit 1	Definition and Scope of Science
Unit 2	Meaning and Scope of Forensic Science
Unit 3	Techniques of Crime Scene Investigation, as Related to Forensic Science
Unit 4	Forensic Psychologists, Roles and Responsibilities
Unit 5	Forensic Medical/Application and Critique

UNIT 1 DEFINITION AND SCOPE OF SCIENCE**CONTENTS**

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Definition of Science
3.2	Scope of Science
3.3	Aims of Science
3.4	Scientific Knowledge
3.5	The Scientific Method
3.6	The Science Process Skills
4.0	Conclusion
5.0	Summary
6.0	Tutor-Marked Assignment
7.0	References/Further Reading

1.0 INTRODUCTION

How is the knowledge of science useful in Forensic and Police Science? Scientific knowledge has increased both in quantity and quality. It is applied in every facet of human activity. The various issues that will be examined in this unit will introduce you to definition and scope of science. We shall discuss the aims of science, scientific knowledge, scientific method, science process, skills and scope of science.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the concept of science
- discuss the various dimensions or characteristics of science
- mention aims of science
- list 4 main divisions of science
- describe science process skills

- discuss the applications of scientific knowledge
- state the different branches of science.

3.0 MAIN CONTENT

3.1 Definition of Science

This section introduces you to the definition of science as will be useful in forensic and police science.

Science has been described in so many ways by authors that one is left with no clear-cut definition. But generally, science is seen as a system of thought. It is generally described as a process of thinking, a means of acquiring new knowledge and a means of understanding the natural world.

Science has no singular definition. To understand what science means, we have to know its various dimensions or characteristics. In general, science is:

- a body of knowledge
 - a method for acquiring knowledge or cognising (studying and understanding) the world
 - an instrument which enables us to practically transform the world in accordance with our purpose and an institution.
- a. **As a body of knowledge**, scientific knowledge differs from other forms of knowledge in both content and form. It deals with the material aspects of reality. It shows what is in the world, how the world (reality) and at its various aspects function, their various properties and the changes which they undergo. Science expresses this knowledge in quantifiable terms, in concepts, laws and theories.

Science has branches which can be grouped into formal science and empirical science. They differ from other branches of knowledge, say the humanities or arts.

- b. **As a method for acquiring knowledge**. Empirical science proceeds by way of observation, experimentation, forming of hypothesis, testing, use of instruments, and formation of theories. Formal science utilises concepts, rules and theories expressing them in quantitative and statistical manner and finally, expressing knowledge so obtained in systematic and deductive form.

- c. **The body of knowledge** and method of science are instruments in our hands for transforming the world in a practical manner. The practical application of science is technology which we see in the complex material structures and objects which humanity has created to serve his purpose. Thus, scientific knowledge enables us to understand and explain the world, to predict and change the world.
- d. **Science is also an institution** involving millions of experts all over the world, who engage in the study and development of human knowledge in various institutions, laboratories, research centres and organisation. Today, scientists are found in various research and educational institutions, industries, hospitals, companies, etc. The co-operation and interaction among them make development of science possible and reliable. Among them, there is a common belief in the method and efficacy of science.

SELF-ASSESSMENT EXERCISE 1

State and discuss the characteristics of science.

3.2 Scope of Science

Having attempted to define science and explain the various dimensions and characteristics of science, the next issue to deal with is the scope of science. That is the different branches and other broad divisions of the sciences

Branches of Science

The first general distinction among the various disciplines that make up science is that between **formal sciences** and **empirical sciences**.

- **Formal Science** includes Mathematics (Geometry, Algebra, Trigonometry, and Arithmetic). Logic, Theoretical Physics, Statistics, etc.
Empirical Science includes Physics, Chemistry, Biology, Psychology, Botany, Zoology, Biochemistry, Microbiology, Geology, Medical Science, etc.

Formal Science has a formal and deductive character. Science is said to be formal if its contents, arguments and procedures obey certain rules. The results and conclusions are valid and authentic only if they conform to those rules. For example, in Mathematics, we have rules of addition, subtraction, multiplication and division. We have rules for solving certain equations and

problems, theorems, etc. Also in logic or even mathematical logic, we have rules of inference, implication disjunction, conjunction, etc. To make our thinking and reasoning scientific, there are laws of for our general argument. A systematic body of scientific knowledge must have clearly defined terms and concepts, inference and formula to arrive at its conclusions. Thus, a body of formal science is systematic and deductive in character.

- **Empirical Sciences**, on the other hand, deal mainly with materials drawn from experience. They treat physical entities and phenomena which we can observe through any of the senses and which we can test with instruments such as those for measuring distance, weight, volume, size (e.g. telescope, microscope, ruler, tapes, scales, etc.).

In empirical sciences, we deal with the nature and functioning of objects like the human body, and bodies of other animals, natural objects (e.g. the weather, diseases, plants, insects, etc.).

Thus, in empirical sciences, we observe and experiment in order to find out how things originate, grow or develop, function and relate to each other. We also try to find out the laws which govern their behaviour. We are interested in the regularities or laws which can enable us to understand or explain the object or phenomenon under study. The knowledge we derive in empirical sciences includes inductive generalisations, laws and theories which we formulate in clearly defined statements, propositions or in statistical equations or formulae.

Other Broad Divisions of the Sciences

Apart from the distinction between formal and empirical sciences, we also group the various scientific disciplines according to two classes of objects or phenomenon they deal with. For example:

- a. **Natural Sciences** deal with all natural objects. Under it we have other branches such as:
 - **Physical Sciences** e.g. Physics, Chemistry, Biochemistry, Geology, Applied Mathematics, Astronomy, etc. these deal with physical and inanimate objects.
 - **Biological Sciences**. These deal with living bodies such as human beings, animals, insects and plants. They include Biology, Zoology, Botany, Microbiology, etc.
 - **Medical Science** deals with objects and problems that affect human and animal health. They include General Medicine,

- Anatomy, Surgery, Physiology, Neurology, Veterinary Medicine, etc.
- **Pharmaceutical Science** which is concerned with drugs and content of plants and other objects.
 - b. We also have social sciences which deal with society and social institutions (e.g. Economics, Social Psychology, Sociology and Anthropology, Geography, Social Philosophy, etc.).
 - c. Human Science. There has been a progressive attempt to extend the procedure and techniques of science such as systematisation, deduction, statistical and mathematical formulae and even experimentation to the study of the humanities especially language, music, drama and poetry, art, history, etc. in that case, we also can tell about Human Sciences.

SELF-ASSESSMENT EXERCISE 2

Differentiate between formal and empirical sciences.

3.3 Aims of Science

What are the aims of science?

Science enables us to attain a systematic, objective and reliable body of knowledge of the world and of ourselves. Being systematic means that all the various elements in a body of scientific knowledge are logically related and each can be inferred from the other. Being objective means that all those who adopt the same method or procedure can prove or verify the claims or statements which the body of scientific knowledge contains.

Being reliable means that the body of scientific knowledge can enable us to adequately and correctly explain, predict and control any phenomenon in question.

Thus, science aims at enabling man to explain how the world, events and objects around him originate, develop, operate or function. It also helps him to predict how they will behave in future and thus enables him to control the behaviour of things around him, once he is able to develop the appropriate instruments for such control. We can therefore say that science is theoretical knowledge about the world (in terms of concepts, laws, and theories) which helps us to express and systematise our understanding of objects and phenomena. It also equips us with practical knowledge in terms of the various ways, mechanisms and instruments which enable us to control objects and phenomena. Science is, therefore,

not only a source of knowledge; it is also a source of power. Generally, scientific knowledge is said to be objective, factual, systematic, verifiable and quantifiable.

SELF-ASSESSMENT EXERCISE 3

Discuss the basic aims of science.

3.4 Scientific Knowledge

The ultimate source of scientific activity is the human experience by observing objects and events. Events in this sense could be regarded as interactions among objects. One does not have to be a scientist in order to recognise that some objects have striking similarities and that under similar conditions, these objects appear to interact in similar ways.

People's modes of behaviours are often based on concepts and structures that reflect internal assumptions about the similarity of objects and the consistent manner in which they interact. These internal assumptions are always interpreted in various ways by people. For people with little or no scientific background, such assumptions are usually based upon social, religious or cultural experiences acquired through communication with other people.

Science and scientific knowledge militates against assumptions. Science suggests that there is a better way to deal with the biological and physical worlds. Scientific knowledge and activities strive to articulate natural phenomena with some systematic scheme that can be used as a framework for perceiving, organising and dealing with these phenomena in more rational ways.

Science is a human activity and scientific knowledge is a human creation. For it to be communicated to other persons or stored for future reference, scientific knowledge is expressed in symbols.

Natural phenomena or objects must be well classified before relationships could be interpreted. These objects must first be classified into groups and then the interactions among them also classified, that is the events between the objects. Once objects and events have been classified into types, one can then look for consistency in the types of interactions that occur among a selected set of objects under a given set of conditions. Such a consistency, when found is interpreted as a relationship among classes of objects under certain conditions and may be thought of as an empirical law.

SELF-ASSESSMENT EXERCISE 4

1. Explain how science differs from scientific knowledge.
2. List the importance of scientific knowledge to humanity.

3.5 The Scientific Method

By definition, scientific method is meant the method of reporting scientific information. The various steps in scientific method are:

1. Stating the problem
2. Formulating hypothesis
3. Designing experiments
4. Observation
5. Collecting data from experiment
6. Conclusions

The disciplines of science are meaningless unless they are geared towards practical application in human affairs. To Dewey (1966), science is the outcome of methods of observation and testing which are deliberately adopted to secure a settled assured subject matter. Scientific method to him therefore, is a non-authoritarian democratic self correcting intellectual and moral authority by which man may govern his actions.

At the experimentation stage, one must devise a control which is a condition or situation which is neutral to the test in hand, and whose effects, if any, are known completely as far as the test in question is concerned. Principles and theories emerge from the results of such conclusions as they emanate from the scientific method. Science therefore is not just learning about knowledge but doing things. To experience the language, the process (method) of doing these things to experience knowledge is what is referred to as the scientific method.

Science as a process or way of knowing consists of local methods of approach and the right attitudes of mind which guide inquiring into truth about natural phenomena. The scientific approach to inquiring and problem solving involves the scientific method, and the various steps which have been given earlier science as product yields scientific hypotheses' theories, principles and laws.

SELF-ASSESSMENT EXERCISE 5

List the various steps involved in a scientific method.

3.6 Science Process Skills

The development of science process skills is a very important objective of science. This is because these process skills play vital roles in scientific and technological activities. They are often seen as the foundation of scientific enquiry. Since they can be generalised and are required for carrying out scientific activity.

Science process skills can be defined as ways in which scientists carry out their activities. Or the methods scientist use in arriving at a decision. These science process skills are: observing, classifying, comparing, counting, measuring, raising questions, hypotheses, predicting, making operational definitions, controlling or manipulating variables, experimenting, collecting data, interpreting data, inferring and manipulating apparatus.

Each of the process skill is discussed as follows:

1. **Observing:** This is a common but often misused process skill. It is more than just seeing. One can use all the senses – seeing, tasting, touching, smelling to observe. Observing is the act of paying particular attention to what one experiences with his senses.
2. **Classifying:** This depends on careful observation. It is the sorting out of objects into groups according to some identified properties.
3. **Comparing:** This is the act of comparing two or more objects. Comparison of objects can be made at varying levels of difficulty.
4. **Counting of Numbers:** This is basically an arithmetic process but is a very important process of science. It involves the use of numbers in addition, subtraction, division and multiplication.
5. **Measuring:** This process involves the use of an instrument to determine the quantitative value associated with the properties of objects.
6. **Raising Questions:** Scientists would always want to know many things in their environment. They do so by asking such questions as how, why, when, to what extent among others. Such questions lead to investigations.
7. **Formulating Hypotheses:** When scientists raise questions on any aspect of nature, they also make intelligent guesses which are

referred to as hypotheses. These hypotheses are either accepted or rejected after investigation has been completed.

This involves telling future observation on the basis of previous information. The nature of an event being predicted and the accuracy of other past observations determine the reliability of our prediction. The prediction has to be tested or verified through investigations.

8. **Making Operational Definition:** This refers to defining terms used in a particular context under reference. This is necessary because it enables any person reading a report arising from scientific investigations to understand it the way the writer expects.
9. **Controlling or Manipulating Variable:** A variable is something that is capable of change. This is closely linked with experimentation.
10. **Experimentation:** This is an act of testing an idea through practical investigation. The investigation can be based on some information or it may be on the basis of trial and error.
11. **Data Collecting:** This is an act of gathering relevant information. It is an essential element in many scientific investigations.
12. **Interpreting Data:** The process of interpreting implies that scientists should provide a meaning to their experiences, and to provide justification for such meaning.
13. **Inferring:** This involves making a general statement based on the data collected and interpreted. It is an attempt to generalise to other situations on the basis of sufficient evidence obtained.

SELF-ASSESSMENT EXERCISE 6

Enumerate the processes of science and discuss any five of them.

4.0 CONCLUSION

From what has been discussed so far, we have explained that science is a body of organised knowledge, it is a way of discovering truth about natural phenomena. Hence, it is a process and method of enquiring. That science is a social enterprise forming an integral part of the society. Processes of science are the skills used by scientists to arrive at scientific knowledge.

5.0 SUMMARY

In this unit, we have dealt with meaning and scope of science by looking at the following aspect: Definition, scope, aims, scientific knowledge, scientific method and science process skills.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is science?
2. Differentiate between scientific knowledge and scientific methods.
3. List and explain five process skills used by scientists.

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UNIT 2 MEANING AND SCOPE OF FORENSIC SCIENCE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Definition and Meaning of Forensic Science
 - 3.2 History of Forensic Science
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1.0 INTRODUCTION

Forensic science is a very interesting study and refers to something “of pertaining to, or used in a court of law”. In today’s day and age, it almost always refers to a method of obtaining criminal evidence for the purpose of using it in a court of law. The various aspects that will be examined in this unit will introduce you to; definition and meaning of forensic science, history of forensic science, subdivision of forensic science, forensic profiling, and forensic identification.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define forensic science
- state the subdivisions of forensic science
- describe forensic identification procedure
- mention the various steps in forensic profiling
- explain forensic profiling process analysis
- discuss the history of forensic science
- list some notable forensic scientists.

3.0 MAIN CONTENT

3.1 Definition and Meaning of Forensic Science

The word forensic comes from Latin (forensic meaning “before the forum”) and refers to something “of pertaining to or used in a court of law. In today’s day and age, it almost refers to a method of obtaining criminal evidence for the purpose of using it in the court of law.

Forensic science is typically just referred to as “forensics” and is the practical application of numerous sciences to solve legal system – related questions, which can include either a civil or criminal action or suit.

The use of the term “forensics” in place of “forensic science” is actually a globally–accepted misnomer considering that the term “forensic” is effectively a synonym for “legal” or “pertaining to court”, from the root Latin meaning. Because it is now so closely associated with the criminal scientific field, many dictionaries equate the word “forensics” with forensic science”.

Forensic science extends into a broad range of sub-sciences which utilises natural science technique to obtain relevant criminal and legal evidence.

Also forensic science (often shortened to forensics) is the application of a broad spectrum of science to answer questions of interest to a legal system. This may be in relation to a crime or a civil action. Besides, its relevance to a legal system, more generally forensics encompasses the accepted scholarly or scientific methodology and norms under which the facts regarding an event, or an artefact or some other physical item (such as a corpse) are ascertained as being the case. In that regard, the concept is related to the notion of authentication, whereby an interest outside of a legal form exists in determining whether an object is what it purports to be, or is alleged as being.

As earlier stated, the word forensic comes from the Latin adjective forensic, meaning “of or before the forum”. In Roman times, a criminal charge meant presenting the case before a group of public individuals in the forum. Both the person accused of the crime; and his side of the story will determine the outcome of the case. Basically, the person with the sharpest forensic skills would win. This origin is the source of the two modern usages of the word forensic – as a form of legal evidence and as a category of public presentation.

In modern use, the term “forensics” in place of “forensic science” can be considered incorrect as the term “forensic” is effectively a synonym for “legal” or “related to courts” however, the term is now so closely associated with the scientific field that many dictionaries include the meaning that equates the word “forensics” with forensic science”

SELF-ASSESSMENT EXERCISE 1

Explain the meaning of forensic science and define the term forensic”.

3.2 History of Forensic Science

After the definition and meaning of forensic science as discussed in the above section, the next issue to deal with is the history or evolution of forensic science of course, simply put, how does these forensic practice come to be?

The ancient world lacked standardised forensic practices, which aided criminals in escaping punishment. Criminal investigations and trials relied on forced confessions and witness testimony. However, ancient sources contain several accounts of techniques that foreshadow the concepts of forensic science, developed centuries later, such as the “Eureka” Legend told of Archimedes 289 – 212 BC.

The first written account of using medicine and entomology to solve (separate) criminal cases is attributed to the Book xi Yuan Ji Lu, (translated as “Collected Cases of Injustice Rectified), written in a Song Dynasty China by Sung Ci, in 1248. In one of the accounts, the case of a person murdered with a sickle was solved by a death investigator who instructed everyone to bring his sickle to one location. Flies, attracted by the smell of blood, eventually gathered on a single sickle. In light of this the murderer confessed. The book also offered advice on how to distinguish between a drawing (water in the lungs) and with other evidence from examining corpses or determining if a death was caused by murder, suicide, or an accident.

In sixteenth century Europe, medical practitioners in army and university settings began to gather information on cause and manner of death. A French army surgeon systematically studied the effects of violent death on internal organs. Two Italian surgeons laid the foundation of modern pathology by studying change which occurred in the structure of the body as the result of disease. In the late 1700s, writings on these topics began to appear. These included: *A Treatise on Forensic Medicine and Public Health* by French Physician Fodere’ and *The Complete Police Medicine* by the German medical expert Johann Peter Frank.

In 1776, Swedish chemist, Scheele devised a way of detecting arsenous oxide, a simple arsenic in corpses, although only in large quantities. This investigation was expanded in 1806 by German chemist Val Ross, who learned to detect the poison in the walls of a victim's stomach, and by English chemist James Marsh who used chemical processes to confirm arsenic as the cause of death in an 1836 murder trial.

Two early examples of English forensic science in individual legal proceedings demonstrate the increasing use of logic and procedure in criminal investigations. In 1784, in England, John Toms was tried and convicted for murdering Edward Culshaw with a pistol. When the dead body of Culshaw was examined, a pistol wad (crushed paper used to secure powder and balls in the muzzle) found in his head wound matched perfectly with a torn newspaper found in Tom's pocket. In Warwick, England in 1816, a farm labourer was tried and convicted of the murder of a young maid servant. She had been drowned in a shallow pool and bore the marks of violent assault. The police found foot prints and an impression from corduroy cloth with a sewn patch in the damp earth near the pool. There were also scattered grains of wheat and chaff. The breeches of the farm labourer who had been threshing wheat nearby were examined and corresponded exactly to the impression in the earth near the pool. Later in the 20th century, there were several British pathologists, Bernard Spitsbury, Francis camps, Sydney Smith and Keith Simpson.

SELF-ASSESSMENT EXERCISE 2

Trace the evolution of forensic science to modern times.

3.3 Subdivisions of Forensic Science

Having looked at the history of modern forensic science, we shall now consider the subdivisions of forensic science. Forensic science specialties include:

Forensic Accounting

The acquisition, interpretation and study of accounting evidence.

Computational Forensics – also known as digital forensics is the retrieval, reconstruction and interpretation of digital media (i.e. images, PDFs, e-mail messages, etc.) stored on a computer, for use as evidence.

Forensic Document Examination

The reconstruction, study and interpretation of physical document-related evidence, such as hand writing analysis and printmaking.

Forensic Economics

The acquisition, study and interpretation of evidence related to economic damage, which includes determination of lost benefits and earnings, business value and profit loss, household service value, labour replacement and future medical expense cost, etc.

Forensic Engineering

The scientific examination and analysis of structures and other objects to answer questions as to their failure or cause of damage. Typically their evaluation is used to answer legal questions.

Forensic Linguistics

The study and interpretation of language for use as legal evidence.

Forensic Origin and Cause

The study, interpretation and identification of a fire for the express purpose of determining the cause of ignition and origin of the fire (i.e. arson cases).

Forensic Photography

The art-science of reconstructing, interpreting and producing an accurate photographic reproduction of a crime scene for a court's benefit.

Forensic Psychology and Psychiatry

The study of the mind of an individual, using forensic methods. Also it is the study, evaluation and identification of mentally-related illnesses and human behaviour for the purpose of obtaining legal evidence.

Forensic Anthropology

The practice of physical anthropology, as applied to a legal situation - typically the identification and recovery of skeletonised human remains (bones).

Forensic Entomology

Deals with examination of insects in, and around human remains to assist in determination of time or location of death. It is also possible to determine if the body was moved after death.

Criminalistics

Includes evidence collected from a wide range of sciences to determine the answers of questions relating to the examination and comparison of criminal investigations. This evidence is typically processed in a crime laboratory.

Forensic DNA Analysis

Performing individual's DNA to answer forensic questions such as determining paternity/maternity or placing a suspect at a crime scene.

Forensic Geology

The application of trace evidence found in soils, minerals and petroleum, as applied to legal setting.

Forensic Meteorology

Is the analysis of prior weather conditions, specific on the site being examined.

Forensic Odontology

Is the study of teeth – specifically, the uniqueness of dentition.

Forensic Pathology

This combines the discipline of medicine and pathology, as applied to a legal inquiry, to determine the cause of injury or death.

Forensic Toxicology

Is the study evaluation and identification of the effects of poison chemicals or drugs in and on the human body.

Forensic Linnology

Is the analysis of evidence collected from crime scenes in or around fresh water sources. Examination of biological organisms, particularly diatoms can be useful in connecting suspects with victims.

SELF-ASSESSMENT EXERCISE 3

List ten areas of forensic science and discuss on any of five of them.

3.4 Forensic Profiling

You may want to ask yourself what is forensic profiling and its relevance?

Forensic profiling refers to the study and the exploitation of traces in order to draw profile that must be relevant to the context of supporting various security tasks, mostly in the criminal justice system. The term forensic in this context refers to “information that is used in court as evidence”. Geralt & Summer (2006), traces originate from criminal or litigious activities themselves. However traces are information that are not strictly dedicated to the court, but also that may bring knowledge on broader domains linked to security that deal with investigation, intelligence, surveillance, or risk analysis.

Forensic profiling is different from offender profiling, which only refers to the identification of an offender to the psychological profile of a criminal.

In particular forensic profiling should refer to profiling in general, i.e. “the process of ‘discovering’ correlations between data in data bases that can be used to identify and represent a human or non human subject (individual or group), and/or the application of profiles (set of correlated data) to individuate and represent a subject or to a group or category.” Geralt & Summer (2006).

3.4.1 The Profiling Process

The technical process of profiling can be separated in several steps.

- **Preliminary Grounding**

The profiling process starts with a specification of the applicable problem domain and the identification of the goals of analysis.

- **Data Collection**

The target data set or database for analysis is formed by selecting the relevant data in the light of existing domain knowledge and data understanding.

- **Data Preparation**

The data is pre-processed for removing noise and reducing complexity by eliminating attributes.

- **Data Mining**

The mined patterns are evaluated on their relevance and validity by specialists and/or professionals in the application domain (e.g. excluding spurious correlations).

- **Application**

The constructed profiles are applied, e.g. to categories of persons to test and fine – tune the algorithms.

- **Institutional Decision**

The institution decides what actions or policies to apply to groups or individuals whose data match a relevant profile.

Data collection, preparation and mining all belong to the phase in which the profile is under construction. However, profiling also refers to the application of profiles, meaning the usage of profiles of groups or individual persons as can be seen in step 6 (application) the process is circular. There is a feedback loop between the construction and the application of profiles. The interpretation of profiles can lead to the reentrant – possibly real time – fine tuning of specific previous steps in the profiling process. The application of profiles to people whose data were not used to construct the profile is based on data–matching, which provides new data that allows for further adjustments. The process of profiling is both dynamic and adaptive.

3.4.2 Profiling Techniques

Forensic profiling is generally conducted using data mining technology, as a mean by which relevant patterns are discovered and profiles are generated from large quantities of data.

The data available to law enforcement agencies are divided into two categories.

- Nominal data directly designates persons or objects (intelligence files and suspect files, stolen vehicles or objects, etc.) and their relations. Nominal data may also be obtained in the framework of

specific investigations, for instance a list of calls made with a mobile phone (card and/or phone) that cover a certain period of time, a list of people corresponding to a certain profile, or data obtained through surveillances.

- **Crime data:** Consist of traces that result from criminal activities: physical traces, other information collected at the scene, electronic traces, as well as reconstructed descriptions of cases. (Modus operandi, time intervals, duration and place) and their relations (links between cases, series).

3.4.3 Types of Forensic Profiling

- **DNA profiling:** Used for the identification of individuals on the basis of their respective DNA profiles.
- **Digital Image Forensic:** This covers image source identification (which is based on specific characteristics of the image acquisition device or technology) and malicious post-processing or tampering (which aim is for instance to verify the integrity of particular features).
- **Illicit Drug Profiling:** Which refers to the systematic extraction and storage of chemical attributes of drugs seized in order to obtain indications on the manufacture and distribution processes, the size and the evolution of the market).
- **Forensic Information Technology (forensic IT)** which refers to the analysis of the digital traces that people leave when using information technology.
- **Offender Profiling:** That is psychological profiling of the criminal.

DNA Profiling

DNA profiling (also called DNA testing, DNA typing, or genetic fingerprinting) is a technique employed by forensic scientists to assist in the identification of individuals on the basis of their respective DNA profiles. DNA profiles are encrypted sets of numbers that reflect a person's DNA make up, which can also be used as the person's identifier. DNA profiling should not be confused with full genome sequencing. It is used in, for example parental testing and rape investigation.

Although 99.9% of human DNA sequences are the same in every person, enough of the DNA is different to distinguish one individual from another. DNA profiling uses repetitive (“repeat”) sequences that are highly variable, called variable number tandem repeats (VNTR). VNTRs loci are very similar between closely related human, but also variable that unrelated individuals are extremely unlikely to have the same VNTRs.

The DNA Profiling technique was first reported in 1984 by Sir Alec Jeffreys at the University of Leicester in England, and is now the basis of several national DNA databases.

DNA Profiling Process

The process begins with a sample of an individual’s DNA (typically called a reference sample”). The most desirable method of collecting a reference sample is the use of a buccal swap, as this reduces the possibility of contamination. When this is not available (e.g., because a court order may be needed and not obtainable) other methods may need to be used to collect a sample of blood, saliva, semen or other appropriate fluid or tissue from personal items (e.g. toothbrush, razor, etc.) or from stored samples (e.g. banked sperm or biopsy tissue). Samples obtained from blood relatives (biological relative) can provide an indication of an individual’s profile as could human remains which had been previously profiled.

A reference sample is then analysed to create the individual’s DNA profile using one of a number of techniques. The DNA profile is then compared against another sample to determine whether there is a genetic match.

SELF-ASSESSMENT EXERCISE 4

Discuss the role of forensic profiling in forensic science.

3.5 Forensic Identification

Forensic Identification is the application of forensic science and technology to identify specific objects from the trace evidence left, at a crime scene. Forensic means “for the courts”.

Human Identification

Droplets of human blood: In addition to analyzing for DNA, the droplets round also show the impact at a relatively slow velocity, in the case of a height of two feet.

People can be identified by their fingerprints. This assertion is supported by this philosophy of friction ridge identification, which states that “friction ridge identification is established through the agreement of friction ridge formations, in sequence, having sufficient uniqueness to individualise.

Friction ridge identification is also governed by four premises or statements of fact:

1. Friction ridges develop on the foetus in their definitive form prior to birth.
2. Friction ridges are persistent throughout life except for permanent scarring, disease or decomposition, after death
3. Friction ridge paths and the details in small areas of friction ridges are unique and never repeated.
4. Overall, friction ridge patterns vary within limits which allow for classification.

People can also be identified from traces of their DNA by DNA fingerprinting; from their teeth or bite by forensic odontology; from a photograph or a video recording by facial recognition systems; from the video recording of their walk by gait analysis; from an audio recording by voice analysis; from the content of their writing style (e.g. typical phrases, factual bias, and/or misspelling of words); or from other traces using other biometric techniques.

Body identification is a subfield of forensics concerned with identifying someone from their remains.

Product Identification

- Colour copier and maybe some colour computer printers embed their identification number to some printouts as a counter measure of currency forgeries.
- Copiers and computer printers can be potentially identified by the minor variants of the way they feed the paper through the printing mechanism leaving banding artefacts. Analysis of the toners is also used.
- Documents are characterised by the composition of their paper and ink.
- Firearms can be identified by the striations on the bullets they fired and imprints on the cartridge casings.
- Paper shredders can be potentially identified in a similar way, by spacing and wear of their blades.

- Photo identification is used to detect and identify forged digital photos.
- Typewriters can be identified by minor variations of positioning and wear of their letters.

Networks

- Cars can be automatically found on CCTV records by automatic number plate recognition.
- Computers connected to the internet can often be identified by their IP address or MAC address.
- Radio transceivers can be potentially identified by minute variations of their output signal.
- Social networks can be discovered by network analysis of banking, telecommunications and postal records.

Applications

Sometimes, manufacturers and film distributors may intentionally leave subtle forensic markings on their products to identify them in case of piracy or involvement in a crime.

SELF-ASSESSMENT EXERCISE 5

State and discuss 3 methods of forensic identification.

4.0 CONCLUSION

We have explained the concept of forensic science, as something pertaining to, or used in a court of law. Forensic science developed long ago in China and is subdivided into about twenty areas.

We also discussed the role of forensic profiling as a process of discovering correlations between data in data bases, and using the information to identify subjects. Types of forensic profiling were also discussed, especially the DNA profiling used for the identification of individuals on the basis of their respective DNA profiles.

5.0 SUMMARY

In this unit, we have dealt with the meaning and scope of forensic science, by looking at the following areas, definition and meaning of forensic science subdivision of forensic science, history of forensic science, forensic profiling and identification.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is forensic science?
2. Describe the steps involved in forensic profiling.
3. Discuss DNA profiling.

7.0 REFERENCES/FURTHER READING

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UNIT 3 TECHNIQUES OF CRIME SCENE INVESTIGATION, AS RELATED TO FORENSIC SCIENCE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Meaning of Crime
 - 3.2 Techniques of Crime Scene Investigation
 - 3.2.1 Initial Response/Prioritisation of Efforts
 - 3.2.2 Preliminary Documentation and Evaluation of the Scene
 - 3.2.3 Processing the Scene
 - 3.2.4 Completing and Recording the Crime Scene Investigation
 - 3.2.5 Crime Scene Equipment
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

1.0 INTRODUCTION

How can you establish a relationship between crime scene investigation and forensic science? Directly related to forensic science, though not quite the same, is crime scene investigation (CSI).

The primary function of a crime scene investigator is to collect, identify, document, and preserve physical evidence left at the scene of a crime, with the ultimate goal of presenting a court with evidence to identify and apprehend the perpetrator. CSI combines the knowledge and techniques of several disciplines, including science, mathematics, logic, and law.

The primary difference between CSI and forensics is that CSI involves on-site investigation (field forensics) of the physical scene of crime, whereas standard forensics takes place in a controlled environment lab setting. The various aspect that will be discussed in this unit will introduce you to meaning of crime, techniques of crime scene investigation viz. initial response/prioritisation of efforts, preliminary documentation and evaluation of the scene, processing the scene, completing and recording the crime scene investigation and crime scene equipment.

2.0 OBJECTIVES

At the end of the unit, you should be able to:

- define the concept of crime
- employ the techniques of forensic science in crime scene investigation
- record evidence in a crime scene
- identify the various steps involved in crime scene investigation.
- explain the relationship between forensics and crime scene investigation
- describe the various steps involved in preliminary investigation and evaluation of the scene
- differentiate between crime scene investigation and forensics
- name crime scene equipments.

3.0 MAIN CONTENT

3.1 Meaning of Crime

Crime is the breach of rules or law for which some governing authority (via mechanisms such as legal systems) can ultimately prescribe a conviction. Individual human societies may each define crime and crime differently. While every crime violates the law, not every violation of the law counts as a crime, for example breaches of contract and of other civil law may rank as “offences” or as “Infractions” when informal relationships and sanctions prove insufficient to establish and maintain a desired social order, government may impose more formalised or stricter systems of social control.

The label of “Crime” and the accompanying social stigma normally confine their scope to those activities seen as injurious to the general population or to the state, including some that cause serious loss or damage to individuals.

The following elements are significant in this definition and need to be elaborated upon:

1. Crime is a deviant behaviour that violates prevailing norms-cultural standards prescribing how humans ought to behave normally.
2. Changing social, political, Psychological and economic conditions may affect changing definitions of crime and the form of the legal, law enforcement and penal responses made by society.

3. Legislatures can pass laws (called *Mala Prohibit*) that define crime which violate social norms. These laws vary from time to time and from place to place. Other crimes, called *Mala in se* count as outlawed in almost all societies (murder, theft and rape).

SELF-ASSESSMENT EXERCISE 1

Define the term crime and discuss its effects on the society.

3.2 Techniques of Crime Scene Investigation

One of the most important aspects of securing the crime scene is to preserve the scene with minimal contamination and disturbance of physical evidence. The initial response to an incident shall be expeditious and methodical; upon arrival the officer(s) shall assess the scene and treat the incident as a crime scene.

The initial responding officer(s) shall promptly, yet cautiously, approach and enter crime scenes, remaining observant of any persons, vehicles, events, potential evidence and environmental conditions.

The initial responding officer(s) should:

- note or log dispatch information (e.g. address)
- be aware of any persons or vehicles leaving the crime scene
- approach the scene cautiously, scan the entire area to thoroughly assess the scene, and note any possible secondary crime scenes. Beware of any persons and vehicles in the vicinity that may be related to the crime
- make initial observations (look, listen, smell) to assess the scene and ensure officer safety before proceeding
- remain alert and attentive. Assume the crime is ongoing until determined to be otherwise
- treat the location as a crime scene until assessed and determined to be otherwise.

SELF-ASSESSMENT EXERCISE 2

List the essential steps a responding officer(s) takes in a crime scene situation.

3.2.1 Initial Response/Prioritisation of Efforts

You may want to know the initial steps to be taken by a responding officer(s) towards a crime scene situation. They are as follows:

- **Initial response/receipt of information:** It is important for the initial responding officer(s) to be observant when approaching, entering and exiting a crime scene.
- **Safety procedures:** The safety and physical well-being of officers and other individuals in and around the crime scene, are the initial responding officer(s) priority. On arrival at the scene he shall identify and control any dangerous situation or persons. Ensure that there is no immediate threat to other responders - scan area for sights, sounds, and smells that may present danger to personnel (e.g. hazardous materials such as gasoline, natural gas). Survey the scene for dangerous persons and control the situation. Notify supervisory personnel and call for assistance/backup.
- **Emergency care:** After controlling any dangerous situations or persons, they should ensure that medical attention is provided to injured persons while minimising contamination of the scene. If the victim or suspect is transported to a medical facility, send law enforcement official with the victim or suspect to document any comment made and preserve evidence. Point out potential physical evidence to medical personnel, instruct them to minimise contact with such evidence (e.g. ensure that medical personnel preserve all clothing and personal effects without cutting through bullet holes, knife tears) and document movement of persons or items by medical personnel, ensure medical personnel not to “clean up” the scene and to avoid removal or alteration of items originating from the scene if to obtain “dying declaration document, any statements/comments made by victims, suspects or witnesses at the scene.”
- **Secure and control persons at the scene:** Controlling, identifying and removing persons at the crime scene and limiting the number of persons who enter the crime scene and the movement of such persons is an important function of the initial responding officer(s) in protecting the crime scene. He should control all individuals at the scene-prevent individuals from altering/destroying physical evidence by restricting movement location and activity while enduring and maintaining safety at the scene.

Identify all individuals at the scene such as suspects, secure and separate witnesses.

- **Boundaries:** identify, establish, protect and secure. Defining and controlling boundaries provide a means for protecting and securing the crime scene(s). The number of crime scene and their boundaries are determined by their location(s) and the type of crime. Boundaries shall be established beyond the initial scope of the crime scene(s) with the understanding that the boundaries can be reduced in size if necessary but cannot be as easily expanded. He shall conduct an initial assessment to establish and control the crime scene(s) and its boundaries. Establish boundaries of the scene(s) starting at the focal point and extending outward to include where the crime occurred. Potential points and paths of exit and entry of suspects and witnesses places where the victim/evidence may have been removed, (be aware of trace and impression evidence while assessing the scene).

Set up physical barriers, e.g. ropes, cones, crime scene barrier tape, available vehicles, personnel, other equipments, etc. Document the entry/exit of all people entering and leaving the scene to maintain integrity of the scene. Effect measures to preserve/protect evidence that may be lost or compromised (e.g. protect from the elements (rain, snow, wind and from footsteps, fire tracks, sprinklers). Document the original location of the victim or objects that you observe being moved. Consider search and seizure issues to determine the necessity of obtaining consent to search and/or obtaining a search warrant.

The officer(s) shall brief the investigators taking charge. Assist in controlling the scene and remain at the scene until relieved of duty.

- Document actions and observations. All activities conducted and observations made at the crime scene must be documented as soon as possible after the event to preserve information. Documentation must be maintained as a permanent record.

The initial responding officer(s) at the crime scene must produce clear, concise, documental information encompassing his or her observations and actions. This documentation is vital in providing information to substitute investigative considerations.

SELF-ASSESSMENT EXERCISE 3

Describe the initial steps to be taken by a response officer in a crime scene.

3.2.1 Preliminary Documentation and Evaluation of the Scene

Assessment of the scene by the investigator(s) in charge allows for the determination of the type of incident to be investigated and the level of investigation to be conducted. The investigator(s) in charge shall identify specific responsibilities, share preliminary information and develop investigative plans in accordance with departmental policy and local, state and federal laws.

The investigator(s) in charge should:

- Converse with the first respondent(s) regarding observations/activities.
- Evaluate safety issues that may affect all personnel entering the scene(s).
- Evaluate search and seizure issues to determine the necessity of obtaining consent to search and/or obtaining a search warrant.
- Evaluate and establish a path of entry/exit to the scene to be utilised by authorised personnel.
- Evaluate initial scene boundaries.
- Determine the number/size of scene(s) and prioritise.
- Establish a secure area within close proximity to the scene(s) for the purpose of consultation and equipment staging.
- If multiple scenes exist, establish and maintain communication with personnel at those locations.
- Establish a secure area for temporary evidence storage in accordance with rules of evidence/chain of custody.

In addition, the investigator(s) shall perform the following functions:

- **Conduct Scene Assessment:** Scene assessment allows for the development of a plan for the coordinated identification, collection, and preservation of physical evidence and identification of witnesses. It also allows for the exchange of information among law enforcement personnel and the development of investigative strategies. He shall also conduct scene “walk through” and initial documentation. The scene ‘walk through’ provides an overview of the entire scene, identifies any threats to scene integrity, and ensures protection of physical evidence, written and photographic.

- **Determine Team Composition:** Based on the type of incident and complexity of the scene, investigator(s) shall determine team composition. Trained personnel shall perform scene processing. Assess forensic needs and call forensic specialists to the scene for expertise and/or equipment. Ensure that scene security and the entry/exit documentations are continued.

SELF-ASSESSMENT EXERCISE 4

Discuss the importance of evaluating the crime scene by an investigator.

3.2.2 Processing the Scene

The essence of scene processing is to have contamination control and preventing cross contamination at single or multiple scenes, and also in maintaining the safety of personnel and the integrity of evidence.

Other responders and/or team members should limit scene access to people directly involved in scene processing, follow established entry/exit routes at the scene, clean/sanitise or dispose of tools/equipment and personal protective equipment between evidence collections and/or scenes.

Documentation

An assessment of the scene determines what kind of documentation is needed (e.g. photography, video, sketches, measurement, notes, etc). Review assessment of the scene to determine the type of documentation needed. Coordinate photographs, video, measurements and notes. Prepare preliminary sketch(es) and measuring immediate area of the scene, noting case identifiers and indicating notes on the sketch. A well documented scene ensures the integrity of the investigation and provides a permanent record for latter evaluation.

Prioritise Collection of Evidence

The investigator(s) shall prioritise the collection of evidence to protect loss, destruction, or contamination. Conduct a careful and methodical evaluation considering all physical evidence possibilities (e.g. biological fluids, latent prints, and trace evidence). Select a systematic search pattern for evidence collection based on the size and location of the scene(s). Select a progression of processing/collection methods so that initial techniques do not compromise subsequent processing/collection methods. Concentrate on the most transient evidence and work to the least transient forms of physical evidence. Continually assess environmental and other factors that may affect the evidence. Be aware

of multiple scenes (e.g. victims, suspects, vehicles, locations, etc.). In fact, prioritisation provides for timely and methodical preservation and collection of evidence.

Collect, Preserve, Inventory, Package, Transport and Submit Evidence

The handling of physical evidence is one of the most important factors of the investigation. The team member(s) shall ensure the effective collection, preservation, packing and transport of evidence. These they shall accomplish by:

- Maintaining scene security throughout the processing and until the scene is released.
- Document the collection of evidence by recording its location at the scene, date of collection and who collected it.
- Identify and secure evidence in containers (e.g. label, date, initial container, etc.) at the crime scene. Different types of evidence require different containers (e.g. porous, nonporous, and crushproof).
- Package items to avoid contamination and cross-contamination.
- Maintain evidence at the scene in a manner designed to diminish degradation or loss.

In summary, evidence at crime scene that is in the process of documentation, collection, preservation, or packaging should be handled with attention to scene integrity and protection from contamination or deleterious change. During the processing of the scene, and following documentation, evidence should be appropriately packaged, labelled and maintained in a secure, temporary manner until final packaging and submission to a secured evidence storage facility or the crime laboratory.

Establish Crime Scene Debriefing Team

The crime scene debriefing enables law enforcement personnel and other responders to share information regarding particular scene findings prior to releasing the scene. It provides an opportunity for input regarding follow-up investigation, special requests for assistance, and the establishment of post-scene responsibilities.

The team which includes the investigator(s) in charge of the crime scene, other investigators and evidence collection personnel (e.g. photographers, evidence technician, latent print personnel, specialised personnel and initial responding officer(s) is still present). Determine

what evidence was collected and discuss potential technical forensic testing and the sequence of test to be performed.

Initiate any action(s) identified in discussion required to complete the crime scene investigation.

SELF-ASSESSMENT EXERCISE 5

List measures you will adopt to avoid contamination of evidence at the crime scene.

3.2.3 Completing and Recording the Crime Scene Investigation

Final survey of the crime scene ensures that evidence has been collected and the scene has been processed prior to release. In addition, a systematic review of the scene ensures that evidence, equipment, or materials generated by the investigation are not inadvertently left behind and any dangerous materials or conditions have been reported and addressed.

The investigator(s) in charge shall direct a walk through at the conclusion of the scene investigation, and ensure that the scene investigation is complete. He shall note the following:

- Each area identified as part of the crime scene is visually inspected.
- All evidence collected at the scene is accounted for.
- All equipment and materials generated by the investigations area are removed.
- Any dangerous materials or conditions are reported and addressed.
- The crime scene is released in accordance with jurisdictional requirements.

Also he shall carry out the following:

- **Documentation of the Crime Scene:** Reports and other documents pertaining to the crime scene investigation shall be completed into a “case file” by the investigator(s) in charge of the crime scene. This file should be a record of the actions taken and evidence collected at the scene. This documentation shall allow for independent review of the work conducted.

The investigator(s) in charge should obtain the following for the crime scene case file:

- Initial responding officer(s) documentation
 - Emergency medical personnel documents
 - Entry/exit documentation
 - Photographs/videos
 - Crime scene sketches/diagrams
 - Evidence documentation
 - Other responders' documentation
 - Record of consent form or search warrant
 - Reports such as forensic/technical reports should be added to this file when they become available.
 - Establish Crime Scene Debriefing Team
- Brief person(s) in charge upon completion of assigned crime scene tasks.
- Establish post-scene responsibilities for law enforcement personnel and other responders.

The crime scene debriefing is best opportunity for law enforcement personnel and other responders to ensure that the crime scene investigation is complete.

SELF-ASSESSMENT EXERCISE 6

Discuss the role of a debriefing team in crime scene investigation.

3.2.4 Crime Scene Equipment

We are going to discuss the equipments used in crime scene investigations under the following:

- Initial Responding Officer(s)
- Crime Scene Investigator/Evidence Technician

The Essential ones are as follows:

- Bindle Paper
- Biohazard Bags
- Body Fluid Collection Kit
- Camera (35mm) with Flash/Film/Tripod
- Casting Material
- Consent/Search Forms
- Crime Scene Barricade Tape

- First-Aid Kit
- Flares
- Flashlight and Extra Batteries
- Paper Bags

Personal Protective Equipment

- These items should be in police vehicles or readily available to initial responding Officer(s)
- Evidence Collection Kits (example)

a. Blood Collection

- Bindle
- Coin Envelopes
- Disposable Scapels
- Distilled Water
- Ethanol
- Evidence Identifiers
- Latex Gloves
- Photographic Ruler (ABFO Scales)
- Presumptive Chemical
- Sterile Swabs
- Test Tubes/Test Tube Rack

b. Bloodstain Pattern Documentation

- ABFO Scales
- Calculator
- Laser Pointer
- Permanent Markers
- Protractor
- String
- Tape

c. Excavation

Cones/Markers

- Evidence Identifiers
- Metal Detectors
- Paint Brushes
- Shovels/Trowels
- Sifting Screens
- Strings

- Weights
 - Wooden/Metal Stakes
- d. Fingerprints
- Black and White Film
 - Brushes
 - Chemical Enhancement Supplies
 - Cyanoacrylate (Super Glue) Wand/Packets
 - Flashlight
 - Forensic Light Source
 - Lift Cards
 - Lift Tape
 - Measurement Scales
 - One-to-one Camera
 - Powders
- e. Impression
- Bowls/Mixing Container
 - Boxes
 - Dental Stone (die Stone)
 - Evidence Identifiers
 - Measurement Scales
 - Permanent Markers
 - Snow Print Wax
 - Water
- f. Pattern Print Lifter
- Chemical Enhancement Supplies
 - Electrostatic Dust Lifter
 - Gel Lifter
 - Wide Format Lift Tape
- g. Tool Marks
- Casting Materials
- h. Trace Evidence Collection
- Acetate Sheet Protectors
 - Bindle Paper
 - Clear Tape/Adhesive Lift

- Flashlight (Oblique Lighting)
 - Forceps/Tweezers
 - Glass Vials
 - Trace Evidence Vacuum with Disposables
 - Collection Filters
- i. Trajectory
- Calculator
 - Canned Smoke
 - Dummy
 - Laser
 - Mirror
 - Protractor
 - String
 - Trajectory Rods

SELF-ASSESSMENT EXERCISE 7

List the essential equipments for a crime scene investigator.

4.0 CONCLUSION

We have explained the relationship between crime scene investigation and forensic science. Crime Science Investigation combines the knowledge and techniques of several different disciplines, including science, mathematics, logic and law. One of the most important aspects of securing the crime scene is to preserve the scene with minimal contamination and disturbance of physical evidence.

We also discussed the initial steps an investigator will take on the preliminary documentation and evaluation of the scene. List of crime scene equipments are also mentioned.

5.0 SUMMARY

In this unit, we have dealt with the meaning of crime and techniques of crime scene, investigation by looking at the following areas: Initial response/prioritisation of efforts, preliminary documentation and evaluation of the scene processing the scene, completing and recording the crime scene and crime scene equipment.

6.0 TUTOR-MARKED ASSIGNMENT

1. Differentiate between Crime Scene Investigation and Forensic.
2. Discuss the steps an investigation must undertake in a crime scene situation.
3. List and describe the steps involved in processing a crime scene.

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UNIT 4 FORENSIC PSYCHOLOGIST, ROLES AND RESPONSIBILITIES

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 What is Forensic Psychology?
 - 3.2 Forensic Psychologists Roles and Responsibilities
 - 3.3 Forensic Psychology and Criminal Profiling
 - 3.4 Hypnosis in Criminal Investigations
 - 3.5 Psychological Autopsies
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
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1.0 INTRODUCTION

What is the relevance of forensic psychology to forensic science?

The field of forensic psychology has gotten the attention of the public as we enter the 21st century. Prominent cases involving such topics as the insanity defense, the use of jury consultants with psychological training, the use of psychology in the profiling of criminal suspects, eyewitness memory, interrogations and confessions, child custody, and child sexual abuse have been featured in the press, television and movies. Within the field of psychology itself, forensic psychology has become an important focus of clinical practice as well as scientific research.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define forensic psychology
- state the roles of a forensic psychologist
- apply the knowledge of forensic psychology to criminal profiling
- describe the procedures used in criminal profiling
- discuss the use of hypnosis in criminal investigations
- outline the guidelines in criminal autopsies
- differentiate between forensic psychology and psychology.

3.0 MAIN CONTENT

3.1 What is Forensic Psychology?

One definition has been proposed by Bartol and Bartol (1984): It is both (a) The research endeavour that examines aspects of human behaviour directly related to the legal process (e.g. eyewitness memory and testimony, jury decision making, or criminal behaviour) and (b) the professional practice of psychology within or in consultation with a legal system that encompasses both criminal and civil law with numerous areas which they interact.

Therefore, forensic psychology refers broadly to the production and application of psychological knowledge to the civil and criminal justice systems.

In other words, forensic psychology is the intersection between psychology and the criminal justice system. It involves understanding criminal law in the relevant jurisdictions in order to be able to interact appropriately with judges, attorneys and other legal professionals. An important aspect of forensic psychology is the ability to testify in court, reformulating psychological findings into the legal language of the courtroom, providing information to legal personnel in a way that can be understood.

Questions asked by the court of a forensic psychologist are generally not questions regarding psychology but are legal questions and the response must be in a language the court understands. For example, a forensic psychologist is frequently appointed by the court to assess a defendant's competency to stand trial. The court also frequently appoints a forensic psychologist to assess the state of mind of the defendant at the time of the offense.

Forensic psychologists provide sentencing recommendations, treatment recommendations, and any other information the judge requests, such as information regarding mitigating factors, assessment of future risk, and evaluation of witness credibility. Forensic psychology also involves training and evaluating police or other law enforcement personnel, providing law enforcement with criminal profiles and in other ways working with police departments. Forensic psychologists work both with the public defender, and state and private attorneys.

SELF-ASSESSMENT EXERCISE 1

Differentiate between forensic psychology and psychology.

3.1 Forensic Psychologist, Roles and Responsibilities

Forensic psychologists perform a wide range of tasks within the criminal justice system. By far the largest is that of preparing for and providing testimony in the court room. This task becomes increasingly difficult as attorneys have become sophisticated at undermining psychological testimony. Evaluating the client, preparing for testimony, and testimony itself require the forensic psychologist to have a firm grasp of the law and the legal situation at issue in the courtroom, using crime classification manual and other sources. This knowledge must be integrated with the psychological information obtained from testing, psychological and mental status exams, and appropriate assessment of background materials, such as police reports.

Another role performed by a forensic psychologist is that of forensic assessment.

- **Malingering:** An overriding issue in any type of forensic assessment is the issue of malingering and deception. A defendant may be intentionally faking a mental illness or may be exaggerating the degree of symptomatology. The forensic psychologist must always keep this possibility in mind.
- **Competence Evaluation:** If there is a question of the accused competency to stand trial, a forensic psychologist is appointed by the court to examine and assess the individual. The individual may be in custody or may have been released on bail. Based on the forensic assessment, a recommendation is made to the court whether or not the defendant is competent to proceed to trial. If the defendant is considered incompetent to proceed, the report or testimony will include recommendations for the interim period during which an attempt at restoring the individual's competency to understand the court and legal proceedings, as well as participate appropriately in their defense will be made. Often this is an issue of commitment, on the advice of a forensic psychologist, to a psychiatric treatment facility until such a time the individual is deemed fit.

A prominent role of a forensic psychologist is seen in the case of Ford Vs Wainwright, a case by a Florida inmate on death row that was brought before the Supreme Court of United States. Forensic psychologist was appointed to assess the competency of an inmate to be executed in death penalty cases.

- **Sanity Evaluations:** The forensic psychologist may also be appointed by the court to evaluate the defendant's state of mind at the time of the offense. These are defendants who the judge, prosecutor or public defender believes, through personal interaction with the defendant or through reading the police report, may have been significantly impaired at the time of the offense. In this case, usually the court appoints forensic evaluators and the defense may hire their own forensic expert.
- **Ethical Implication:** This is another role performed by a forensic psychologist. A forensic psychologist generally practices within the confines of the courtroom, incarceration facilities, and other legal setting. It is important to remember that the forensic psychologist is equally likely to be testifying for the prosecution as for the defense attorney.
- **Sentence Mitigation:** Another responsibility of a forensic scientist is sentence mitigation. Even in situations where the defendant's mental disorder does not meet the criteria for not being guilty, be it the reason of insanity defense, the defendant's state of mind at that time, as well as relevant past history of mental disorder and psychological abuse can be used to attempt a mitigation of sentence. The forensic psychologist's evaluation and report is an important element in persecuting evidence for sentence mitigation.
- **Other Evaluations:** Forensic Psychologists are frequently asked to make an assessment of an individual's dangerousness or risk of re-offending. They may provide information purposes, grants of probation, and the formulation of conditions of parole, which often involves an assessment of the offender's ability to be rehabilitated. They are also asked questions of witness credibility and malingering, occasionally, they may also provide criminal profiles to law enforcement.

SELF-ASSESSMENT EXERCISE 2

Discuss the role of a forensic psychologist in a judicial system.

3.2 Forensic Psychology and Criminal Profiling

You may want to ask yourself, why develop criminal profiles? What do we mean by a criminal profile? Crime is always a concern world wide. Next to crime prevention, crime detection is of the highest priority.

A “profile” of what? Some profilers emphasise the personality and motivations of the offender, including characteristic ways of committing crimes and treating their victims. But certainly physical characteristics are important – the criminal’s age, gender, race, height and weight. Whether the perpetrator is left-handed or right-handed is sometimes easily determined from an analysis of the criminal act, because these qualities plus other demographic data (e.g. occupation, education) are sought in addition to a personality sketch of the criminal.

What is Criminal Profiling?

The origin of criminal profiling is unclear, but for centuries, elements of society have tried to pinpoint those physical or psychological qualities linked to criminal or deviant behaviour Pinizzotto (1984). Criminal profiling has been described as an educated attempt to provide specific information about a certain type of suspect, and as a biographical sketch of behavioural pattern, trends and tendencies, Geberth (1981).

The basic premise of criminal profiling is that the way a person thinks directs the person’s behaviour. It is important to recognise that profiling does not provide the specific identity of the offender. Similarly, not all types of crimes are susceptible to successful criminal profiling. Holmes and Holmes (1996) concluded such crimes as check forgery, bank robbery and kidnapping are not good candidates for profiling.

Criminal profiling consists of analyzing a crime scene and using the information to determine the identity of the perpetrators. While this doesn’t directly give you the perpetrators name, it is very helpful in narrowing down suspects. For example, a profile based on a crime scene provides information that may include the perpetrator’s personality, sex, age, ethnic background and possible physical features such as disfigurements or height and weight. This information can then be used to identify possible suspects, depending on who fits the profile. Personality is one of the most important parts of a criminal profile.

How does Criminal Profiling Work?

Personality profiles of criminals are based on the way in which a crime is committed, also known as “Method of Operation”. The M. O. includes the identity of the victim(s), what the victim(s) (in case of a serial offender) have in common; the weapon(s) used, the degree of the hostility, the existence (or lack) of any torture and/or sexual molestation, and so on. Analyzing these aspects of the crime scene, an investigator (usually a trained forensic psychologist) can determine the motives of the perpetrator, which leads to a description of the perpetrators personality or personality profile.

It may seem so far that criminal profiling depends on a lot of speculation on the part of the forensic psychologist. While some speculation is required, personality profiling is actually the result of many years of research.

Also criminal profiling is the act of developing a psychological profile of an offender based on the state of the crime scene. Profiling is most often done by a forensic psychologist – some has studied the criminal mind. This profile can then be used by the police departments to assist in apprehending the criminal.

A profile is a psychological sketch of an offender. There is a lot that a crime scene can tell a forensic psychologist about the person who committed the crime. This is especially true in homicide investigations. Criminal profiling is often used to help investigators catch psychopaths and serial killers that may otherwise go free. It can also be used to help catch other types of offenders, such as arsonists and rapist. In criminal profiling, a crime scene helps to label the perpetrator as organised, disorganised or mixed. An organised offender plans ahead, picking out the victim ahead of time. Any tools needed are brought by the offender. He is meticulous with details, and it is clear that the crime was well thought out ahead of time. This tells a forensic psychologist a lot about the criminal.

Organised offenders tend to be high in the birth order of their family, usually an oldest child. They are very intelligent, and usually had their lives together, but a series of stressful situations caused them to act out. Most of them have a live-in partner, are socially adept, and will follow the coverage of their crime in the media very carefully.

A spontaneous offense is often the work of a disorganised offender. He will often depersonalise the victim, to make the crime less real, allowing him to remain detach throughout the course of the crime. There is very little conversation, if any, between the offender and the victim, and the crime scene has a random and sloppy feel to it. Criminal profiling makes it possible to draw a lot of conclusions about this offender, too. Disorganised offenders are often of average or slightly below-average intelligence. They are younger children, live alone and are not as socially mature as an organised offender. They often live or work near the scene of the crime, and have poor work history.

A mixed offender is harder to use criminal profiling for, but is still possible. The crime scene combines characteristics of both organised and disorganised offenders. For example, the offender may have provided his own tools, but picked a victim randomly. The profile of a

mixed offender may not be as accurate as other profiles, giving police lies to go on.

Criminal profiling is used not only to find potential offenders, but also to narrow down a list of offenders that has already been compiled by the police. Although it doesn't work in every case, criminal profiling has helped investigators to apprehend hundreds of criminals. By assessing the patterns and motives of previous criminals, profiling allows investigators to fairly, accurately predict the characteristics of current and future offenders, allowing killers and other perpetrators to be caught before they can continue on to other crimes.

Phases of Profiling

How many phases of profiling do we have?

According to Gregg O. McCray, the basic premise is that behaviour reflects personality. In a homicide case, for example, crime profilers try to collect the personality of the offender through questions about his or her behaviour at four phases.

1. **Antecedents:** What fantasy or plan, or both, did the murderer have in place before the act? What triggered the murderer to act some days and not others?
2. **Method and manner:** What type of victim or victims did the murderer select? What was the method and manner of murder, shooting, stabbing, strangulation or something else?
3. **Body disposal:** Did the murder and body disposal take place all at one scene, or multiple scenes?
4. **Post-offense behaviour:** Is the murderer trying to inject himself into the investigation by reacting to media reports or contacting investigators?

The Criminal Profile Generating Process

Investigators used criminal profile infrequently until 1978, when FBI established a psychological profiling programme within its Behavioural Science unit. Since then, investigators of this facility have developed a criminal profile generating process with five main stages. Apprehension of a suspect is the main goal and the final step in the process. This criminal profile generating process involves the following steps:

1. A comprehensive study of the nature of the criminal act and the types of persons who have committed like offenses in the past.
2. A detailed analysis of the crime scene.
3. An in-depth examination of the background and activities of the victim or victims.

4. A formulation of possible motivating factors for all parties involved.
5. The development of a description of the perpetrator based on overall characteristics from the crime scene and past criminal behaviour.

Initial information gathered in the crime investigation stage includes evidence from the crime scene, knowledge of the victim, and specific forensic evidence about the crime (case of death, nature of wounds, autopsy report, etc.). Photographs of the victim and crime scene are included. Efforts are made to understand why this person, in particular, was the victim. Information about possible suspects is not included, so as not to subconsciously prejudice the profilers.

The second stage emphasises decision making, by organising and arranging inputs into meaningful patterns. Classifications are established, for example, the crime may be a mass murder (defined as anything more than three victims in one location and within one event). Two other classifications are the spree murder (killing at two or more locations with no emotional cooling-off period between homicides) and the serial murder involving three or more separate events with a cooling-off period between the homicides.

The next step is to reconstruct the sequence of events and the behaviour of both the perpetrators and the victim. One important distinction is that between organised (or non social) and disorganised (or social) criminals.

Organised murderers are those who plan their murders, target their victims (who are usually strangers), show self-control at the crime scene by leaving few clues, and possibly act out a violent fantasy against the victim, including dismemberment or torture.

The disorganised murderer is “less apt to plan his crime in detail, obtains victims by chance and behaves haphazardly during the crime”. In summary, organised offenders are more apt to:

- Plan
- Use restraints
- Commit sexual acts with live victims
- Emphasise control over the victim by using manipulative or threatening techniques
- Use car or truck.

Disorganised offenders are more likely to:

- Leave a weapon at the crime scene
- Reposition the dead body
- Perform sexual acts with a dead body
- Keep the dead body
- Try to depersonalise the body
- Not use a vehicle.

The final step usually generates a profile that follows a standard format, including hypotheses about the perpetrator's age, race, educational level, marital status, habits, family characteristics and type of vehicle, plus indications of psychopathology.

Distinctions between Criminal or Offender Profiling and Psychological Profiling

Criminal or offender profiling is a method of identifying the perpetrator of a crime based on an analysis of the nature of the offense and the manner in which it was committed. Various aspects of the criminal's personality make up are determined from his or her choice before, during, and after the crime. This information is combined with other relevant details and physical evidence, and then compared with the characteristics of known personality types and mental abnormalities of developing a practical writing description of the offender.

Psychological profiling may be described as a method of suspect identification which seeks to identify a person's mental, emotional and personality characteristic (as manifested in things done or left at the crime scene)

SELF-ASSESSMENT EXERCISE 3

Discuss the importance of conducting criminal profile on a suspected offender.

3.3 Hypnosis in Criminal Investigations

The use of hypnosis by police grew rapidly during the 1970's, partly facilitated by the rules in most states at that time which permitted wide admissibility of hypnotically induced memories. Actually, hypnosis had been used by the legal system for more than 100 years, though shrouded with controversy. Even today, experts disagree about whether hypnosis is effective in recovering memories and whether it is unduly suggestive.

Guidelines for the use of Hypnosis

Given the concerns about the accuracy of hypnotically assisted memory, a prime function of a forensic psychologist is to offer and encourage guidelines for the use of hypnosis. For example, if memories produced by hypnosis should not be used as evidence in court, can the police seek them during the early stages of a crime investigation?

The following guidelines are suggested:

- 1. Qualifications of the person using hypnosis:** Traditionally, police officers have conducted the hypnosis of witnesses, but the society for criminal and Experimental Hypnosis has proposed that only trained psychiatrists or psychologists – independent of the police department should conduct a forensic hypnosis and questioning. One benefit of this approach is a possible reduction in the use of leading or suggestive questions.
- 2. Pre-hypnosis Records:** It is important to keep separate what the witness knew before the hypnosis and what he or she remembered as a result of it.
- 3. Electronic recording of hypnosis session:** All the interactions between the examiner and the subject should be recorded electronically, preferably on videotape. If the latter is used, focus should be on both the subject and the hypnosis to defeat any subtle influence in the interaction.
- 4. Measurement of hypnotisability:** One guideline suggested by Spiegel and Spiegel (1987), that prescribe limits, is the level of hypnotisability of the subject should be determined by use of one of the standardised hypnotisability scales in order to document the subject's degree of responsiveness, if any. These scales include the Hypnotic induction profile.
- 5. Pre-hypnosis briefing:** The hypnotist should not give the subject any indication that will recall new information or that the memory of the relevant experience will be any clearer. An effort should be made to determine exactly what memories were held before hypnosis.
- 6. Management of the hypnotic session:** The person conducting the session should provide a setting in which the subject can remember new facts if there are any, but in which none is introduced in the questioning.

The person should be allowed to review the events as they occurred with little prompting, prompting is best done through non-leading questions such as “and then what happens?”

7. **Selective use:** Forensic hypnosis should never be used as a substitute for routine investigative procedures. Recall that these are guidelines for the use of hypnosis during the crime investigation stage. The inherent dangers in hypnotically assisted memories mean that if police choose to hypnotise a victim at this early stage, the authorities should exert great caution in allowing the same person to testify at the trial, because of the suggestibility involved in the procedure and the risk of producing false memories.

SELF-ASSESSMENT EXERCISE 4

List the steps involved when using hypnosis during investigation.

3.4 Psychological Autopsies

You may want to ask yourself, why the need for psychological autopsies?

Often, the cause of a person’s death is a matter of forensic concern even if no criminal act is assumed to be involved. Even when the cause of death is certain, issues related to the mental state of the person prior to his or her death lead to the application of a psychological analysis. Ogloff & Otto (1993) suggested several types of situations:

- a. The need to determine whether the person was competent to draw up a will (called the decedent’s testamentary capacity)
- b. In workers’ compensation cases, claims may be made that stressful working condition contributed to the person’s premature death.
- c. In a criminal case, the defendant under trial for murder may claim that the victim was a violent person who instituted such fear in the defendant that the act was truly one of self defense.

The term psychological autopsy refers to the investigative method used by psychologists or other social scientists to help determine the mode of death in equivocal cases. It is estimated that between 5% and 20% of all deaths that need to be certified are equivocal deaths. The beginnings of psychological autopsies grew out of the frustration of the then Los Angeles county Chief Medical Examiner and Coroner, Dr. Curphy in 1958 was faced with a number of drug-related deaths for which the mode of death (how the death occurred) was uncertain.

The psychological autopsy technique is currently used to answer three distinct questions: Why did the individual do it? How and when did the individual die (that is why at that particular time)? And what might be the most probable mode of death?

Section (1987) concluded that the most common inquiry in a psychological autopsy concerns whether the death was an accident or a suicide. A basic job of medical examiners is to certify whether a death could reliably be classified as natural, accidental, suicidal or homicidal.

SELF-ASSESSMENT EXERCISE 5

Define the concept “psychological autopsy” why is it necessary to a forensic scientist?

4.0 CONCLUSION

We have discussed the roles and responsibilities of forensic psychologists. And we went further to explain the meaning of forensic psychology as the intersection between psychology and the criminal justice system. We also noted that a forensic psychologist can be trained in criminal, social, organisational or any branch of psychology. Specific roles and responsibilities of a forensic psychologist were also mentioned as forensic assessment, malingering, competency evaluations, sanity evaluations, Ethical implications, sentence mitigation and other evaluations. Criminal profiling was also discussed as an important component of forensic psychology, with its attendant benefits.

5.0 SUMMARY

In this unit, we have discussed the relevance of forensic psychology, its meaning, roles and responsibilities of forensic psychologists, criminal profiling, and Procedures of criminal profiling.

We also discussed the essence of hypnosis in criminal investigation and psychological autopsies.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define forensic psychology.
2. Discuss the procedures in criminal profiling.
3. Differentiate between criminal or offender profiling and psychological profiling.

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UNIT 5 FORENSIC MEDICAL/APPLICATIONS OF SAMPLED SPECIMENS TO BE USED AS EVIDENCE

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- 2.0 Objectives
- 3.0 Main Content
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 - 3.2 Hair, Fibres and Threads
 - 3.3 Firearms Evidence
 - 3.4 Toolmarks
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- 7.0 References/Further Reading

1.0 INTRODUCTION

One special important element to crime solving is the effective use of science and technology. Science and technology applied to the solution of criminal acts, or forensic science, solves criminal acts by assisting police investigators to identify suspects and victims, clearing innocent persons of suspicions and ultimately bringing the wrongdoer to justice. The science is methodical, premeditated actions to gather and analyse evidence.

Your job as a forensic investigator is to do your best to comb through the sources of evidence and make sure you preserve it, and try to reconstruct the events that occurred during a criminal act and produce a meaningful starting point for police and prosecutors to do their jobs.

It is important to remember that the steps in preserving and collecting evidence should be done slowly, carefully, methodically and deliberately. One thing is common to every investigation, and it cannot be stressed enough. Keep a regular old notebook handy and take careful note of what you do during your investigation.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- apply the knowledge of forensic science in handling specimens to be used as evidence
- discuss standard blood specimens to be used as evidence
- list steps in the recovery of evidence samples
- describe how firearms evidence could be preserved
- list how tool marks could be preserved
- describe how paint evidence are marked and preserved.

3.0 MAIN CONTENT

3.1 Blood and Seminal Samples as Evidence

You may want to know how blood and seminal stains are preserved and used as evidence by a forensic scientist in the court of law.

Blood that is in liquid pools should be picked up on a gauze pad or other clean sterile cotton cloth and allowed to air dry thoroughly at room temperature. It should be refrigerated or frozen as soon as possible and brought to the laboratory as quickly as possible. Delays beyond 48 hours may make samples useless. You should note the following:

- If close to the laboratory, deliver stained object immediately.
- If unable to deliver to the laboratory or if the object must be mailed, allow the stain to air dry completely before packing.
- Do not heat stained material or place it in bright sunlight to dry. Hang clothing and similar articles in a room where there is adequate ventilation.
- If not completely dry, label and roll in paper in a brown paper bag or box and seal and label container. Place only one item in each container. Do not use plastic containers.

Dried Blood Stains

- On clothing, if possible, wrap the item in clean paper, place the article in a brown paper bag or box and seal and label container. Do not attempt to remove stains from the cloth.
- On small solid objects, send the whole stained object to the laboratory, after labelling and packaging.
- On large solid objects, cover the stained area with clean paper and seal the edges down with tape to prevent loss or contamination. If impractical to deliver the whole object to the

laboratory, scrape the stain onto a clean piece of paper, which can be folded and placed in an envelope. Do not scrape blood from objects using a freshly washed knife or similar tool. Wash and dry the tool before each stain is scraped off. Seal and mark the envelope.

- Do not mix dried stains. Place each stain in a separate envelope.
- Never attempt to wipe dried stains from an object using moistened cloth or paper.

Standard Blood Specimens

Autopsy Blood Samples

Request that a pathologist obtain the sample directly from the heart into a yellow (ACD) or purple stoppered vacutainer (some labs request both). In rare cases when no liquid blood is available, ask a pathologist to collect a section of liver, and/or deep muscle tissue and freeze for typing. In such cases, proceed also with collection of a secondary standard as described below:

- **Blood samples from live individuals**

For typing purposes, have sample drawn into yellow and purple stoppered vacutainers. Note: these are distinguished from the BA tubes which have grey stoppers

If the victim is injured to the extent that a transfusion is necessary, make an effort to obtain or begin necessary procedures to obtain the pre-transfusion sample collected by the hospital. These samples are not retained for long periods by the hospital, so it is important to act promptly. Also make sure that some blood stained garment worn by the individual has been air dried and frozen to serve as a secondary standard.

- **Handling and storage of Physiological Fluids Evidence**

Obligation under *People vs. Nation* and *Hitch* suggest that a reasonable and good effort be made to preserve perishable evidence.

Stains and Control

1. Air dry
2. Package in paper
3. Freeze

Consider special handling of non-absorbent items on (metal or plastic). Any condensation from thawing could disturb or destroy such evidence. Such items should be kept at room temperatures and submitted to the lab as soon as possible.

Liquids (General Standards)

Blood

- Refrigerate, do not freeze standards collected in yellow stoppered vacutainers.
- Submit to the laboratory as soon as possible saliva.
- Collect on a sterile gauze pad or scrabs, allow to air dry and package in paper. Do not use plastic containers.
- Seminal stains are often, but not always found on clothing, blankets, sheets, etc. allow any stains to air dry, wrap in paper and package evidence in paper bags. Do not use plastic bags.
- For sex offense cases, the victim should always be examined by a physician. A Sexual Assault Evidence collection kit is used to collect evidence from the victim. It is very important that the instructions on the kit be followed with care in order to gain the greatest benefits from the collected evidence.
- Label all garments such as under shorts, panties or other exhibits and package each garment separately.
- If damp, allow fabric to dry completely before packaging.
- Handle fabrics as little as possible.

SELF-ASSESSMENT EXERCISE 1

Describe how you will preserve blood and seminal stains be used as evidence in the court.

3.2 Hair, Fibres and Threads

How can these be used as evidence in the court?

Hair

- An examination of human hair can occasionally reveal the possible race of the individual from whom it came and the part of the body from which it originates.
- Human hair can be compared to determine whether or not two samples could have had a common origin. The value of the laboratory examinations of such specimens will depend upon the

amount of hair recovered and the characteristics found in the examinations.

- Recover all hair present. If possible, use the fingers or tweezers to pick up hair, place in paper bindles or coin envelopes, which should then be folded and sealed in larger envelopes. Label the outer sealed envelope.
- If hair is attached, such as in dry blood or caught in metal or a crack of glass, do not attempt to remove it but rather leave hair intact on the object. If the object is small, mark it, wrap it, and seal it in an envelope. If the object is large, wrap the area containing the hair in paper to prevent loss of hairs during shipment.
- In rape cases, the victim's pubic region should be combed prior to collecting standards. Obtain known hair samples from the victim, suspect or any other possible sources for comparison with unknown specimens. The recommended method for collecting head hairs is to start by having the person from whom they are being collected bend over a large sheet of clean paper, rubbing or massaging their hands through the hair so that loose hair will fall over on the paper. More should then be gathered by plucking them from representative areas all over the head. A total of 50 – 100 hairs are desired. Do not cut the hair. This same method may be used to collect hairs from other parts of the body. 30 – 60 pubic hairs are required. When the person is a suspect, hair should be gathered from all parts of the body even though there may only be an interest in hair from the head at the particular time.

Fibres and Threads

- Such evidence is often found in fabric abrasions or caught in torn materials or other areas on hit-and-run vehicles. In some burglary cases, it may be found caught in torn screens, broken glasses or other locations.
- Examination of fibres can normally be conducted to determine the type or colour of fibre. Such examinations will sometimes indicate the type of garments or fabric from which they originated.
- Fibres and threads can also be compared with suspects clothing to determine whether or not they could have come from this clothing.

- If threads or large fibres are found, they can often be picked up with the fingers and laced in a paper bindle, then in a coin envelope, which can be lost from this type of envelope.
- If the fibres are short or few in number and if it is possible to do so, wrap the area or the entire item containing the fibres in paper and send the whole exhibit to the laboratory.
- Pick up fibres on tape only if the laboratory in your jurisdiction allows it and gives you its requirement. When fibres or thread are recovered, always send all clothing of persons from which they might have originated to the laboratory for comparison purposes.
- In sex offenses, assaults, and some other cases, it may be possible to indicate or demonstrate contact between two individuals or between one other individual and some other objects, such as a car seat, by comparing fibres. Such examinations are only of value when it is known no contact occurred between the two individuals or an individual and some other objects prior to, or subsequent to the offense. Extra care must be taken to keep each article of clothing of each individual or other object separated. Each garment should be laid on a clean sheet of paper, and separately rolled up in the paper after marking the exhibit. If the clothing of another, or if it is laid down on the table or placed on the car seat contacted by the clothing of the other suspect, the comparisons may be of no value.

Glass

Windows are frequently broken in burglaries, headlights in hit-and-run cases, and bottle or other objects may break or leave fragments on personal belongings of suspects involved in various types of crimes.

Recovery of Evidence Samples:

- Shoes and clothing of suspects or other objects contaminated with glass should be wrapped in paper and submitted to the laboratory for examination.
- All glass found at hit-and-run scenes should be recovered. The search should not be limited to the point of impact, since headlight glass may be dropped off at some distance away as the car leaves the crime scene. Glass from different locations should be kept in different containers. All glass should be collected because more than one type may be present. In addition, if just a few representative samples are saved, individual pieces that could

be physically matched with glass remaining in the headlight shell of the suspected vehicle may be overlooked.

- Place small glass fragments in paper bindles, then in coin envelopes, pillboxes, or film cans which can be marked and completely sealed.
- Place large glass fragments in boxes. Separate individual pieces with cotton or tissue to prevent breakage and damaged edges during shipment. Seal and mark the box containing them.

Standards for Comparison

- **Windows:** If the broken window is small, send the whole window or all glass remaining to the laboratory. If the window is large, recover several samples from different areas of the window. If the evidence glass is large enough for physically matching the broken edges or comparing the fracture lines, hackle marks, surface abrasions or contamination, the broken window is necessary.
- **Auto Glass – Auto Headlights:** All glass remaining in the shell should be recovered if it is suspected that a new glass has been installed, this should be removed and a careful examination made for small chips remaining in the shell from the previous lens which is broken. In such cases, also submit the new lens to the laboratory.
- **Other Glass:** When bottles or other glass objects are broken, recover all remaining glass.

Headlights and Taillights of Motor Vehicles

- As part of the investigation of vehicle accidents, it may be of importance to determine whether or not a headlight or taillight was illuminated at the time light was broken.
- Recovery of the filaments is of primary importance. These are quite small and their location may require a careful search. If recovered, they should be placed in a paper bindle or a small pill box sealed with tape. Whether or not the large filaments are located, all remaining parts of the lamp socket, glass, envelope or sealed beam headlight unit should be wrapped in paper and saved for laboratory study.

Paints

Paint evidence is frequently encountered in hit-and-run cases, on tools used by burglars and occasionally in other types of cases.

Hit and Run Cases

- Paint may be transferred to clothing of pedestrian victims. Examine all areas, with particular attention being paid to areas of showing pressure glaze, tears or other contact which may be marked and sealed. Sealed tape may be used to seal the bundle, but such containers should never be stapled.
- Glass vials or other suitable containers are used only as a last resort.
- Never place paint directly into envelopes unless large pieces are enclosed. Most envelopes have unsealed cracks in the corners and loss or contamination can occur.

Flammable Fluids

The search for flammable fluids in arson cases should include a thorough examination of the entire fire scene. This should extend to areas where burning may not occur, since flammable fluids may have been placed in other locations where ignition failed.

Traces of flammable fluid may be found in cans at the fire scene in arson cases, mattresses, rugs, upholstery, wallboard and other objects at the scene may also contain fluids, which can be separated and identified in the laboratory, even though these objects are partially burned. Wood upon which such fluids have been poured and ignited may still contain detectable traces of the liquid, if the wood has not been completely charred by the fire. Even where a large and hot fire has occurred, traces of such liquid seeped into the ground through cracks in the floor or flowed under base boards and sills.

While most flammable fluids, commonly used have characteristic odours, some substances commonly available are almost odourless and quite easily escape detection. These include some alcohols, deodorised kerosene, charcoal lighter fluids.

- If volatile liquids are found in open containers, pour a small amount of this material into a clean glass vial with an airtight seal so no loss will occur. Do not use any rubber-lined lids or plastic containers.

- Small samples of soil wood, cloth, paper, etc. should be placed in small, clean metal cans and sealed immediately to prevent loss of additional volatile components by evaporation.
- Large pieces of wood, upholstery, wallboard and similar exhibits, which will not fit in cans, should be placed in heat-sealed KAPAK plastic. Be sure the laboratory has examined a sample of the plastic from each other before using.
- When the exhibits themselves can be marked, this should be done. In all cases, the package or the container should be marked.
- Samples of flammable fluids normally present at fire scenes should also be submitted for comparison with any material recovered from partially burned substance.

SELF-ASSESSMENT EXERCISE 2

List and discuss the steps involved when a forensic investigator wants to tender, hair, fibres and thread as evidence.

3.3 Firearms Evidence

Firearms

- Never submit a loaded gun to the laboratory, unless it is delivered in person. Unfired cartridges may be left in the magazine of a weapon, provided the magazine is removed from the gun. A firearm with the cartridge in the chamber should never be shipped by any method, even if the weapon is not cocked or on safety.
- Never clean the bore, chamber or cylinder before submitting a firearm, and never attempt to fire the gun before it is examined in the laboratory.
- Never pick up a weapon by placing pen or other objects in the end of the barrel.
- Record serial number, make, model and calibre of the weapon, and mark it in some inconspicuous manner that does not detract from its value before sending it to the laboratory. Marking firearms is important since duplicate serial numbers are sometimes found on different guns of the same make and general type. Do not confuse model numbers or patent numbers with serial numbers.

- Place weapons in strong cardboard or wooden boxes, well packed, to prevent shifting of guns in transit.
- Rifles or short guns should not be taken apart.
- If blood or any other material, which may pertain to an investigation, is present on the gun, place a clean paper around the gun and seal it with tape to prevent movement of the gun and loss of the sample during shipment.

Bullets

- Never mark bullets.
- Wrap recovered bullets in paper and seal in separate labelled pillbox or envelopes.
- Submit all evidence bullets recovered to the laboratory. A conclusive identification may be possible on only one of several bullets recovered even when they all appear to be in good condition.
- Do not attempt to clean recovered bullets before sending them to the laboratory. Bullets recovered from a body should be air dried and wrapped in paper. Washing may destroy trace evidence.

Cartridge Cases

- Wrap recovered cartridge cases in and seal in separate labelled pillboxes or envelopes.
- Fired shotgun shells may be marked either on the inside or outside of the paper or plastic portion of the shell.
- If an examination is required to determine the point of a shot shell, or where the cartridge case was fired by a specific weapon, submit the weapon and all recovered identified ammunition.
- Submit all evidence cartridge cases or shotgun shells recovered to the laboratory. Some cases contain more identifying details than do others.
- Wrap each cartridge in paper to prevent damaging the breech clock, firing pin or other markings by contact with other cartridge cases. Place wrapped cartridge cases in envelopes or pillboxes. Label and seal container.

Ammunition

- Always attempt to recover unused ammunition for comparison purposes when firearms are obtained as evidence. If not in the weapon itself, subjects often have additional ammunition in their

cars, clothing, houses or other locations. It may be important for test purposes to duplicate exactly the make, type and age of the ammunition used in the crime. Other ammunition in the suspect's possession is identified to that fired during the crime.

- Unfired ammunition should not be marked; the box with the ammunition may be marked without marking every round in the box.

Powder and Shot Pattern

- Submit clothing or other materials showing evidence of gunpowder residue or shot holes to the laboratory. The clothing should be carefully wrapped in clean paper and folded as little as possible to prevent dislodging powder particles. Photographs of the pattern will not suffice, as in most instances, microscopic examination and chemical tests must be conducted on the exhibits themselves. Package each item separately.
- For gunpowder or shot pattern tests to have significance, it is essential to obtain ammunition identical in make, type and age to that used at the crime scene. This duplicate ammunition is necessary for firing in the weapon in question to determine the distance of the muzzle of the weapon from the victim or other object at the time the questioned bullet was fired.

Gunshot Residue

- Gunshot residue is extremely fragile evidence and should be collected as soon as possible (preferably within three hours of the discharge of firearm). Use the laboratory supplied GSR kits and carefully follow the directions. In the case of live subjects, if more than six hours he may have washed his hands, it is unlikely that meaningful results will be obtained. If a body is to be sampled, whenever possible, gunshot residue collection should be performed prior to moving the body. If this is not possible, protect the hands with paper bags.

SELF-ASSESSMENT EXERCISE 3

State precautions you, as a forensic scientist or investigator, will observe in order to tender firearms and ammunition as evidence.

3.4 Tool Marks

You may ask yourself, what are tool marks and what is the nature of evidence?

Tool marks are encountered most frequently in burglary cases but may also be found in other types of crimes. The evidence consists of striations or impressions left by tools on object at the crime scene and on various types of tools found in the possession of suspects. In other cases, it is possible by means of physical and other comparisons to prove that parts of tools left at crime scenes were broken from damaged tools found in the possession of suspects. In many cases, it is possible to identify the specific tool which made the questioned marks by means of a laboratory comparison of tools and marked objects. In some instances, it is also possible to prove that marks of various types on tools were produced by objects, which they contacted at crime scene.

Preservation and Packaging of Tools

- All areas on recovered tools which contain transferred paint, building material, or other contamination should be wrapped in paper and packaged to prevent the prying blades or cutting edges, from contacting any other surface or object.

Make No Test with Tools

- Attempts should never be made to fit tools into questioned marks or to make test marks prior to laboratory examination. If done, the questioned mark or tool may be altered and this may make any laboratory examination valueless. In addition, traces of transferred paint or other stains on the tool may be lost or additional material may be transferred to the tool.

Preservation of Tool Marks

- Whenever possible, submit the whole object containing tool marks to the laboratory instead of just removing the area containing the mark. If this is not possible, carefully photograph and sketch the area containing the mark.
- Casts of tool marks can be made by a person who has had considerable experience in this work. Poor casts are useless for comparison purposes and some marks will be damaged if improper methods are used.

- Pack the object containing tool marks so that no alteration or damage will occur during shipment. Small objects should be wrapped with clean paper and placed in envelopes or boxes, while important areas on larger object can be protected with paper. Whole, large objects can be packed in cartons or crates, if not delivered in person.

SELF-ASSESSMENT EXERCISE 4

Define tool marks. Why is it necessary not to make any test with tools?

3.5 Paint Evidence

Paint evidence is frequently encountered in hit-and-run cases, on tools used by burglars and occasionally in other types of cases.

Hit-and-Run Cases

- Paint may be transferred to clothing of pedestrian victims. Examine all areas, with particular attention being paid to areas showing pressure glaze, tears or other contact.
- If found, do not remove the paint, but mark the garment, carefully wrap it by rolling it in paper and send it to the laboratory.
- Such paint will at least show the colour of part of the responsible car. It must be remembered, however, that many modern cars have more than one colour and the paint transferred only represents the colour of the particular area on the car that made contact with the victims.
- Rarely will an examination of paint transfer on clothing indicate the make and model of the vehicle involved, since only portions of the top oxidised layer on cars are usually transferred. In addition, many vehicles are repainted using colours and type of paint, which may be different from those specified by the automobile manufacturer, which could cause confusion in the search for the responsible car.
- Sometimes whole chips of paint will be transferred to the clothing. If these flakes contain several layers, and in particular if they come from a repainted car, such evidence may have great value when the responsible vehicle is located. Chips of paint may also be found on the ground near the point of impact in some cases.

- Obtain samples for comparison from all areas showing fresh damage on suspected vehicles. This is very important since the paint may be different in type or composition in different areas, even if the colour is the same. If the paint can be flaked off by bending the metal slightly, remove it in this manner. If not, scrap or chip the paint off, using a clean knife blade. Carefully wipe the blade before collecting each sample, collect all layers down to the metal. Place each sample in a separate container.
- Cross transfer of paint commonly occur in hit-and-run cases of two or more vehicles. If loose paint chips are found, attempt to remove and place them in a paper bindle. If, however, the transfers are smeared on the surfaces, flake off chips or scrape paint, as well as the top layer of paint originally on the car keep all transfers recovered from different areas in separate containers. Do not place samples directly into envelopes, placed into paper bindles first.
- When Cross transfers occur, always collect contaminated sample from each vehicle from areas immediately adjacent to each transfer collected. This is of great importance, since such specimens permit the laboratory to distinguish between the transferred paint and to the paint originally present on the vehicle.

Collection and preservation of paint specimens

- Keep all samples collected in separate containers.
- Small paper bindle can be used to collect and hold many paint samples. A satisfactory method is to tie one side of the bindle to the side of the vehicle, building, or safe just under the area where the sample is to be collected. By holding the bindle open with one hand, and using a clean knife blade, paint can be scraped loose and into the bindle. With the sample on the bindle scotch tape can be removed and the open end of the bindle folded several times. It can be placed in a corn or mailing envelope.

Burglary Cases

- Tools used to gain entry into building, safes or other places often contain traces of paint, as well as other substances such as plastic, safe insulation, etc. Care must be taken that such traces are not lost. If such transfers may be present, wrap the end of the tool containing the material in clean paper and seal with tape to prevent loss. In no case should attempts be made to set the tool into marks or impressions found. If this is done, transfers of paint

or material can occur and any traces found later will have no significance as evidence.

- Collect specimens of paint from all areas which the tools may have contacted at the crime scene. These samples should include all layers present. Do not destroy the tool mark in collecting the paint. If possible cut out around the mark, and send it to the laboratory.
- The tool itself may contain paint or other coatings, tracings of which may be left at the crime scene. A careful search should be made for such matters, particularly in each tool mark.

A Critique on Forensic Science

Questions about forensic science, finger print evidence and the assumption behind these disciplines have been brought to light in some publications, the latest being an article in the New York post. The article stated that “No one has proved even the basic assumption: That everyone’s fingerprint is unique” The article also stated that “Now such assumptions are being questioned and with it may come a radical charge in how forensic science is used by police departments and prosecutors. Also it has been cited that on June 25, 2009 the supreme court issued a 5-to-4 decision in Melendez Vs Massachusetts stating that crime laboratory reports may not be used against criminal defendants at trial unless the analysts responsible, gives testimony and subject themselves to cross-examination.

There is also an assertion that forensic evidence is not uniquely immune from the risk of manipulation

SELF-ASSESSMENT EXERCISE 5

Examine the role of paint evidence in detecting crime, in a crime scene investigation

4.0 CONCLUSION

We have explained that the knowledge of forensic science can be applied in handling specimens to be used as evidence, and also methods of preserving specimens in a crime scene investigation.

5.0 SUMMARY

In this unit, we have discussed forensic medical/applications of sampled specimens to be used as evidence by looking at the following areas:

Blood sample evidence, hairs, fibres and threads evidence, firearm evidence, tool marks, and paint evidence. Also a critique on forensic science was highlighted.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss the preservation of blood and seminal samples, to be used as evidence.
2. List the steps to follow when handling firearms as evidence.
3. What are tool marks? How can they be preserved?

7.0 REFERENCES/FURTHER READING

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MODULE 2 POLICE SCIENCE

Unit 1	Criminology
Unit 2	Community Policing
Unit 3	Penology
Unit 4	Criminal Justice System
Unit 5	Jurisprudence

UNIT 1 CRIMINOLOGY

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1.0 INTRODUCTION

What is police science? Police science is often an ambiguous term that denotes the studies and research which directly or indirectly deal with police work. Studies and research in criminology, forensic science, jurisprudence, community policing, criminal justice, correctional administration and penology all come under this umbrella term 'police science'. The issues that will be discussed in this unit will introduce you to the meaning of crime and criminology, development of criminology, theories of crime and schools of thought of criminology.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the concepts of crime and criminology
- outline the development of criminology
- mention the goals of criminology
- discuss the theories of crime
- assess the effects of crime in the society

- compare the schools of thought on crime and criminology
- state the various types/causes of crime.

3.0 MAIN CONTENT

3.1 Meaning of Crime and Criminology

This section introduces you to the definition of crime and the concept of criminology.

Crime is the breach of rules or laws for which some governing authority (via mechanisms) such as legal systems) can ultimately prescribe a conviction. Individual human societies may each define crime and crimes differently. While every crime violates the law, not every violation of the law counts as a crime, for example: breaches of contract and of other law may rank as “offences” or as infractions. When informed relationships and sanctions prove insufficient to establish and maintain a desired social order, a government or a sovereign state may impose more formalised or stricter systems of social control. With institutional and legal machinery at their disposal, agents of the state can compel populations to conform to codes, and can opt to punish or to attempt to reform those who do not conform.

A normative definition views crime as deviant behaviour that violates prevailing norms – cultural standards prescribing how human ought to behave normally. This approach considers the complex realities surrounding the concept of crime and seeks to understand how changing social, political, psychological and economic conditions may affect changing definitions of crime and the form of the legal, law-enforcement and penal responses made by society.

These structural realities remain fluid and often contentious. For example, as culture change and political environment shift, societies may criminalise or decriminalise certain behaviours, which directly affect the statistical crime rates, influence the allocation of resources for the enforcement of laws, and (re) influence the general public opinion.

Authorities employ various mechanisms to regulate (encouraging or discouraging) certain behaviours in general. Governing or administering agencies may for example, codify rules into laws, police citizens and visitors to ensure that they comply with those laws, and implement other policies and practices designed to prevent crime. In addition, authorities provide remedies and sanctions, and collectively these constitute a criminal justice system. Legal sanctions vary widely in their severity; they may include incarceration aimed at reforming the convict. Some

jurisdictions have penal codes written to inflict permanent harsh punishments, legal mutilation, capital punishment or life without parole. The label “crime” and the accompanying social stigma normally confine their scope to those activities seen as injurious to the general population or to the state, including some that cause serious loss or damage to individuals.

Types of Crime

Religion and Crime: Different religious traditions may promote distinct norms of behaviour, and these in turn may clash or harmonise with the perceived interests of a state.

Socially accepted or imposed religious morality has influenced secular jurisdictions on issues that may otherwise concern only an individual’s conscience. Activities sometimes criminalised on religious grounds include, alcohol-consumption (prohibition), abortion and still-cell research. In various historical and present-day societies institutionalised religions have established systems of earthly justice which punish crimes against the divine will and against specific devotional, organisational and other rules under specific codes, such as Islamic (Sharia) or Roman Catholic (canon law).

Military Jurisdictions and States of Emergency: In the military sphere, authorities can prosecute both regular crimes and specific acts (such as mutiny or desertion) under martial law codes that either supplant or extend civil codes in times of war.

Many constitutions contain provisions to curtail freedoms and criminalise otherwise tolerated behaviours under a state of emergency in the event of war, natural disaster or civil unrest. Undesired activities at such times may include assembly in the streets, violations of curfew or possession of firearms.

Employer Crime: Two common types of employee crime exist: Embezzlement and sabotage. The complexity and anonymity of computer systems may help criminal employees camouflage their operations. The victims of the most costly scams include banks, brokerage houses, insurance companies, and other large financial institutions. Some places of employment have developed measures in an attempt to combat and prevent employee crime.

Criminology

Criminology (from Latin *crimen*, “accusation”, and Greek – *logia*) is the scientific study of the nature, extent, causes and control of criminal

behaviour in both the individual and in society. Criminology is an interdisciplinary field in the behavioural sciences, drawing especially upon the research of sociologists (particularly in the sociology of deviance) and psychologists as well as on writings in law. Areas of research in criminology include forms, causes and consequences of crime as well as social and governmental regulations and reaction to crime. For studying the distribution and causes of crime, criminology mainly relies upon quantitative methods. The term criminology was coined in 1885 by Italian law professor Raffaele Garofalo as *criminologia*. Around the same time, but later, French anthropologist Paul Topinard used the analogous French term “*Criminologie*”.

Criminologists attempt to build theories that explain why crimes occur and test those theories by observing behaviour. Criminological theories help shape society’s response to crime both in terms of preventing criminal behaviour and responding to it after it occurs.

SELF-ASSESSMENT EXERCISE 1

Define the term police science. Differentiate between crime and criminology.

3.2 Development of Criminology

How does criminology evolved?

The discipline of criminology has evolved in three phases beginning in the 18th century. Although crime and criminals have been around for as long as societies have existed, the systematic study of these phenomena did not begin until the late 1700s. Prior to that time, most explanations of crime equated it with sin – the violation of sacred obligation. When scholars first distinguished crime from sin, they made possible explanations of criminal behaviour that were not theological (religious). This in turn, allowed for the dispassionate, scientific study of why crime occurs. The development of this study is now known as the era of classical criminology.

The second phase, which began in the 19th century, is referred to as modern criminology. During this era, criminology distinguished itself as a subspecialty within the emerging discipline of psychology, sociology, and economics. Scholars formed criminological societies and founded criminology journals. Criminologists conducted empirical tests (observations or experiments) of their theories, rather than relying solely on speculation, and consequently developed a wide range of theories.

The third phase, beginning in the second half of the 20th century, may best be called independent criminology. During this period, criminology began to assert its independence from the traditional disciplines that spawned it. In Western Europe, the USA and the Canada, criminologists expanded their professional associations and published an increasing number of journals. A number of universities developed graduate programmes in criminology. Criminological theories have become more multidisciplinary (spanning various fields of study) because independent criminologists seek to understand crime itself rather than study crime as one aspect of an overall sociological or psychological theory.

SELF-ASSESSMENT EXERCISE 2

Discuss the evolution of modern criminology.

3.3 Goals of Criminology

What are the goals of criminology as an area of specialty to the society?

The classical criminologists of the 18th century were primarily concerned with ending brutality and inequality against criminals by enforcing limitations on government power. They believed that criminal behaviour was the product of the offender's rational choice and that crime could be prevented through the speedy and certain application of penalties that attached painful and unattractive consequences to such behaviour. Beginning in the era of modern criminology, the emphasis of the discipline shifted. Criminologists sought to develop theories to explain why crime occurred. They no longer relied as strongly on explanations of crime based on the offender's rational choice. Instead, they attributed criminal behaviour to the motivation to commit crime and the social context that allows people to pursue criminal inclinations.

Contemporary scholars believe that criminal motivation is the product of one or more of a complex set of factors. These factors are so numerous and so varied that no system of classification can describe the current theories of crime causation with complete accuracy. However, broadly speaking, these theories may be considered in one of the following three categories:

- (1) Theories attributing criminal behaviour to biological or congenital (inherited) defects of the offender,
- (2) Theories relating crime to psychological factors or mental disorders, and
- (3) Theories relating crime to environmental or social factors. Many criminologists have suggested theories of multiple causation involving factors from more than one of these categories.

SELF-ASSESSMENT EXERCISE 3

Outline the goals of Criminology.

3.4 Theories of Crime

Biological Theories of Crime: The idea that crime is caused by biological effects or deficiencies in the offender was not new when advanced by Lombroso, but it received its most emphatic statement in the work of the Italian School. Goring, a British Criminologist, concluded that Lombroso's findings had no adequate scientific support and that statistical evidence disproved the existence of a biological criminal type. Although most investigators found Goring's work persuasive, research continued into the possible relevance of inherited deficiencies.

During the first half of the 20th century as the social sciences developed, biological theories of crime causation became less popular. The public became wary of biological typology after the National Socialist (Nazi) leaders in Germany relied on theories of racial superiority and inferiority to justify mass murder during World War II (1939 – 1945). However, with the passage of time and the development of sophisticated technologies in the field of biological sciences, biological theories of criminal behaviour have reappeared.

Current theories rely on specific features of genes or the brain, rather than appearance, as physical indicators of a propensity toward crime. They are less deterministic than earlier biological theories, substantial influence of social factors in addition to or in interaction with biologically caused predisposition to crime.

Two different types of biological or, more accurately, biological theories exist; one set of theories emphasises genetic factors that is, the traits transmitted from parents to offspring. Other studies emphasise irregularities in neurological development that might undermine certain self controls that inhibit criminality. These irregularities may occur in the structure of the brain or in the chemical composition of the brain.

Genetic Factors: The evidence for an association between genetic makeup and criminality comes from empirical studies of identical twins (who have the same genetic make-up) and adopted children who are genetically dissimilar from other family members). These studies attempt to show that biological inheritance affects the tendency toward criminality independently, of or in conjunction with the social environment.

Studies of the interrelationship between the criminal tendencies of parents and children have found that children whose parents are involved in crime are more likely to engage in criminal behaviour than children whose parents were law abiding. This finding is unsurprising due to a number of sociological factors that influence the children. Studies of twins provide somewhat more persuasive evidence.

Researchers have compared identical twins to fraternal twins (who share no more genes than siblings who are not twins). In most studies of twins, the degree of consistency between the criminality of identical twins is approximately twice that of fraternal twins. While this evidence is more persuasive than family studies, it is still possible that identical twins may be treated more similarly on social environments than fraternal twins.

Studies of identical and fraternal twins reared apart would provide more accurate indications of the relative contribution of biology and socialisation. However, such situations are very rare and only scattered case studies of this type have been done.

Finally, comparisons have been made between the criminal involvement of parents and their adopted children and that of the children's biological parents. In most cases criminality of the biological parent is a better predictor of the child's criminal involvement than the criminality of the adoptive parents. The evidence for a link between genetic makeup and a predisposition to criminality remains inconclusive. New technologies to map (DNA) deoxyribonucleic acid may identify specific gene patterns that are associated with predispositions towards criminal behaviour.

Neurological Abnormalities: The second major type of biological theory of criminality emphasises the role of neurological factors. Studies in this area focus on abnormalities in brain functioning that reduce inhibitions toward aggression.

Abnormalities affecting aggression may occur in the structure of the brain. Researchers have discovered a positive relationship between aggressive behaviour – including violent crime – and impairment of the frontal lobe of the brain's cerebrum.

Another type of the dysfunction that may be related to aggression is chemical imbalances in the brain. Human thoughts, behaviour and emotions depend upon the transmission of electrical impulses within the central nervous systems. The gaps between cells in the nervous system are called synapses and the chemicals that enable the flow of electrical impulses across the synapses are called neurotransmitters. Scientists believe that abnormally low levels of this neurotransmitters interrupt the flow of electronic impulses, thereby short-circuiting emotions such as

sympathy or empathy that can inhibit aggressive behaviour. Researchers have found a relationship between levels of specific neurotransmitters, such as serotonin and certain antisocial behaviours, including violence.

The evidence concerning the relationship between neurological functioning and criminal behaviour is mixed. For example, although there is some indication of a link between low serotonin levels and aggressive behaviour, it is largely restricted to specific populations, such as alcoholics. Frontal-lobe disorders may be the cause of aggressive behaviour or conversely, they may result from injuries incurred as a result of aggressive behaviour.

Psychological Theories of Crime: To account for criminal motivation in people, criminologists have used various psychological theories that attempt to explain human intellectual and emotional development. These theories can be divided into three categories: (1) Moral Development Theories, (2) Social Learning Theories, and (3) Personality Theories. Moral development theories describe a sequence of developmental stages that people pass through when acquiring the capacity to make moral judgments. According to these theorists, this developmental process may or may not be completed, and people who remain unable to recognise right from wrong will be more likely to engage in inappropriate, deviant or even criminal behaviour.

Social learning theories emphasise the process of learning and internalising moral codes. Learning theorists note different patterns of rewards and sanctions that affect this process. Personality theories assume a set of enduring perceptions and predispositions (tendencies). These theorists propose that certain predispositions or extroversion, increase the chances of criminal behaviour. These predispositions are sometimes discussed in terms of personality traits, such as impulsiveness and stubbornness, or personality types, such as introvert and extrovert. All other things being equal, people will consistently display behaviours that they are predisposed towards. Accordingly, some social scientists believe that certain predispositions or personality types may be associated with criminal tendencies or activities.

Environmental and Social Theories of Crime: The most common criminological theories attribute criminal motivation to environmental or social factors rather than biological or psychological traits. These theories may focus on social influences, crime or on economic factors.

- a. **Social Causes:** Gabriel Tarde, a French Sociologist asserted that the causes of crime are chiefly social. His basic theory on the causes of crime was founded on laws of imitation. Tarde believed that persons predisposed to crime are attracted to criminal activity

by the example of other criminals. He also felt that the particular crimes committed and the methods of committing these crimes are the products of imitation. The predisposition to crime, while in part reflecting many factors, is explained principally by the offender's social environment, particularly the environment of his younger years.

- b. Economic Causes:** Studies concerning the influence of economic factors on criminal behaviour have attempted to link economic deprivation to increased motivation to commit crimes (especially property crimes). Such studies assume that when economic conditions worsen more people experience deprivation and turn to crime to reduce that deprivation. These same theories have been used to explain why people of lower socio-economic status are disproportionately represented among known criminals.

Other studies attempt to relate the disproportionate involvement of poor people in crime to the distribution of power in society. The assumption in these studies is that criminal law is a tool used by the social group with higher economic status to advance its class interests. Studies of the relationship between unemployment and crime have yielded conflicting results. Some studies indicate a negative relationship between unemployment and crime – that is when unemployment decreases, crime increases or vice versa.

Theories of Criminal Opportunity: Sociologists like Marcus Felson, and others changed the focus of criminological theory from explaining criminal motivation to explaining the occurrence of criminal events. They argued that criminal motivation alone was not sufficient to cause crime. In addition to motivation, the offender requires the opportunity to pursue his or her inclinations. According to these opportunity theorists, the physical and social environment of the offender and the victim (or targets) encourage or limit criminal opportunity. They sought to identify environmental factors that provided the opportunity to commit crime.

According to opportunity theory, the dangerousness of a particular environment relates to four factors (1) the accessibility of the victim or target, (2) the perceived attractiveness of the target, (3) the proximity to numerous potential offenders, and (4) the absence of capable guardians. The chance of a crime occurring is greatest in environments where accessibility, attractiveness, and proximity are high and where guardianship is low.

SELF-ASSESSMENT EXERCISE 4

State and discuss the various theories of crime.

3.5 Schools of Thought on Criminology

What are the various views that relates to criminology and their effects on the society.

In the mid-18th century, criminology arose as social philosophers gave thought to crime and concepts of law. Over time, several schools of thought have developed.

Classical School: The classical school, which developed in the mid 18th century, was based on utilitarian philosophy. Classical school philosophers argued that (1) people have free will to chose how to act. (2) Deterrence is based upon the notion of the human being as a “hedonist” who seeks pleasure and avoids pain, and a rational calculator weighing up the costs and benefits of the consequences of each action. Thus, if ignored, the possibility of irrationality and unconscious thrives as motivational factors. (3) Punishment of (sufficient severity) can deter people from crime, as the costs (penalties) outweigh benefits, and that severity of punishment should be proportionate to the crime. (4) The more swift and certain the punishments, the more effective it is in deterring criminal behaviour. The classical school of thought came about at a time when major reform in penology occurred, with prisons developed as a form of punishment.

Positivist School: The positivist school presumes that criminal behaviour is caused by internal and external factors outside of the individual’s control. The scientific method was introduced and applied to study human behaviour. Positivism can be broken up into three segments which include biological, psychological and social positivism.

Italian School: Cesare Lombroso, an Italian prison doctor suggested that physiological traits such as the measurements of one’s chest bones or hairline, or a cleft palate were indicative of criminal tendencies.

He asserted that criminals are a distinct physical and biological type. He believes that a true criminal could be identified by observing certain physical traits, such as lower jaw, asymmetric cranium, etc. these traits according to him, did not cause criminal behaviour, but they revealed an inherent propensity (inclination) to crime.

- **Lacassagne School:** The Lacassagne School rejected Lombroso’s theory of “criminal importance of social factors. Furthermore, Lacassagne criticised the lack of efficiency of prisons. And insisted on social responsibilities toward crime and on political voluntarism as a solution to crime, and thus

advocated harsh penalties for those criminals thought to be unredeemable.

- **Sociological Positivism:** Sociological positivism postulates that societal factors such as poverty, low levels of education can predispose people to crime. There is a relationship between crime and sociological factors. It is found also that age, gender, poverty, education, and alcohol consumption are important factors related to crime.

SELF-ASSESSMENT EXERCISE 5

Compare and contrast the various schools of thought on criminology.

4.0 CONCLUSION

We have defined, and explained the terms crime and criminology. The types of crime are also mentioned as religion and crime, military crimes and employee crime. We also noted that criminology is the scientific study of the nature, extent causes and control of criminal behaviour. Goals of criminology were also mentioned and explained. Theories of criminology were outlined as, Biological, Psychological, Environmental, social, and theories of criminal opportunity were discussed. The various schools of thought on criminology were listed as the classical school and positivist school and were also discussed.

5.0 SUMMARY

In this unit, we have dealt with the meaning of crime and criminology by looking at the following aspects; definition, development of criminology, goals, theories of crime and schools of thought.

6.0 TUTOR-MARKED ASSIGNMENT

1. Differentiate between crime and criminology.
2. What is Police Science?
3. Outline the various theories of crime and discuss on any one of them.

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UNIT 2 COMMUNITY POLICING

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Meaning of Community Policing
 - 3.2 Goals & Philosophy of Community Policing
 - 3.3 Characteristics & Types of Community Policing
 - 3.4 Principles & Strategies of Community Policing
- 4.0 Conclusion
- 5.0 Summary
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1.0 INTRODUCTION

How is Community Policing different from the conventional police? Community policing is the newest terminology for law enforcement. It is a federally funded initiative. Built on the premise that fear of crime, is a way to foster better relations between the police and community. Community policing became a popular term and was instituted in the 1990's. This philosophy was seen as a way of reducing future crime problems. The various issues that will be examined in this unit include the following; Meaning of Community Policing, Goals and Philosophy of Community Policing, Characteristics and Types of Community Policing and finally Principles and Strategies of Community Policing.

2.0 OBJECTIVES

At the end of this unit you should be able to:

- define community policing
- differentiate community policing from the conventional police
- discuss the types of community policing
- list the goals of community policing
- state the principles of community policing
- describe the characteristics of community policing.

3.0 MAIN CONTENT

3.1 Meaning of Community Policing

Community policing or neighbourhood policing is a policing strategy and philosophy based on the notion that community interaction and support can help control crime and reduce fear, with community members helping to identify suspects, detain vandals and bring problems to the attention of police.

Community policing is a philosophy that promotes organisational strategies, which support the systematic use of partnerships and problem-solving techniques, to proactively address the immediate conditions that give rise to public safety issues such as crime, social disorder, and fear of crime.

One of the major objectives of community policing efforts is to establish an active partnership between the police and the community that can analyse problems and design and help implement solutions and services that are truly community-based.

This requires the police to make a conscious effort to create an atmosphere in which community partners actively and willingly co-operate with the police.

Community policing consists of three key components:

- **Community Partnerships:** Collaborative partnerships between the law enforcement agency and the individuals and organisations they serve to develop solutions to problems and increase trust in police. These partnerships are encouraged with other government agencies, community members and groups, human and social service providers, private businesses, and the media.
- **Organisation Transformation:** The alignment of a law enforcement agency, organisational management practices, structure, personnel and information systems seems to support community partnerships and proactive problem solving. Police departments engaged in effective community policing seek to transform their organisational culture, leadership and management structure, labour relations, strategies, planning process, how they evaluate performance, the transparency of their operations, the geographic assignments of officers, the alignment of their fiscal resources, recruitment and hiring practices, training and information gathering systems. The objective of these changes is to create an organisational infrastructure that can best

support proactive operations intended to prevent crime. Traditional law enforcement practices are reactive and emphasise process such as response times, arrest rates, and other rote responses to crime. Community policing emphasises solving community problems and addressing the factors that contribute to crime instead of how the police respond to crime.

- **Problem Solving:** The process of engaging in the proactive and systematic examination of identified problems to develop and rigorously evaluate effective responses. Community policing requires agency to become proficient in what is known as the SARA model of problem solving. Scanning, identifying, and prioritising problems. Analysis: Researching what is known about the problem response: Developing solutions to bring about lasting reductions in the number and extent of problems Assessment: evaluating the success of the response.

Community policing shifts the focus of police by placing equal emphasis on crime control, order maintenance, and service provision. In addition, it asks police to work with citizens and with other government agencies in efforts to increase overall quality of life. Thus, the model moves away from police-dominated crime control through reactive responses to calls for service community policing models move toward active problem solving centred on the underlying conditions that give rise to crime and disorder and on fostering partnerships between the police and the community.

There is no one commonly recognised definition of community policing. Here we offer one possible definition that we will then apply to preventing and responding to crime. Community policing can be defined as a philosophy that, through the delivery of police services, focuses on crime and social disorder; the philosophy includes aspects of traditional law enforcement as well as prevention, problem-solving tactics, and partnerships. As a fundamental shift from traditional, reactive policing, community policing stresses the prevention of crime. Community policing requires police and citizens to join as partners in identifying and effectively addressing the underlying conditions that give rise to crime and disorder. Community policing can be roughly divided into three inter-related elements as discussed above; Organisational change, problem solving, and external partnerships.

SELF-ASSESSMENT EXERCISE 1

How is Community Policing different from the traditional policing?

3.2 Goals & Philosophy of Community Policing

Having attempted to discuss the meaning of community policing and explaining its major differences from the traditional policing, the next issue to deal with is, what are the goals and philosophy of community policing.

As earlier stated, community policing is both a philosophy and an organisational strategy that allows police and community residents to work closely together in new ways to solve the problems of crime, fear of crime, physical and social disorders, and neighbourhood decay.

Goals of Community Policing

The following are the goals of community policing:

- Maintaining or increase public confidence in the police department
- Decrease fear of crime
- Listen to and address citizen concerns
- Bring community resources together to solve problems
- Impact specific crime problems
- Reduce repetitive calls for service
- Educate the public about its police department.

Community policing is in essence, collaboration between the police and the community that identifies and solves community problems with the police no longer the sole guardians of law and order, all members of the community become active allies in the effort to enhance the safety and quality of neighbourhood.

Community policing has far-reaching implications. The expanded outlook on crime control and prevention, the new emphasis on making community members active participants in the process of problem solving, and the patrol officers pivotal role in community policing require profound changes within the police organisation.

We want our community members to voice their concerns, contribute advice and take action to address these concerns. Creating a constructive partnership will require the energy, creativity, understanding, and patience of all involved.

The goal of community policing is to reduce crime and disorder by carefully examining the problems in neighbourhoods and then applying appropriate problem-solving remedies.

Operationally, the town or city could be divided into 6 “districts”. Each of these districts will then be assigned its own community policing officer who is given the responsibility of that district. Main police officers are the primary providers of police services and have the most extensive contact with community members. Although the officers assigned to each district will be available to offer advice on security and helping to organise and support neighbourhood watch groups. They will let you know what district you are in and begin to develop positive contact in bringing the police closer to the community. They will leave their business card so that you will know who to contact to help you solve any non-emergency issues that occur. Our goal is for each officer to get to know our citizens on a first name basis.

They could be community district meetings to afford community members an opportunity to air concerns and find ways to address them. We want to establish and maintain mutual trust with the citizens.

The Community Policing Philosophy

A great deal of the responsibility for preparing for and responding to crime rests with local police departments. Community policing presents an over reaching philosophical orientation that agencies can use to better deal with the threat and fear that crime may create. The community policing philosophy can be roughly divided into three interrelated elements: Organisational change, problem solving, and external partnerships.

The philosophy of community policing is important for police in preparing for possible crime acts and in responding to the fear they may create. Community policing involves broadening the nature and number of police functions compared to traditional policing models. It emphasises organisational change, active problem solving, and external partnerships to address issues that concern both the police and citizens. However, the community policing philosophy is well positioned to play a central role in local law enforcement responses to crime.

Organisational Change: Ideally, community policing should be adopted organisation-wide and be reflected through department participation at all levels as well as through the organisation’s mission, goals, objectives, performance evaluations, hiring and promotion practices, training, and all other systems that define organisational culture and activities. One of the most important specific aspects of organisational change relevant to community policing is a flattened organisational structure. Community policing departments are often less hierarchical, supporting management’s dispersion of decision making authority to the lowest organisational level and holding those individuals

accountable for the outcomes. A second important element of organisational change is fixed geographic responsibility. Officers or deputies are assigned to fixed geographic areas for extended periods, based on social and cultural considerations and on the assumption that this fosters better communication with residents, increase the police officers ability to understand, prevent and respond to community problems, and enhances accountability to the citizens in that area.

Problem Solving: Community policing department also actively address the underlying conditions that give rise to or facilitate crime or disorder in an effort to prevent future problems by identifying and analyzing problems and by developing tailored strategies that may include traditional and nontraditional responses that focus on deterring offenders, protecting likely victims, and making locations less conducive to crime and disorder. Departments should use a wide array of relevant traditional and nontraditional data sources to better understand and evaluate the nature of problems and work in conjunction with the community and other organisations to develop effective long term solutions. Problem solving often manifests itself in the “scanning, analysis, response and assessment” problem solving model. Department first identify relevant or perceived crime problems (scanning), determine the nature and underlying conditions that give rise to those problems (analysis), craft and implement interventions that are linked to that analysis (response), and evaluate its effectiveness (assessment). The process is understood as continually involving feedback among the components. For instance, through in-depth analysis, agencies may come to define problems differently, effectively returning to the scanning phase. Likewise, an assessment may determine that a response was ineffective and that the problem requires additional analysis.

External Partnerships: Under a community policing philosophy, departments partner with other government, social service, and community agencies in attempts to identify and address persistent problems in the community. They form external partnerships in recognition of others that can be leveraged when addressing community problems. The police are only one of a host of local government agencies responsible to community problems.

Under community policing, coordination with other government agencies in developing comprehensive and effective solutions is essential. In addition, the police are encouraged to develop working partnerships with civic and community groups to accurately survey community needs and priorities and to use the public as a resource in problem-solving and in developing and implementing interventions.

SELF-ASSESSMENT EXERCISE 2

Discuss the philosophy behind the community policy model.

3.3 Characteristics and Types of Community Policing

What are the distinguishing features of community policing and types?

Community policing is service oriented, promoting the concept of community as client, and police as provider. The needs of the client become the goals of the provider in delivering professional, client-central service that is effective, efficient, and accountable.

Community policing is a partnership whose objective is to determine community needs and policing priorities, and to promote police accountability and effectiveness. Consultation with the community, through community police forums is of critical importance. But community policing forums are not the only means of consultation; other channels may also be developed and should include the participation of all stakeholders. Surveys, interviews, workshops, community profiles, and other methods can help identify community needs.

Community policing is effective at problem solving. The actual and potential causes of crime and conflict within the community can be jointly identified and analysed. With the results that guiding measures can be developed that can address the problems in the short, medium and long-term. Problem solving also involves conflict resolution and other creative methods to address service delivery and police-community relations problems.

Community policing is an agent of empowerment, creating a sense of joint responsibility and a joint capacity for addressing issues of concern to the campus community and police personnel. This will require training about community policing so everyone has a constructive role.

In community policing, accountability is achieved by making the provider responsible to the client; creating mechanisms through which the police are accountable for addressing the needs and concerns of the community they serve.

Types of Community Policing: There are basically two major types of community policing models, namely:

- **Traditional Policing:** Within a traditional policing model, the police officer would respond when a call comes in, that a crime has occurred. The officer would then take a report and hand the

investigation up to a detective. At that point, the officer will then go back to his patrol car and wait for another call to come in that a crime had occurred.

The officer has little interaction with the citizens within a community and can end up responding to crimes at various points in the city. The officer hardly knows anyone in the area where he is responding nor do the citizens really know the officers. Also under this type of policing, there is nothing in place to try to prevent crime from occurring. It is just a supply and demand sort of policing system. You have seen the police shows where a crime took place and no witnesses are talking well in this police shows, this is the type of policing model that is being used.

Within this model there is an emphasis on trying to prevent crime from happening. This policing model has detectives watching for patterns in crimes to help understand when and how crimes are being committed. Once they have a pattern, they will search for ways in which to help prevent crimes from continuing to happen in those areas.

- **Community Oriented Policing:** Within this model, the officers will take a more community involvement stance. No longer does an officer sit in his patrol car and wait for a call that a crime has happened. Within this type of policing, the officers will have a zone in which to work in during their shifts. This is the area and they will work to get to know the citizens of the community and help out in any way they can. The officers will make their presence known and also rely on community citizens to report any suspicious behaviour or tips on criminals in the area.

This method takes a lot of trust on the officer's part as well as the citizen's part. They will have to trust each other and know what each other is looking out for. Many citizens have attested to several agencies that, when they know the officers they can start to view them as part of their families and are willing to look out for "their officers" and help keep them safe.

SELF-ASSESSMENT EXERCISE 3

List the main features of community policing and describe any of the types or models.

3.4 Principles and Strategies of Community Policing

What are the strategies to be adopted for effective community policing?

Principles

Community policing principles inform, guide, and sustain all policing activities.

Community Policing:

- Respects and protects human rights
- Appreciations, respects, and accommodates the languages, cultures, and values of our diverse community
- Creates understanding and trust between the police, the community, and other constituencies
- Shares responsibility and decision making
- Solves problems in consultation with the community, and consistently strives to improve responsiveness and to identify and prioritise community needs.
- Educates police personnel and members of the community to enable constructive participation in addressing the problems of safety and security
- Resolves conflict between and within community groups in a manner that enhances peace and stability.
- Enhances accountability of the police to the community they serve.
- Sustains commitment from both the police and the community to safety and security.

According to community policing by Trojanowicz (1990), in contemporary perspective, there are ten principles of community policing.

1. **Philosophy and Organisational Strategy** – People deserve input into the police process in exchange for their participation and support. New, creative ideas should be explored to address neighbourhood concerns beyond individual crimes.
2. **Commitment to Community Empowerment** – The philosophy of power sharing must be translated from philosophy to practice. There will be more autonomy for line officers and more expectation of citizen involvement in the problems solving process.

3. **Decentralised and Personalised Policing** – There must be a new breed of line officers who serves as a link between police and the community. These officers must be in the community, and not in their patrol cars or face to face contact in a defined area.
4. This **Immediate and Long-Term Practice of Problem Solving** has continued and sustained contact with the law abiding people of the community which helps them to solve and plan together.
5. **Ethics, Legality, Responsibility and Trust:** There will be a new “contract” between police and citizens to overcome widespread apathy while restraining vigilantism. This relationship is based on mutual trust and respect. It will require citizens to work to solve minor concerns while freeing the police to work with the community to develop solutions.
6. **Expanding the Police Mandate** – The role of police moves from reactive to proactive while they will still respond to crises and incidences of crime, they will work to make changes today that will have an impact on the quality of life for tomorrow within the community.
7. **Helping those with Special Needs** – Police will explore new ways to protect those who are most vulnerable - juveniles, elderly, minorities, poor, disabled, and homeless.
8. **Grass-Roots Creativity and Support** – Never underestimate the possibilities of a small group of dedicated people. Technology is a tool, but human beings, talking and working together to solve a problem, have the potential to do great things.
9. **Internal Change** - Community policing requires a commitment to the approach that involves the community policing officer who acts as the bridge between the community and the police force.
10. **Building for the Future:** Decentralisation, personalised police service is the order of the day. Police cannot impose order and they must work with the community to create it. This cannot be a “flavour of the mouth”. It must be something that is initiated and worked toward every day. It is a new philosophy and organisational strategy for positive change.

Strategies for Community Policing

- Participation by all members of the police department in community policing and problem solving initiatives.
- Commitment from police service commission to develop new skills through training that facilitates conflict resolution and community involvement.
- Encouragement for police officers to assume responsibility for addressing safety and security problems within their areas of responsibility; to promote initiative, creativity self-discipline and motivated personnel.
- Identification and mobilisation of community resources and organisation to assist in addressing safety and security concern.
- Development of a police department crime prevention officer to help form a closer relationship with the community.
- Establishment of a community service officer programme, to promote and maintain safety awareness through community outreach programmes.

SELF-ASSESSMENT EXERCISE 4

What are the guiding principles of community policing. Discuss strategies for effective community policing.

4.0 CONCLUSION

We have explained that community policing is a policy and strategy aimed at achieving more effective and efficient crime control, reduced fear of crime, improved quality of life, improved police services and police legitimacy, through a proactive reliance on community resources that seeks to change crime causing conditions. There is a need for greater accountability of police, greater public share in decision making, and greater concern for civil right and liberties.

5.0 SUMMARY

In this unit, we have dealt with the concept of community policing by looking at the following aspects; meaning of community policing, goals, and philosophy, characteristics and types, principles and strategies of community policing.

6.0 TUTOR-MARKED ASSIGNMENT

1. Differentiate between community policing and traditional policing.
2. Discuss the main components of community policing.
3. What strategies will you adopt to improve on community policing?

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UNIT 3 PENOLOGY

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 - 3.1 Meaning of Penology
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1.0 INTRODUCTION

Penology generally is a branch of criminology dealing with prison management and the treatment of offenders, and it is an important aspect of police science. Penological studies have sought to clarify the ethical bases of punishment, along with the motives and purposes of society in inflicting it, differences throughout history and between nations in penal laws and procedures, and the social consequences of the policies in force at a given time. Influential historical works includes Cesare Beccaria's *On Crimes and Punishments*, Cesare Lombroso's *Crime* and Michael Foucault's *Discipline and Punishment*. The various aspects that will be examined in this unit include the following: Meaning of Penology, Theories of punishment, Prison, including Prisoner Abuse, Prison Reforms and Prisoner's Rights, Criminal Rehabilitation and Prison Management.

2.0 OBJECTIVES

At the end of this unit you should be able to:

- define the term penology
- discuss the various theories of punishment
- explain prisoner's right and abuse
- describe the importance of criminal rehabilitation
- identity the goals of prison management
- justify the importance of prison reforms.

3.0 MAIN CONTENT

3.1 Meaning of Penology

What is penology all about? Penology (from the Latin word “poena”, punishment) is a section of criminology that deals with the philosophy and practice of various societies in their attempts to repress criminal activities, and satisfy public opinion via an appropriate treatment regime for persons convicted of criminal offenses.

Penology is concerned with the effectiveness of those social processes devised and adopted for the prevention of crime, via the repression or inhibition of criminal intent via the fear of punishment. This study of penology therefore deals with the treatment of prisoners and the subsequent rehabilitation of convicted criminals. It also encompasses aspects of probation (rehabilitation of offences in the community) as well as penitentiary science relating to the secure detention of offenders committed to secure institutions.

Penology concerns many topics and theories, including those concerning prisons (prison reform, prison abuse, prisoner’s rights, and recidivism), as well as theories of the purposes of punishment (such as Deterrence, Rehabilitation, Retribution and concerns itself mainly with criminal rehabilitation and prison management. The word seldom applies to theories and practices of punishment in less formal environments such as parenting, school and workplace correctional measures.

Historical theories of punishment were based on the notion that fearful consequences would discourage potential offenders. Example of the principle can be found in the Draconian law of ancient Greece and the bloody code which persisted in Renaissance England. When at various times, capital punishment was prescribed for over 200 offenses. Similarly, certain hundred offences under Sharia Hadith tradition may incur fearful penalties.

Modern theories of the punishment and rehabilitation of offenders are broadly based on ancient scriptural texts of the Christian Bible and the Moslem Quran, which principles only reappeared in Europe some time after the publication of a seminal pamphlet “On Crimes and Punishment” published by Cesare Marquius of Beccaria in 1764. It is based on the notion of proportionality. Previously (for example, under England’s Bloody Code) the penalty of theft had been the same regardless of the value stolen; giving rise to English expression “it is as well to be hanged for a sheep or a lamb”.

Subsequent development of the ideas of Beccaria made a non-lethal punishment more socially acceptable. Consequently, convicted prisoners had to be re-integrated into society when their punishment was complete. In Europe, and many westernised legal systems, criminal punishments now tend to be in accordance with a popular theory once expressed by Martin Luther King around 1958. Hates begets hate violence begets violence; toughness begets a greater toughness, we must meet the forces of hate with the power of love ... our aim must never be to defeat or humiliate the white man (e.g. our enemies) but to win his friendship and understanding.

Penologists have consequently evolved occupational and psychological education programmes for offenders detained in prisons, and a range of community service and probation orders which entail guidance and after care of the offender within the community.

The importance of inflicting some measure of punishment on those persons who breach the law is however maintained in order to maintain social order and to moderate public outrage which might provoke appeals for cruel vengeance. Penalties can only be imposed by a criminal court and include fines, damages, unpaid compensatory work and mandatory training as well as physical detention.

SELF-ASSESSMENT EXERCISE 1

Define the concept of penology and its evolution.

3.2 Theories of Punishment

What is punishment and the various theories of punishment? Punishment is the practice of imposing something unpleasant or aversive on a person or animal or property, usually in response to disobedience, defiance, or behaviour deemed morally wrong by individuals, government or religious principles. In common usage, the word "punishment" might be described as "an authorised imposition of deprivations – of freedom or privacy or other goods to which the person otherwise has a right, or the imposition of special burdens – because the person has been found guilty of some criminal violation, typically (though not invariably) involving harm to the innocent."

Punishments are applied for various purposes, most generally, to encourage and enforce proper behaviour as defined by society or family. Criminals are punished judicially, by fines, corporal punishment or custodial sentences such as prison, detainees risk further punishment for breaches of internal rules, children, pupils and other trainees may be punished by their educators or instructors (mainly parents, guardians or

teachers, tutors and coaches). Domestic and other servants used to be punished by their masters. Employees can still be subjected to a contractual form of fine or demotion. Most hierarchical organisations, such as military and police forces, or even churches, still apply quite rigid internal discipline, even with a judiciary system of their own (court martial, canonical courts).

Punishment may also be applied on moral, especially religious grounds, as in penance (which is voluntary) or imposed in a theocracy with a religious police (as in a strict Islamic state like Iran or under the Taliban) or (though not a true theocracy) by inquisition.

You will realise that the progress of civilisation has resulted in a change in the theory and in the method of punishment. In primitive society, punishment was left to the individuals wronged or their families, and was vindictive or retributive. In quantity and quality it would bear no special relation to the character or gravity of the offense. Gradually, there would arise the idea of proportionate punishment of the characteristic type, which is “an eye for an eye”. The second stage was punishment by individuals under the control of the state or community. The third stage, with the growth of law, the state took over this primitive function and provided itself with the machinery of justice for the maintenance of public justice. Henceforward, crimes are against the state, and the exaction of punishment by the wronged individual is illegal.

Governments have several theories to support the use of punishment to maintain order in society. These theories of punishment can be divided into two general philosophies: Utilitarian and Retributive. The utilitarian theory of punishment seeks to punish offenders to discourage or “deter” future wrongdoing. The retributive theory seeks to punish offenders because they deserve to be punished.

Under the utilitarian philosophy or theory, laws should be used to maximise the happiness of society. Because crime and punishment are inconsistent with happiness, they should be kept to a minimum. Utilitarians understand that a crime-free society does not exist, but the endeavour to inflict only as much punishment as is required to prevent future crimes. The utilitarian theory is “consequentialist” in nature. It recognises that punishment has consequences for both the offender and society and holds that the total good produced by the punishment should exceed the total evil. In other words, punishment should not be unlimited. One illustration of consequentialism in punishment is the release of a prison inmate suffering from a debilitating illness. If the prisoner’s death is imminent, society is not served by his continued confinement because he is no longer capable of committing crimes.

Under the utilitarian theory or philosophy, laws that specify punishment for criminal conduct should be designed to deter future criminal conduct. Deterrence operates on a specific and a general level. General deterrence means that the punishment should prevent other people from committing criminal acts. The punishment serves as an example to the rest of society, and it put others on notice that criminal behaviour will be punished.

Specific deterrence means that the punishment should prevent the same person from committing crimes. Specific deterrence works in two ways. First, an offender may be put in jail or prison to physically prevent him from committing another crime for a specified period. Second, this incapacitation is designed to be so unpleasant that it will discourage the offender from repeating his criminal behaviours.

The counterpart to the utilitarian theory of punishment is the retributive theory. Under this theory, offenders are punished for criminal behaviour they deserve punishment. Criminal behaviours upset the peaceful balance of society, and punishment helps to restore the balance. The retributive theory focuses on the crime itself as the reason for imposing punishment. Where the utilitarian theory looks forward by basing punishment on social benefits, the retributive theory looks backward at the transgression as the basis for punishment.

According to the retributivist, human beings have free will and are capable of making rational decisions. An offender who is insane or otherwise incompetent should not be punished. However, a person who makes a conscious choice to upset the balance of society should be punished. There are different moral bases for retribution. To many retributivists, punishment is justified as a form of vengeance. Wrongdoers should be forced to suffer because they have forced others to suffer. To other theorists, retribution against a wrongdoer is justified to protect the legitimate rights of both society and the offender. Society shows its respect for the free will of the wrongdoer through punishment. Punishment shows respect for the wrongdoer because it allows an offender to pay the debt to society and then return to society, theoretically free of guilt and stigma.

The third theory of punishment is denunciation theory. Under this theory, punishment should be an expression of societal condemnation. The denunciation theory is a hybrid of utilitarianism and retribution. It is utilitarian because the prospect of being publicly denounced serves as a deterrent. Denunciation is likewise, retributive because it promotes the idea that offenders deserve to be punished.

SELF-ASSESSMENT EXERCISE 2

Discuss the distinguishing features of retributive and utilitarian theories of punishment.

3.3 Prisons (Reform, Prisoner's Right and Abuse)

You may want to know what constitutes a prison, prisoner's abuse and rights as well as prison reforms.

A prison (from old French *prisoun*) is a place in which people are physically confined and usually, deprived of a range of personal freedoms. Other terms are penitentiary, correctional facility and jail (gaol). Prisons are conventionally institutions which form part of the criminal justice system of a country, such that imprisonment or incarceration is a legal penalty that may be imposed by the state for the commission of a crime. A criminal suspect who has been charged with criminal offenses may be held on remand in prison if he is denied or unable to meet conditions of bail, or is unable or unwilling to post bail. A criminal defendant may also be held in prison while awaiting trial or a trial verdict, if found guilty, a defendant will be convicted and may receive a custodial sentence requiring imprisonment.

As well as convicted or suspected criminals, prisons may be used for internment of those of those not charged with a crime. Prisons may also be used as a tool of political repression to detain political prisoners, prisoners of conscience and "enemies of the state", partially by authoritarian regimes. In times of war or conflict, prisoners may also be detained in prisons. A prison system is the organisational arrangement of the provision and operation of prisons, and depending on their nature, may involve a corrections system.

For most of history, imprisonment has not been a punishment in itself, but rather a way to confine criminals until corporal or capital punishment was administered. There are prisons used for detention in Jerusalem in Old Testament times, Dungeons were used to hold prisoners; those who were not killed or left to die there often became gallery slaves or faced penal transformations. In other cases, debtors were often thrown into debtor's prison, until they paid their jailers enough money in exchange for a limited degree of freedom.

Only in the 19th century beginning in Britain, did prisons as we know them today become commonplace. The modern prisons system was born in London, as a result of the views of Jeremy Bentham. The notion of prisoners being incarcerated as part of their punishment and not simply as a holding till trial or hanging was at the time revolutionary. The first

“modern” prisons of the early 19th century were sometimes known by the term “penitentiary”. As the name suggests, the goal of these facilities was that of penance by the prisoners, through a regime of strict discipline, silent reflections and perhaps forced and deliberately pointless labour.

Prison Reform

Prison reform is the attempt to improve conditions inside prisons aiming at a more effective penal system. The processes include the following:

Rehabilitation/Reform/Correction

“Reform” here refers to reform of the individual, not the reform of the penal system. The goal is “repair” the deficiencies in the individual and return them as productive members of society. Education, work skills, deferred gratification, treating others with respect, and self-discipline are stressed. Younger criminals who have committed fewer and less severe crimes are most likely to be successfully reformed. “Reform schools” and “boot camps” are set up according to this model. One criticism of this model is that criminals are rewarded with training and other items which would not have been available to them had they not committed a crime.

Removal from Society

The goal here is simply to keep criminals away from potential victims, thus reducing the number of crimes they can commit. The criticism of this model is that others increase the number and severity of crimes they commit to make up for the “vacuum” left by the removed criminals. For example, incarcerating a drug dealer will then result in an unmet demand for drugs at that locale and an existing or new drug dealer will then appear, to fill the void. This new drug dealer may have been innocent of any crimes before this opportunity, or may have been guilty of less serious crimes, such as being a lookout for the previous drug dealers.

Restitution/Repayment

Here prisoners are forced to pay their “debt” to society. Unpaid or low pay work is common in many prisons often to the benefit of the community. In some countries prisons operate as labour camps. Critics say that the repayment model gives government an economic incentive to send more people to prison.

Reduction in Immediate Cost

Government and prison officials also have the goal of minimising short term cost. In wealthy societies, this calls for keeping prisoners placated by providing them with things like television and conjugal visits. Inexpensive measures like these prevent prison assaults and riots which in turn allow the number of guards to be minimised. Providing the quickest possible parole and/or release also reduces immediate costs to the prison system (although this may very well increase long term costs to the prison system and society due to recidivism).

In poor societies, which lack the resources to imprison criminals for years, frequently use execution in place of imprisonment for severe crimes. Less severe crimes such as theft might be dealt with by less severe physical means.

Some of the goals of criminal justice are compatible with one another, while others are in conflict. In the history of prison reform, the harsh treatment, torture and executions used for deterrence first came under fire as a violation of human rights. The salvation goal and the methods were later treated as violations of the individual's freedom of religion. This led to further "reforms" aimed principally at reform/correction of the individual, removal from society and reduction of immediate costs. The perception that such reforms sometimes denied victims justice then led to further changes.

Prisoner's Rights

The movement for prisoner's rights is based on the principle that prisoners, even though they are deprived of liberty, are still entitled to basic human rights. Advocates for prisoner's rights argue that they are often deprived of very basic human rights, with the cooperation of the prison authorities. Alleged violations include:

- Prison authorities turning a blind eye to assault or rape of prisoners, failing to take sufficient steps to protect prisoners from assault or rape, or even allegedly arranging for prisoners to be assaulted or raped by other inmates as a form of punishment.
- Providing insufficient treatment to serious medical conditions.
- Refusing freedom of expression, to read materials, and communicate (particularly in cases of foreign languages in prisons).
- Punishing prisoners who complain about conditions.

- Taking away prisoner's right to sue prison officials or government for maltreatment, or to receive compensation for injuries caused by the negligence of prison authorities.
- Depriving inmates of freedom of religion.
- Blockading inmate's rights to legal materials and access to the courts.
- Not properly feeding and clothing the prisoner.
- Disenfranchising prisoners.

As a corollary of the above, the following list represents a part of a prisoner's rights:

- Right to be protected by authorities in the case of assault or rape.
- Right to medical treatment.
- Right to freedom of expression, reading materials and communication.
- Right to express concern with the prison's standard of living.
- Right to a court of law with regards to prison authorities
- Right to freedom of religion.
- Right of access to a court of law.
- Right to drink safe water and get treated the same as everyone else.
- Right to food and clothing.

Some of the prisoner's rights movements also advocate

- Conjugal visitation
- Education for inmates
- Increasing the wages for workers who are employed with prisons.

Prisoner's rights are limited. For the most part, jail and prison inmates may demand only a "minimal civilized measure of shelter". Generally, courts follow three basic principles when deciding whether to recognise a particular right. First, an inmate necessarily gives up many rights and privileges enjoyed by the rest of society. Second, an inmate does not relinquish all constitutional rights upon placement in prison, and thirdly, the constitutional rights retained by the inmates must be balanced against the security concerns of the prison. The established rights of prison inmates include FREEDOM OF SPEECH and RELIGION.

Prisoner Abuse

Prisoner abuse is the maltreatment of persons while they are under arrest or incarcerated. Prisoner abuse falls under this category:

- Physical abuse: Needless beating, hitting or other corporal punishment
- Psychological abuse: Taunting, sleep deprivation, or other forms of psychological abuse.
- Sexual abuse: Forced intercourse, genital mutilation or other forms of sexual abuse.
- Other abuse: Refusal of essential medication, humiliation, etc.
- Enhanced interrogation: Methods implemented in the war or terror purportedly needed to extract information since other techniques would not yield results.
- Torture: Any act by which severe pain whether physical or psychological is intentionally inflicted.

SELF-ASSESSMENT EXERCISE 3

What constitutes Prisoner's Abuse? And how are the rights of Prison Inmates Abused?

3.4 Criminal Rehabilitation

Rehabilitation means to restore to useful life, as through therapy and education or to restore to good condition, operation or capacity. The assumption of rehabilitation is that people are not permanently criminals and that it is possible to restore a criminal to a useful life, to a life in which they contribute to themselves and to society. A goal of rehabilitation is to prevent habitual offending, also known as criminal recidivism. Rather than removing the harm out of a criminal, rehabilitation would seek, by means of education or therapy, to bring a mind into an attitude which would be helpful to society, rather than being harmful to society.

This theory of punishment is based on the notion that punishment is to be inflicted on an offender so as to reform him/her, or rehabilitate them so as make their reintegration into society easier. Punishments that are in accordance with this theory are community service, probation orders, and any form of punishment which entails any form of guidance and aftercare towards the offender.

This theory is found on the belief that one cannot inflict a severe punishment of imprisonment and expect the offender to be reformed and to be able to re-integrate into society upon his release. Although the

importance of inflicting punishment on those persons who breach the law, so as maintain social order, is retained, the importance of rehabilitation is also given priority. Humanitarians have, over the years, supported rehabilitation as an alternative, even for capital punishment.

In criminal rehabilitation, prisoners are given opportunity to increase their content knowledge base. This is essential as studies show that many inmates do not have basic education. This would severely impede their success of acquiring jobs, thus many had to turn to a life of crime. Basic criminal rehabilitation programmes ensure that there is a standard level of literacy amongst the inmates who sign up for the course.

Rehabilitation also ensures that inmates are socially well adjusted. Psychological assessments are being administered to test for mental or physical disabilities that led to incarceration in the first place. Should the inmates be ready and willing to accept counseling and assessment, many of them are able to return to society as relatively well-balanced individuals. For drug addicts, this is a pertinent issue, as many of them are struggling with additional problems. Counseling would help to balance inner dynamics that led to the addiction, and possibly the criminal behaviour that fuelled the addiction.

Criminal rehabilitation has many positive benefits and can impact the lives of many inmates as well as their families; it can help with wider social issues as well, such as reducing discrimination and stigma.

Measures for Criminal Rehabilitation

The first step in increasing the effectiveness of criminal rehabilitation is education on two levels. One level is to educate the workforce involved in the criminal justice system as ways to promote the system into being a revolving door for better citizens instead of for habitual offenders. Education is one of the ways in which this positive change is effected. Education works in two levels to successfully rehabilitate the criminal on a macro level, society as a whole is being educated to promote the importance of keeping the laws as well as ensuring that there is less discrimination against former criminals. This ensures that the propensity for ex-convicts to return to a life of crime is less, as they are able to secure jobs after their release. Education is also being offered within the prison to allow the prisoners to upgrade and stay relevant to the changing society outside the prison walls.

Part of the education programme in criminal rehabilitation would be to help the prisoners increase their knowledge base. Many inmates do not even have basic education; this limits their ability for success in the working world. Basic criminal rehabilitation programmes would ensure

that there is a standard module for literacy amongst the inmates who are willing and able to learn.

The next step in a good criminal rehabilitation programme involves the social adjustment level of the inmates. Each criminal could be assessed as to any mental or physical disabilities and problems that contribute to their incarceration. If appropriate counselling and behaviour modification techniques could be utilised, many prisoners may be able to shift back in to society in a more balanced manner.

Criminal rehabilitation is gaining popularity among many who are forward thinking. Such forms of rehabilitation can help to reduce the number of repeat offenders who return to jail after being unable to adapt to life outside of jail. This can also help solve some of the more serious cases, such as sexual offenders who may continue in their ways after being released, preying on women or children. Criminal rehabilitation can also help solve the problem of overcrowding in most prisons.

SELF-ASSESSMENT EXERCISE 3

Examine the role of “rehabilitation” in repositioning a criminal.

3.5 Prison Management

In the changing world of today, the need for highly effective management of prisons and other related institutions has never been greater. The effective management of prisons, has been linked, both in theory and practice to sustained economic development and is a major vehicle through which to develop modern prison management systems and principles. Government and prison services around the world are undergoing processes of renewal and reform that pose new challenges and opportunities in prison management. These same challenges and opportunities demand new knowledge, skills and leadership abilities.

The shift in the focus of prison management, which leads to the move from an input to an output orientation, a stress on quality prisoner-based service and the increasing role of performance based management systems, give rise to a new concept of responsible professionalism within the prison. The following components are necessary in developing a prison management system. This system should contain the modules like nominal roll, case register, parole register, interview requests, in-out register and an automated release diary generator.

Nominal Roll: The details of the prisoner and his/her demographic details should be captured. A digital photo comprising different views of

the prisoner and the list of articles surrendered by the prisoner during nominal roll are to be recorded.

Case Register: All the details of the cases against the prisoner should be captured. This must include the sentence details, remand/conviction details, etc.

Automated Release Diary Generator: This report should display the list of prisoners to be released on a day, the next day, the next week, the next month or any given duration of time.

Parole Register: This module should track all prisoners on parole and provide necessary reports on this data.

Interview Requests and In-Out Register: All interview requests by the relatives of the prisoners need to be recorded and tracked. An in-out register will track all prisoners and others who move in and out for various reasons. This should include provisions for recording the prisoners sent to courts for hearing.

Various Status Reports and demographical analysis reports are to be generated.

SELF-ASSESSMENT EXERCISE 4

Give an outline aimed at developing an efficient prison management system.

4.0 CONCLUSION

We have discussed that penology is a branch of criminology that deals with prison management, treatment of offenders and also an important aspect of police science. Punishments are applied for various purposes, most generally to encourage and enforce proper behaviour as defined by society or family. Also prison reform is the attempt to improve conditions inside prisons aiming at a more effective penal system. We also explained prisoner's rights and abuse. Prisoner's right is based on the principle that prisoners, even though they are deprived of liberty, are still entitled to basic human rights. While prisoner abuse is the maltreatment of persons while they are under arrest or incarcerated. Criminals are normally rehabilitated to ensure that inmates are socially well adjusted.

5.0 SUMMARY

In this unit, we have discussed the concept of penology by looking at the following aspects: Meaning, Theories of punishment, Prisons including prison reforms, Prisoner's abuse and rights, criminal rehabilitation and prisons management.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is penology?
2. Discuss the various theories of punishment.
3. Differentiate between prisoner's rights and abuse.

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UNIT 4 CRIMINAL JUSTICE SYSTEM

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 - 3.1 Meaning of Criminal Justice System
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- 3.5 Importance of Criminal Justice System
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1.0 INTRODUCTION

Criminal Justice covers every aspect of our legal system; from police through the courts on to correctional facilities and even covering probation and parole. Criminal justice is a field of study pertaining to the institutions used to maintain social control through policies, laws and procedures aimed to deter and mitigate crime and to sanction those who violate laws with penalties and rehabilitation.

The Criminal Justice System includes the agencies charged with enforcement of the law of various stages of the process for an alleged criminal offender. This includes initial police contact, pre-trial services, criminal court proceedings, sentencing and corrections. The various aspects that will be examined in this unit that will introduce you to criminal justice system are Meaning, History, Goals, Components and Importance of viewing criminal justice as a system.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define criminal justice system
- discuss the components of criminal justice system
- mention the importance of criminal justice as a system
- explain the goals of criminal justice system
- outline the historical development of the criminal justice system
- differentiate between Criminal Justice and Criminal Justice System.

3.0 MAIN CONTENT

3.1 Meaning of Criminal Justice System

What is the meaning of criminal justice and criminal justice system? Criminal justice is defined as the group of practices, policies and courts designed to uphold social responsibility, deterring and mitigating crimes and enforcing penalties against those who are found guilty of committing crimes. Criminal Justice is the system of practices and institutions of governments directed at upholding social control, deterring and mitigating crime, and sanctioning those who violate laws with criminal penalties and rehabilitation efforts.

“Criminal Justice System” includes all activities and agencies, whether state or local, public or private, pertaining to the prevention, prosecution and defense of offenses, the disposition of offenders under the criminal law and the disposition or treatment of juveniles adjudicated to have committed an act, which if committed by an adult would be a crime. The “Criminal Justice System” includes police, public prosecutors, defense counsel, courts, correction systems, mental health agencies, crime victims and all services in connection with elements, whether voluntarily, contractually or by order of a court.

The Criminal Justice System can be overwhelming, confusing and intimidating for anyone who does not work within the system on a regular basis. Mainly individuals – including victims and their advocates – believe that the justice system focuses on the criminal to the detriment of the victim. Criminal justice is a generic term for the procedure by which criminal conduct is investigated, arrest made, evidence gathered, charges brought, defenses raised, trials conducted, sentences rendered and punishment carried out.

The pursuit of criminal justice is, like all forms of “Justice” or “fairness” or “process”, essentially the pursuit of an ideal. Thus, this field has many relations to anthropology, economics, history, law, political science, psychology, sociology and theology.

One question which is presented by the idea of creating justice involves the rights of victims and the rights of accused criminals, and how these individual rights are related to one another and to social control. It is generally argued that victim’s and defendant’s rights are inversely related, and individual rights as a whole are likewise, viewed as inversely related to social control. Rights, of course, imply responsibilities or duties, and this in turn requires a great deal of consensus in the community regarding the appropriate definitions for many of these legal terms.

There are several basic theories regarding criminal justice and its relation to individual's rights and social control.

- Restorative justice assumes that the victims or their heirs or neighbours can be in some way restored to a condition "just as good as" before the criminal incident. Substantially, it builds on traditions that exist in common law and the law that requires all who commit wrong to be penalised. In recent time these penalties that restore justice advocates community service, restitution and alternatives to imprisonment that keep the offender active in the community, and re-socialised him into society. Some suggest that it is a weak way to punish criminal who must be deterred, these critics are often proponents of
- Retributive justice of the "eye for an eye" approach. Assuming that the victim or their heirs or neighbours have the right to do to the offender what was done to the victim. These ideas fuel support for capital punishment for murder, amputation for theft (as in some versions of the sharia).
- Transformative justice does not assume that there is any reasonable comparison between the lives of victims nor offenders before and after the incident. It discourages such comparisons and measurements, and emphasises the trust of the society in each member, including trust in the offender not to re-offend and of the victim (or heirs) not to avenge.

In addition, there are models of criminal justice systems which try to explain how these institutions achieve justice.

- The consensus model argues that the organisations of a criminal justice system do, or should cooperate.
- The conflict model assumes that the organisations of a criminal justice system do, or should compete.

SELF-ASSESSMENT EXERCISE 1

What is "Criminal Justice System"? How is it different from "criminal justice?"

3.2 History of Criminal Justice System

Throughout the history of criminal justice, evolving forms of punishment, added rights for offenders and victims, and policing reforms have reflected changing customs, political ideals and economic conditions.

The modern criminal justice system has evolved since ancient times, with new forms of punishment, added rights for offenders and victims and policing reforms. These developments have reflected changing customs, political ideals and economic conditions. In ancient times through the middle ages, exile was a common form of punishment. During the Middle Ages, payment to the victim (or the victim's family) known as wergild, was another common punishment, including violent crimes. For those who could not afford to buy their way out of punishment, harsh penalties included various forms of corporal punishment. These included mutilation, branding and flogging as well as execution.

Though a prison, le stiche, existed as early as the 14th century in Florence, Italy, incarceration was not widely used until the 19th century. Correctional reform in the United States was first initiated by William Penn, towards the end of the 17th century. For a time, Pennsylvania's criminal code was revised to forbid torture and other forms of cruel punishment, with jails and prisons replacing corporal punishment. These reforms were reversed upon Penn's death in 1718. Under pressure from a group of Quakers, these reforms were revived in Pennsylvania toward the end of the 18th century and led to a marked drop in Pennsylvania's crime rate. Patrick Colquhoun, Henry Fielding and others led significant reforms during the late eighteenth and early nineteenth centuries.

Modern Police

After the troubles of the French Revolution, the Paris Police Force was reorganised by Napoleon I on February 17, 1800 as the prefecture of police, along with the reorganisation of police forces in all French cities with more than 5,000 inhabitants. On March 12, 1829, a government decree created the first uniformed policemen in Paris and all French cities, known as Sergeants de Ville ("city sergeants") which the Paris prefecture police's website claims were the first uniformed policemen in the world.

In the United Kingdom, the development of police forces was much slower than in the rest of Europe. The word "Police" was borrowed from French into the English Language in the 18th century, but for a long time, it applied only to French and continental European police forces. The word, and the concept of police itself, was "disliked as a symbol of foreign oppression" (according to Britannica 1911) Prior to the 19th century, the only official use of the word "Police" recorded in the United Kingdom was the appointment of commissioners of police for Scotland in 1714 and the creation of the marine police in 1798.

On June 30, 1800, the authorities of Glasgow, Scotland, successfully petitioned the government to pass the Glasgow police Act establishing the city of Glasgow police. This was the first professional police service in the country that differed from previous law enforcement agency which was a preventive police force. This was quickly followed in other Scottish towns, which set up their own police forces by individual Acts of parliament. In London, there existed Watchmen hired to guard the streets at night since 1663, the first paid law enforcement body in the country, augmenting the force of unpaid constables. On September 29, 1829, the metropolitan police Act was passed by parliament allowing Sir Robert Peel, the then home secretary to found the London Metropolitan Police. This group of police are often referred to as 'Bobbies' because it was Sir Robert (Bobby) Peel who authorised it. They were regarded as the most efficient forerunners of a modern police and became a model for the police forces in most countries such as the United States and most of the then British Empire (common wealth).

In North America, the Toronto police was founded in Canada on 1834, one the first municipal police departments on that continent, followed by police forces in Montreal and Quebec City both founded in 1838. In the United States, the first organised police service was established in Boston in 1838, New York in 1844, and Philadelphia in 1854. The first police force was established in London in 1829 by Sir Robert Peel with police departments established in Boston in 1838 and New York City in 1844. Early on, Police were not respected by the community, as corruption was rampant. In the late 19th and early 20th century, there were few specialised units in police departments.

The first modern police force is commonly said to be the London Metropolitan Police established in 1829 by Sir Robert Peel, which promoted the preventive role of police as a deterrent to urban crime and disorder. In the United States, police departments were first established in Boston in 1838 and New York City in 1844.

In the 1920s, led by Berkeley, California police chief, August Vollmer and O. W. Wilson, police began to professionalise, adopt new technologies and place emphasis on training and professional qualifications of new hires. Despite such reforms, police agencies were led by highly autocratic leaders and there remained a lack of respect between police and the community. Following urban unrest in the 1960s, police placed more emphasis on community relations, enacted reforms such as increased diversity in hiring and many police agencies adopted community police strategies.

In 1990s, compstat was developed by the New York Police Department as an information-based system for tracking and mapping crime patterns

and trends and holding police accountable for dealing with crime problems. Compstat has since been replicated in police departments across the United States and around the world, with problem oriented policing, intelligence-led policing and other information-led policing strategies also adopted.

SELF-ASSESSMENT EXERCISE 2

1. Discuss the evolution of the “Modern Police.”
2. What is the persistent problem that is still occurring in today’s police system?

3.3 Goals of Criminal Justice System

What are the primary goals of the criminal justice system?

The primary goals of the criminal justice system are to maintain order, punish the guilty and remove threats from society. All societies are based on the idea of trust in the system that governs the people. In order to maintain that trust, the system must have a set of rules for dealing with transgressions of the laws of the society. Essentially, having a criminal justice system takes away the anger and the retribution of the mob by following a code to determine guilt or innocence in any given circumstance. Without a civilised system, the angry mob can hand out sever vigilante “Justice” that can be cruel, vile and, perhaps, wielded upon an innocent victim.

The Criminal Justice System with its ritualistic separation of judge, jury, prosecution and defense, is designed to be civilised and to temper the heat of emotion, anger and rage. The main goal in any case – according to the foundations of law – is to find the truth, uphold the law and punish the guilty, but not unduly.

The way the system does this is through law enforcement officials investigating crimes and gathering evidence. The prosecutions – representing the “state” or the people then must go over the evidence, sometimes perform interviews and then decide whether a case can and should be brought against individuals. If the prosecutor determines there is a case, the goal is to “set right” the situation in the view of society. A judge is assigned and the accused person is represented by counsel. Throughout the proceedings, the decorum of the court, the criminal justice system itself, must be maintained for a fair outcome, which in the end is the ultimate goal.

The purpose of the Criminal Justice System (CJS) is to deliver justice for all, by convicting and punishing the guilty and helping them to stop

offending, while protecting the innocent. It is responsible for detecting crime and bringing it to justice, and carrying out the orders of the court, such as collecting fines, and supervising community and custodial punishment. The key goals for the Criminal Justice System (CJS) are:

- To improve the effectiveness and efficiency of the Criminal Justice System (CJS) in bringing offences to Justice.
- To increase public confidence in the fairness and effectiveness of the Criminal Justice System.
- To increase victim satisfaction with the police, and victim and witness satisfaction with Criminal Justice System.
- To consistently collect, analyse and use good quality data to identify and address offenders in the Criminal Justice System.

It should be known that Criminal Justice is the branch of law that deals with disputes or actions involving criminal penalties. It regulates the conduct of individuals, defines crime, and provides punishment for criminal acts. More so, it means activities relating to the detection, apprehension, detention, pretrial release, post trial release, prosecution, adjudication, correctional supervision or rehabilitation of accused persons or criminal offenders. Also the administration of criminal justice includes criminal identification activities and the collection, storage and dissemination of criminal history records. The Criminal Justice System is purposive of delivering justice for all, by convicting and punishing the guilty and helping them to stop offending, while protecting the innocent. It is responsible for detecting crime and bringing it to justice and carrying out the orders.

The goal of the Criminal Justice System (CJS) is to deliver justice for all, by convicting and punishing the guilty and helping them to stop offending while protecting the innocent. It is responsible for detecting crime and bringing it to justice and carrying out the orders of court such as collecting fines, and supervising community and custodial punishment.

Today there are things the criminal justice system aims to do by imposing punishments and sentences. Goals of punishment have moved from satisfying the victim, as in early days, to more of a broad scale. There are theories on how punishment and sentencing may serve to reduce crime as a whole; general and specific deterrence, incapacitation, rehabilitation and retribution.

SELF-ASSESSMENT EXERCISE 3

Outline the major goals for the criminal justice system.

3.4 Components of Criminal Justice System

What are the various components of the Criminal Justice System? Criminal Justice System consists of four main parts or components.

- a. Law enforcement (police)
- b. Prosecution
- c. Adjudication (courts or judiciary)
- d. Corrections, which includes both adult and juvenile institutions as well as probation and parole (community correction)

Although these four components have distinct purposes, responsibilities and legal duties, the Criminal Justice System fails if they do not effectively work together.

a. Law Enforcement

In most instances, it is the law enforcement community that has the first contact with a victim of crime. Law enforcement officers are responsible for such legal duties as:

- Receiving and documenting reports of crime within the agency's jurisdiction.
- Investigating the reported crime.
- Gathering and holding evidence of the crime.
- Arresting the alleged offender, and
- Conducting follow-up investigations as needed.

Depending upon several factors, including the size of the department and how divisions are arranged, the officer that responds to the scene of a crime may not be the individual to conduct the follow-up investigation. After the initial report is taken, a detective may be assigned to pursue the investigation.

Once the alleged offender has been identified, he or she is most often arrested and taken to the local jail or corrections facility, for processing. In some cases, depending upon the nature of the crime – the alleged offender may be eligible to receive a citation to appear in court, and therefore would not be taken into a facility for processing. In other cases – normally involving more sensitive and/or serious crimes – the evidence may be presented to a grand jury by the prosecutor. After hearing the evidence, the grand jury decides whether or not to indict (charge) the alleged offender.

The law enforcement officer's role does not end with the arrest of the alleged offender. Officers are routinely called upon to testify in the

prosecution of a case. They may be involved in grand jury hearings, preliminary hearings and as witnesses at the actual trial.

b. Prosecution

The prosecutorial phase is perhaps the most critical stage of the criminal justice process, as it is at this point that many of the rights of an alleged offender and crime victim are brought into play. The offender's rights in the court proceedings include:

- The right to have legal representation.
- The right to a speedy trial
- The right to be informed regarding the proceedings, and
- The right to be heard.

It is the role of the prosecutor to represent the interests of the state in every criminal proceeding – from first court appearance when the release or detainment of the accused is determined, during any plea negotiations, through the numerous preliminary hearings, throughout the trial and, finally, at the sentencing stage. The prosecutor also has the power to decide whether a case will be prosecuted or dismissed.

c. Judiciary

The courts serve as the venue where disputes are then settled and justice is administered. With regard to criminal justice, there are a number of critical people in any court setting. These critical people are referred to as the courtroom work group and include both professional and nonprofessional individuals. These include the judge, prosecutor and the defence attorney. The judge or magistrate is a person elected or appointed, who is knowledgeable in the law, and whose function is to objectively administer the legal proceedings and offer a final decision to dispose of a case.

Essentially, the role of the judge is to oversee the court proceedings associated with the prosecution of any criminal case. The judge is responsible for ensuring that the law is followed at all stages of the criminal justice process. The judge makes the final decision, or ruling at each stage. The judge will:

- Decide the release status of an offender.
- Decide whether or not to accept a guilty plea or a negotiated plea by an offender.
- Oversee the trial where the indicted offender is determined to be guilty or not guilty, and

- Determine the final sentence of the court for a convicted offender.
- d. Corrections**

The final component of the Criminal Justice System is corrections. The term “Corrections” can be used to describe either institutional suspension or community supervision – which is known as probation when granted by a judge on a suspended prison sentence, and which is known as parole when granted by a parole board after a portion of a prison sentence has been served.

Offenders are then turned over to the correctional authorities, from the court system after the accused has been found guilty. Like all other aspects of Criminal Justice, the administration of punishment has taken many different forms throughout history. Early on, when civilisations lacked the resources necessary to construct and maintain prisons, exile and execution were the primary forms of punishment.

The most publicly visible form of punishment in the modern era is the prison. Prisons may serve as detention centres for prisoners after trial. For containment of the accused, jails are used. Early prisons were used primarily to sequester criminals and little thought was given to living condition within their walls.

SELF-ASSESSMENT EXERCISE 3

Examine the role of the judge and law enforcement officer in the Criminal Justice System.

3.5 Importance of Criminal Justice System

The Use of Criminal Profiling

Criminal profiling is a method of identifying the perpetrator of a crime based on an analysis of the nature of the offense and the manner in which it was committed. Crimes that are suitable for profiling are those in which there is much evidence at the crime scene or considerable interaction with the victim where in the offender displays severe mental disturbance. Ritualistic crimes, torture and murders involving post-mortem disfigurement are especially conducive to this kind of analysis because they are committed by criminals.

Criminal justice is the application or study of laws regarding criminal behaviour. Those who study criminal justice include the police, those working in the judiciary capacity, and lawyers who either defend or prosecute those accused of a crime. Others work to advocate for changes in the Criminal Justice System.

Justice also refers not only to the fair trial accorded to the citizens of most countries, but also to the just retribution for victims of a crime, as for example, seeing an offender jailed. Criminal justice is always a goal. All involved in the arrest, prosecution, defense or judgment of a suspect aim to be fair. However, this goal is not always met, accounting for the flexibility in the application of laws, the changes to laws that are unfair, and the judiciary power of interpretation.

As a field of study, most who will work with parts of the law that involve behaviour defined as criminal, will study criminal justice. The knowledge of criminal justice is important for training and certification for police officers. Police officers train specifically on what powers they have in relationship to a suspect, and what powers they do not have. They learn how to legally administer criminal justice in their capacity as law enforcement officers.

Criminal Justice System helps balance the short-term and long-term perspective. As much as we may hate criminals, it is in our long-term interest to help them, since almost all of them return to the community (usually after only a few months or years). Application of the system concept to criminal justice research and evaluation has many advantages.

4.0 CONCLUSION

We have explained that “Criminal Justice System” includes all activities and agencies, whether state or local, public or private, pertaining to the prevention, prosecution and defence of offenses, the disposition of offenders under the criminal law and the disposition or treatment of juveniles adjudicated to have committed an act which, if committed by an adult, would be a crime. The “Criminal Justice System” includes police, public prosecutors, defense counsels, courts, correction systems, mental health agencies, crime victims and all public and private agencies providing service in connection with these elements, whether voluntarily, contractually or by order of a court.

5.0 SUMMARY

In this unit, we have discussed “Criminal Justice System” by looking at the following aspects: Meaning, History, Goals, Components and Importance of Criminal Justice System.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define Criminal Justice System.
2. List the Components of Criminal Justice System and explain any two.
3. Discuss the goals of Criminal Justice System.

7.0 REFERENCES/FURTHER READING

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UNIT 5 JURISPRUDENCE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Meaning of Jurisprudence
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 - 3.3 History of Jurisprudence
 - 3.4 Types of Jurisprudence
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1.0 INTRODUCTION

The concept of Jurisprudence has been around for quite a long time. Both the Ancient Greeks and Romans considered the philosophy of law, and earlier societies probably did as well. The term itself is derived from a Latin phrase, “juris prudential”, meaning “knowledge of the law”. As long as humans have had laws governing their activities, philosophers and commentators have been thinking about these laws and considering how they fit in with the societies which they are supposed to codify and protect. The various aspects that will be examined in this unit will include the following: Meaning of Jurisprudence, the Nature of Law, History of Jurisprudence and Types of Jurisprudence.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the term jurisprudence
- examine the nature of law
- discuss the history of jurisprudence
- mention the types of jurisprudence
- state the elements of legal system.

3.0 MAIN CONTENT

3.1 Meaning of Jurisprudence

What is the meaning of Jurisprudence?

Jurisprudence is the study of law, specifically legal philosophy and science. There are numerous branches of jurisprudence which focus on a range of issues, from whether or not law should exist to what sort of penalties are appropriate for violations of the law. Jurisprudence is largely dominated by Western laws and ethics, although students of Eastern law do not exist. The term is also used to refer to a specific branch of law, such as environmental jurisprudence or medical jurisprudence.

Jurisprudence also refers to the science of judicial law, the knowledge of the laws, customs and rights of men in a state or community, necessary for the due administration of justice.

Jurisprudence is derived from the Latin term *juris prudential*, which means “the study, knowledge or science of law” in the United States, more broadly associated with the philosophy of law. Philosophers of law ask “what is law?” And “what should it be?” Jurisprudence is the theory and philosophy of law. Scholars of jurisprudence, or legal philosophers, hope to obtain a deeper understanding of the nature of law, of legal reasoning, legal systems and of legal institutions.

Modern jurisprudence began in the 18th century and was focused on the first principles of the law of nature, civil law, and the law of nations. General jurisprudence can be broken into categories both by address and by the theories of jurisprudence or schools of thought regarding how those questions are best to be answered.

Legal philosophy has many branches, with four types being the most common. The most prevalent form of jurisprudence seeks to analyse, explain, classify, and criticise entire bodies of law, ranging from contract to tort, to constitutional law. Legal encyclopaedias, law reviews, and law school textbooks frequently contain this type of jurisprudential scholarship.

The second type of jurisprudence compares and contrasts law with other fields of knowledge such as literature, economics, religion, and social sciences. The purpose of this type of study is to enlighten each field of knowledge by sharing insight that have proven to be important in advancing essential features of the compared discipline.

The third type of jurisprudence raised fundamental questions about the law itself. These questions seek to reveal the historical, moral and cultural underpinnings of a particular legal concept. *The Common Laws* (1881), written by Oliver Wendell Hoimes JR. is a well-known example of this type of jurisprudence. It traces the evolution of civil and criminal responsibility from underdeveloped societies where liability for injuries was based on subjective notions of revenge, to modern societies where liability is based on objective notions of reasonableness.

The fourth and fastest-growing body of jurisprudence focuses on even more abstract questions, including, what is law? How does a trial or appellate court judge decide a case? Is a judge similar to a mathematician or a scientist autonomous and determinant rules and principles? Or is a judge more like a legislator who simply decides a case in favour of the most politically preferable outcome? Must a judge base a decision only on the written rules and regulations that have been enacted by the government? Or may a judge also be influenced by unwritten principles derived from ideology, moral philosophy, and historical practice?

Four schools of jurisprudence have attempted to answer these questions: formalism proposes that law is a science, realism holds that law is just another name for politics, positivism suggests that law must be confined to the written rules and regulations enacted or recognised by the government, and naturalism maintains that the law must reflect eternal principles of justice and morality that exist independent of governmental recognition.

SELF-ASSESSMENT EXERCISE 1

Discuss the meaning of Jurisprudence.

3.2 Nature of Law

Lawyers are interested in the question: what is law on a particular issue? This is always a local question and answers to it are bound to differ according to the specific jurisdiction in which they are asked. In contrast, the philosophy of law is interested in the general question: what is law? This general question about the nature of law presupposes that law is a unique social-political phenomenon, with more or less universal characteristics that can be discerned through philosophical analysis.

Generally, jurisprudence as philosophical inquiry, is about the nature of law, and is meant to be universal. It assumes that law possesses certain

features and it possess them by its very nature, or essence, as law, wherever and whenever it happens to exist.

However, even if there are such universal characteristics of law, the reasons for a philosophical interest in discussing them remain to be explained. First, there is the sheer intellectual interest in understanding them or such a complex social phenomenon which is, after all, one of the most intricate aspects of human culture.

Law, however, is also a normative social practice; it purports to guide human behaviour, giving rise to reasons for action. An attempt to explain this normative, reason-giving aspect of law is one of the main challenges of general jurisprudence. These two sources of interest in the nature of law are closely linked. Law is not the only normative domain existing in our culture, morality, religion, social conventions, etiquette, and so on, also guide human conduct in many ways which are similar to law.

Therefore, part of what is involved in the understanding of the nature of law consists in an explanation of how law differs from these similar normative domains, how it interacts with them, and whether its intelligibility depends on such other normative orders, like morality or social conventions.

There are two kinds of law. One is based on justice; the other is based on control. The predominant form in use today, and which has greater ancient heritage, is the latter. Basically, what the vast majority of individuals view as law today is a bastardisation of the Golden Rule: “Dem wit de gold, makes de rules”. Which means it is the law of control of power, of “might-making right” and it is retribution instead of restoration.

Law at its most fundamental level is a means by which individuals and groups with worldly different agendas, goals, and aspirations can function in a tolerant, cooperative, and/or competitive environment. Just as law cannot be dismissed merely because of its misuse by those in power, they use it as a manipulative and enslaving tool – there is also no reason to assume that the latter is the only viable form of law. The law of control is not the law which at a fundamental level is what one desires.

The ‘Me’ of the Sumerian civilisation includes one of the earliest known forms of law which was based – curiously enough – on fairness, justice, and equality – as opposed to making it easier for those with the gold to run roughshod over everyone else. Today, the same system of just law is called common law or Restoration Justice.

The key to this early form of law – and its modern equivalents – is that the victim is the focus, instead of the state. The idea is to seek justice, do what is fair for all concerned. One alternative is to seek retribution – retribution which is almost always to the distinct benefit of those in control of the state’s bureaucracy. According to the famous code of Hammurabi, which was one of the earliest examples of the concept, where the idea of the crime and punishment was introduced and has persisted to this day in most forms of law.

Consider our current body of laws. They define what is permissible and what isn’t. If there is no law on the books for a particular act, then no matter how damaging or hurtful it is to others, then there is no crime. But if there is a law which defines a crime for an action which harms no one, a crime has indeed been committed. In the latter case, the state then claims injury to “peace and dignity” of the state. Such a state has no “peace and dignity” when they would enforce victimless crimes.

Common law is by comparison the simplest of concepts. If someone is injured or their property damaged, then there is a crime. If not, there’s no crime. This would mean that such things as environmental damage would be a crime, but only if someone could show injury or damage to their property.

Running alongside common law is Restorative Justice, where justice is emphasised instead of retribution. What everyone wants is a system which is fair, where there is some semblance of what “ought to be”.

Therefore, general jurisprudence necessarily relies on some normative, moral considerations. Both of these views, and similar ones, purport to rely on insistence that a normative social practice, like law, cannot be understood without taking into account the participant’s internal point of view, a point of view that is essentially normative, rationalising the ways in which the participants regard the law as reasons for their actions.

SELF-ASSESSMENT EXERCISE 2

Outline the importance of law as a social practice.

3.3 History of Jurisprudence

In the central criminal court of England and Wales at the Old Bailey, Jurisprudence had its meaning in Ancient Rome. There was a body of oral laws and customs which verbally transmit values of the system from father to son. Praetors established a workable body of laws by judging whether or not singular cases were capable being prosecuted either by

the edicta, the annual pronouncement of prosecutable offense, or extraordinary situations, additions made to the edicta. An iudex then would judge a remedy according to the facts of the case.

Their sentences were supposed to be simple interpretations of the traditional customs, but effectively it was an activity that, apart from formally reconsidering for each case what precisely was traditionally in the legal habits, soon turned also to a more equitable interpretation, coherently adapting the law to the never social instances. The law was then implemented with new evolutive institutions (legal concepts), while remaining in the traditional scheme. Praetors were replaced in the 3rd century BC by a local body of prudentes. Admission to this body was conditional upon proof of competence or experience.

In ancient Indian verdict society, the law or Dharma, as followed by Hindus was interpreted by use of “Manu Smṛti” – a set of poems which defined sin and the remedies. They were said to be written between 200 BC – 200 AD. In fact, these were not codes of law but norms related to social obligations and ritual requirements of the era.

Under the Roman Empire, schools of law were created, and the activity constantly became more academic. In the age from the early Roman Empire to the 3rd century, a relevant literature was produced by some notable groups including Proculians and Sabinians. The degree of scientific dept of the studies was unprecedented in ancient times and reached still unrivaled peaks of skill.

After the 3rd century, Juris Prudentia became a more bureaucratic activity, with few notable authors. It was during the Byzantine Empire (5th century) that legal studies were once again undertaken in depth, and it is from this cultural movement that Justinian’s corpus Juris Civilis was born.

SELF-ASSESSMENT EXERCISE 3

Outline the historical development of Jurisprudence.

3.4 Types of Jurisprudence

What are the various types of jurisprudence? There are about three major types of jurisprudence, namely Formalism, Realism, and Natural Law and Historical Jurisprudence.

Formalism

Legal formalism, also known as conceptualism, treats law like a math or science. Formalists believe that in the same way a mathematician or scientist identifies the relevant axioms, applies them to given data, and systematically reaches a demonstrable theorem, a judge identifies the relevant legal principles, applies them to the fact of a case, and logically deduces a rule that will govern the outcome of a dispute. Judges derive relevant legal principles from various sources of legal authority, including state and federal constitutions, statutes, regulations and case law.

For example, most states have enacted legislation that prohibits courts from probating a will that was not signed by two witnesses. If a court is presented with a number of wills to probate for the same estate, and only one of those wills have been witnessed by at least two persons, the court can quickly deduce the correct legal conclusion in a formalistic fashion: each will that has been signed by fewer than two witnesses will have no legal effect, and only the will executed in compliance with the statutory requirements may be probated.

Formalist also rely on inductive reasoning to settle legal disputes, whereas deductive reasoning involves the application of general principles that will yield a specific rule when applied to the facts of a case, inductive reasoning starts with a number of specific rules and infers from them a broader legal principle that may be applied to comparable legal disputes in the future.

English jurist Sir Edward Coke was among the first to popularise the formalistic approach to law in Anglo-American history. Coke believed that the common law was “the peculiar science of judges”. The common, Coke said, represented the “artificial perfection of reason” obtained through “long study, observation and experience”. Coke also believed that only lawyers and judges, and others trained in the law could fully comprehend and apply this highest method of reasoning.

Langdell, an American compared the study of law to the study of science, and suggested that law school classrooms were the laboratories of jurisprudence. Judicial reasoning, Langdell believed, parallels the reasoning used in geometric proofs. He urged professors of law to classify and arrange legal principles much as a taxonomist organises plant and animal life.

Since the early 1970s, Professor Roland M. Dworkin has been the foremost advocate of the formalist approach with some subtle variations. Although Dworkin stops short of explicitly comparing law to science,

and math, he maintains that law is best explained as a rational and cohesive system of principles that judges must apply with integrity. The principle of integrity requires that judges provide equal treatment to all litigants presenting claims that cannot honestly be distinguished.

Realism

The realist movement, which began in the late eighteenth century and gained force during the administration of President Franklin d. Roosevelt, was the first to attack formalism. Realist held a skeptical attitude toward Langdelian legal science. “The life of the law has not been logic, it has been experience,” Holmes wrote in 1881.

Realists held two things to be true. First, they believed that law is not a scientific enterprise in which deductive reasoning can be applied to reach a determinate outcome in every case. Instead, most litigation presents hard questions that judges must resolve by balancing the interests of the parties and ultimately drawing an arbitrary line on one side of the dispute. This line is typically drawn in accordance with the political, economic, and psychological proclivities of the judge.

For example, when a court is asked to decide whether a harmful business activity is a common law nuisance, the judge must ascertain whether the particular activity is reasonable. The judge does not base this determination on a precise algebraic equation instead, the judge balances the competing economic and social interest of the parties, and rules in favour of the litigants with the most persuasive case. Realist would thus contend that judges who are ideologically inclined to foster business growth will authorise the continuation of a harmful activity, whereas judges who are ideologically inclined to protect the environment will not.

Second, realists believed that because judges decide cases based on their political affiliation, the law tends always to lag behind social change.

Some realists only sought to demonstrate that law is neither autonomous, apolitical, nor determinate; for example, Jerome Frank, who coined the term legal realism, emphasised that the psychological foundation of judicial decision making, arguing that a judge’s decision may be influenced by mundane things like what he or she ate for breakfast.

Natural Law or Law of Nature (Latin *Lex Naturalis*) is a theory that posits the existence of a law whose content is set by nature and that therefore has validity everywhere.

The Phrase Natural Law is opposed to the positive law (which is man-made) of a given political community, society, or nation-state, and thus can function as a standard by which to criticise that law. In natural law jurisprudence, on the other hand, the content of positive law cannot be known without some reference to the natural law (or something like it). Used in this way, natural law can be involved to criticise decisions about the status, but less so to criticise the law itself. Some use natural law synonymously with natural justice or natural right.

Historical Jurisprudence

Positivists and naturalists tend to converge in the area of historical jurisprudence. Historical jurisprudence is marked by judges who consider history, tradition, and custom when deciding a legal dispute. Strictly speaking, history does not completely fall within the definition of either positivism or natural law. Historical events like the civil war, are not legislative enactments, although they may be the product of governmental policy. Nor do historical events, embody eternal principles of morality, although they may be the product of clashing moral views. Yet, historical events shape both morality and law. Thus, many positivists and Naturalist find a place for historical jurisprudence in their legal philosophy.

SELF-ASSESSMENT EXERCISE 4

List the various types of jurisprudence and discuss on one of them.

4.0 CONCLUSION

We have explained that jurisprudence is the study of law, specifically legal philosophy and science. It is derived from the Latin term *juris prudentia*, which means “the study, knowledge, or science of law. That law at its most fundamental level is a means by which individuals and groups with widely different agendas, goals and aspirations can function in a tolerant, cooperative, and/or competitive environment. There are four schools of jurisprudence, Formalism, Realism, Positivism and the Naturalists.

5.0 SUMMARY

In this unit, we have examined the concept Jurisprudence under the following headings; meaning, Nature of Law, History and Types of Jurisprudences.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is Jurisprudence?
2. Compare the views of formalists and realists on law.
3. Trace the history of Jurisprudence to modern times.

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MODULE 3 LIGHT AND CRIMINAL PHOTOGRAPHY

Unit 1	Meaning and Principles of Photography
Unit 2	Criminal Photography
Unit 3	Crime Scene Photography
Unit 4	Photographing Evidence
Unit 5	Fingerprints

UNIT 1 MEANING AND PRINCIPLES OF PHOTOGRAPHY

CONTENTS

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Definition of Photography
3.2	Principles of Photography
3.3	Evaluating Negatives
3.4	Exposure Review/Camera
3.5	Principles of Sketching
4.0	Conclusion
5.0	Summary
6.0	Tutor-Marked Assignment
7.0	References/Further Reading

1.0 INTRODUCTION

What is the meaning of photography?

Photography generally is the science which relates to the action of light on sensitive bodies leading to the production of picture, the fixation of images, and the like. The various areas that will be examined in this unit, to introduce you to meaning and principles of photography are the definition, principles, evaluating negatives, exposure review and principles of sketching.

2.0 OBJECTIVES

At the end of this unit, you should be able to

- define photography
- discuss the basic principles of photography
- explain how negatives are evaluated

- mention types of lens
- describe the mechanism of exposure
- list the basic principles of sketching.

3.0 MAIN CONTENT

3.1 Definition of Photography

What is photography and how did the concept develop? The term photography comes from the Greek word photos, photos-light and graphos-writing. The word photography means writing with light but most photographers claim they are painting with light.

Photography can be defined as the science which relates to the action of light on sensitive bodies on the production of pictures, also the fixation of images and the like. It is also the art or process of producing pictures by this action of light; the art or process of producing images of objects on photosensitive surfaces. Photography is the art, practice, or occupation of taking and printing photographs, it can also be regarded as a body of photographs.

Photography is also a method of reading permanent images by the action of light projected by a lens in a camera onto a film or other-sensitive material. It was developed in the 19th century through the artistic aspirations of two French men, Nicephore Niepc and Louis – Jacques-Mande Daguerre, whose combined discoveries led to the invention of the first commercially successful process, the dagueo type (1837). In addition, two Englishmen, Thomas Wedgwood and William Henry Fox Talbot, patented the negative-positive calotype process (1839) that became the fore runner of modern photographic technique. Photography was initially used for portraiture and landscapes. In the 1850s and 60s, Mathew B. Brady and Roger Fenton Pioneered war photography and photojournalism. From its inception, two views of photography predominated. One approach held that the camera at its resulting images truthfully document the real world, while the other considered the camera simply to be a tool, much like a paintbrush, with which to create artistic statements.

The latter notion, known as pictorialism, held sway from the late 1860s through the first decade of the 20th century, as photographers manipulated their negatives and prints to create hazy elaborately staged images that resembled paintings. By the 1920s and '30s, a new more realistic style of photography gained prominence, as photographers such as Paul Strand, Edward Weston, and Ansel Adams began to pursue sharply focused, detailed images. The Great Depression and two world wars inspired many photographers, including Walkers Evans and

Doratheia Lauge, to pursue documentary often socially conscious photography. Inspired by such work, many photojournalists, including Alfred Eisenstaedt and Margret Bourke-white, also emerged during this period.

In the second half of the 20th century the urban social scene became a subject of much interest to photographers, as did celebrity portraiture and fashion photography. At the turn of the 21st century, photographers took advantage of digital capabilities by experimenting with enormous formats and new manipulative techniques. As technological advances improve photographic equipment, materials, and techniques, the scope of photography continues to expand enormously.

SELF-ASSESSMENT EXERCISE 1

Define the term photography and discuss its developmental stages.

3.2 Principles of Photography

Having defined and explained photography in the last section, the next issue to deal with is the basic principles of photography. How are photographs made? Photographs are captured moments in time and they are made with light, camera, film and knowledge. These are the main principles underlying the concept of photography.

Light is important to photography. Light is a form of energy released by the sun or man-made source. Without light, the chemical reaction necessary in forming images on a piece of acetate (film) or within a digital imaging camera cannot take place. Light comes in form of electromagnetic spectrum. The sun releases various wavelengths of energy which are measured in nanometers. Visible light propagates as a wavelength and is characterised by the length of two peaks. In white light, the three primary colours (Red, Green and Blue) when evenly mixed produce white light. The primary, or additive colours also produce other colours when equally mixed or unequally.

The various light sources are daylight, electronic flash, fluorescent, Tungsten, metal Halide, Sodium or Mercury vapour illumination and alternate light sources. Note that all light sources have temperature, which are measured on a colour temperature scale, the colour temperature scale is known as the Kelvin scale.

Daylight balanced film- colour films are normally balanced for only "sunlight" or flash photography. If "Daylight" balanced film is used with the artificial lighting, a true colour rendition is more difficult to achieve. There are various types of film, namely, Negative, Positive

(Transparency) Instant and Digital. Films come in a variety of Iso's fast speed films, medium speed films and shows speed films. Films with lower Iso's (25, 64, 100 and 200) are less sensitive to light, and therefore need more light. These films are called "show films". Film with higher Iso's (400, 800, 1000, P 3200) are more sensitive to light. These films are called "fast films". The most popular Iso's are 100, 200 and 400. However, there are a variety of Iso's available for differing conditions and applications.

How Does the Film Record the Images We See?

Film is several layers of acetate sandwiched together-one layer, the emulsion layer, contains silver halide crystals (bromine, iodine or chlorine. Silver halide crystals upon exposure to light darken and form a latent image. Upon development, a permanent negative or positive image is formed. The amount of rays and the intensity of the rays affect the sensitivity of film. Light rays also affect the quality of the print to be produced from particular films.

Film latitude is the ability of a light sensitive material to compensate for over and under exposure. Over-exposure is when light sensitive material receives too much exposure resulting in dense negatives with opaque highlights and blocked up shadows.

While under-exposure is when a light sensitive material receives too little light resulting in a thin negative, a dark slide or a muddy (greyish) looking print. B & W films have the greatest exposure latitude typically, B & W films can reproduce acceptable positive prints. Underexposed colour negative films do not have the same latitude as B & W films. However, acceptable prints can be made up to 2 or 3 stops underexposed.

Film Storage. The following are guidelines on how to store films

- Film must be stored in cool, dry place
- Long term storage in freezers
- Short term storage in a refrigerator
- Never store film in direct sunlight, or on areas that have constant temperature above 60 degrees

SELF-ASSESSMENT EXERCISE 2

Describe the general principles of photography.

3.3 Evaluating Negatives & Exposure

Another principle in photography is the evaluation of negatives. Dark areas in a negative will appear lighter on the print, and light areas of the negative will be dark on a print. Always evaluate a negative by the amount of detail in the shadow areas.

What is Exposure? Exposure is the amount of light reaching a light sensitive material specifically, the intensity of light multiplied by the time light falls on a material.

- What controls Exposure?
- Light (Quality and Quantity)
- Film (sensitivity)
- Diaphragm (Aperture – F Stops)
- Shutter curtains (speeds)

Exposure Controls – Light

Remember, film needs light in order to create an image. The amount and type of light present determines how much exposure is needed to create an acceptable image.

How can light intensity change? Using inverse square law, illumination intensity on a surface will vary inversely with the square distance from the light source to the illuminated surface. In other words, as light travels in distance, the intensity of the light source diminishes.

Diaphragm

The diaphragm controls the amount of light that penetrates through the lens the F/stop ring on lens controls the size of opening of the diaphragm. The relative size opening of the diaphragm is called the aperture. The aperture size is expressed in fractions, known as F/stops. In aperture, we have minimum and maximum aperture. The lower the F/stop number, the wider the diaphragm opening on the lens. This wider opening allows more light to make exposure. The crest opening of a given lens is called the maximum aperture while the smallest opening of a given lens is called the minimum aperture. The higher the F/stop number, the smaller the diaphragm opening in the lens. This smaller opening allows less light to make exposures.

Depth of Fields

The diaphragm controls three things in the depth-of-field:

- aperture
- lens of focal length
- lens to subject distance.

The Shutter Curtain

The shutter controls the amount of light that is passed through the camera body. Similar to the diaphragm, the shutter is controlled by the photographer. The shutter allows the photographer to give more or less exposure to the film when needed. Focal plane shutters are located directly in front of the film in the back of the camera. Focal plane shutters can move either horizontally or vertically, leaf shutters are located inside of the lens, leaf shutters are limited in shutter speeds when compared to focal plane shutters. The shutter determines the movement to be stopped. The higher the number (1/125, 1/250, 1/500... etc.), the more motion will be stopped.

Using Reciprocity Law

Time (T) x Intensity (I) = Exposure (E)

- If the time is doubled and the intensity is cut in half (and vice versa), the exposure remain the same.
- Your camera has control equivalents for exposure control, when used together properly, proper exposure can be achieved.

SELF-ASSESSMENT EXERCISE 3

Outline and discuss factors that control exposure, when evaluating photographic negatives.

3.4 Exposure Review/Camera

The intensity of light and length of time that light is subjected to a piece of film, determines the exposure necessary to create an image.

- Lens diaphragm F/8, F/5.6, etc.)
- Shutter curtain 1/125, 1/250, 1/500, etc.
- Film (100, 200, 150, etc.)
- Light, the quality and quantity of light control exposure
- The camera.

The camera is an electro-mechanical device that allows us to make an image that preserves what the eye sees at a given scene. With the use of a box (the camera), a hole (aperture) a means of focusing (lens), and film we are able to preserve on film what we see at a given moment, but that which our mind forgets.

Small format or 35mm camera has the following features:

- Versatility/portability
- Film selection
- Lens selection
- Accessories

Medium format or 120mm camera

- Slightly larger in size than 35mm
- Larger Negative
- Fewer lenses
- Fewer functions
- Fewer films to select from

Large format camera or 4x5 & 8x10 inch cameras

- Very cumbersome
- Is not user friendly
- Fewer accessories
- Smaller film selection than even medium format

Digital Cameras

- Instant Images
- Portability
- Cost: The cost can be extremely high for equal quality images
- Integrity issues

Polaroid

- instant images
- lacks negative
- quality of images
- cost

Lens

A lens is a device that uses convex glass or mirrors, enabling us to focus on the subject at hand. There are various types of lens, short curdle angle, normal, telephoto and zoom.

Lenses with F/stops such as F/1.4 though F/2.8 are considered fast lenses. Fast lenses are called such because they have greater light gathering capabilities. Lenses with F/stops above F/4.0 are considered show lenses. Show lenses do not always have ideal light gathering capabilities, especially in low light situations.

SELF-ASSESSMENT EXERCISE 4

List different types of cameras you know and also their advantages.

3.5 Principles of Sketching

Closely related to photography is sketching. Even experienced artists occasionally struggle with creating naturalistic three-dimensional pictures. Of course they know the basic concepts and create naturalistic drawings instinctively.

For beginners it is even more difficult, they have to exercise hard to climb a steep learning curve. Its long-familiar that outstanding drawing skills are the outcome of hard exercising. Instead knowing the three most important rules of third-dimensional drawing will make things easier for you. They will be a shortcut to improving your drawing skills and help even experienced draftsmen to nail elements that call for rewriting.

So what causes a picture look realistic and third-dimensional? There are three rules that contribute to the naturalistic outlook of your drawing. Every single one of them must be understood thoroughly. Together they ensure outstanding results. The three basic principles of sketching are as follows.

- Composition
- Perspective
- Lighting and shadow.

Composition

Does composition actually contribute to the third-dimensional appearing of your drawing? Naturally, the third-dimensional outlook of any drawing is strongly influenced by the relationships connecting the different objects inside the drawing. You can create an image with

objects that all follow the rules of perspective and have ideally composed lighting and dark parts. But a weak composition will spoil most of the third-dimensional effect. There is just one important composition.

Law

Allow your drawing's objects overlap! Frequently we see beginners avoiding to let objects in their pictures overlap, because they fear to mess it up. Sure if your drawing has lots of interesting parts it gets more difficult to depict. There are more dark parts and also perspective and proportions of the objects must be a great deal more exact.

Tightly composed objects in your picture will reveal all weak points. On the other side if you try to get the perspective, lighting and shadows right, a denser composition will strengthen the third-dimensional effect. So have courage to put your picture's object closer together. Let them overlap and demonstrate how good you can draw them according to the rules of third-dimensional drawings.

Composition really contributes to the third-dimensional appearance of your images. Naturally, the third-dimensional outlook of any picture is strongly influenced by the relation connecting the various elements inside the picture. You can create an image consisting of elements created according to the rules of perspective and have ideally composed lightening and dark parts. But a weak composition will cripple most of the third-dimensional effect.

There is only one crucial composition law: let your drawing's element overlap. Often we see beginning artists avoiding to let elements in their drawings overlap because they are afraid to ruin it completely. Sure if your picture has many intersecting parts it is more difficult to depict. The dark parts and dimensions of the elements must be much more exact. That's demanding indeed. Tightly arranged elements in your drawing may reveal all weak points. On the other side, if you manage to get the perspective, lighting and shades right, a denser arrangement will strengthen the third-dimensional effect. So have bravery to put your pictured elements closer together. Make them overlap and demonstrate how good you can draw them according to the rules of third-dimensional pictures.

Perspective

This is the second principle of sketching. Creating a drawing employing correct perspective is the point where a little bit of maths comes into

play. Do not worry – no rocket science formulas, just drawing some extra lines.

By creating a drawing, keeping the rules of perspective in mind you make sure that:

- Your drawing's elements have the correct proportions and size.
- Your drawing's elements have the correct distortion according to the distance of the viewer.
- Your drawing's elements are correlating properly to one another.

All this is achieved by employing one small law: “objects and parts of them grow smaller the farther the distance to the viewer”. This law cannot be stressed enough. Once you fail to apply it correctly, your drawings will appear distorted and awkwardly. So drawing some extra lines will allow you to apply this law properly.

Light and Shadow

The correct lighting and shadowing is the 3rd important principle for sketching scenes. It's for the lights in your drawings that shadows emerge. And shadows are essential for a truthful appearing drawing – except you depict “gray rainy day” scenes only.

To create naturalistic shadows there are some rules you have to consider.

- You have to know where exactly illumination originates from.
- This enables you to find the right dimension of the shade.
- The right bearing and alignment for the shade.
- And the correct shape of the shade.

4.0 CONCLUSION

We have explained that the concept ‘photography’ refers to the science which related to the action of light on sensitive bodies in the production of pictures, the fixation of images, and the act of producing pictures by this action of light. We also understand that photographs are captured moments in time and that photographs are made with lights, camera, film and knowledge. Closely related to photography is the concept of sketching images, with three major guiding principles as follows: composition, perspective, and light and shadows.

5.0 SUMMARY

In this unit, we have dealt with the meaning and principles of photography by looking at the following aspects: definition, principles of photography, evaluating photographic negatives, cameras and principles of sketching.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is photography?
2. List and explain the basic principles of photography.
3. Discuss the guiding principles when sketching a crime scene.

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UNIT 2 CRIMINAL PHOTOGRAPHY

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Meaning of Criminal Photography
 - 3.2 History of Criminal Photography
 - 3.3 Elements of Criminal Photography
 - 3.4 Importance of Criminal Photography
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

1.0 INTRODUCTION

The word photography derives from the Greek words “fos” – meaning light and “grofo” – to write. The word was popularised by Sir John Herchel in 1839. Modern criminal photography began in the 1820s with the first permanent photographs. The use of criminal photography and the documenting of victims of violent crimes have increased awareness by exposing the crimes. The various issues that will be examined in this unit, to introduce you to criminal photography are the meaning, history, elements and importance of criminal photography. The development of chemical and digital photography will also be discussed.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define photography
- explain the meaning of criminal photography
- discuss the levels of development of criminal photography
- describe the elements of criminal photography
- state the importance of criminal photography.

3.0 MAIN CONTENT

3.1 Meaning of Criminal Photography

How is criminal photography different from the conventional photography?

Criminal photography encompasses documenting both suspected and convicted criminals, and also the crime scenes, victims, and other evidence needed to make a conviction. Although photography was widely acknowledged as the most accurate way to depict and document people and objects, it was not until key development in the late 19th century that it came to be widely accepted as a forensic or criminal means of identification.

Criminal photography resulted from the modernisation of criminal justice system and the power of photographic realism. During the nineteenth and twentieth centuries, these two developments were significant to both criminal and forensic photography and police work in general. They can be attributed to a desire for accuracy. First, government bureaucracies became more professionalised and thus collected much more data about their citizens. Then, Criminal Justice Systems began incorporating science into the procedures of police and judiciaries. The main reason, however for the acceptance of police photography is a conventional one. Other than its growing popularity, the widespread notion of photography was the prominent belief in the realism of the medium.

SELF-ASSESSMENT EXERCISE 1

Differentiate criminal photography from ordinary photography.

3.2 History of Criminal Photography

You can trace the development of criminal photography from ancient times.

The earliest evidence of photographic documentation of prison inmates dates back to 1843 – 44 in Belgium and 1851 in Denmark. This, however, was solely experimental and was yet to be ruled by technical or legal regulations. The shots ranged from mug shot resemblances, to prisoners in their cells, and the purpose of them also varied from documentation to experimentation. There was no training required and pictures were often taken by amateurs, commercial photographers, and even policemen or prison officials.

By the 1870s, the practice had spread to many countries, though limited to larger cities. Professional photographers would then be employed to take posed portraits of criminals. This was early evidence that led to the standard mug shot known today and was unlike any previous known portraiture. Though there was no set standard as of yet, there was rarely creativity employed with lighting or angle. This was not like photographing portraits of families or children. These were documenting

criminals. It was one of the first times people saw portraiture being used for something other than art. Though these were slowly adapted to police regulations, photographing criminal suspects was widespread until the latter part of the 19th century. When the process of having one's picture taken and archived was limited to individuals convicted of serious offenses. This was, of course, by the discretion of the police.

As the number of criminals increased, so too did the number of photographs, organising and storing archives became a problem. Collections called "Rogues Galleries" classified criminals according to the types of offenses. The earliest evidence of these galleries was found in Birmingham, England in the 1850s. Shortly after this were initial attempts at standardising the photographs.

French photographer, Alphonso Bertillon was the first to realise that photographs were futile for identification if they were not standardised by using the same lighting scale and angles. He wanted to replace traditional photographic documentation of criminals with a system that would guarantee a reliable identification. He suggested anthropological studies of profiles and full-face shots to identify criminals. He published *La Photographie Judiciaire* (1890), which contained rules for scientifically exact form of identification photography. He stated that the subjects should be well lit, photographed full face and also in profile, with the ear visible. Bertillon maintained that the precepts of commercial portraits should be forgotten in this type of photography. By the turn of the century, both his measurement system and photographic rules had been accepted and introduced in almost all states. Thus, Bertillon is credited with the invention of the mug shot.

Some people believed that Bertillon's methods were influenced by crude Darwinian ideas and attempted to confirm assumptions that criminals were physically distinguishable from law-abiding citizens. It is speculated in the article 'Most wanted photography' that it is from this system that many of the stereotype works (stains, colour, eye colour, hair colour, body type and more) of criminals in movies, books and comics were founded. Although the measurement system was soon replaced by fingerprinting, the method of standardised photographs survived.

A photographer appears to be photographing himself in a 19th Century photographic studio. The daguerreotype proved popular in responding to the demand for portraiture emerging from the middle classes during the industrial revolution. This demand that could not be met in volume and in cost by oil painting added to the push for the development of photography.

In 1847, Count Sergel Lvovich Levitsky designed a bellows camera which significantly improved the process of focusing. This adaptation influenced the design of cameras for decades and is still found in use today in some professional cameras. While in Paris, Levitsky would become the first to introduce interchangeable decorative backgrounds in his photos, as well as the retouching of his negatives to reduce or eliminate technical deficiencies.

Levitsky was also the first photographer to portray a photo of a person in different poses and even in different cloths. In the twentieth century, photography developed rapidly as a commercial service. End-user supplies of photographic equipment accounted for only about 20 percent of industry revenue. For the modern enthusiast, photographic processing in black and white film has little change since the introduction of the 35mm film Leica camera in 1925.

The first digitally scanned photograph was produced in 1957. The digital scanning process was invented by Russell Kirsch, a computer pioneer at the National Institute of Standards and Technology. He developed the system capable of feeding a camera's images into a computer. His first fed image was that of his son, Walden Kirsch. The photo was set at 176x176 pixels.

Since then, a canon power-shot A95, the Charged-Couple Device (CCD) was invented in 1969 by Willard Boyle and George E. Smith at AT & T Bell labs. The lab was working on the picture phone and on the development of semi-conductor bubble memory. Merging these two initiatives, Boyle and Smith conceived of the design of what they termed "Charge "Bubble Devices". The essence of the design was the ability to transfer charge along the surface of a semi-conductor. It should be noted that all these attempts led to the development of criminal photography.

SELF-ASSESSMENT EXERCISE 2

Discuss the development of criminal photography.

3.3 Elements of Criminal Photography

What are the main features of criminal photography?

Criminal photography falls within the spectrum of forensic photography. In criminal photography, it involves documenting the scene of the crime, rather than the criminal. Though this type of forensic photography was also created for the purpose of documenting, identifying and convicting, it allows more room for creative interpretation and variance of style. Criminal photography includes taking pictures of the victims (scars,

wounds, birthmarks, etc.) for the purpose of identification or conviction; and pictures of the scene (placement of objects, position of body, photos of evidence of fingerprints). The development of this type of forensic photography is responsible for radical changes in the field, including public involvement (crime photos appearing in the newspaper) and new interpretations and purposes of the field.

Bertillon was also the first to methodically photograph and document crime scenes. He did this both at ground level and overhead, which he called “God’s-eye-view” while his mug shots encourage people to find differences (from themselves) in physical characteristics of criminals, his crime scene photographs revealed similarities in the public. This made people question, when looking in a newspaper at pictures of a murder that took place in a home that resembles their own, “Could this happen to me? For the first time, people other than criminologists, police or criminal photographers were seeing the effects of crime through criminal photography.

Among the most famous crime photographers, is Arthur Fellig, better known as “Weegee”. He was known for routinely arriving at crime scenes before other reporters, or often even before the police. The nickname is speculated to come from an alternate spelling of the word “Ouija” implying that Fellig had a supernatural force telling where the action was going to occur. His first exhibition, entitled “Weegee: Murder is my Business” showed in 1941 at the photo League in New York. The museum of modern Art purchased five of his photos and showed them in an exhibit called “Action Potography.

Criminal photography had now transcended mere documentation. It was considered an art. Weegee did not consider his photos art, but many perceived them that way. He is a prime example of the different purposes of criminal photography. His photographs were intended as documentations as were viewed that way in the paper by many people. But Weegee was shown in museums and seen as art by many others. His first book was published in 1945 and was titled *Naked City*.

As criminal photography grew in practice and popularity, it yielded both positive and negative results, depending on the individual and his response. Many people find it easy to agree with Barbara Miller’s essay “The New Flesh” when she writes, “the newsworthy status of criminals continues to increase exponentially. Graphic accounts appear not only in tabloid media but in publications as *Time* and *The New York Times*. More recently, the photograph documentations of killers and their violent acts has become ubiquitous on televisions. While most can agree that what Miller writes is true, there is a positive and negative side to this picture. While many people argue that these images are too graphic

for their kids or even themselves to see on TV or that they do not want to see killers or even suspected criminals like O. J. Simpson being glorified like celebrities, the growth of the publicity of the criminal image had had its positive effects as well.

The use of criminal photography and the documenting of victims of violent crimes have increased awareness by exposing the crimes. While people may have been aware of the existence of these evils, they may have tried not to imagine the severity of the crime. However, a visual aid is something that is much harder to ignore and is often shocking and moving to the viewer. While it may not be pleasant image to rest one's eyes upon, the discomfort felt by the viewer directly affects the way he or she feels about the subject being shown, and even if it is only to avoid seeing more graphic images, the viewer is more inclined to do something to help stop the crimes being committed. The gained support has led to the starting of movements and programmes dedicated to aid victims and stop future instances of these crimes. Among these are child abuse, spousal abuse, rape, and many others.

With technology like digital photography taking the world by storm, criminal photography continues to advance and now includes many categories that specialists are required to perform more sophisticated tasks. The use of infrared and ultraviolet light is used to trace evidence photography of fingerprints, tiny blood samples and many other things. Necropsy photographs or photographs taken both before and after the victims clothing is removed. These photos include close-ups of scars, tattoos, wounds, teeth marks and anything else that would help in identifying the victim, or determining his or her time and cause of death. Technology is what guided the field and placed it where it is today, and so it will continue to guide it. As technology constantly changes and progresses, so too will the means of identifying criminals and documenting crime scenes.

SELF-ASSESSMENT EXERCISE 3

Outline the main features of criminal photography. Also list the advantages of criminal photography.

3.4 Importance of Criminal Photography

Of what relevance is criminal photography to the investigation of criminal activities?

Criminal photography is an integral part of a crime scene investigation. Criminal investigation is not a simple thing to do because it involves various individuals, agencies, and roles. On TV series, you can see how

criminal investigation can solve various crime cases. Unfortunately, this is not always the outcome in the real world as many cases remain unsolved or when they go to court, they lead to an acquittal or mistrial.

Therefore, crime scene investigation is not intended only to understand what has happened, but also to collect important evidence to prove what has happened. If evidence cannot be produced, the guilty will remain free and the victim will not receive justice.

Forensic chemistry and psychology are popular among crime scene investigation where people are arguing various theories across internal and external networks. In this process, criminal photography is very important because without the photographs, it will be difficult to prove or even develop theories. Criminal photography involves two scenarios. First are the pictures of the actual crime scenes and second are the pictures of the recreated scenes. Both approaches are equally important to give evidence and solve cases.

At the actual crime scene, criminal photography will capture the position and location of bodies, locations, broken objects, and many other aspects. At the recreated crime scene, the same things are applied. Those subjects are positioned following the facts to create a realistic account of the crime that has happened in the past or a crime that did not produce any concrete evidence. Providing photographs that show what has truly happened in criminal events so they can serve as court evidence is the final goal of criminal photography.

You can consider criminal photography as an art because photographers need to do certain activities commonly done to produce fine art photography, such as choose the lighting, lens angles and correct viewpoints so the pictures can serve as evidence in court. It is very important for photographs to be clear and have proper scales so people can imagine the real size of different objects. Different viewpoints are necessary to counter the problem of parallax. Criminal photography must not be tampered, which means that every person who touches the photographs must be recorded to ensure that they are the real ones and unedited.

Most criminal photography is in colour, although black and white is used occasionally. Both film and digital images are accepted in most courts. Surveillance and even mobile phone cameras can be used as evidence, especially when the photographs are taken at the time of the crime. Then these amateur pictures will be examined by the criminal photography professionals to determine whether they can be used as evidence or not.

We are all familiar with the work of the criminal photographer through detectives such as crime scene investigation (CSI). While it may not always be quite as glamorous as depicted on TV, criminal photography is still a fascinating area of work suitable to highly organised photographers who combine excellent technical skills with a methodical and meticulous working practice. While it is the job of many other photographers to interpret a brief, it is the job of the criminal photographer to produce accurate, detailed photographs that faithfully record the location and evidence as clearly and as objectively as possible.

Criminal photographs are used for measurement or analysis, to accompany forensic reports, articles or research papers. Criminal photography is an integral part of criminal investigation procedures employed by police and security forces throughout the world. Photographers must therefore, follow standard methodology and produce images of a rigorous technical standard so that they can be used as evidence in hearings, tribunals and court proceedings. Since the subject matter often relates to accident, injury or criminal investigations, criminal photographers will be expected to be able to work efficiently in distressing and challenging environments, without disturbing other evidence or interfering with the work of other investigators.

Criminal photographers produce a permanent visual record of the scenes of accidents and crime scenes for use as evidence in court. They must be able to produce detailed recordings of all available evidence at the scene, including overview photographs as well as accurate images of tire marks, fingerprints, footprints, blood spatters, bullet holes and other unique evidence at the scene. They must also be able to take detailed photographs of injuries sustained through accidents or assaults and may also be required to photograph dead bodies. Much of the work is routine, but photographing crime scenes and road traffic accidents, or visiting patients in hospital, can be emotionally distressing.

Many criminal photographers are forensic scientists employed directly by the police or a specialist forensic services company. They work pre-defined shifts and enjoy the benefits of a salaried post. There are also other independent criminal photographers who provide forensic photo imaging services to lawyers, insurance companies and some police forces. However, most of these will have worked as forensic photographers with a police force or the forensic science service before branching out on their own. Photographers specialising in forensic imaging are usually expected to work unsocialable shifts, and be part of an on-call rota.

While most lead photographers in criminal photography units will usually have a strong background and qualification in photography, most criminal photographers start as crime scene investigators or scene of crime officers (Socos) before specialising in photography and forensic imaging.

Criminal photographers need a thorough grasp of photographic principles, particularly those involving non-standard techniques, such as high-density and low level aerial imaging, as well as an appreciation of the importance of their work. They must also pay close attention to details, and take a meticulous approach to image and data recording. They must be able to select and use the best equipment and techniques for the job in all environments and lighting conditions. Photographs must be correctly lit and exposed, have maximum depth of field, be free from distortion and be in sharp focus. Experience of digital imaging techniques is also desirable. Criminal photographers need a good grounding in police methods and conventions, and a sound understanding of anatomy. They must be able to methodically record the original scene and the initial appearance of physical evidence without the photograph appealing to the emotions of the jury or in anyway prejudicing the case. They must also keep detailed records of exactly where photographs were taken, the type of camera and lenses, what stock the picture was taken on, and whether flash or artificial lights were used.

This work requires a dedication and care which is not always necessary in other less objective forms of photography. The role also requires tact and discretion when dealing with distressed victims of crime, and the ability to interact with a wide variety of professionals including police officers, doctors, lawyers and court officials.

Criminal photographers usually receive general training in crime scene photography once they have already been selected as a crime scene investigator or crime scene officer. It should be noted that all photographers need to understand health and safety rules, and should be capable of assessing and managing the risks and potential dangers associated with the use of electrical lighting, equipment and properties. Criminal photographers may be subject to physical stresses from carrying heavy camera equipment and lighting indoors and out, in all seasons and all environmental conditions. They should therefore seek advice about appropriate techniques for lifting and moving equipment. There may also be a range of other risks specific to their area of work and they should seek suitable training in appropriate risk management procedures and best practices.

SELF-ASSESSMENT EXERCISE 4

Discuss the role of a criminal photographer in a crime scene investigation. State the importance of criminal photography.

4.0 CONCLUSION

We have explained that criminal photography involves documenting both suspected and convicted criminals, and also crime scenes, victims and other evidence needed to make a conviction. It includes taking pictures of the victim (scars, wounds, birthmarks, etc.) for the purpose of identification or conviction, and pictures of the scene (placement of objects, position of body, photos of evidence and fingerprints). We are also made to understand that criminal photography is an integral part of crime scene investigation (CSI). Because criminal photographers produce a permanent visual record of the scenes of accidents and crime scenes for use as evidence in court.

5.0 SUMMARY

In this unit, we have examined the concept of criminal photography by looking at the following aspects: Meaning, History, Elements and Importance of Criminal Photography.

6.0 TUTOR-MARKED ASSIGNMENT

1. Explain the term criminal photography.
2. Outline the main functions of a criminal photographer in a crime scene.
3. Discuss the importance of criminal photography.

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UNIT 3 CRIME SCENE PHOTOGRAPHY

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Meaning and Types of Crime Scene Photography
 - 3.2 Purpose of Crime Scene Photography
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- 4.0 Conclusion
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1.0 INTRODUCTION

In detective movies or television shows like 'CSI', photographers swarm in and take countless pictures of a crime scene. They twist and turn their cameras haphazardly as agents discuss leads over the background hum of the photographs' flash explosions. But how does crime scene photography really go down? Since its purpose is to record evidence that will be admissible in court, it's hardly a haphazard operation.

The various issues that will be examined in this unit that will introduce you to crime scene photography are the meaning and types of crime scene photos, purpose of crime scene photography, principles of crime scene photography, basic crime scene photography equipments and photographing specific crime scenes.

2.0 OBJECTIVES

At the end of this unit, it is hoped that you should be able to

- define crime scene photography
- describe the types of crime scene photos
- discuss the basic principles underlying crime scene photography
- list the basic crime scene equipment kit
- state the purpose(s) of crime scene photography.

3.0 MAIN CONTENT

3.1 Meaning and Types of Crime Scene Photography

Crime scene photography, also called forensic photography, has been around almost as long as the camera itself. Criminologists quickly realised that such technology could freeze time – creating a supposedly incontestable record of a crime scene, a piece of evidence or even a body. The 19th century French photographer Alphonse Bertillon was the first to approach a crime scene with the systematic methods of an investigator. He had capture images at various distances and take both ground level and over head shots.

Today crime photographs are essential for investigating and prosecuting a crime. This is because most evidence is transitory. Fingerprints must be lifted, bodies must be taken away and state. Photographs help preserve not only the most fleeting evidence examined, and homes or business must be returned to their normal – like the shape of a blood stain that will soon be mopped up-but also the placement of items in a room and the relation of evidence to other objects. Such images can prove vital to investigators long after the crime scene is gone.

The first piece of evidence viewed by jurors is oftentimes the photographs recorded by the crime scene investigator. Professional and accurate photographic documentation is critical for creating lasting impressions in the minds of a jury. Advanced crime scene photographic evidence that is engaging, interesting, and informative; giving them greater credibility when testifying in court. Crime scene photography uses both basic photographic principles and integrates this information with corresponding applications in crime scene photography. Mindful of cost-saving concerns in most law enforcement agencies, it provides useful tips on creating compelling photographic presentations on a limited budget using everyday items in lieu of expensive equipment. It demonstrates how to photograph images used in identification, including fingerprint, footwear, and tirewear impressions, tool and birthmarks and bloodstain patterns.

Crime scene photography also encompasses nighttime and low-light photography, flash photography, and painting with light techniques, the photography of luminol reactions, laser trajectories and ultraviolet and infrared light photography.

Thinking outside of the box, analyzing photographic challenges, and determining the best way to record a particular composition are all key to the successful capture of photographic images that will leave a lasting impression with the viewer.

Types of Crime Scene Photos

A crime scene photographer takes a close-up image of a containers door in Lagos, Nigeria. Police had just discovered million of naira stolen in a bank robbery. Crime scene photographers must be methodical in their work. They can't afford to leave out an important piece of evidence or produce photographs that could be considered misleading in court. But they also have the pressure of the entire operation behind them. Before other crime scene investigators can touch or move any of the evidence and even before the medical examiner can remove the body, the forensic photographer must document the scene.

There are three classifications of crime scene photos – overviews, mid-range and close-ups.

If the crime took place inside, overviews include photos of the outside of the building, its entrances and exits as well as images that place the building in relation to its surroundings. Photos of spectators at the crime scene can later help locate witnesses or suspects. Overviews also include images of all rooms, taken from overhead and from each corner.

The crime scene photographer then hung in on key pieces of evidence and captures images of them in the context. This evidence, like a knife, but at enough of a distance to show its relation to furniture, a blood stain or the rest of the room. Mid-range images establish the distance of object from surrounding objects.

Finally, the crime scene photographer thoroughly documents evidence with close-up images. Close-ups include identifying marks like scars on a corpse or serial numbers on bloodied piece of electronic equipment. A crime photographer will often include a ruler in the shot to establish scale but always takes a duplicate image without the measuring device. In court, the defence could claim the device covered something important. And, of course, pictures are of no value unless they're in context. A crime photographer keeps a photo log that includes every relevant detail, the photo number, any filters applied, the time and date and the location and a description of the object. The advent of digital photography has helped to make some aspects of recording the time and date simpler and more verifiable.

SELF-ASSESSMENT EXERCISE 1

Describe the various types of crime scene photos that may be shot by a crime scene photographer.

3.2 Purpose of Crime Scene Photography

Why does a crime scene photographer document a scene? The purpose of crime scene photography includes the following:

- To record the original scene and related areas
- To record the initial appearance of physical evidence.
- It will provide investigators and others with this permanent visual record of the scene for latter use.
- Photographs are also used in court trials and hearing.

Admissibility of Photographic Evidence

There are certain points to be considered for a photograph to be qualified to be tendered in the court.

The object pictured must be material or relevant to the point in issue.

The photograph must not appeal to the emotions or tend to prejudice the court or jury.

The photographs must be free from distortions and not misrepresent the scene or the object it purports to reproduce.

You do not need to be an expert in photography to take crime scene photographs or testify about them.

SELF-ASSESSMENT EXERCISE 2

List the purpose(s) of taking photographs in a crime scene.

3.2 General Principles of Crime Scene Photography

The following are the guiding principles of crime scene photography:

Photographs are one way to record a crime scene

- Field note
- Photographs
- Sketches

In crime scene photographing, the following conditions must be considered: what photographs can show and what photographs do not show.

Five steps in recording the crime scene are as follows:

- Secure the scene
- Take preliminary notes
- Take overview photographs
- Make a basic sketch
- Record each item of evidence

In taking overview photographs, the purpose is to show the scene exactly as it was when you arrived, don't try to reconstruct the scene as it was. The photographs should show the scene as you find it. In major crime photography, the following principles should be followed:

- First discuss the crime, evidence and photographs needed with other investigators at the scene.
- Be careful not to destroy any evidence while taking the photographs, outside the scene.

The exterior of the building where the crime occurred and in some cases the whole locale, also aerial photographs of the scene and the surrounding area can be useful in some type of cases. The original series of photographs should also show all doors, windows and other means of entrance or exit.

Inside the scene, begin with a view of the entrance, then photograph the scene as it appears when you first step into the room, next move around the room to get photographs of all the walls. These photographs should also show the positions of any potential items of evidence. Finally, include photographs of other rooms connected with the actual crime scene. The use of video to record the crime scene is valuable so as to show an overview of the scene.

In taking photographs to record items of evidence, the following principles should be adhered to: take two photographs of each item of evidence, one should be an orientation (mid-range) shot to show how the item is related to its surrounding and secondly, the other photograph should be a close-up to bring out the details of the object itself. In measuring and marking devices, the following should be noted: Take two photographs if a marking or measuring devices is used, one photograph without the device, the other with the device. So the defence can't claim that the scene was altered or that the device was concealing anything important.

In night photograph, use multiple flash, paint with light available, for extra long skid-marks or to show two vehicles some distance apart. The following steps should be followed in using flash fill:

- Set the shutter speed to the camera's flash synchronisation speed (usually $\frac{1}{60}$ seconds).
- Use the camera's light meter to determine the correct F/stop. Set the F/stop on your lens.
- With the flash on manual, find the flash to subject distance for the above F/stop.
- Position the flash unit at the distance and take the photograph.

SELF-ASSESSMENT EXERCISE 3

State the guiding principles of crime scene photography.

3.3 Basic Crime Scene Photography Equipment

Early detectives used to sketch the scene of a crime. Photography introduced a way to produce images that were more true-to-life and credible than drawings. And while an honest and technically sound photograph can record original state of a crime scene, it's simple enough to manipulate a photograph or record an image that's drastically different from reality. A good photograph of a crime scene must meet certain technical specifications: correct exposure, sharp focus and maximum depth of field, the portion of the photograph that appears sharp. The image must also be free from distortion. Such technical standards produce photos that will actually aid agents in their investigation of a crime.

But there are additional qualities that make a photo admissible in court. The image pictured cannot alter the scene or evidence.

- Say through strategic blocking with a measuring device or an intentionally shallow depth of field. The image must also be relevant to the case and should be composed with technical precision in mind, not emotional appeal.

Crime scene photographers might vary their kit based on personal preferences or the type of crime scene. But the following are the basic crime scene and evidence photography kit:

Camera

- Normal lens (a 50mm lens is considered a normal lens for a 35mm camera)
- Wide angle lens (28mm or similar for a 35mm camera)
- Close-up lenses or accessories (e.g. macro lens, 1:1 adaptor, extension tubes, bellows, reversing ring, or close-up filters)
- Filters (red, orange, yellow, blue, and green)

- Electronic flash
- Remote syncord for electronic flash (to operate flash when not mounted on camera)
- Extra camera and flash batteries
- Locking cable release
- Tripod
- Film (colour and black and white print film)
- Owner's manual for camera and flash
- Note book and pen
- Scales (ruler)
- Gray card (to aid getting accurate exposures)
- Index cards and felt pen
- Flashlight

Lenses

- Normal lens
- Wide angle lens
- Other lenses

Care and Maintenance of Crime Scene Photography Equipment

- Cleaning lens and camera
- Camera repair
- Protection from extreme heat and cold.
- Protection from rain

Film

- Colour vs. Black and White
- Print film vs. slide film
- Film speed
- Matching film to the light source.

Other equipments that should be considered include:

- Telephoto lenses (135mm, telephoto zoom lens for surveillance photography)
- Supplementary light meter for low light level reading
- Small tools for emergency camera repairs
- Blocks of wood, clothespins, and other devices for positioning evidence for close-up photography
- White handkerchief or other flash diffusion material
- Levels

- Tape measure
- Colour chart or colour control patches (injury photography)
- ABFO #2 scale (injury photography)

SELF-ASSESSMENT EXERCISE 4

Mention the basic equipments necessary for a forensic photographer.

3.4 Photographing Specific Crime Scenes

Each crime scene has unique characteristics and the type of photographs needed will be determined at the scene by the investigator familiar with the crime

Homicide

- Use colour film
- Photographs (example, homicide inside a residence)
 - a. Extension of the building
 - b. Evidence outside the building
 - c. Entrance into the scene
 - d. Room in which the body was found
 - e. Close-up of body wounds
 - f. Weapons
 - g. Trace evidence
 - h. Signs of activity prior to the homicide
 - i. Evidence of a struggle
 - j. View from positions witnesses had, at time of the crime
 - k. Autopsy

Suicide: Other death call. If there is any doubt, photograph the scene as a homicide.

Burglaries

Photographs (residential or commercial burglaries)

- a. Exterior of building
- b. Point of entry
- c. Entrance into the scene
- d. Interior views
- e. Area from which valuable articles were removed
- f. Damage to locks, safe, doors, tool marks
- g. Articles or tools left at the scene by the suspect
- h. Trace of evidence
- i. Other physical evidence

Assault, Injuries

- a. Face of victim in the photographs
- b. Bruises
- c. Bit marks
- d. Orientation shot
- e. Close-up at 90 degrees angle to avoid distortion
- f. Ruler in same plane as bite mark
- g. Focus carefully
- h. Bracket exposures

In equipments

- a. Always use colour film and filter
- b. Use colour charts and ruler
- c. Flash unit with diffused lighting

Traffic Accident and Hit-and-run cases**Photographs at the accident scene**

- a. Where the vehicles came to rest and in what position.
Photographs should show the relationship of each vehicle with each other.
- b. Damage to vehicles

Technical photographs of Damage to Vehicles

- a. Do not take any oblique or corner photographs to show damage for reconstruction purposes because they are not aligned with the axis of the vehicle. They tend to conceal the amount and direction of the damage.
- b. Take six photographs. Two from each side in line with the axles. Take one of each, take one more from overhead.
- c. Use electronic flash to fill in shadows within the damage.
- d. Debris or marks on the road way.
- e. View if each driver had approach the key point of the accident.
- f. View from the point a witness observed the accident, at witness' eye level.
- g. Evidence to identify hit-and-run vehicles.

Photographing specific crime scenes is highly technical photography.

The following procedure must be followed:

- A. Photographs must be correctly exposed, have maximum depth of field, be free from distortion and be in sharp focus.

Correctly Exposed

- a. Exposure is controlled by the shutter speed and lens aperture.
- b. Automated camera exposure systems and automated flash units can be fooled and give incorrect exposures.
- c. Front, side and back lighting.
- d. Light meters
- e. Flair
- f. Using gray card
- g. Bracketing exposures.

B. Maximum Depth of Field

- a. Depth of field is the area in photograph I which objects are in sharp focus.
- b. How to control depth of field
- c. Zone focusing. Preview depth of field.

C. Free from distortion (must have good perspective)

- a. Use a normal focal length lens when ever possible.
- b. Keep the camera as level as possible
- c. Photograph with the camera at eye level whenever possible.

D. Sharp focus

- a. Keep the camera steady.
- b. Focus carefully and use maximum depth of field.

Flash and Night Photography

Types of Flash

1. Manual Flash

Set F/stop for the flash-to-subject distance

2. Automatic Flash

Uses Distance Ranges

A change to a new range requires a change in f/stop. Never work an automatic flash at its maximum range, especially in less than ideal conditions. When in automatic flash, make sure the shutter speed dial is set to the flash synchronisation speed. When photographing a high key scene (light or reflective background) bracket opening up one or two f/stops.

3. Dedicated Flash

Sets correct flash synchronisation speed when the flash is in operation. Still uses automatic sensor and ranges. The photographer must set the appropriate f/stop for the distance range. OR sets the correct flash synchronisation speed and f/stop for the automatic range selected.

4. Dedicated TTL (through-the-lens)

Uses a sensor inside the camera. Use smaller f/stops for short distances and larger f/stops for long distances. For compensation or bracketing use the exposure compensation dial.

b. Problems with Electronic Flash

Flash Synchronisation

Coverage

- Distances ... inverse square law of light
- Long distances when outdoor at night or at arson scenes.
- Automatic flash units can shut off too soon due to reflected light.
- Rain

c. Lighting Techniques

Electronic Flash (note: disregard the light meter in the camera when using electronic flash)

- Flash mounted on camera
- Flash off camera
- Bounce flash, bounce flash off a white or light coloured surface.
- Manual flash: Add the distance up and down for the flash-to-subject distance figure in the absorbance loss (one to three f/stops)
- Automatic flash with sensor facing the subject: use a range for two times or more times the actual flash-to-subject distance
- Multiple flashes: Distance the units to provide the same f/stop for each flash
- Available light (no electronic flash)

Painting with Light

The shutter is left open while the light source is moved around until the entire scene is properly illuminated.

Procedure

- Mount the camera on a steady tripod
- Equip the camera with a lens shade (if available)
- Screw a locking cable release into the camera shutter release
- Set the shutter speed dial to B (bulb)
- Determine the f/stop based on the flash-to-subject distance (not the camera-to-subject distance)
- Focus carefully
- Depress the cable release and lock it to hold the shutter open
- Fire the electronic flash to light areas of the scene. The number of flashes and angle of the flashes will depend on the size and character of the scene. Do not point the flash directly at the camera and keep yourself out of the view of the camera.
- Unlock the cable release and allow the shutter to close
- Advance the film.

4.0 CONCLUSION

We have explained that crime scene photography involves recording evidence that will be admissible in court, and that it is hardly a haphazard operation. Crime scene photography assists investigators in creating photographic evidence that is engaging, interesting, and informative, giving them greater credibility when testifying in court.

There are three types of crime photos: overview, mid-range and close-ups. Since crime scene photography is technical photography, the photographs must be correctly exposed, have maximum depth of field, be free from distortion and be in sharp focus.

Crime scene photographers might vary their kit based on personal preferences or the type of crime scene but must carry certain basics: a camera, obviously, and may be multiple cameras, filters, electronic flashes, various lenses for wide-range angle, mid-range and close-up shots, a tripod, a measuring device, a gray card, which when combined with a light meter helps produce correctly exposed photographs.

5.0 SUMMARY

In this unit, we have discussed crime scene photography by examining the following areas: Meaning and types, purpose, general principles, basic crime scene photographic equipments and photographing specific crime scenes.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is crime scene photography?
2. List the basic crime scene equipments.
3. Mention the general principles of crime scene photography.

7.0 REFERENCES/FURTHER READING

Aobertis, E. K. (2004). "Light and Crime Scene" in *Groundbreaking Scientific Experiments, Inventions and Discoveries*. UK: Greenword Publishing Company.

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UNIT 4 PHOTOGRAPHING EVIDENCE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Meaning, Nature and Laws of Evidence Photography
 - 3.2 Photographing Fingerprints
 - 3.3 Photographing Toolmarks
 - 3.4 Photographing Bloodstains
 - 3.5 Photographing Impressions
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

1.0 INTRODUCTION

Photographing evidence at crime scene is a vital aspect of crime scene investigation. A crime photographer will thoroughly document evidence with close-up, mid-range or overview photo. And of course, pictures are of no value unless they are in context. A forensic or crime photographer keeps a photo log that includes every relevant details, the photo number, any filters applied, the time and date and the location and a description of the object. The various issues that will be examined in this unit in order to introduce you to photographing evidence are: the Meaning, Nature and Laws of evidence photographing, Photographing fingerprints, toolmarks, bloodstain, and impressions.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define evidence photography
- mention types of evidences in a crime scene
- discuss nature of photographic evidence
- apply the laws of evidence photography
- described photographic techniques of recording evidences like fingerprint, toolmarks, bloodstains and impressions.

3.0 MAIN CONTENT

3.1 Meaning, Nature and Laws of Evidence Photography

Evidence photography can also be called crime scene or forensic photography. The purpose of evidence photography is to record the crime or accident scene as accurately as possible so that such evidence can be used in a court of law to assist a judge or jury in understanding what happened at the crime scene or at the time of the accident.

Nature

Even before the photographic invention was officially announced to the public in 1839, light sensitive materials were already being used to make scientific observation on the spectrum and on the chemical precipitation of metals. By the late nineteenth century, this use of the photochemical trace in addition to more modern photographic techniques was providing scientists with innumerable insight into the natural world. It became, as J. B Biot predicted in 1839, “an artificial retina, placed at the disposal of physicists”, physiologists, biologists, astronomers, geologists, doctors and all manner of social scientists. Photography recorded things that were, to the human eye and human memory: too small, too fast, invisible, too far away and far too ephemeral.

The relationship between photography and the sciences is wholly symbiotic. Not in the sense that one cannot exist without the other, but instead, that the effect one has on the other flows irregularly backwards and forwards, new experiments are generated because photography is capable of doing what it does, and new photographic technologies are developed in response to particular experimental and observational needs.

Taking as important not only how photography was used, but how photography was surrounded by the language and rhetoric of science photography has been seen to operate in experimental and observational settings ever since Sir John Herschel first used” photograph to explain the result of an experiment on March 1839. the project was used in examining ways in which photographs were seen to generate facts, how different types of photographs are used to photochemical trace differs from photographic images made with lenses, how photographic materials alter the way in which experiments and observations are structured, and finally, but certainly not the least, how photographic desiderata is treated, discussed and disseminated to a public audience and as evidence.

Law that Apply to Evidence Photography

Louis Daguerre is considered the first to capture a photographic image and preserve it permanently; the result is what we know as the daguerreotype. Daguerre believed himself to be creator of a chemically created, therefore automatic, image that was not dependent on the memory of a human being, as a sketch or drawing would be. Many after him agreed, believing photography to be objective and incontrovertible in its accuracy.

The general rules of evidence were formulated in 1975 to govern the admissibility of evidence offered by both sides of a dispute into a court of law. In particular, Article X of the General Rules of Evidence covers the admissibility of photographic evidence. Key to admission of photographic evidence is its relevance and authentication, which may require the sworn testimony of the party requesting its admission. Among other things, the General Rules of Evidence also defines what an “Original” and “duplicate” image are, these definitions are used frequently to determine how photographic recorded can be used in the legal process.

Regulated Types of Photographs

The General Rules of Evidence have long governed the use of film-based photography efficiently because of the difficulty of altering conventional photographs without detection. Although Digital photography has complicated the field of evidence photography because of the ease with which digital photos can be altered, not just by changing the colour and lighting but by adding or eliminating key elements of the photo.

SELF-ASSESSMENT EXERCISE 1

Differentiate evidence photography with conventional photography.

3.2 Photographing Fingerprints

When do you photograph fingerprints and how?

A fingerprint is an impression of the friction ridges of all or any part of the finger. A friction ridge is a raised portion of the epidermis on the palmar (palm) or digits (fingers and toes) or plantar (sole) skin, consisting of one or more connected ridge units of friction ridge skin. These are sometimes known as “epidermal ridges” which are caused by the underlying interface between the dermal papillae of the dermis and the interpapillary (rete) pegs of the epidermis. These epidermal ridges

serve to amplify vibrations triggered when finger trips brush across an uneven surface, better transmitting the signals to sensory nerves involved in fine texture perception. The ridges assist in gripping rough surfaces, as well as smooth wet surfaces.

Fingerprints may be deposited in natural secretions from the eccrine glands present in friction ridge skin (secretions consisting primarily of water) or they may be made by ink or other contaminants transferred from the peaks of friction skin ridges to a relatively smooth surface such as a fingerprint card.

The term fingerprint normally refers to impressions transferred from the pad on the last joint of fingers and thumbs, though fingerprint cards also typically record portions of lower joint areas of the fingers.

When to Photograph Fingerprints

- Lift all major cases in the latent so that it may not be destroyed.
- Lift to bring out all details in the latent

Equipment:

- 1:1 cameras and copy cameras
- 35mm cameras with macro or chese-up lens attachments
- Gray card for available light exposures

Films

Well defined fingerprints can be photographed with colour film but black and white film provides more contrast and is preferred for latent print photography. Kodak, T-MAX film. Develop in T-MAX developer while increasing the development time by 25% for increased contrast.

Kodak TECHNICAL PAN this film has a variable contrast range between high and low and a variable speed of Iso 25 to 320. For high contrast, expose at Iso 100 and develop in HC – 110 Kodak KODALITH FILM for highest contrast.

Packaged as Kodak Ekagraphic Hc – Slide film (HCS 135 – 36) and has an approximate Iso of 8. if develop0ed in D-76 of Hc – 110 there will be a limited gray scale.

liford XP-2 black and white film can be processed in colour processors. Iso 410, fine grain with good sharpness \propto resolution can be processed in C-41colour chemistry.

Filters

Colour filters, when used in black and white photography, can be used to build contrast by either lightening or darkening the background (background drop-out).

- To lighten a colour, the colour filter closest to the colour is used.
- To darken a colour, the opposite colour filter is used.

Procedures

- Establish the location of the latent
 - Close-up to show detail
1. A 1:1 camera or device must be used.
 2. A scale must be included in the photograph on the same plane as the latent.
 3. Photograph with the film plane parallel to the latent surface.
 4. Get as much depth of field as possible, especially for curved surfaces.

Exposures

- Available light exposures of latents with normal contrast can be metered using a gray card.
- Bracketing may reveal more detail in “low contrast” latents.
- Underexposing the film will separate the steps on the white end of the gray scale or on the black end of the gray scale.
- The latitude for black and white film is generally two steps underexposure and six steps overexposure.

Specific Types of Fingerprint Subjects

- Normal, dusted prints. Usually can be photographed with no problem. Impressions in soft substances (wax, putty, clay, adhesive tape, grease, etc.) or in dust.
 - Use cross lighting at an oblique angle.
 - Preview with flashlight lighting.
- Porous surfaces.
 - May need to use close to a 90 degree lighting angle
 - Preview with flashlight lighting

- Glass and mirrors.
- Glass – place whole card of cloth behind glass, use low oblique angle of light
- Perspiration prints on glass.
- Use back (transmitted) lighting diffusion screen
- Ninhydrin fingerprint
- use normal black and white film (T- MAX or Plus –X) with a green filter and increase development time 25%.

Impressions

Footprints and tire tracks

Procedure

Take an orientation photograph to show where in the scene the impression is located.

Take a close-up for detail

- Use a scale in the same plane as the impression.
- Keep the film plane parallel to the plane of the impression.
- Block out ambient light and use a strong light source at different angles to find the light angle(s) that shows the best detail in the impression ... then put the electronic flash or light source at that angle for the photograph.

Photograph tire impressions in sections showing one circumference of the tire then use a tape measure for overlapping photographs.

SELF-ASSESSMENT EXERCISE 2

What are fingerprints? List ways of photographing fingerprints

3.3 Photographing Toolmarks

What are toolmarks? And what is the link between the toolmark and the tool.

Toolmarks examination is an important discipline of forensic science. When tools are used at a crime scene they can be linked to the unique

tool marks. When tools like screwdrivers, pliers, hammers and wire cutters are manufactured, the manufacturing process leaves certain imperfections or patterns embedded in the tool's surfaces. These patterns are believed to be unique for each tool. This means that when criminals use the tools at a crime scene, to force open a window or to jam a door or stab a person in the chest, the tool marks are often left behind for forensic scientist to analyse.

What are Toolmarks?

Toolmarks are impressions or marks that are produced by a tool or instrument on a receptive surfaced by a tool, or instrument that makes contact with the surface with sufficient force to create an indentation, the pattern of the tool is permanently reproduced onto the surface. In the world of forensic science, toolmarks can take the form of a negative impression (stamping type) or an abrasion (Friction type) mark. Some toolmarks are a combination of both types

Toolmarks are the identifying characteristics of a specific tool. Toolmarks impressions are usually microscopic and are the result of the imperfections found on the cutting surface of a tool. These marks are the "signature" or identifying characteristics of a specific tool. Laboratory examinations and comparisons of toolmarks from a "suspect tool" with toolmarks recovered from a crime scene can often prove conclusive evidence to link a suspect to a specific crime and wrap up the criminal investigation.

In creating a link between toolmark and the tool, we often know that in criminal investigation, the goal is to establish a link between a toolmark and the tool that created it at the crime scene. Such links are crucial in forensic sciences, as tools are often used in criminal activities, particularly in burglaries, and can help to identify a criminal. For example, when someone uses a screw driver to force a window open, the marks lefts by the tool on the window frame are direct evidence of the presence of that tool for that particular use at the crime scene. (Then the tool needs to be matched to its owner).

Evidence submitted in Toolmarks cases may include tools like bolt cutters, screwdrivers and chisels, scissors, knives and box cutters, pliers and wrenches, crowbars, tire, irons, saws, knives, etc. Places and surfaces where toolmarks might be observed in criminal investigations include wire, chains, door and window frames, sections of sheet metal, safety deposit boxes, safes, human bone or cartilage, padlocks, doorknobs, bolts and a variety of other materials.

Toolmarks can also be scratches or impressions that are left on a surface that is softer than the object or tool that caused the marks. At a crime scene, the unique and individual imperfections on the tool surfaces – that are transferred to the softer surface of the damaged object – can be used to make a positive identification of the tool that may have been used to cause the toolmark striations or impressions. Minute scratches (striations) produced by tests made in the crime laboratory by the questioned tool, will be compared to the striations noted on the evidence toolmark areas. The forensic scientist (toolmark examiner) using a comparison microscope will conduct comparison examination to determine whether or not a particular tool may or may not have caused the markings on the evidence from the crime scene.

Impressed marks – crowbars, car bumpers, and screwdrivers are also considered to be toolmarks. For example, the top of a screwdriver or chisel that is used to indent a metal surface but does not penetrate the object will leave an impression that can be identified to that tool.

Photographing and Recording Toolmark Evidence

Toolmarks should be completely documented prior to removal or casting. Notes, sketches and photographs must accurately reflect the position of all toolmarks to a fixed reference point, and should depict the height from the floor or ground. Toolmarks should be examined carefully for any trace evidence. The first consideration should be for the presence of latent fingerprints. Processing for latent fingerprints should be preceded by careful examination for any loosely adhering particles of evidence. This evidence may be photographed and removed prior to application of fingerprints developing techniques (fingerprinting techniques can destroy trace evidence).

Requested fingerprints and trace examinations will be performed prior to the toolmark examination. On painted surfaces, bearing toolmark evidence, sample scrapings of the paint should be submitted to the laboratory for examination. Paint may not be readily seen adhering to the tool, however, microscopic examination may reveal minute particles that may be of evidentiary value. Toolmark evidence should be packaged so as not to subject it to damage or loss of trace evidence. Flakes of adhering paint or other trace materials may be lost from the tool while in transit. It could also be damaged, changing the microscopic characteristics. The tool should be padded with soft cotton or tissue and covered with a paper bag to prevent damage or loss of or contamination of trace evidence. Do not place evidence tape over the working surface of the tool.

In photographing, doors, windows or other openings with hinged or sliding doors should not be opened, closed or handled in any manner that might compromise latent fingerprints. These are usually found near the points of entry or exit. Notes and photographs, with scales included in the photos, should be made to document any broken, forced, or cut locks, latches or bolts in the immediate area. Two types of photographs are necessary for courtroom presentation as well as for investigative purposes. The first scene and the object which bears the toolmark. secondly close-up photos showing the detail of the toolmark. The photos should contain a scale used for identification and orientation only.

Note that photos cannot be used for actual comparisons. Photographs should depict the physical location and arrangement of the door, window, etc. bearing the mark. These can reveal the direction of tool use and whether or not the tool is physically capable of making the mark. A scale/ruler should be included in these photographs. The photos should be submitted, with the evidence, for examination. Photographs should also include serial numbers and other small items, etc.

Removal and Marking of Evidence

Any items removed as evidence should be clearly marked with the case number, initials of recovering officer and date/time of removal. The evidence should also be marked to show the configuration in which it was located, i.e. inside or outside, top or bottom, front or back and the surface area bearing the tool mark. Many objects bearing tool marks that are detached during a forced entry, may be submitted directly as they are found. This includes segments of window or door molding, window or door sill, latches, bolts, locks or doorknobs (where door knobs are twisted) note whether anything obstructs access to the knob from either side i.e. posts, door, set back) if the mark appears on large items it may be possible to remove the area containing the mark. If it is removed, a sufficiently large piece of the surrounding surface area must be included to prevent damage to the tool mark through bending, splintering or breaking. Any small removable item such as door knob, latch plate, lock or hinge should be marked showing the top and front of the item as it was positioned before removal including your photographs will greatly enhance the situation for the examiner.

SELF-ASSESSMENT EXERCISE 3

What are tool marks? How can they be photographed?

3.4 Photographing Bloodstain

Blood that is in liquid pools should be picked up on a gauze pad or other clean cotton cloth and allowed to air dry thoroughly, at room temperature. Once the walk through in a crime scene is completed, the notes must be supplemented with other forms of documentation, such as videotape, photographs, and/or sketches.

Videotape can be an excellent medium for documenting bloodstains at a crime scene. If a video camera is available, it is best used after the initial walk through. This is to record the evidence before any major alterations have occurred at the scene. Videotapes provide a perspective on the crime scene layout that cannot be as easily perceived in photographs and sketches. It is a more natural viewing medium to which people can readily relate, especially in demonstrating the structure of the crime scene and how the evidence relates to those structures.

The value of videotaping blood evidence is that the overall relationship of various blood spatters and patterns can be demonstrated. One example of this could be a beating homicide. In this case, videotape can show the overall blood spatter patterns and how these spatters are interrelated. The videotape can also show the relationship of the spatters to the various structures at the crime scene. In cases where the suspect may have been injured (such as stabbing homicides) the video camera can be used to document any blood trails that may lead away from the scene. If videotaping indoors, the camera can show how the various cases or areas are laid out in relation to each other and how they can be accessed. This is particularly valuable when recording peripheral bloodstains that may be found in other rooms. The high intensity light source can also be used for illuminating the bloodstains to make them more visible on the videotape.

Whether a video camera is available or not, it is absolutely essential that still photographs are taken to document the crime scene and any associated blood evidence. If a video camera is available, then still photography will be the second step in recording the crime scene. If video is not available then still photography will be the first step. Photographs can demonstrate the same type of things that the videotape does, but crime scene photographs can also be used to record close up details, record objects at any scaled size and record objects at actual size. These measurements and recordings are more difficult to achieve with videotape.

Blood evidence can be photographed using colour print film and/or colour slide film. Infrared film can also be used for documenting bloodstains on dark surfaces. Overall, medium range, and close up

photographs should be taken of pertinent bloodstains. Scaled photographs (photographs with a ruler next to the evidence) must also be taken of items in cases where size relevance is significant or when direct (one-to-one) comparisons will be made, such as with bloody shoeprints, fingerprints, high velocity blood spatter patterns, etc. A good technique for recording a large area of blood spatter on a light coloured wall is to measure and record the height of some of the individual blood spatters. The overall pattern on the wall including a yardstick as a scale is then photographed with a slide film. After the slide is developed, it can be projected onto a blank wall or onto the actual wall many years after the original incident. By using a yardstick, the original blood spatters can be viewed at their actual size and placed in their original positions. Measurement and projections can then be made to determine the spatter's point of origin. The following point should be noted in bloodstain.

Photography

- Use colour film
- Orientation photographs to show locations of bloodstain evidence at the scene.
- Close –up photos to show detail by using a scale on the same plane as the blood stain, also keep the film parallel to the plane of the bloodstain. And finally use a low oblique light angle.

SELF-ASSESSMENT EXERCISE 4

Discuss the importance of videotape and photographs in documenting a bloodstain scene crime.

3.5 Photographing Impressions

The following steps should be followed in photographing impression evidence at the crime scene.

Secure and preserve the crime scene first. After that walk the crime scene from the perimeter ... inwards.

The essence of this is to interpret crime scene footwear and tire track impressions for assistance in reconstructing events of the crime. For example, direction of travel by suspects, and/or victim(s) to, from and while at the scene may be determined. Also the number of suspects involved at the scene may be determined. Use any video surveillance or witness accounts to pinpoint searches for impression evidence. Mark the impression(s) with a numbered cone or card for reference when taking any crime scene photographs.

Impression evidence, such as footwear and tire track, are often overlooked. To avoid contamination, visualise this type of evidence first, using visualisation techniques like oblique light with flashlight or other light source – in low light or total darkness if possible. Also electrostatic dust print lifter can be used.

In recording impression evidence, first take examination quality photographs before using any chemical or physical enhancement techniques. If three dimensional impressions are located, cast with dental stone. Whenever possible, submit the original evidence

The following procedure should be followed in photographing impression like footprints and tire tracks.

Take an orientation photograph to show where in the scene the impression is located.

Take a close-up for detail by using a scale on the same plane as the impression

Keep the film plane parallel to the plane of this impression and finally block out ambient light and use a strong light source at different angles to find the light angle(s) that shows the best detail in the impression. Then put the electronic flash or light source at the angle for the photograph.

Photograph tire impressions in sections showing one circumference of them.

4.0 CONCLUSION

We have explained that photographing evidence is an important aspect of crime scene investigation. A crime or forensic photographer keeps a photo log that includes every relevant detail.

We learnt also that the purpose of evidence photography is to record the crime or accident scene as accurately as possible so as to tender such evidence in the court of law to assist a judge in taking a decision. Crime scene photographs can be taken overviews, midrange or close-ups.

5.0 SUMMARY

In this unit, we have examined photographing evidence or evidence photography by looking at the following aspects: meaning, nature and laws of evidence photography, fingerprints, toolmarks, bloodstain and impressions photographing.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is the purpose of evidence photography.
2. What are Toolmarks? Discuss the various types of Toolmarks.
3. Explain Bloodstain photography.

7.0 REFERENCES/FURTHER READING

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UNIT 5 FINGERPRINTS

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- 2.0 Objectives
- 3.0 Main Content
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1.0 INTRODUCTION

Construction workers tend to have rough hands, and musicians tend to develop calluses on the tips of their fingers. It's important not to rely too heavily on these clues as they are not facts. Prints can substantiate or disprove the story of a victim or witness by locating their prints where they said they were. Even the absence of prints may be a key factor.

Fingerprints are used to identify an unknown victim, witness or suspect, to verify records, and most importantly, as links and matches between a suspect and a crime. Even when you have no suspect, prints can develop leads, and sometimes provide clues about the criminal's size, sex, and occupation. Small prints tend to be made by small people, and prints on a wall indicate the suspects height. The various issues that will be examined in this unit that will introduce you to fingerprints are the definition, history, types, methods and uses of fingerprints.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the concept of fingerprints
- discuss the history of fingerprinting
- describe the various types of fingerprints
- list methods of detecting fingerprints
- state the uses of fingerprints.

3.0 MAIN CONTENT

3.1 Definition of Fingerprint

What is fingerprint?

Fingerprints are made of ridges on the upper skin on hands and feet of all people and some animals. A fingerprint is an impression of the friction ridges of all or any part of the finger. A friction ridge is a raised portion of the epidermis on the palmer (palm) or digits (fingers and toes) or plantar (sole) skin, consisting of one or more connected ridge units of friction ridge skin. These are sometimes known as “epidermal ridges” which are caused by the underlying interface between the dermal papillae of the dermis and the interpapillary (rete) pegs of the epidermis. These epidermal ridges serve to amplify vibrations triggered when fingertips brush across an uneven surface, better transmitting the signals to sensory nerves, involved in fine texture perception. The ridges assist in gripping rough surfaces, as well as smooth wet surfaces.

Fingerprints may be deposited in natural secretions from the eccrine glands present in friction ridge skin (secretions consisting primarily of water) or they may be made by ink or other contaminants transferred from the peaks of friction skin ridges to a relatively smooth surface such as fingerprint card. The term fingerprint normally refers to impressions transferred from the pad on the last joint of fingers and thumbs, though fingerprint cards also typically record positions of lower joint areas of the fingers.

Fingerprint can also be defined as an impression on a surface of the curves formed by the ridges on a fingertip, especially such an impression made in ink and used as a means of identification.

A distinctive or identifying mark or characteristic “the invisible fingerprint that is used on products from counterfeits”. (Gene G. Marcial) it could also be a DNA fingerprint or a chemical fingerprint.

Occasionally, a print is found that is made with the palm of the hand or bare foot. These are ordinarily processed by the same methods used for fingerprints. Several months before a baby is born, ridges develop on the skin of its fingers and thumbs. These ridges arrange themselves in more or less regular patterns referred to as fingerprints.

Fingerprints offer an infallible means of personal identification. That is the essential explanation for their having supplanted other methods of establishing the identities of criminals reluctant to admit previous arrest.

SELF-ASSESSMENT EXERCISE 1

Explain the term fingerprint in relation to forensics.

3.2 History of Fingerprints

How did fingerprints evolve as a means of identification?

Before the mid-1800s, law enforcement officers with extraordinary visual memories, so called “camera eyes”, identified previously arrested offenders by sight. Photography lessened the burden on memory but was not the answer to the criminal identification problem. Personal appearances change.

Around 1870, French anthropologist Alphonse Bertillon devised a system to measure and record the dimensions of certain bony parts of the body. These measurements were reduced to a formula which, theoretically, would apply only to one person and would not change during his/her adult life. The Bertillon system was generally accepted for thirty years, but it never recovered from the events of 1903, when a man named Will West was sentenced to the U.S. Penitentiary at Leavenworth, Kansas. It was discovered that there was already a prisoner at the penitentiary at the time whose Bertillon measurements were nearly the same, and his name was William West.

Upon investigation, there were indeed two men who looked exactly alike. Their names were Will and William West respectively. Their Bertillon measurements were close enough to identify them as the same person. However, a fingerprint comparison quickly and correctly identified them as two different people. (per prison records discovered later, the West men were apparently identical twin brothers and each had a record of correspondence with the same immediate family relatives).

In the early days of police work, one of the great plagues of the professional judge was not being able to prove that a suspect, and likely convict, was a repeat offender. Society then as now frowned on the career criminal and wanted a way to be able to punish him or her accordingly, with a stiffer sentence. Different countries took different approaches to this problem: France took the method of branding their criminals with the Fleur-di-lis symbol, as an indication that this person had offended the crown before, Rome sometimes tattooed criminals, other countries went the route of removing the hand of a thief (although those that had merely suffered an accident might be confused with having a criminal past).

Beginning in the 1850s, some areas began photographing (daguerreotyping) criminals as they went into prison. This method became popular in the 1880s with the advent of the Kodak camera, which was quicker and easier to use. However, photographs were still not foolproof – people can drastically change their appearance and what they do not do, time may. Nonetheless, police spent a great deal of time studying “Rogues Galleries” thick books of photographs of known criminals in the hopes of being able to identify them in the case of similar crimes occurring near them. (There was apparently very little faith that a criminal wouldn’t return to his or her illicit ways).

Other methods included the Bertillon system developed by a French anthropologist (Alphonso Bertillon) who posited that there were specific body measurements that would not change; an example would be the length of the femur. This was a very popular method despite the obvious problems of obtaining measurements. The system received a severe blow in 1903 in Leavenworth, Kansas, while taking the measurement of one Will West, officials found that he was indeed a repeat offender. Mr. West mightily protested this charge, and upon further examination of the records, the jailers discovered that they already had one William West in their custody, with the same Bertillon measurements. (There is still some confusion as to whether these men were related, some believe they may have been twins, others believe it was merely a fluke).

Happily, however, another system of identification was developing – fingerprinting. Fingerprints had been used as source of identification since the T’ang Dynasty in China, and in 18th century Japan – a thumbprint could suffice for a signature on legal documents. The first crime solved using fingerprints is sometimes stated to be a murder case that occurred in ancient Rome, where a bloody handprint was later found to be the match for the killer. Western awareness of the possibilities of fingerprinting first came to notice in 1684, with a lecture given by British doctor Nehemiah Grew, who spoke on the ridge patterns of fingerprints. Two years later, Italian physician Marcello Malpighi wrote a treatise describing the ridge patterns. (Latter the “Malpighi” skin layer would be named in his honour). And there interest ended for over a hundred years, in 1823 Johannes Evangelist Purkinje wrote his doctoral thesis for the University of Breslaw that divided fingerprints into nine different types.

In 1858, however, fingerprinting found a firm believer in William James Hershel. It all started innocently enough. An employee of the East India Company, Hershel wanted a good way to seal a contract with a Bengali firm, and settled on using a handprint on the contractor. Two years later, Hershel became a magistrate at Nuddea. One of his official duties was to make sure that only the natives of the area receive the pensions that were

due them, but to prevent as much fraud as possible. High illiteracy rates, and therefore the inability to get a signature, drastically raised the potential for fraud. Remembering the success of the handprint, Hershel began requiring pensioners to use their fingerprints as a form of signature in order to receive the money due them. Fraud avoided, and a passion born. In 1877, Hershel requested permission to try his system in a small prison in Bengal, but was refused.

The use of fingerprints during this time was somewhat stagnant. In 1893, the British Home Office set up a committee to determine the best criminal identification system for Scotland Yard to use. After consideration, they recommended the Bertillon system, but to also use fingerprinting as a complementary means of identification. In the United State, interest was growing, Gilbert Thompson, a geologist in New Mexico used his fingerprints on documents in 1882 to prevent forgery, thinking of Hershel's work, perhaps. At any rate, Thompson thus became the first person to use fingerprinting in United States. Great Britain and most of Europe accepted the Galton-Henry system, with the exception of France, Belgium, and Egypt, who used an amalgam of the two systems. France also held on to anthropometry for the first half of the 20th century. Edward Henry finished his system of identification and retrieval of fingerprints in 1896, to great success. The following year, the Indian government made fingerprinting the official means of keeping track of criminals. In 1901, Henry became the head of Scotland Yard's Criminal Investigation Division. The four basic divisions that Henry created were: Arches, Loops, Whorls, and Composites. Every fingerprint will fall into one of these four groups, narrowing down potential matches.

And from this point on, progress is swift, with the notable exceptions of France, Belgium and Egypt, all of whom will continue to use both the Bertillon method and fingerprinting. The New York Civil Service began testing fingerprinting in 1902. in March, 1903, the New York State Prison System began fingerprinting criminals (in Ossining Prison, better known as Sing Sing) and in 1904, the federal prison at Leavenworth began to do so (as a direct result of the Will/William case). The US army began using them in 1905 and the Navy in 1906. In 1908, P. A. Flak of the Library Bureau Company in Chicago designed the basic form still in use today – an 8inch square of medium weight cardboard, with the fingerprints on it in printer's ink. Printer's ink is preferred because it rarely smudges and dries quickly.

After eight years of testing, the FBI created a computerised criminal fingerprint file in 1980. In 1983 the FBI created the National Crime Information Centre, to allow for dissemination of information about criminals between the federal and local governments. As part of this, the

FBI standardised the methods of fingerprint classification, eradicating local differences in classification, and making national retrieval easier. By 1989, all fingerprints match requests were done on the computer, and the response time cut from 14 days to 1 day.

Fingerprinting and identification are still key to solving criminal cases despite the technological advances that are making DNA testing more reliable and easy to obtain. It is possible that they may one day become obsolete, as new methods supersede them, but for the foreseeable future, the ends of the fingers will continue to point the way.

SELF-ASSESSMENT EXERCISE 2

Discuss the historical development of fingerprints.

3.3 Types of Fingerprints

What are the various types of fingerprints?

The first workable system of classifying fingerprints was introduced by British anthropologist Sir Francis Gallon in 1888. A few years later, Sir Edward Henry, an Inspector-General of Police in British- controlled India, refined the Galtonian method of classification so successfully that the system became known by Henry's name. For decades, law enforcement agencies in the English-speaking world used the Henry system, which often proved cumbersome because of the need for fingerprint experts and the time required to manually match the often staggering number of prints on file.

There are essentially seven different types of fingerprints patterns that are being used for fingerprint identification, which are:

- **Loops** – Loops make up almost 70% of the patterns that have been encountered so far. A loop pattern is basically the existence and combination of one delta and one core and a ridge count. There are basically two types of loops – 'ulnar' and 'radical'.
- **Whorls** – whorls constitute around 25 – 35 percent of the patterns that have been brought in and mainly consist of whorls. A fingerprint pattern that contains 2 or even more deltas will always be a whorl pattern.
- **Plain whorl** – A plain whorl is that whorl that consists of at least one ridge that could possibly make a complete circuit, with 2 deltas, where an imaginary line will be drawn and it should have at least 1 recurving ridge.

- **Central Pocket Whorl** – This type of a whorl consists of one recurving ridge, 2 deltas, an obstruction to the line of flow and no recurving ridge inside the pattern area is touched or cut.
- **Double Loop Whorl** – This whorl is made up of 2 distinct yet separate loop formations having 2 separate and distinct shoulders and also 2 deltas.
- **Arches** – Arches are encountered in only 5 percent of the patterns received. Arch patterns consist of ridges that run from one side of the pattern to the other. There is generally no delta. There are two types of arches – Plain arches and Tented arches.
- **Whorl Tracings** – There are essentially two different components to a whorl classification – the first is the pattern and the second is the tracing. To find a whorl tracing you must identify the left delta.

The arch fingerprint type has a pattern of ridges that curve upward, forming what resembles a stacked row of arches. In the plain arch, the line usually flows consistently from one side of the fingertip to the other. This is widely considered the easiest type of print to identify. The tented arch is similar but has at least one ridge that point upward and breaks up one or more of the lines above.

The loop fingerprint has ridges that curl around the fingertip. The ridges point in one direction before rising and flowing in the opposite direction. Like the arch type, the loop is divided into two categories. The radial loop's ridges move in a downward slope from the direction of the pinky toward the thumb. The ulna loop's ridges downward in the opposite direction toward the pinky, the digit found on the same side as the forearm's long ulna bone.

One of the most varied, complex fingerprint patterns is the whorl, which is broken down into four sub-categories. Whorl ridges form frequently closed, rounded shapes that expand outward from the delta, the point at which the ridges converge or form a different pattern. A fingerprint can have one or more delta. The plain whorl is the easiest of the four to classify because it consists of round circuits within round circuits emanating towards the fingerprint edge. The central pocket whorl, in contrast, has one or more ridges that disrupt the curving flow of lines, sometimes at right angles. The double loop whorl contains two distinct set of loop patterns. Composite whorl combine two fingerprint patterns – with the exception of the plain arch pattern – and also include complete circuits among the ridges.

Experts note a fourth type of fingerprint pattern known as the composite, although it is not part of the original Henry system. Like the whorl pattern, the composite has four sub-categories which have varying

combinations of arch, loop and whorl features. The central pocket loop composite has one ridge that forms a complete loop and at least two deltas. The twinned loop is like the central pocket except that it has two complete, rounded shapes within the pattern. The lateral pocket loop is similar to the twinned loop with its two distinct, rounded circuits, the difference being at some point the ridges curve sharply downward in one direction. Lastly, the accidental loop combines rounded circuits and two distinct deltas with any of the known fingerprint types except the plain arch.

SELF-ASSESSMENT EXERCISE 2

Discuss the various types of fingerprints.

3.4 Methods of Detecting Fingerprints

What methods are used in detecting fingerprints of suspects A and B in a crime investigation?

Since the late nineteenth century, fingerprint identification methods have been used by police agencies around the world to identify both suspected criminals as well as the victims of crime. The basis of the traditional fingerprinting technique is simple. The skin on the palmar surface of the hands and feet forms ridges, so-called papillary ridges, in patterns that are unique to each individual and which do not change overtime. Even identical twins (who share their DNA) do not have identical fingerprints. Fingerprints on surfaces may be described as patent or latent. Patent fingerprints are left when a substance (such as paint, oil or blood) is transferred from the finger to a surface and are easily photographed without further processing. Latent fingerprints in contrast, occur when the natural secretions of the skin are deposited on a surface through fingertip contact and are usually visible, so that they can be photographed. The complex ones depend on the type of surface involved. It is generally necessary to use a 'developer', usually a powder or chemical reagent, to produce a high degree of visual contrast between the ridge patterns and the surface on which the fingerprint was left.

There are several methods of detecting latent fingerprints.

Powder and Tape

Probably the most well-known method of detecting latent prints is dusting for them. A variety of powders are used in dusting for prints, many containing aluminium or carbon. This finely crushed powder is gently applied to a surface, and the minute particles of powder cling to the print residue, making it visible to the human eye. These prints are

then lifted using adhesive tape. For dusting to work, the surface that is being dusted must be completely dry and relatively free of other contamination.

Magna Brush

This is a magnetic wand that attracts iron. It is dipped in iron dust, and the particles cling to it. This then used in the same way as using dusting carbon and aluminium powders. The Magna Brush is also less messy, as any excess iron particles can be easily collected with the magna brush. A variety of fluorescent colours are available for this, and some of these powders reflect alternative light sources such as UV and lasers.

The Cyanoacrylate Fuming Method

The cyanoacrylate fuming method, also known as the superglue fuming method, has proved to be another very useful way of detecting latent prints. This method was first used by the Criminal Identification Division of the Japanese National Police Agency in 1978. Shortly after this, it was adopted in USA and now it is commonly used method of detecting prints. Most superglue is methyl cyanoacrylate or ethylcyanoacrylate. This reacts with the traces of amino acids, fatty acids, and proteins in fingerprints as well as the moisture in the air, making them visible.

Ninhydrin

Another common method of fingerprint detection is the use of ninhydrin. This is sprayed, swabbed or dripped onto the surface. Ninhydrin reacts with the amino acids in the prints, forming a purple or pink compound.

Iodine Fuming

Iodine crystals are placed in a glass tube known as a fumer. The examiner then blows into the fumer, causing the transformation from solid to gas. The iodine vapours are emitted from the other end, and if the tube is aimed at a latent print, it will become visible for a short time.

Silver Nitrate

Silver Nitrate is a less toxic way of detecting prints on paper. Silver chloride turns black in light, and one of the components of sweat is sodium chloride. The silver nitrate is placed with distilled water and applied to the paper. The paper is exposed to light, and any prints will turn black.

Amido Black

Amido Black is a chemical used to develop fingerprints in blood. A fixing agent is first applied to the blood stain, and then amido black is used. There are other methods of detecting latent prints most similar to the techniques mentioned above. Some methods even include laser technology. Different surfaces will require different techniques for developing latent prints. For example, when developing a print on paper, Ninhydrin should be used, though powders may work but not as effectively.

When developing prints in blood, Amido Black should be used, and powder works best on non-porous surfaces. When taking fingerprints from people, ink is rolled over the fingers and then the fingers are pressed down on papers or cards. However, when it come to finger printing the dead, it does not come so easy. If we are fingerprinting a corps recently deceased, there is no problem. However, if we are dealing with decomposition or mummification where the skin has become hardened and contracted, a special method is required. Usually the fingers are soaked in a solution of glycol, lactic acid and distilled water, softening the finger tissues. If the skin has been wrinkled by the damp, the fingers can be printed by either use of hypodermic syringe, gently manipulating the fingertips by hand, or removing the finger skin altogether and mounting it to be printed. Fingerprints found at crime scenes are very rarely fully intact, which means the quality of the print is lower, and can be more difficult to positively match.

When multiple sets of prints are being compared, a certain number of characteristics points must be a match. Worldwide, there is no set number of how many points must match before it is accepted as a match, but it does differ in some countries. For example, in Netherlands, 12 points are required, whereas in Africa, only 7 points are required. Paris has a requirement of 17 points, whereas the rest of France only requires 12. It should be noted that people of African ancestry tend to have plenty of arches; people of European background have frequent loops; and Asians/Oriental have a fairly high frequency of whorls.

Crime scene fingerprints may be detected by simple powders, or some chemicals applied at the crime scene, or more complex, usually chemical techniques applied in specialist laboratories to appropriate articles removed from the crime scene. With advances in these more sophisticated techniques some of the more advanced crime scene investigation services from around the world are now reporting that 50% or more of the total crime scene fingerprints result from these laboratory based techniques.

SELF-ASSESSMENT EXERCISE 4

List the methods of detecting latent fingerprints and describe two of them.

3.5 Uses of Fingerprints

In crime investigation: Fingerprints are the cheapest and best means to prove the identity of the criminal. Most of the crime cases, like murder and theft cases, do not have an eye witness or other evidence. Even the testimony of an eye witness can be strongly challenged in court. But one can never deny his presence at a crime scene if his fingerprints are collected there. A fingerprint itself is conducive evidence.

To prevent impersonation: Fingerprints can be included with social security cards, passports, driving licenses, bank accounts, etc. to prevent unauthorised use.

To prove the identity of an unidentified dead body: Fingerprint comparison is one way to prove the identity of a dead body when it is mutilated or decomposed, thus making it difficult to identify the person. It becomes useful when a natural calamity occurs or a war breaks out. The mutilated bodies of the victims may be identified with the use of earlier recorded fingerprints.

In biometrics based electronic gadgets: Fingerprints plays a vital role in the manufacturing of the biometric based electronic gadgets, such as door security systems, door access control systems, automatic safe boxes, fingerprint attendance systems, fingerprint security system, etc.

Fingerprints offer an infallible means of personal identification: That is the essential explanation for their having supplanted other methods of establishing the identities of criminals reluctant to admit previous arrests. The science of fingerprint identification stands out among many all other forensic sciences for many reasons, including the following:

It has served all governments worldwide during the past 100 years to provide accurate identification of criminals. No two fingerprints have ever been found alike in many billions of human and automated computer comparisons. Fingerprints are the very basis for criminal history foundation at every police agency on earth. Remains the most commonly used forensic evidence worldwide – in most jurisdictions fingerprints examination cases match or outnumber all other forensic examination casework combined.

Worldwide, fingerprints harvested from crime “scenes lead to more suspects and generate more evidence in court than all other forensic

techniques combined. Other visible human characteristics change – fingerprints do not. In earlier civilisation, branding and even maiming were used to make the criminal for what he was. The thief was deprived of the hand which committed the thievery. The Romans employed the tattoo needle to identify.

4.0 CONCLUSION

We have explained that fingerprints are used to identify an unknown victim, witness, or suspect to verify record, and most importantly as links and matches between a suspect and a crime. Even when you have no suspects, prints can develop leads, and sometimes provide clues about the criminal's size, sex and occupation. We have also learnt that there are three major types of fingerprints namely: Arches, Loops and Whorls, with each class further subdivided into numerous sub categories. We also learnt that fingerprints can be detected using a powder or chemical reagents, like ninhydrine, cyanoacrylate fuming method, etc. Finally fingerprints are used in crime investigation, to prevent impersonation and also to prove the identity of an unidentified dead body.

5.0 SUMMARY

In this unit, we have examined the concept 'Fingerprints' by looking at the following aspects: Definition, History, Types, Methods of Detecting, and Uses of fingerprints.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are fingerprints?
2. Mention the various types of fingerprints and discuss two of them.
3. Discuss the importance of fingerprints to forensic science.

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MODULE 4 FIREARMS AND AMMUNITIONS

Unit 1	Ballistics
Unit 2	Projectiles
Unit 3	Explosives
Unit 4	Landmines

UNIT 1 BALLISTICS**CONTENTS**

1.0	Introduction
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3.4	Types of Ballistics
3.5	Ballistics Fingerprinting
4.0	Conclusion
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1.0 INTRODUCTION

Ballistics is the science of how ammunition operates. Ballistics is a science which is important for soldiers, law enforcement, hunters and anyone who seeks to protect their life, their home, and family. The various issues that will be discussed in this unit that will introduce you to ballistics are: the meaning, History, Types, Basic Ballistics and Ballistic fingerprinting.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the term Ballistics
- discuss basic ballistic knowledge
- mention types of ballistics
- explain ballistic fingerprinting
- list the basic characteristics of firearms
- discuss the history of ballistics.

3.0 MAIN CONTENT

3.1 Meaning of Ballistics

What is Ballistics all about?

The best firearm in the world will perform horribly if not fed equally good ammunition. A well-designed round can significantly increase the accuracy and stopping power of any caliber bullet.

Ballistics is the science of how ammunition operates. Ballistics is a science which is important for soldiers, law enforcement, hunters, and anyone who seeks to protect their life, home, and their family. The study of ballistics can help any shooter to achieve better results from their rifle, pistol or shotgun. Ballistic is the science of mechanics that with flight, behaviour, and effects of projectiles, especially bullets, gravity bombs, rockets, or the like, the science or art of designing and accelerating projectile so as to achieve a desired performance. Gun ballistics is the study of projectiles from the time of shooting to the time of impact with the target.

A ballistic body is a body which is free to move, behave, and be modified in appearance, contour, or texture by ambient condition, substances, or forces as by the pressure of gases in a gun, by rifling in a barrel, by gravity, by temperature, or by air particles. A ballistic missile is a missile only guided during the relatively brief initial powered phase of flight and its course of classical mechanics.

In the field of forensic science, forensic ballistics is the science of analyzing firearm usage in crimes.

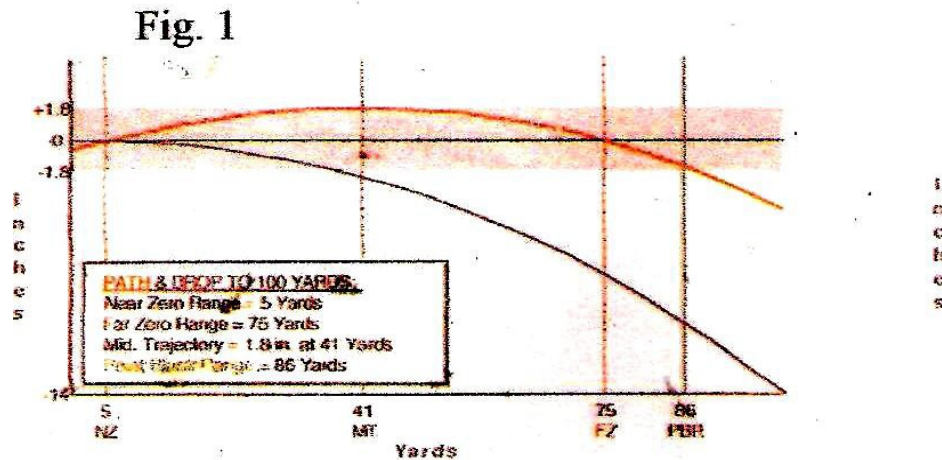
SELF-ASSESSMENT EXERCISE 1

Explain the meaning of the term ballistics.

3.2 Basic Ballistics

As shooters, we are all interested in where the bullet goes once we fired the gun. The ability to place the bullet where we want it is vital to any accurate shooter, and an understanding of ballistics is necessary to accomplish that in a consistent and reliable fashion. The body of knowledge as to the factors effecting the flight of the bullet from the instant it leaves the muzzle of the gun until it strikes the target is termed Extend Ballistics.

In order to make clear our discussion, let us study figure 1 below:



Line of Sight

A perfectly straight line from the shooter's eye through the rear sight, then the front sight, then the target. Line of sight starts at "0" and is the black line running straight across the chart in the centre of the shade area. Obviously, when the shooter aims the gun, he is looking along the line of sight.

Line of Bore

A straight line running along the centre of the bore of the gun, as we all see, this does not coincide with the line of sight.

True Drop

Illustrated as the blue line on the chart, true drop is the actual distance the bullet falls during the time of flight to the target. It is important to realise that this is not the same as what we speak of when we discuss drop in the ordinary sense, which is more properly termed Effective or Apparent Drop. A simple way to think of this is as follows: hold in your hand a round ball perfectly identical to the one being shot, at exactly the same level above the ground, make the line of Bore of the gun exactly parallel to the earth, fire the gun, and at the instant the ball clears the muzzle, drop the ball from your hand. The ball fired from the gun and the one dropped from your hand will both strike the ground at the same instant, one at your feet and the other many yards down range. Since two identical balls dropped from the same height, hit the ground at the same instant, they must be dropping at the same rate. That's true because both balls, like everything else on earth, are subject to the acceleration of

gravity, which is constant under all circumstances. Regardless of what we do, the ball is 'falling' all the time it is in flight, even when it is travelling upwards.

Path

The red line on the figure shows the one thing we are vitally interested in, the actual path through the air of the bullet after it leaves the muzzle of the gun. It is in fact the True Drop of that path. Many factors affect the final shape of the path. It is the fact that True Drop is constant and inescapable that everything else in basic ballistics revolves round. To illustrate this, this figure or chart was prepared using a 600 round ball travelling at 1247/sec. The ball weighs 324.3 grains, the gun is sighted in at 75 yard and shooting was done under standard atmospheric conditions. This figure or chart represents a hypothetical situation.

The data used to create the chart show that true drop at 75 yards is 7.55 inches. This means that if we point the barrel, the line of Bore, directly at the target, the ball will strike 7.55 inches low every time, and we can't change that. So, we cheat in a very simple way. We aim the barrel above the target just enough to cancel out that 7.55 inches of drop. We then adjust the sights of the gun so that the line of sight points directly at the target, and we forget it. Now it is easy to see the difference between True Drop and Apparent Drop. We know the ball is actually falling 7.55 inches, but since it hits the target when we aim at it, apparent drop is zero at the target range.

Several things follow from the setup. We know that the line of Bore is below the line of sight at the muzzle, crosses the line of sight, going upward. The ball, which starts out along the line of Bore, quickly falls below it, but not before it has crossed the line of sight. Depending upon the gun, the velocity and the range the gun is sighted for, this happens at 5 to 10 yards in front of the muzzle. Where the bullet crosses the line of sight the first time, going upward is called the Near Zero Range, NZ on the cart of figure. The bullet travels on, reaching its maximum height above the line of sight, then begins to fall. The point at which this maximum above line of sight is reached is called Mid-range Trajectory MRT on the figure. This occurs, in general at a little more than 50 percent of the distance to the target. Continuing on, the bullet falls closer to the line of sight, until it crosses it again at the target range, the Far Zero Range.

We now have the picture of the path from muzzle to target... below the line of sight at the muzzle, crosses the Line of sight close to the muzzle at the Near Zero, reaches a maximum height above the line of sight at

the Mid-range Trajectory, stays above the line of sight until it crosses it again at the target range, Far Zero.

If we see the shape of red line on the figure, the perfect path would coincide exactly with the line of sight, and to see the target happen, obviously, different bullets, fired at different velocities, will perform differently. A major factor in determining the shape of the path is the rate at which the bullet, of whatever shape, slows down. Since True Drop is a constant, occurring at a constantly accelerating rate, we can see that if a bullet is traveling very fast, it will travel a long distance downrange for any given unit of time, and for a certain amount of True Drop, if it is travelling slowly, it will travel a much shorter distance downrange in that same unit of time, but it will drop exactly the same amount. Thus, the shape of the path is fairly flat at the beginning, but curves more and more as it nears the target, because the bullet is slowing down. The shape of all trajectories is similar to that of a parabola, with constantly increasing rate of curvature.

Why does one bullet slow down more quickly than another? Simply put, because it has more drag (more friction through the air) or less inertia. Why does one have more drag? Because of a difference in shape which creates more friction. A streamlined bullet cuts the air more easily than a blunt, irregularly shaped one. So, a bullet designed for and fired from a modern, high velocity rifle will have much less drag than a conical or a round-ball fired from a black powder gun. Inertia is the property that makes any moving body tends to keep moving in the same direction and at the same speed, unless acted upon by some outside force. Inertia is increased by increasing mass (think weight) and velocity. Our flying bullet is acted upon by two outside forces, gravity forcing it to drop and air friction forcing it to slow down.

It becomes obvious, then, that heavier bullets and more streamlined bullets resist slowing best.

In order to be able to compare the efficiency of various bullets, a mathematical tool was developed, and it's called Ballistic coefficient. A bullet of a given shape (the shape doesn't matter) and weight was fired thousands of times, and its drag, its rate of slowing, was determined precisely. This was named standard Bullet. Now in order to compare the performance of our favourite projectile, all we have to do is compare its rate of slowing with that of the standard bullet. If it slows exactly the same as the standard bullet, it is said to have a Ballistics coefficient of 1.0. Any BC lower than 1.0 indicates a bullet which is not as good at plowing through the air and retaining its velocity as the standard Bullet is. Those of us interested in black powder shooting and the ballistics of our bullets quickly learn that the BC of a round-ball is lower than the

standard Bullet. Because a round-ball is ... a round ball ... its shape cannot be changed. To compensate for a low BC, we can do two things, increase the weight, because a heavier projectile has more inertia and resists slowing more and starts with greater initial velocity, so that velocity at the target is higher, even after all the loss.

SELF-ASSESSMENT EXERCISE 2

1. Explain the following terms, Line of Sight, True Drop and Line of Bore.
2. Explain also why one bullet slows down more quickly than another.

3.3 History of Ballistics

Ballistics experiments have been with us since ancient times, when war machines were slinging rocks over the walls of fortified towns. As a science it began with the study of flight-paths when shooting at targets. One of the first to apply the science of ballistics to criminology was Eugene Francois Vidocq, the first head of the French Surete.

The modern ballistics expert is concerned with three areas.

- Internal ballistics is what happens inside a weapon when it is fired. The firing pin makes a distinct mark on the cartridge. Then explosive pressure causes the bullet to expand slightly to fill the spiral 'rifling' grooves cut in the bore. This makes the bullet spin as it passes down the barrel, but it leaves tell-tale marks on the bullets that are unique to that particular firearm. The presence of nest or spider silk indicates the gun that has not fired recently. At close range, particles from a wound may lodge inside the barrel.
- External ballistics is what happens to the bullet and residues outside the gun, including the direction and velocity of the shot, as well as any deviation in the trajectory.
- Terminal ballistics looks at the changes in trajectory and speed caused by ricochet and penetration of objects, as well as layered deposits on parts of the bullet accumulated as it contacts these objects. Terminal ballistics includes examination of the shape of rounds and the extent of tissue damage. If a bullet cannot be removed for examination, its Calibre can be measured by CT scanning.

The mysteries of gunpowder and its tremendous force attracted such scientists as Leonardo da Vinci, Galileo, and Isaac Newton. Firearms

operate faster than the human eye can see, and so these early researchers tried to determine the flight of projectiles. A recent development combines ballistics with DNA analysis. With DNA ammo bullets are tagged with a coded DNA sequence and are directly traceable to the purchaser.

Rifling, which first made an appearance in the 15th century, is the process of making grooves in gun barrels that imparts a spin to the projectile for increased accuracy and range. Bullets fired from rifled weapons acquire a distinct signature of grooves, scratches, and indentations which are of value for matching a fired projectile to a firearm.

The first firearms evidence identification can be traced back to England in 1835 when the unique markings on a bullet taken from a victim were matched with a bullet model belonging to the suspect when confronted with the damning evidence, the suspect confessed to the crime. Alexandre Lacassagne was the first scientist to try to match individual bullet to a gun barrel.

The first court case involving firearms evidence took place in 1902 when a specific gun was proven to be the murder weapon. The expert in the case, Oliver Wendel Holmes, had read about firearm identification, and had a gunsmith test-fire the alleged murder weapon into a wad of cotton wool. A magnifying glass was used to match the bullet from the victim with the test bullet.

SELF-ASSESSMENT EXERCISE 3

Mention three areas that modern ballistics expert emphasises as compared former experts. Discuss them briefly.

3.4 Types of Ballistics

What are the various types of ballistics? As we all know, ballistics is the science of the motion of projectiles and the conditions that influence that motion. The four major types of ballistics influencing helicopter fired weapons are interior, exterior, aerial, and terminal. Each type produces dispersion, which is the degree that projectiles vary in range and deflection about a target.

Interior Ballistics

Interior ballistics deal with characteristics that affect projectile motion inside the barrel or rocket tube. It also includes effects of propellant charges and rocket motor combustion. These characteristics affect the

accuracy of all aerial-fired weapons. Aircrews cannot compensate for these characteristics when firing free-eight projectiles. The characteristics of interior ballistics are discussed below.

- a. **Barrel Wear:** Gaseous action, propellant residue, and projectile motion wear away the barrels inner surface or cause deposits to build up. These conditions result in lower muzzle velocity, a decrease in accuracy, or both.
- b. **Propellant Charge:** Production variances can cause difference in muzzle velocity and projectile trajectory. Temperature and moisture in the storage environment can also affect the way propellants burn.
- c. **Projectile Weight:** The weight of projectiles of the same caliber may vary. The variance is most noticeable in linked-ball projectiles. The variations do not significantly influence trajectory.
- d. **Launcher Tube Alignment:** Individual rocket launcher tubes are aligned by the rocket launchers internal or end bulkhead. However, the precise alignment of each tube may vary. Because of variances in alignment, the launcher boresighting of the launcher should include checking the boresight of several tubes and selecting the one that best represents the alignment of the entire launcher
- e. **Thrust Misalignment**
 - i. A Perfectly Thrust – Aligned free-flight rocket has thrust control that passes directly through its centre of gravity during motor burn. In reality, free-flight rockets have an inherent thrust misalignment, which is the greatest cause of error in free flight. Spinning the rocket during motor burn reduces the effect of thrust misalignment.
 - ii. Firing rockets at a forward airspeed above ETL provides a favourable relative wind, which helps to counteract thrust misalignment when a rocket is fired from a hovering helicopter, the favourable relative wind is replaced by an unfavourable and turbulent downwash caused by rotor. This unfavourable relative wind results in a maximum thrust misalignment and a larger dispersion of rockets.
 - iii. Rockets spin to counteract thrust misalignment. Rockets with MK66 motors exhibit less dispersion in the target effect area than

those with MK40 motors according to data provided by Rock Island Arsenal.

Exterior Ballistics

Exterior ballistics deal with characteristics that influence the motion of the projectile as it moves along its trajectory. The trajectory is the flight-path of the projectile as it flies from the muzzle of the weapons. It has all the exterior ballistic characteristics associated with ground-fired weapons. They also have other characteristics unique to helicopters. The characteristics of exterior ballistics are discussed below.

- a. **Air Resistance:** Air resistance, or drag, is caused by friction between the air and the projectile. Drag is proportional to the cross-section area of the projectile with its velocity. The bigger and faster a projectile is, the more drag it produces.
- b. **Gravity:** The projectile's loss of altitude because of gravity is directly related to range. As range increases, the amount of gravity drops increase. This drop is proportional to time of flight (distance) and inversely proportional to the velocity of the projectile. Crew members that fire weapons without FCC solutions must correct for gravity drop.
- c. **Yaw:** Yaw is the angle between the centre line of the projectile and the trajectory. Yaw causes the projectile's trajectory to change and drag to increase. The direction of the yaw constantly changes in spinning projectile. Yaw maximises near the muzzle and gradually subsides as the projectile stabilises.
- d. **Projectile Drift:**
 - i. When viewed from the rear, most projectiles spin in a clockwise direction. Spinning projectiles act like a gyroscope and exhibit gyroscope precession. This effect causes the projectile to move to the right, which is called the horizontal plane gyroscopic effect. As the range to target increases, projectile drift increases.

ii. Aerial Ballistics

Common characteristics of aerial-fired weapons depend on whether the projectiles are spin stabilised or fin-stabilised and whether they are fired from the fixed mode or the flexible mode. Some characteristics of aerial-fired weapons are discussed below:

Rotor Downwash Error: Rotor downwash acts on the projectile as it leaves the barrel or launcher. This downwash causes the projectile's trajectory to change. A noticeable change in trajectory normally occurs when the helicopter is operating below effective translational lift. Although rotor downwash influences the accuracy of all weapons

system, it most affects the rockets. Maximum error is induced by rotor downwash when the weapon system is fired from an aircraft hovering. When the rocket passes beyond the rotor risk, air flow upward and causes the rocket to nose-dive. This air flow causes both lateral (a azimuth) and linear (range) errors.

iii. Terminal Ballistics

Terminal ballistics describes the characteristics and effects of the projectile at the target. Projectile functioning, including blast, heat and fragmentation is influenced as described below:

- a. **Impact Fuses:** Impact fuzes activate surface and subsurface burst of the warhead. The type of target engaged and its protective cover determine the best Fuze for the engagement. Engage targets on open terrain with a super quick Fuze that causes the warhead to detonate upon contact. Engage targets with overhead protection, such as fortified positions or heavy vegetation, with either a delay or forest penetration Fuze.
- b. **Remote set or Variable Time Fuzes:** Time Fuzes produce airburst and are most effective against targets with no overhead protection. Flechette, smoke, and illumination war heads incorporate a timed fuze, which depends on motor burnout. The range for this type of fuze is fixed. Remote range-set fuzes are used for high explosive, multipurpose submunition, smoke, illumination, and chaff warheads.

iv. Dispersion

If several projectiles are fired from the same weapon with the same settings in elevation and deflection, their points of impact will be scattered about the mean point of impact group of rounds. The degree of scatter (range and azimuth) of these rounds is called dispersion. The mean point of impact with respect to the target centre, or intended air point, is an indication of the weapon's accuracy. Both dispersion and accuracy determines whether a particular weapon can hit an intended target, or firing rockets at maximum ranges decreases range dispersion and normally increases accuracy. The reverse is true with other weapon system that is as range increases, dispersion increases and accuracy decreases. Dispersion is caused by errors inherent in firing projectiles. These errors are influenced, in part, by the factors such as vibrations, sights and boresight.

Vibrations: Because mounts for weapons are fixed to the helicopter, vibration in the helicopter transmits through the mounts. These

vibrations affect azimuth and elevation sights. The condition of the sights and the accuracy of their alignment with the bore axes of weapons cause a displacement of the dispersion pattern of the projectiles.

Bore sight: Proper bore sighting of aircraft weapons is critical to accurate fires; improper bore sighting is a factor in dispersion differences between aircraft.

SELF-ASSESSMENT EXERCISE 4

List the various types of Ballistics you know. Also explain dispersion in projectiles.

3.5 Ballistic Fingerprinting

Ballistic fingerprinting refers to a set of forensic techniques that rely on marks that firearms leave on bullets to match a bullet to the gun it was fired with. It is a subset of forensic ballistics (the application of ballistics to legal questions) and internal ballistics (the study of events between the firing of a gun and the bullet leaving the barrel).

Ballistic fingerprinting techniques are based on the principle that all firearms have inevitable variations due to marks left by the machining process, leaving shallow impressions in the metal which are rarely completely polished out. Also, normal wear and tear from use can cause each firearm to acquire distinct characteristics overtime. The following are some of the variations.

Gross Differences

The simplest considerations are the gross differences. A 10mm bullet, for example, could not have been fired from a 9mm barrel, nor could a 357 magnum cartridge have been fired from a 38 special revolver.

Striations

When a bullet is fired through a rifled barrel, the raised and lower spirals of the rifle are called “striations”. These can be matched with the barrel through which the bullet was fired. Examiners distinguish between striation common to all guns of a particular type (“class characteristics”) and those unique to a particular gun (“individual characteristic”). The class characteristics depend upon the type of rifling in the barrel, which varies among manufacturers and models in numbers and shape of the grooves, twist rate, and direction individual characteristics are caused by imperfections in the rifling process and tools, but also by the wear and tear caused by regular use, and can therefore change over time.

Criminals or those concerned with government intrusion in privacy sometimes attempt to alter a gun's individual characteristics by changing or shorting the barrel or by rubbing its interior with a steel brush.

Breech Markings

Marks on the cartridge case can be matched to marks in the chamber and breech. Cartridge cases are often easier to identify than bullets. There are a couple of reasons for this. First the parts of a firearm that produce marks on cartridge cases are less subject to long-term wear, and second, bullets are often severely deformed on impact, destroying much of the markings they acquire.

Shotguns

Ballistic fingerprinting of bullets does not write with firearms such as shotguns that fire shot-containing cartridges. In many cases the shot rides inside a plastic sleeve that prevents it from ever touching the barrel, and even in cases where the shot does touch the barrel the random movement of the shot down the barrel will not leave any consistent marks but shotgun cases can still be examined for firing pin marks and the like.

SELF-ASSESSMENT EXERCISE 5

Describe the techniques used in ballistic fingerprinting.

4.0 CONCLUSION

We have discussed that Ballistics is the science of how ammunitions operate; the study of ballistics can help any shooter to achieve better results from their rifle, pistol or shotgun. We also know that there are four major types of ballistics, namely interior, exterior, aerial and terminal ballistics. We also understand that, both dispersion and accuracy determine whether a particular weapon can hit an intended target. Dispersion is caused by errors inherent in firing projectiles. In addition, they may be influenced by the vibrations in the mount and condition of the sighting systems.

5.0 SUMMARY

In this unit, we have studied ballistics by looking at the following aspects: Meaning, History, Types, Basic Ballistics and Ballistic Fingerprint.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are ballistics.
2. Mention types of ballistics and discuss any two of them.
3. Why does one bullet have more 'drag' than the other?

7.0 REFERENCES/FURTHER READING

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UNIT 2 PROJECTILES

CONTENTS

- 1.0 Introduction
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1.0 INTRODUCTION

A projectile is any object that has been thrown, shot or launched, and ballistics is the study of projectile motion. Examples of projectiles range from a golf ball in flight, to a curve ball thrown by a baseball pitcher to a rocket fired into space.

The flight paths of all projectiles are affected by two factors, gravity and on earth at least, air resistance. The various issues that will be examined in this unit, so as to introduce you to the concept of projectile are the meaning/definition, properties, types and applications of projectiles.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the concept projectile
- discuss the various types of projectiles
- state the properties of projectile motion
- explain how projectiles work
- mention some applications of projectiles.

3.0 MAIN CONTENT

3.1 Meaning of Projectile

What is a projectile?

A projectile is any object propelled through space by the exertion of a force which ceases after launch. Although a thrown baseball could be

considered a projectile the word more often refers to a weapon. Arrows, darts, spears and similar weapons are fired using pure mechanical force applied by another solid object, apart from throwing without tools; mechanisms include the catapult, slingshot, and bow. Other weapons use the compression or expansion of gases as their motive force. Blowguns and pneumatic rifles use compressed gases, while most other guns are liberated by sudden chemical reactions. Light gas guns use a combination of these mechanisms. Rail guns utilise electromagnetic fields to provide a constant acceleration along the entire length of the device, greatly increasing the muzzle velocity.

Some projectiles provide propulsion during (part of) the flight by means of a rocket engine or jet engine. In military terminology, a rocket is unguided, while a missile is guided. Note the two meanings of "rocket". Many projectiles, e.g. shells, contain an explosive charge. With or without explosive charge a projectile can be designed to cause special damage, e.g. fire (early thermal weapons), or poisoning (arrow poison). Projectiles which do not contain an explosive charge are termed kinetic projectiles, kinetic penetrator. Classic kinetic energy weapons are blunt projectiles such as rocks and round shot, pointed ones such as arrows, and somewhat pointed ones such as bullets. Among projectiles which do not contain explosives are those launched from rail guns, coil guns, and mass drivers, as well as kinetic energy penetrators. All of these weapons work by attaining a high muzzle velocity, that is hypervelocity, and collide with their objectives, converting their kinetic energy into destructive shock waves and heat.

Some kinetic weapons for targeting objects in spaceflight are anti-satellite weapons and anti-ballistic missile. Since they need to attain a high velocity any way, they can destroy their target with their released kinetic energy alone. Explosives are not necessary.

Compare the energy of TNT, 4.6 MJ/kg, to the energy of a kinetic kill vehicle with a closing speed of 10 km/s, which is 50 MJ/kg. This saves costly weight and there is no detonation to be precisely timed. This method, however, requires direct contact with the target, which requires a more accurate trajectory.

A kinetic projectile can also be dropped from an aircraft. This is applied by replacing the explosive of a regular bomb e.g. by concrete, for a precision hit with less collateral damage. A typical bomb has a mass of 900kg and a speed of impact of 800km/hr (220m/s). It is also applied for training the act of dropping a bomb with explosives. This method has been used in operation Iraq Freedom and the subsequent military operations in Iraq by mating concrete-filled training bombs with JDAM GPS, guidance kits, to attack vehicles and other relative "soft" targets

located too close to civilian structures for the use of conventional high explosive bombs.

We also have wired projectiles, where some projectiles stay connected by a cable to the launch equipment after launching it:

- for guidance wired projectiles or guided missile (range up to 4000 meters).
- to administer an electric shock, as in the case of a Taser (range up to 10.6 meters), two projectiles are shot simultaneously, each with a cable.
- to make a connection with the target, either to tow it towards the launcher, as with a whaling harpoon or to draw the launcher to the target, as a grappling hook does.

A projectile or shell is a missile fired from the muzzle of a gun, it is always the projectile, whether issuing from the muzzle of a Breech-loading rifle, using separate ammunition, or from the muzzle of a Rapid-Fire Gun, using fixed, cartridge-case ammunition. Projectile for guns of and above seven inches in calibre are called major-calibre projectiles. For guns of six-inch calibre and smaller they are called minor-calibre projectiles. The charge intact to the enemy's most vulnerable point and its relative efficiency will be a measure proportional to its carrying capacity. The first projectiles used were stones thrown from slings, afterwards lead bullets were projected in the same way, arrows, from long bow, and darts javelins thrown, in very early days, ballista, and catapults were used as a species of ordinance, the former to hurl large stones, and the latter, wooden beams shod with iron and often covered with inflammable material. The projectile, as it is understood in modern times, came in with the use of gunpowder in warfare, and small-arms, it was found too soft for battering with larger guns, and stone shot being not only too light for good flight, but also deficient in tenacity and gave way to iron.

SELF-ASSESSMENT EXERCISE 1

Explain the concept of projectile.

Types of Projectiles

What are the various types of projectiles?

As earlier explained, a projectile is any object that has been thrown, shot, or launched. Examples of projectiles range from a golf ball in flight, to a curve ball thrown by a baseball pitcher to a rocket fired into space.

Projectiles can be broadly classified according to three main types. Spin-stabilised, fin-stabilised, and rocket assisted (both fin and spin-stabilised). Formal military classification is based on the intended use of the projectile and the composition of the explosive charge (i.e. antipersonnel, antitank, and incendiary). Some very significant progress in projectile design has been made in the past few years. The form of all projectiles is approximately the same, namely, that of a hollow steel cylindrical case with pointed head, having a soft metal band near the base which takes the rifling of the gun and gives the projectile the twisting motion which keeps its steady flight.

Spin-Stabilised Projectiles

Most guns in today use spin-stabilised projectiles. Spinning a projectile promotes flight stability. Spinning is obtained by firing the projectiles through a rifled tube. The projectile engages the rifling by means of a rotating band normally made of copper. The rotating band is engaged by the leads, grooves and at a nominal muzzle velocity of 2800 feet per second. The spin rate is on the order of 250 revolutions per second. Spin-stabilised projectiles are full bore (flush with the bore walls) and are limited approximately to a 5:1 length – to – diameter ratio. They perform very well at relatively low trajectories (less than 45⁰ quadrant elevation). In high trajectory applications they tend to over stabilised, i.e. maintain the angle at which they were fired and, therefore, do not follow the trajectory satisfactorily.

Fin-Stabilised Projectiles

These projectiles obtain stability through the use of fins located at the left end of the projectile. Normally, four to six fins are employed. Additional stability is obtained by imparting some spin (approximately 20 revolutions/second) to the projectile by canting the leading edge of the fins. Fin-stabilised projectiles are very often sub calibre. A sabot wood or metal fitted around the projectile is used to centre the projectile in the bore and provide a gas seal. Such projectiles vary from 10:1 to 15:1 in length –t–diameter ratio. Fin-stabilised projectiles are advantageous because they follow the trajectory very well at high-launch angles, and they can be designed with very low drag thereby increasing range and/or terminal velocity. However, fin-stabilised projectiles are disadvantageous because the extra length of the projectile must be accommodated and the payload volume is comparatively low in relation to the projectile length.

In contrast to conventional spin-stabilised projectiles which derive their in-flight stability from the gyroscopic forces resulting from the high rate of spin, the finned projectiles are stabilised during flight by aerodynamic

forces acting on the projectile. Although projectile spin does not contribute to the stabilisation of finned projectiles, a low rate of roll around the longitudinal axis is desired to minimise the adverse effects of mass and configurational asymmetries which may result from material imperfections and from manufacturing tolerances.

Fin-stabilised projectiles are ideally launched from smooth bore guns which due to the absence of rifling do not impart a rolling motion. Such weapons are installed for instance, on advanced battle tanks and commonly have calibres of 60 millimetres or more.

Commonly, fin-stabilised projectiles consist of a sub calibre penetrator and a fin assembly of four or more fins attached to the rear of the penetrator. The projectile assembly is symmetric to its longitudinal axis and is fired from the gun by means of a discarding sabot. Two important functions of the discarding sabot are to support and guide the sub calibre projectile along the centreline of the gun barrel during acceleration and to form a seal to contain the propellant gasses during travel in the barrel. The latter function is accomplished by the rotating band which engages the rifling grooves of the gun barrel and in doing so imparts spin to the projectile commensurate with the rifling twist of the barrel and the projectile muzzle velocity.

Fin-stabilised projectiles reflecting the current state of the art incorporate a sliding seat between the rotating band and the sabot body. The sliding seat is designed such as to reduce by approximately 70 to 90 percent the amount of spin transmitted from the rotating band, which picks up the full spin, to the sabot body. The degree of spin transmission within the seat of the rotating band is determined by sliding friction. Thus, upon exit from the muzzle of the gun the fin-stabilised projectile has a rate of spin equal to approximately 10 to 30 percent of that of a spin-stabilised projectile launched at the same muzzle velocity.

There are two problem areas encountered with this method of firing fin-stabilised projectiles from a rifled cannon. Firstly it is difficult to control the spin reduction in the sliding seat with a degree of repeatability necessary to assure acceptable projectile accuracy over the entire range of operating conditions specified for military employment. Variation in projectile temperature from 40⁰ to +60^{0c} changes in humidity finite manufacturing tolerances, contamination by dust, salt and other substances entering between the rotating band and its seat, etc. influence the friction coefficient in the band seat and with it the degree of spin transmission.

Secondly, centrifugal forces acting on sabot components are very effective in initiating the instantaneous and symmetric separation of the

sabot from the penetrator upon exists from the muzzle of the gun. With reduced projectile spin the centrifugal forces acting on the sabot components are reduced by the square of the spin ratio. As a result, the sabot separation is neither as rapid nor as precise as with a non - slipping rotating band and is increasingly more dependent on aerodynamic forces.

The access of aerodynamic forces to the projectile is delayed by the influx of high velocity propellant gases upon exit of the projectile from the muzzle of the gun. The temporal reverse flow field occurs only upon entering into the ambient air. This occurs at a range of approximately 30 calibres from the muzzle, when the aerodynamic forces become fully effective. The magnitude of the separation is only a fraction of the centrifugal forces available when launching at full spin and therefore a considerably more fragile sabot construction is required to assure its fracture and separation. In addition, because of size limitations of ammunition of calibres up to 40 millimetres, the physical dimensions of sliding rotating bands, inclusive of their seats, are small, thus resulting in rather delicate and vulnerable components. In contrast, utilisation of a non-sliding rotation band allows for the use of a stronger sabot which is advantageous when employed from high rate of fire cannons and their correspondingly high structural loads during feeding and ramming.

Fin-stabilised projectiles equipped with discarding sabots incorporating slipping rotating bands experience considerable variations in spin rate at exit from the muzzle due to elevations in the friction coefficient within the sliding seat of the band. As a result the subsequent acceleration or deceleration of the projectile spin may result in conditions where the spin rate is equal to the notation frequency of the projectile and resonance instability will occur. The lower projectile spin rate at muzzle exit and consequent reduction in centrifugal forces acting on the sabot decrease the rapidly and symmetry of the discard of the sabot components and therewith result in increased projectile dispersion.

Sabot

What is a sabot and its influence on projectiles?

A sabot is a lightweight carrier used both to position a missile or sub calibre projectile inside a gun tube and to transmit energy from the propellant to the projectile. The sabot works much like a person throwing a dart, where the thrower's arm movement acts as both the propellant-driving gas and the sabot's energy gathering pusher.

In general, guns operate with a fixed mass to be propelled out of the gun's tube. The sabot is necessary to transfer propellant energy but is a

parasitic weight in terms of projectile target performance. Reducing the sabot's weight allows greater projectile velocity. The weapons thus penetrate deeper with more lethal results. But materials used to fabricate sabots can only be as lightweight as they are strong enough to withstand great pressures and loads during gun-tube acceleration.

Rocket-Assisted Projectiles

There are two main reasons for developing rocket-assisted projectiles (1) to extend the range over standard gun systems, and (2) to allow for lighter mount and barrel design and reduce excessive muzzle flash and smoke the recoil and setback forces of standard gun systems. Since the ranges are different, the above two objectives represent opposite approaches in the development of rocket-assisted projectiles. Normally, one or the other establishes the performance of the rocket-assisted projectile under development although the two approaches may be established by the design objectives.

SELF-ASSESSMENT EXERCISE 2

List the types of projectiles. What advantages does fin-stabilised projectile have over other types of projectiles?

Properties of Projectiles

Projectiles or objects experiencing projectile motion have the following common characteristics: All have a constant velocity in the horizontal direction, and a constantly changing velocity in the vertical direction. Also the trajectory resulting from this combination always has the shape of a parabola.

For example, if we throw a green-ball and a red-ball, and a blue-ball, the green-ball will illustrate constant velocity in the x-direction, the red-ball illustrates constant acceleration from gravity in the negative y-direction. The blue-ball illustrates projectile motion, its y-coordinate at any time is the same as the x-coordinate of the green-ball, and its y-coordinate at any time is the same as the y-coordinate of the red-ball. Note that the trajectory is always a parabola.

As mentioned above, the time required for an object to complete its motion is the same whether you consider the y-direction or the x-direction. This has an interesting implication for projectile motion, particularly if the initial velocity is zero. The time required for initially horizontal projectile motion to occur is the same as the time required for the object to fall to its final height. Thus, a ball thrown horizontally will reach the ground at the same time as a ball dropped from the same height.

SELF-ASSESSMENT EXERCISE 3

Mention two properties of projectiles in motion.

Applications of Projectiles

One of the first things people think of when they hear the word “projectile” or “ballistics” is the study of gunfire patterns for the purposes of crime-solving. Indeed this application of ballistics or projectile is a significant part of police science, because it allows law-enforcement investigators to determine when, where, and how a firearm was used. In a larger sense, however, the term as applied to firearms refers to efforts towards creating a more effective, predictable, and longer bullet trajectory.

From the advent of firearms in the west during the 14th century until about 1500, muskets were hopelessly unreliable. This was because the lead balls they fired had not been fitted to the barrel of the musket. When fired, they bounced erratically off the sides of the barrel, and this made their trajectories unpredictable. Compounding this was the unevenness themselves, and this irregularity of shape could lead to even greater irregularities in trajectory.

Around 1500, however, the first true rifles appeared, and these greatly enhanced the accuracy of firearms. The term rifle comes from the “rifling” of the musket barrels: that is the barrels themselves were engraved with grooves, a process known as rifling.

Despite these improvements, soldiers over the next three centuries still faced many challenges when firing lead balls from rifled barrels. The lead balls themselves, because they were made of a soft material, tended to become misshapen during the loading process. Furthermore, the gunpowder that propelled the lead balls had a tendency to clog the fact that these rifles took time to load and in a situation of battle, this could cost a man his life. The first significant change came in the 1840s, when in place of lead balls, armies began using bullets. The difference in shape greatly improved the response of rounds to aerodynamic factors.

Finally, Claude-Etienne Minis, a captain in the French army developed a bullet made of lead, but with a base that was slightly hollow. Thus, when fired, the lead in the round tended to expand, filling the barrel’s diameter and gripping the rifling. As a result, the round came out of the barrel and spinning, and continued to spin throughout its flight not only were soldiers able to fire their rifles with much accuracy, but thanks to the developments of chambers and magazines, they would reload more quickly.

The most complex form of projectile widely known in modern life is the rocket or missile. Missiles are unmanned vehicles, most often used on warfare to direct some form of explosive toward an enemy. Rockets, on the other hand, can be manned or unmanned, and may be propulsion vehicles for missiles or for spacecraft. The term rocket can refer either to the engine or to the vehicle it propels.

4.0 CONCLUSION

We have explained that a projectile is any object propelled through space by the exertion of a force which ceases after launch. Also objects experiencing projectile motion have a constant velocity in the vertical direction. We were also made to understand that projectiles can be broadly classified according to three main types: Spin-stabilised, fin-stabilised and rocket assisted. Application of projectiles and ballistics is a significant part of police science, because it allows law-enforcement investigators to determine when, where, and how a firearm was used.

5.0 SUMMARY

In this unit, we have discussed the concept of projectile by looking at the following areas: Meaning of projectile, types, properties and application of projectiles.

6.0 TUTOR-MARKED ASSIGNMENT

1. Explain the meaning of projectile.
2. List the types of projectiles and discuss any two mentioned.
3. State two properties of projectile motion.

7.0 REFERENCES/FURTHER READING

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UNIT 3 EXPLOSIVES

CONTENTS

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- 2.0 Objectives
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1.0 INTRODUCTION

An explosive material is a substance that contains a great amount of stored energy that can produce an explosion, a sudden expansion of the material after initiation, usually accompanied by the production of light, heat and pressure. An explosive charge is a measured quantity of explosive material. It is also a substance, especially a prepared chemical, which explodes or causes explosion. The various issues that will be examined in this unit introduce the following: definition, properties, types, classification and the many uses of explosives.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the term explosives
- explain types of explosives
- discuss the characteristics of explosives
- list the compatible class of explosives
- state the uses of explosives
- state the conditions that makes a material explosive.

3.0 MAIN CONTENT

3.1 Definition of Explosives

What are Explosives?

An explosive material, also called an explosive, is a substance that contains a great amount of stored energy that can produce an explosion, a sudden expansion of the material after initiation, usually accompanied by the production of light, heat and pressure. An explosive charge is a measured quantity of explosive material. The energy stored in an explosive material may be:

- chemical energy, such as nitroglycerine or grain dust
- pressurised, compressed gas, such as a gas cylinder or aerosol can
- nuclear, such as fissile isotopes of uranium 235 and plutonium – 239.

Explosive materials may be categorised by the speed at which they expand. Materials that detonate (explode faster than the speed of sound) are said to be high explosive and materials that deflagrate are said to be low explosives. Explosives may also be categorised by their sensitivity. Sensitive materials that can be initiated by a relatively small amount of heat or pressure are primary explosives and materials that are relatively insensitive are secondary explosives.

There are different reasons and conditions that make a material explosive. Explosive material is often classified by the type of reaction that takes place

Chemical

Chemical explosives are substances that undergo or contain a large amount of energy stored in chemical bonds. Explosives are classified as low or high explosive according to their rates of burn: low explosives detonate. While these definitions are distinct, the problem of precisely measuring rapid decomposition makes practical classification of explosives difficult.

Decomposition

The chemical decomposition of an explosive may take years, days, hours, or a fraction of a second. The slower processes of decomposition take place in storage and are of interest only from a stability stand point. If more interest are the two rapid forms of decomposition, deflagration and detonation.

Deflagration

In deflagration, the decomposition of the explosive material is propagated by a flame front, which moves slowly through the explosive material in contrast to detonation. Deflagration is a characteristic of low explosive material

Detonation

Detonation is used to describe an explosive phenomenon whereby the explosive shockwave traverse the explosive material. The shockwave front is capable of passing through the high explosive material at great speeds, typically thousands of meters per second.

Mechanical

In addition to chemical explosives, there exist varieties of more exotic explosive materials, and theoretical methods of causing explosions. Examples include nuclear explosives, antimatter, and abruptly heating a substance to a plasma state with a high-intensity laser or electric arc.

Unlike other chemicals, most explosives detonate rather than burn. A detonation is a very rapid chemical reaction using oxygen that is contained in the material rather than in the air. In a detonation, the chemical reaction releases gases that rapidly expand and give off energy as they become hot. It should be noted that the development of new and improved types of ammunition requires a continuous programme of research and development. Adoption of an explosive for a particular use is based upon both proving ground and service tests.

SELF-ASSESSMENT EXERCISE 1

What are explosive materials? Describe their innate qualities.

3.2 Types of Explosives

What are the various types of explosives?

Explosives are chemicals and, like all chemicals, should be treated safely and with respect. Unlike other chemicals, most explosives detonate rather than burn. A detonation is a very rapid chemical reaction using oxygen that is contained in the material rather than in the air. In a detonation, the chemical reaction releases gases that rapidly expand and give off energy as they become hot.

Explosives are categorised into primary, secondary, high and low explosives.

Primary Explosive

A primary explosive is an explosive that is extremely sensitive to stimuli such as impact, friction, heat, static electricity, or electromagnetic radiation. A relatively small amount of energy is required for initiation. As a very general rule, primary explosives are considered to be those compounds that are more sensitive than PETN. As a practical measure, primary explosives are sufficiently sensitive that they can be reliably initiated with a blow from a hammer, however, PETN can usually be initiated in this manner, so this is only a very broad guideline. Additionally, several compounds, such as nitrogen tri-iodide, are so sensitive that they cannot even be handled without detonating.

Primary explosives are often used as detonators or to trigger larger charges of less sensitive secondary explosives. Primary explosives are commonly used in blasting caps to translate a signal (electrical, shock, or in the case of laser detonation systems, light) into an action, ie an explosion, a small quantity-larger charge of explosive that is usually safer to handle.

Examples of primary high explosives are:

- Acetone Peroxide
- Ammonium permanganate
- Hexamethylene triperoxide diamine
- Lead azide
- Lead styphnate
- Lead picrate
- Mercury fulminate
- Nitrogen trichloride
- Nitroglycerin
- Silver acetylide
- Silver fulminate
- Sodium azide
- Tetacene
- Tetraamine copper II complexes
- Diazodinitrophenol
- Azo-clathrates
- Tetrazoles
- Copper acetylide

Secondary Explosive

A secondary explosive is less sensitive than primary explosive and require substantially more energy to be initiated. Because they are less sensitive they are usable in a wider variety of applications and are safer to handle and store. Secondary explosives are used in larger quantities in an explosive train and are usually initiated by a smaller quantity of a primary explosive. Examples of secondary explosives include TNT and RDX.

Low Explosives

Low explosives are compounds where the rate of decomposition proceeds through the material at less than the speed of sound. The decomposition is propagated by a flame front (deflagration) which travels much more slowly through the explosive material than a shock wave of a high explosive. Under normal conditions, low explosives undergo deflagration at rates that vary from a few centimetres per second to approximately 400 meters per second. It is possible for them to deflagrate very quickly, producing an effect similar to a detonation. This can happen under higher pressure and temperature, which usually occurs when ignited in a confined space.

A low explosive is usually a mixture of a combustible substance and an oxidant that decomposes rapidly (deflagration), however they burn slower than a high explosive which has an extremely fast burn rate. For many years, black powder was the most common low explosive used throughout the world. But black powder or gun powder as it was commonly called, produced a large amount of smoke and was dangerous to use. Today black powder is still used for pyrotechnics (fireworks), special effects, and other specialised works, but it has been replaced in commercial blasting by safer, more productive materials.

High Explosives

High explosives are explosive materials that detonate, meaning that the explosive shock front passes through the material at a supersonic speed. High explosives detonate with explosive velocity rates ranging from 3,000 to 9,000 meters per second. They are normally employed in mining, demolition, and military applications. They can be divided into two explosive classes differentiated by sensitivity: Primary Explosive and Secondary Explosive. The term high explosive is in contrast to the term low explosive, which explodes (deflagrates) at a slower rate.

High explosives create more pressure and burn more quickly, detonating almost instantaneously. The proper use of high explosive by today's

explosives engineer, produces minimal ground vibrations and air overpressure. The first high explosive used in commercial blasting was nitroglycerine, also called “blasting 001” Nitroglycerine was dangerous to use because it is an unstable chemical. But in the late 1800’s a Swedish chemist, named Alfred Nobel, invented dynamite by mixing nitroglycerine with a special clay, called kieselgur, and packed it into stocks. Dynamite became the first safe high explosive used. It can be dropped, hit with a hammer or even burned and will accidentally explode. There are a number of different types of dynamites being used today, all containing nitroglycerine.

SELF-ASSESSMENT EXERCISE 2

Differentiate between Primary and Secondary Explosives, High and Low Explosives

3.2 Properties of Explosives Materials

To determine the suitability of an explosive substance for a particular use, its physical properties must first be investigated. The usefulness of an explosive can only be appreciated when the properties and the factors affecting them are fully understood. Some of the more important characteristics are discussed below:

Availability and Cost

Availability and cost of explosives is determined by the availability of the raw materials and the cost, complexity, and safety of the manufacturing operations.

Sensitivity

Regarding an explosive, this refers to the ease with which it can be ignited or detonated – i.e., the amount and intensity of shock, friction, or heat that is required. When the term sensitivity is used, care must be taken to clarify what kind of sensitivity is under discussion. The relative sensitivity of a given explosive to impact may vary greatly from its sensitivity to friction or heat. Sensitivity is an important consideration in selecting an explosive for a particular purpose. The explosive in an armor-piercing projectile must be relatively insensitive, or the shock of impact would cause it to detonate before it penetrates to the desired point. The explosive lenses around nuclear charges are also designed to be highly insensitive to minimise the risk of accidental detonation.

Velocity of Detonation

Is the velocity with which the reaction process propagates in the mass of the explosive. Most commercial mining explosives have detonation velocities ranging from 1800m/s to 8000m/s. Today, velocity of detonation can be measured with accuracy.

Stability

Chemical stability is the ability of an explosive to be stored without deterioration. The following factors affect the stability of an explosive:

Chemical Constitution

The very fact that some common chemical compounds can undergo explosion when heated indicates that there is something unstable in their structures.

Temperature of Storage

The rate of decomposition of explosives increases at higher temperatures. All of the standard military explosives may be considered to have a high degree of stability at temperatures of -10 to +35⁰c, but each has a high temperature at which the rate of decomposition rapidly accelerates and stability is reduced. Most explosives become dangerously unstable at temperatures exceeding 70⁰c.

Exposure to Sun

If exposed to the ultra violet rays of the sun, many explosive compounds that contain nitrogen groups will rapidly decompose, affecting their stability.

Electrical Discharge

Electrostatic or spark sensitivity to initiation is common to a number of explosive. Static or other electrical discharge may be sufficient to inspire detonation under some circumstances. As a result, the safe handling of explosives and Pyrotechnics almost always requires electrical grounding of the operator.

Power

The term power or performance as applied to an explosive refers to its ability to do work. In practice it is defined as the explosive's ability to accomplish what is intended in the way of energy delivery (i.e. fragment

projection, air blast, high-velocity jets, underwater shock and bubbles energy, etc.) explosive power or performance is evaluated by a tailored series of test to assess the material for its intended use.

Brisance

In addition to strength, explosives display a second characteristic, which is their shattering effect or brisance (from the French meaning to “break”) which is distinguished from their total work capacity. As exploding prepared tank may release more chemical energy than that of nitroglycerine, but the tank would probably fragment into large pieces of twisted metal, while a metal casing around the nitroglycerine would be pulverised. This characteristic is of practical importance in determining the effectiveness of an explosion in fragmenting shells, bomb casings, grenades, and the like. The rapidity with which explosive reaches its peak pressure (power) is a measure of its brisance. Brisance values are primarily employed in France and Russia.

Density

Density of loading refers to the mass of an explosive per unit volume. Second methods of loading are available; including pallet loading, cast loading, and press loading, the one used is determined by the characteristics of the explosive. Increased load density also permits the use of more explosive, thereby increasing the power of the warhead. It is possible to compress an explosive beyond a point of sensitivity, known also as “dead-pressing” in which the material is no longer capable of being reliably initiated, if at all.

Volatility

Volatility is the readiness with which a substance vapourises. Excessive volatility often results in the development of pressure within rounds of ammunition and separation of mixtures into their constituents. Volatility affects the chemical composition of the explosive such that marked reduction in stability may occur, which results in an increase in the danger of handling.

Hygroscopicity and Water Resistance

The introduction of water into explosive is highly undesirable since it reduces the sensitivity, strength and velocity of detonation of the explosive. Hygroscopicity is used as measure of a material’s moisture-absorbing tendencies. Moisture affects explosives adversely by acting as an inert material that absorbs heat when vaporised, and by acting as a solvent medium that can cause undesired chemical reactions. Sensitivity

strength and velocity of detonation are reduced by inert materials that reduce the continuity of the explosive mass, when the moisture content evaporates during detonation, cooling occurs, which reduces the temperature of reaction. Stability is also affected by the presence of moisture since moisture promotes decomposition of the explosive and, in addition, causes corrosion of the explosive's metal container. Explosives considerably differ from one another as to their behaviour in the presence of water. Gelatin dynamites containing nitroglycerine have a degree of water resistance. Explosives based on ammonium nitrate have little or no water resistance.

Toxicity

Due to their chemical structure, most explosives are toxic to some extent. Explosive product gases can also be toxic.

Explosive Train

Another property of explosive material is where it exists in the explosive train of the device or system. An example of this is a pyrotechnic lead igniting a booster, which causes the main charge to detonate.

Oxygen Balance (OB%)

Oxygen balance is an expression that is used to indicate the degree to which an explosive can be oxidised. If an explosive material contains just enough oxygen to convert all of its carbon to carbon dioxide, all of its hydrogen to water, and all of its metal to metal oxide with no excess, the molecule is said to have a zero oxygen balance. The molecule is said to have a positive oxygen balance if it contains more oxygen than is needed and a negative oxygen balance if it contains less oxygen than is needed. The sensitivity, strength and brisance of an explosive are all somewhat dependent upon oxygen balance and tend to approach their maximum as oxygen balance approaches zero

Chemical Composition

A chemical explosive may consist of either a chemically pure compound, such as nitroglycerine, or a mixture of a fuel and an oxidiser, such as black powder or grain dust and air. Some chemical compounds are unstable in that, when shocked, they react, possibly to the point of detonation. Each molecule of the compound dissociates into two or more new molecules (generally gases) with the release of energy.

- **Nitroglycerine:** A highly unstable and sensitive liquid.
- **Acetone Peroxide:** A very unstable white organic peroxide.

- **TNT:** Yellow insensitive crystals that can be melted and cast without detonation.
- **Nitrocellulose:** A nitrated polymer which can be a high or low explosive depending on nitration level and conditions.
- **RDX, PETN, HMX:** Very powerful explosives which can be used pure or in plastic explosives.

The above composition may describe the majority of the explosive material, but a practical explosive will often include small percentages of other materials. For example, dynamite is a mixture of highly sensitive nitroglycerine with sawdust, powdered silica, or most commonly diatomaceous earth, which acts as stabilisers. Plastic and polymers may be added to bind powders of explosive compounds, waxes may be incorporated to make them safe to handle, and aluminium powder may be introduced to increase total energy and blasts effects.

SELF-ASSESSMENT EXERCISE 3

List and discuss some properties of explosive materials or explosives.

3.3 Classification of Explosives

Shipping Label Classifications

Shipping labels and tags may include both United Nations and national markings.

United Nations markings include numbered Hazard class and Division (HC/D) codes and alphabetic compatibility group codes. Though the two are related, they are separate and distinct. Any compatibility group designator can be assigned to any Hazard class and Division. An example of this hybrid marking would be a consumer firework, which is labelled as 1.4G or 1.4S.

United Nations Organisation (UNO) Hazard class and Division (HC/D)

Explosives warning signal

The Hazard class and Division (HC/D) is a numeric designator within a hazard class indicating the character, predominance of associated hazards, and potential for causing personnel casualties and property damage. It is an intentionally accepted system that communicates the primary hazard associated with a substance using the minimum amount of markings.

Listed below are the Divisions for class 1 (Explosives)

1. Mass Detonation Hazard: with HC/D 1:1, it is expected that if one item in a container or pallet inadvertently detonates, the explosion will sympathetically detonate the surrounding items. The explosion could propagate to all or the majority of the items stored together causing a mass detonation. There will also be fragments from the item's casing and/or structures in the blast area.
2. Non-mass Explosive, Fragment-producing: HC/D 1.2 is further divided into three subdivisions, HC/D 1.2.1, 1.2.2 and 1.2.3, to account for the magnitude of the effects of an explosion.
3. Mass fires, minor blast or fragment hazard, propellants and many of the pyrotechnic items fall into this category. If one item in a package or stack initiates, it will usually propagate to the other items creating a mass fire.
4. Molecule fire or blast or fragment HC/D 1.4 items are listed in the table as explosives with no significant hazard. Most small arms and some pyrotechnics items fall into this category. Items that inadvertently initiate most of the energy and fragments, will be contained within the storage structure.
5. Mass detonation hazard, very insensitive.
6. Detonation hazard without mass detonation hazard, extremely insensitive.

Class 1 Compatibility Group

Compatibility group codes are used to indicate storage compatibility for HC/D class 1 (explosive) materials. Letters are used to designate 13 compatibility groups as follows:

- a. Primary explosive substance (1.1A)
- b. An article containing a primary explosive substance and not containing two or more effective protective features. Some articles such as detonator assemblies for blasting and primers, cap-type, are included (1:1B, 2B, 1:4B).
- c. Propellant explosive substance or other deflagrating explosive substance or article containing such explosive substance (1:1C, 1:2C, 1:3C, 1:4C): These are bulk propellants with or without means of ignition.
- d. Secondary detonating explosive substance or black powder or article containing a secondary detonating explosive substance, in each case without means of initiation and without a propelling charge, or article containing two or more effective protection features (1:1D, 1:2D, 1:4D, 1:5D).

- e. Article containing a secondary detonating explosive substance without means of initiation, with a propelling charge (other than one containing flammable liquid, gel or hypergolic liquid) (1:1E, 1:2E, 1:4E).
- f. Containing a secondary detonating explosive substance with its means of initiation, with a propelling charge (other than one containing flammable liquid, gel or hypergolic liquid) or without a propelling charge (1:1F, 1:2F, 1:3F,1:4F).
- g. Pyrotechnic substance or article containing a pyrotechnic substance or article containing both an explosive substance and an illuminating, incendiary, tear-producing or smoke-producing substance (other than a water-activated article or one containing white phosphorus, phosphide or flammable liquid or gel or hypergolic liquid) (1:1G, 1:2G, 1:3G, 1:4G). Examples include flares, signals, incendiary or illuminating ammunition and other smoke and tear producing devices.
- h. Article containing both an explosive substance and white phosphorus (1:2H, 1:3H). These articles will spontaneously combust when exposed to the atmosphere.
- i. Article containing both an explosive substance and flammable liquid or gels (1:1J, 1:2J, 1:3J): This excludes liquids or gels which are spontaneously flammable when exposed to water or the atmosphere, which belong in group.
- j. Examples include liquid or gel filled incendiary ammunition, fuel-air explosives.
- k. Article containing both an explosive substance and a toxic chemical agent 91:3K, 1:3K).
- l. Explosive substance and presenting a special risk (e.g., due to water-activation or pressure of hypergolic liquids, phosphides) needing isolation of each type (1:1L, 1:2L, 1:3L). Damaged or suspect ammunition of any group belongs in this group.
- m. Articles containing only extremely insensitive detonating substance (1.6M).
- n. Substance or article so packed or designed that any hazardous effects arising from accidental functioning are limited to the extent that they do not significantly hinder or prohibit fire fighting or other emergency response efforts in the immediate vicinity of the package (1:4N).

It should be noted that explosives usually have less potential energy than petroleum fuels, but their high rate of energy release produces a great blast pressure. TNT has a detonation velocity of 6,950m/s compared to 1,680m/s for the detonation of a pantone-air mixture, and the 0.33m/s stiochimetric flame speed of gasoline combustion in air.

The properties of the explosive indicate the class into which it falls. In some cases explosives can be made to fall into either class by the conditions under which they are initiated. In sufficiently large quantities, almost all low explosives can undergo a Deflagration to Detonation Transition (DDT). For convenience, low and high explosives may be differentiated by the shipping and storage classes.

SELF-ASSESSMENT EXERCISE 4

Attempt to classify explosives based on their compatibility.

3.3 Uses of Explosives

What are the various uses of explosives?

Many people know that explosive are used in Mining, Building Demolition, Pyrotechnic and even construction, many would be surprised to know about some of the unusual uses of explosives. Did you know that explosives were used to carve Mount Rushmore? Explosives are also used to control Avalanches and Maintenance. Explosives are even used in medicine to break-up kidney stones!

In the United States, explosives are primarily used in Mining, Quarrying and construction as shown below:

- Nationwide Explosive Use Coal Mining 67%
- Non-metal mines and quarries 14%
- Metal mining 10%
- Construction 7% and Miscellaneous 3%

Other uses of explosives include the following:

- Aerospace – As in ejector seats and separation devices for rocket Boosters
- Agriculture – Farmers use explosives to break up boulders, blow tree stumps, felling trees and loosening soil
- Aggregate Blasting
- Art – As in metal clad art and large projects such as mountain carving
- Automotive Restraint Systems – To inflate Airbags
- Avalanche Control
- Coal Blasting
- Commercial and Industrial Products – Door systems, for example construction, Demilitarisation work
- Implosion

- Demolition – The quantities of explosive used on this type of operations vary, depending on the size, construction and location, of the structure to be demolished whether it be Bridges, Building, Chimneys or Towers
- Diamond Manufacturing – jewellery grade and very fine industrial-type diamonds used for grinding and polishing are produced by the carefully controlled action of explosives on carbon
- Emergencies at Sea – Project lifeline to ships in distress off storm-beaten shores
- Excavation – to dig foundations and clear underwater channels/dredging
- Fire Fighting – Along fire paths to cut off oxygen to a large fire and to extinguish oil well fires
- Food preparation –meat tenderizing
- Forestry – Trail Blazing
- Hazardous wastes – For destruction of some hazardous waste materials
- Ice Jams
- Law Enforcement and Security – Used on Exploding Dye capsules and other security systems
- Logging – for cutting and removing timber
- Manufacturing - Man-made diamonds
- Medical Uses – Medicines, fracturing kidney and gall stones
- Metal working – Hardening of metals – including railway frogs, hardening of crusher wear parts, shovel teeth, ripper shanks, and specially wear components such as striker bars and pates for mills
- Metal –cladding – Explosives are sometimes used to bond various metals to each other
- Mining and Quarrying _ Explosives are used to break up rock and displace large quantities of earth
- Nail guns
- Oil Well Perforation
- Pile Driving – When pile drivers are not available, exploding dynamite on an iron plate placed on top of the piles can do their work
- Pyrotechnics – Display fireworks, theatrical special effects
- Quarrying
- Rail Roads – Hardening and removing track parts
- Riveting - Blind rivets are needed when space limitations make conventional rivets impractical. Explosive riveting is an engineering practice
- Rocketry
- Seismic Exploration
- Signal lights

- Soil Compaction - For large-scale construction projects, soil compaction is often accomplished with the use of explosives
- Sport Shooting – Gunpowder (black powder and smokeless powder) is used for shooting purposes such as muzzle-loading handguns and rifles, or events where re-enactments of historical battles involve the use of muzzle-loading muskets and cannon.
- Tools – Hand tools
- Tunnelling
- Welding – Explosives jigs are often used to weld large diameter pipelines

SELF-ASSESSMENT EXERCISE 5

Enumerate the various uses of explosive known to you.

4.0 CONCLUSION

We have discussed the concept explosives, and come to a conclusion that an explosive is a substance that contains a great amount of stored energy that can produce an explosion if ignited. Or a sudden expansion of the material after initiation, usually accompanied by the production of light, heat and pressure. We learnt also that explosives are categorised into primary and secondary explosives, high and low explosives and various properties of explosives are being exhibited like sensitivity, power, Brisance, density, volatility and hygroscopicity. We also studied that explosives are classified based on Hazard class and compatibility groups. Various uses of explosives are also enumerated which include excavation, coal blasting, demolition, seismic exploration, metalworking, and others.

5.0 SUMMARY

In this unit we have discussed explosives by looking at the following areas: definition, types, properties, classifications and many uses of explosives.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define the concept “explosive material.”
2. List the various uses of explosives.
3. Discuss two major types of explosive material.

7.0 REFERENCES/FURTHER READING

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UNIT 4 LANDMINES

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- 2.0 Objectives
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1.0 INTRODUCTION

One of the most deadly legacies of the 20th century is the use of landmines in warfare. Antipersonnel landmines continue to have tragic, unintended consequences years after by and even when the entire war has ended. Even by those who planted them. These mines continue to be functional for many decades, causing further damage, injury and death. A landmine is usually a victim-triggered explosive device which is intended to damage its target via blast and or fragments. The various areas that will be examined in this unit that will introduce you to landmines are the meaning, types, laying of mines, demining, impact and uses of mine.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the concept “landmine”
- list and describe the types of landmines
- differentiate between laying of mines and demining
- discuss the impact of landmines
- state the various uses of landmines.

3.0 MAIN CONTENT

3.1 Meaning of Landmine

What are the meanings of mines and landmine?

The word 'mine' is derived from the Latin word *Mina* which means 'vain of ore' and was originally applied to the excavation of minerals from the earth. The term was then borrowed by military engineers, whose job was to dig landmines in the ground during sieges.

A landmine is usually a victim-triggered explosive device which is intended to damage its target via blast. The name originates from the practice of mining, where tunnels were dug under enemy fortifications or forces. These tunnels ('mine') were first collapsed to destroy fortification above and later filled with explosives and detonated landmines generally refer to device specifically manufactured for this purpose as distinguished from improved explosive devices. Landmines are basically explosive devices that are designed to explode when triggered by pressure or a trip wire. These devices are typically found on or just below the surface of the ground. The purpose of mines when used by armed forces is to disable any person or vehicle that comes into contact with it by an explosion or fragments released at high speeds. These are containers of explosive material with detonating systems that are triggered by contact with a person or vehicle. They are designed to incapacitate that person or vehicle through damage caused by an explosive blast and metal fragments. Military advantages are gained from taking out of action another 3 able bodied soldiers to carry the injured one, as this lowers the moral of the enemies as they are forced to listen to their comrade(s) screaming in pain.

What makes anti-personnel mines so abhorrent is the fact that they are designed to maim and not to kill as well as the indiscriminate nature it selects victims. Antipersonnel mines cannot distinguish between the footfall of a soldier and that of a child. Unlike bullets and artillery shells, mines are not aimed, as persons or animals triggers their detonating mechanism and are often laid in triangular groups of 3 or more. If a mine is laid properly it should be impossible to tell, it is there or not. Most mine fields are unmarked and so there are often few clues to show that it is a mined area. An unsuspecting passer-by may have no idea that there is a danger until it is too late.

Warring groups use landmines to defend positions as it provides a first warning signal of advancing enemy. Landmines are often used to prevent people and vehicles from moving through certain areas, and to channel them onto certain routes from which they cannot deviate. The most common use of mines on civil conflicts is to protect economic and

social targets such as bridges, dams, oil, gas and water pipelines and rail road station from attack or sabotage by the enemy.

Increasingly over the last two decades, landmines have come to serve not only as military weapons but also as political weapons. Many parties to civil conflicts have sought to instil a sense of dissatisfaction and chaos in the civilian population.

Large tracts of agricultural land are rendered unusable, wreaking environmental and economic devastation. Refugees returning to rebuild their lives in war-ravaged countries face the deadly landmine obstacle. Landmines are now a daily threat in Afghanistan, Angola, Bosnia, Cambodia, Croatia, Iraq, Mozambique, Nicaragua, Somalia and dozens of other countries.

In addition, by laying mines in agricultural fields and plantations, around irrigation systems, in forests necessary for firewood, and in villages themselves, groups of combatants have succeeded in driving large numbers of civilians out of rural areas and into large cities and towns, adding enormously to the social and economic burdens of those in control of the cities. In some places, such as Cambodia, mines are even used by civilians as a way to make a living; scrap metal collection; fishing and to protect their property.

Landmines are indiscriminate weapons by nature – they do not distinguish between a soldier's footstep and a child's footstep. Their toll on mine-affected communities is devastating and the consequences of their use are felt years after hostilities ceased "once peace is declared the landmine does not recognise that peace", says Jody Williams. "The landmine is eternally prepared to take victims. Landmine victims suffer debilitating physical and emotional injuries, victims, families and communities are plagued by psychological and economic burdens.

Traditionally, antipersonnel landmines were used for military defense purposes, but increasingly they are used as offensive weapons. They are designed to target civilian populations, disrupt people's lives, and displace entire communities from their homes and agricultural bases. Their purpose is to inflict maximum harm on victims and to a state of military, political, social and economic imbalance in war-torn societies.

SELF-ASSESSMENT EXERCISE 1

What are landmines? Discuss its effects.

3.2 Types of Landmines

How many types of mines are known?

There are two major types of mines classified as contact mines and influenced mines:

Contact Mines

The earliest mines were usually of this type. They are still used today, as they are extremely low cost compared to any other anti-ship weapon and are effective, both as a terror weapon and to sink enemy ships. Contact mines need to be touched by the target before they detonate, limiting the damage to the direct effects of the explosion and usually affecting only the single vessel that triggers them.

Early mines had mechanical mechanisms to detonate them, but these were superseded in the 1870's by the Hertz Horn (or chemical horn), which mine had been in the sea for several years. The mines upper half is studded with hollow lead protuberance, each containing a glass vial filled with sulphuric acid. When a ship's hull crushes the metal horn, it cracks the vial inside it, allowing the acid to run down a tube and into a lead-acid battery which until then contains no acid, detonates into Limpet mine, moored contact mines, drifting, bottom and remotely controlled mines.

Limpet Mines

Limpet mines are a special form of contact mine which are attached to the target by magnets, and are so named because of the superficial similarity to the limpet, a mollusc

Moored Contact Mines

Generally, this mine type is set to float just below the surface of the water or as deep as five meters, a steel cable connecting the mine to an anchor on the seabed to prevent it from drifting away. The explosive and detonating mechanism is contained in a buoyant metal or plastic shell. The depth below surface at which the mine floats can be set so that only deep draft vessels such as aircraft carriers, battleships or large cargo ships are at risk, saving the mine from being used on a less valuable target. In littoral waters it is important to ensure that the mine does not become visible when the sea level falls at low tide, so the preset cable length is adjusted to take account of tide. Floating mines typically have a mass of around 200kg, including 80kg of explosives; e.g. TNT, mine or a matol. During WWII, mine traps were used for blocking port

entrances. Two floating mines were anchored some distance apart on either side of a shipping channel, linked by chain. When a deep draft vessel passed through the trap it would pull the chain along with it, dragging the mines onto the sides of the ship, the resulting double explosion often sank it. This system was not used extensively, but proved effective in blocking ports.

Drifting Contact Mines

Drifting mines were occasionally used during World War I and II. However, they were more feared than effective. Sometimes floating mines break from their moorings and become drifting mines, modern mines are designed to deactivate in this event. After several years at sea, the deactivation mechanism might not function as intended and the mines may remain live. After World War I the drifting contact mine was banned, but was occasionally used during World War II. The drifting mines were much harder to remove than tethered mines after the war, and they caused about the same damage to both sides.

Bottom Contact Mines

A bottom contact mine is the simplest form of mine. It is merely an explosive charge with some form of fuze fitted lying on the seafloor. They have been used against submarines, as submarines sometimes lie on the seafloor to reduce their acoustic signature. They are also used to prevent landing craft from reaching the shore and move a major obstacle during the D-day landings. The Germans used antitank mines here with minor modifications to make them reliable under water, attaching the mines to the front of many of the obstacles seen. These mines usually weigh 2 to 50kg including 1 to 40kg of explosives (TNT or hexanol).

Remotely Controlled Mines

Frequently used in combination with coastal artillery and hydrophones, controlled mines (or command detonation) mines can be in place in peacetime, which is a huge advantage in blocking important shipping routes. The mines can switch (which prevents the enemy from simply capturing the controlling station and deactivating the mines). These can be detonated on a signal or be allowed to detonate on their own. The earliest ones were developed around 1812 by Robert Fulton. The first remotely controlled mines were moored mines used in the American Civil War, detonated electrically from shore. They were considered superior to contact mines because they did not put friendly shipping at risk. Modern examples usually weigh 200kg (440ls), including 80kg (175ls) of explosives (TNT or hexanal).

Influence Mines

These mines are triggered by the influence of a ship or submarine, rather than direct contact. Such mines incorporate electronic sensors designed to detect the presence of vessel and detonate when it comes within the blast range of the warhead. The fuzes on such mines may incorporate one or more of the following sensors; magnetic, passive acoustic or under pressure displacement caused by the proximity of a vessel.

First used during the Second World War, the sophistication of influence mine fuzes has increased considerably over the years as first transistors and then microprocessors have been incorporated into design. Simple magnetic sensors have been superseded by total-field magnetometers. Modern influence mines such as the BAE stonefish are computerised, with all the programmability that this implies; e.g. the ability to quickly load new acoustic signatures into fuzes, or programme them to detect a single, highly distinctive target signature.

Moored Mines

The moored mine is the backbone of modern mine systems. They are deployed where water is too deep for bottom mines. They can use several kinds of instruments to detect an enemy, usually a combination of acoustic, magnetic and pressure sensors, or more sophisticated optical shadows or electro potential sensors. These cost many times more than contact mines. Moored mines are effective against most kinds of ships. As they are cheaper than other anti-ship weapons they can be deployed in large numbers making them useful area denial or a channelising weapons. Moored mines usually have lifetimes of more than 10years and some almost unlimited. These mines usually weigh 200kg (440lbs) of explosives (hexatonal)

Bottom Mines

Bottom mines are used when the water is no more than 60meters (180ft) deep or when mining for submarines down to around 200 meter (660ft). They are much harder to detect and sweep, and can carry a much larger warhead than a moored mine. Bottom mines commonly use pressure sensitive exploders, which are less sensitive to sweeping. These mines usually weigh between 150 and 1,500kg, including between 1250 to 1,400kg of explosives.

Unusual Mines

Several specialised mines have been developed for other purposes than the common minefield.

Anti Sweep Mine

The anti sweep mine is a very small mine (40kg warhead) with as small a floating device as possible. When the wire of a mine sweep hits the mine, it “sinks”, letting the sweep wire drag along the anchoring wire of the mine until the sweep hits the mine. That detonates the mine and cuts the sweeping wire. They are very cheap and usually used in combination with other mines in a minefield to make sweeping more difficult.

Rocket Mine

A Russian invention; the rocket mine is a bottom distance mine that fires a coming high-speed rocket (not torpedo) upwards towards the target. It is intended to allow a bottom mine to attack surface ships as well as submarines from a greater depth.

Torpedo Mine

The torpedo mine is a self propelled variety, able to lie in wait for a target and then pursue it, e.g. CAPTOX Mine. Generally, torpedo mines incorporate computerised acoustic and magnetic fuses.

Bouquet Mine

This is a single anchor attached to several floating mines. It is designed so that when one mine is swept/detonated, another takes its place. It is a very sensitive construction and lacks reliability.

Ascending Mine

The ascending mine is a floating distance mine that may cut its mooring or some other way float higher when it detects a target. It lets a single floating mine cover a much larger depth range.

Nuclear Mine

During the cold war, a number of tests were conducted with naval mines fitted with tactical nuclear warheads. These weapons were experimental and never went into production.

Daisy-Chained Mine

This comprises two moored, floating contact mines which are tethered together by a length of steel cable or chain. Typically, each mine is situated approximately 60 feet (18m) away from its neighbour, and each floats a few meters below the surface of the ocean. When the target ship

hits the steel cable, the mines on either side are drawn to the side of the ship's hull, exploding on contact. In this manner it is almost impossible for target ships to pass safely between two individually moored mines.

SELF-ASSESSMENT EXERCISE 2

List the various types of mines and describe two of them.

3.3 Laying of Mine

Historically several methods were used to lay mines. During the first and second world wars, the Germans used U-boats to lay mines around the UK. In the second world war, aircraft came in favour for mine laying with the one of largest such examples being the mining of the Japanese Sea routes in operation starvation.

Minefield may be laid by several means. The preferred, but most labour-intensive, ways to have engineers bury the mines, since this will make the mines practically invisible and reduce the number of mines needed to deny the enemy an area. Mines can be laid by specialised mine-laying vehicles. Min-scattering shells may be fired by artillery from a distance of several tens of kilometres. Mines may be dropped from helicopters or air planes, or ejected from cluster bombs or cruise missiles.

Laying a minefield in modern times is a relatively fast process with specialised ships, which is still today the most common method. These mine layers can carry several thousand mines and manoeuvre with high precision. The mines are dropped at a predefined interval into the water behind the ship. Each mine is recorded for later clearing, but it is not unusual for these recordings to be lost together with the ships. Therefore many countries demand that all the mining operations shall be planned on land and records kept so that mines can later be recovered more easily. Other methods to lay minefields include:

- Converted Merchant Ships – rolled or slid down ramps
- Aircraft – descent to the water is showed by a parachute.
- Submarine – launched from torpedo tubes or deployed from specialised mine racks on the sides of the submarine.
- Combat boats – rolled off the side of the boat
- Camouflaged boats – Masquerading as fishing boats
- Dropping from the shore – typically smaller shallow-water mines
- Attack divers – smaller shallow –water mines.

In some cases, mines are automatically activated upon contact with the water. In others, a safety layer is pulled (e.g., one end attached to the rail of a ship, aircraft or torpedo tube) which starts an automatic timer

countdown before arming process is complete. Typically, the automatic safety-arming process takes some minutes to complete. This is in order to give the people laying the mines sufficient time to move out of its activation blast zone.

Some minefields are specifically booby-trapped to make them more dangerous. Mixed anti personnel and anti-tank minefields, anti personnel mines under anti-tank mines, and fuses separated from them have all been used for this purpose. Often, single mines are bucked by a secondary device, designed to kill or maim personnel tasked with clearing the mine.

Multiple anti-tank mines have been buried in stacks of two or three with the bottom mine fuzzed, in order to nullify the penetrating ground, which directs the energy of the blast in a single direction-through the bottom of the target vehicle or on the track.

SELF-ASSESSMENT EXERCISE 3

Describe how an ordinary land can be made to become a minefield.

3.4 Demining

What is Demining of a minefield?

Whereas the placing and arming of landmines is relatively inexpensive and simple, the process of detecting and removing them is typically expensive, slow, and dangerous. This is especially true of irregular warfare where mines were used on an ad-hoc basis in unmarked areas. Anti-personnel mines are most difficult to find, due to their small size and the fact that many are made almost entirely of non-metallic materials specially to escape detection. Landmines can remain active more than 50 years after they are planted in the ground. For this reason, there is a growing worldwide effort to rid the world of landmines. Finding these landmines is extremely difficult, as most minefields are unmarked. And those that are marked can take years to de-mine.

Landmine detection is a slow, methodical process due to the danger involved in locating landmines. While location technology is improving, the following conventional techniques are still relied on heavily:

Probing the Ground

For many years, the most sophisticated technology used for locating landmines was probing the ground with a stick or bayonet. Soldiers are trained to poke the ground lightly with a bayonet, knowing that just one mistake may cost them their lives.

Trained Dogs

Dogs can be trained to sniff out vapours coming from the explosive ingredients inside the landmine.

Metal Detector

Metal detectors are limited in their ability to find mines, because many mines are made of plastic with only a tiny bit of metal.

Other techniques involve the use of geo-location technologies. Scientists at Ohio State University are developing a new ground penetrating radar (GPR) device that may be more effective in locating and disarming landmines. This new device would be helpful in locating mines that have little or no metal content. All landmines, including plastic ones, are filled with explosive agents that have electrical properties that make them detectable to the right technology, such as GPR.

A GPR device focuses radar energy just below the ground and just a few feet in front of the user, according to researchers. The device ignores signals that bounce back from the surface and uses specially designed software to make buried objects shine brighter in the radar image. The GPR has been successful in detecting two common landmines casings filled with a waxy substance that once a landmine is detected, the GPR device shoots two chemical agents into the ground to deactivate it. One agent solidifies the triggering mechanism along with surrounding soil, allowing soldiers to cross the ground. The second chemical agent then solidifies the mine and soil permanently. The mine can then be shovelled out and destroyed.

Ironically, the laying of landmines inadvertently proved a positive development on the Falkland Islands. This is because the mine fields laid by the sea during the Falklands war have become favourite places for penguins, which are too light to detonate the mines, and are therefore able to breed safely in areas where humans do not enter. These odd sanctuaries have proven so popular and lucrative for ecotourism that there has been some effort to prevent having the mines removed by offering to finance mine removal in regions with human populations where mines are a persistent danger, such as in Cambodia.

SELF-ASSESSMENT EXERCISE 4

List the methods used in demining a minefield. Describe two of them.

3.5 Impact of Landmines

What effects does laying mines have on human population??

The impact of landmines on war-torn societies is devastating. Broadly speaking, they impede the ability of mine-affected communities to fully recover from conflicts, after the cessation of hostilities.

Children

Of the estimated 26,000 civilians killed or maimed every year by landmines, 8,000 to 10,000 are children, many more lose their parents to landmine accidents or have to bear the difficult responsibility of supporting their families after a family has been disabled or killed.

Children are particularly vulnerable to landmines. Their small size places them closer to the source of a mine's explosion and, consequently, they often sustain more severe injuries than adults. Furthermore, because children are curious and like to play outdoors, they frequently leave known, safe paths or pick up mines, mistaking them for toys.

Medical Impact

Landmines have numerous direct and indirect consequences on the health of people living in mine-affected countries. Mines kill and maim innocent men, women, and children, and they deny people access to adequate medical services, immunisations, and safe water and food, leading to the spread of diseases. Furthermore, many mine-affected countries do not have adequate health facilities or mined roads and bridges virtually cut off entire populations from existing services.

Psychosocial Impact

The psychosocial and social traumas associated with landmines can be as devastating on a mine-affected community as the immediate physical injuries sustained by mine victims. Men, women, and children all suffer terrible psychological consequences associated with the presence of landmines and landmine-related injuries. Some victims are permanently disfigured, while others living in mined areas face the constant fear that they may be next. Many mine victims are ostracised by their communities and not welcomed back after suffering their injuries. Amputated women are less desirable as wives because they are no longer able to work on the fields, which is their traditional role in many countries. Amputated men often become drifters. Spouses leave one another for healthier partners. Children are either left alone when their

parents are killed or must assume primary responsibility for caring for their severely injured parents.

Refugees and Internally Displaced Persons

The traditional problem of refugees and internally displaced persons that accompanies most conflicts is exacerbated by the use of landmines. Mines are increasingly used to terrorise civilian populations and channel their movements, resulting in ever larger numbers of displaced persons forced to leave their homes. After hostilities cease, the continued presence of mines on roads, agricultural fields, and in buildings prevent populations from returning to their homes. This destruction leaves areas of land uninhabited and uncultivated, hampering post-war reconstruction efforts.

Economic Impact

Most mine-affected countries are agrarian societies whose economics are predominantly defined by the quality and quantity of their agricultural production. The peoples of those largely developing countries rely on the land for their food and livelihood. However, the presence of mines in agricultural fields renders large tracts of fertile soil unusable. Farmers and peasants are unable to safely cultivate their land and livestock feeding off the land are frequently killed by mines, constituting grave economic losses for their owners.

Mines destroy national infrastructures and impede economic development and reconstruction efforts. Transportation networks, power lines, and water resources are damaged and inaccessible. The production and distribution of fundamental goods and services are disrupted. Tourism, markets, and important source of income in many countries suffer greatly. In addition, mine clearance programmes divert financial resources from critical development and reconstruction projects.

Environmental Impact

In addition to the impact on their victims, landmines also have severe environmental consequences. Landmines introduce poisonous substances into the environment as their casings erode. Explosives commonly used in landmines, such as Trinitron toluene (TNT) seep into the soil, the decomposition of these substances can cause many environmental problems because they are often water soluble, carcinogenic, toxic, and long-lasting.

Landmines also harm the environment when they explode, scattering debris, destroying surrounding vegetation, and disrupting soil

composition. This substantially decreases the productivity of agricultural land and increases an areas vulnerability to water and wind erosion, which in turn can add sediment into drainage systems, adversely affecting water habits.

Peace and Reconciliation

Landmines pose a continuous threat to peace and reconciliation. They prevent post-conflict reconstruction of war-torn economics and can too easily threaten fragile peace plans. Damaged infrastructures, including roads, bridges, and water supplies, impede efforts to deliver relief supplies to remote areas. This can perpetuate the cycle of poverty inherent in so many mine affected countries, leading to further tension and conflict.

SELF-ASSESSMENT EXERCISE 5

What are the consequences of a landmine affected area.

3.6 Uses of Landmines

What are the uses of Landmines?

Originally, both antitank and antipersonnel landmines were developed as tactical, defensive weapons. They were intended to profit troops, military bases, and key installations take power plants and water supplies. They were also used to delay the advance of enemy troops, to deny them access to certain areas and resources, and to burden them with soldiers injured by landmines. “Nuisance minefields” – two or three mines placed at the entrance of a house or designated sites were intended to have demoralising psychological effect on troops.

After World War II, advances in weapons technology accelerated rapidly. In the 1960’s an antipersonnel landmine was developed that could be delivered by air and automatically activated as it hit the ground. These scatterable mines made it possible to rapidly deploy large numbers of mines, rather than the traditional time-consuming method of manually planting each mine by hand.

This new technology quickly changed the fundamental nature of antipersonnel landmines from a tactical, defensive weapon to a strategic, offensive weapon. Mines are now used to drive a wedge between opposing forces and their military bases, and to channel these forces into diverse terrain. Increasingly, scatterables and hand-deployed mines were used against civilian populations-to terrorise communities, to displace entire villages, to render fertile agricultural land unusable, and to destroy national infrastructures like roads, bridges, and water sources.

In recent decades, new technologies have transformed the improvised “dumb” landmine traditionally used for defensive purposes into a sophisticated “smart” mine that is now used largely for offensive purposes. Technological advances have made landmines more dangerous for civilians and more difficult, if not impossible, to detect. Greater numbers of mines can be level more rapidly than ever before. Furthermore, as landmines have become more sophisticated, mine clearance technologies have developed very slowly. In general, the most effective and reliable method of clearing mines continues to be manual demining – a deminer probing the ground with a prod, checking the ground for mines one inch at a time.

SELF-ASSESSMENT EXERCISE 6

Enumerate and discuss the various uses of landmines.

4.0 CONCLUSION

We have explained that landmines are basically explosive devices that are designed to explode when triggered by pressure or a tripwire. These devices are typically found on or just below the surface of the ground. We also learnt that landmines can remain active for more than 50 years after they are planted in the ground. Methods of detecting landmines include metal detecting probing the ground and the use of trained animals like dogs. We also discussed the impact of landmines on children, medicals, psychosocial, economic and environmental impact; finally uses of landmines were discussed as both defensive and offensive.

5.0 SUMMARY

In this unit, we have dealt with the topic Landmines by looking at the following aspects Meaning, Types, Laying of Mines, Demining, Impact and Uses of Landmines.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss methods of locating mines.
2. List the various impact of landmines and discuss two of them in detail.
3. How are minefields demined?

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MODULE 5 FIRE INVESTIGATION AND COUNTERFEITING

Unit 1	Fire Investigation Unit
2	Signature Forgeries
Unit 3	Counterfeit Currencies
Unit 4	Questioned Documents and Criminal Laboratories

UNIT 1 FIRE INVESTIGATION

CONTENTS

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5.0	Summary
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1.0 INTRODUCTION

Fire investigation, sometimes referred to as origin and cause investigation, is the analysis of fire-related incidents. After firefighters extinguish a fire, an investigation is launched to determine the origin and cause of the fire or explosion. Investigations of such incidents are done using a systematic approach and knowledge of basic fire science. The various issues that will be examined in this unit that will introduce you to the concept of fire investigation are the meaning, classification of fire, conducting fire investigation, methods of extinguishing fire, fire extinguishing media, and principles of fire protection.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of fire investigation
- list the different classes of fires
- describe how a fire-related incident can be investigated

- discuss methods of extinguishing fire
- mention various principles behind fire protection
- list fire extinguishing media.

3.0 MAIN CONTENT

3.1 Meaning of Fire Investigation

How do you determine the origin and cause of a fire?

Fire investigation is one of the most difficult of the forensic sciences to practice. Unlike most forensic disciplines, even the basic question of whether a crime has been committed is normally not obvious. During a fire investigation, an entire process must be undertaken just to determine if the case involves arson or not. The difficulty of determining whether arson has occurred arises because fire often destroys the key evidence of the origin. Many fires are caused by defective equipment, such as shorting of faulty electrical circuits, for example car fires can be caused by families storing fuel and spontaneous combustion is possible where organic wastes are stored.

A fire investigator looks at the fire remains, and obtains information to reconstruct the sequence of events leading up to the fire. One of the challenging aspects of fire investigation is the multi-disciplinary basis of the investigator's job. Investigators need to know not only the basic science of fire behaviour, but knowledge of many different areas of study (including construction, electricity, human behaviour, vehicles, etc.) is helpful. If there is a gas appliance at the origin of the fire, an investigator should know about appliances to either include or exclude it as a possible cause of the fire. Fire investigators must also know their own limitations and call upon experts to assist when needed.

Fire investigation is a field of forensic science dedicated to the determination of the origin and the cause of a fire. Determining the origin of the fire, answers questions like the cause of fire, and why did the fire start.

In order for a fire to occur, three conditions must be met. There must be a combustible (fuel), an oxidiser (oxygen) and a sufficient heat energy source (source of ignition). The key elements that determine the cause of the fire rely on the determination of the first material ignited and to the source of ignition. Heat energy can be produced by mechanical, electrical, chemical, or radioactive means. The role of fire investigation is to identify the event that brought together the combustible, the oxidiser, and the source of ignition that started the fire.

Causes of fire can be natural, accidental, deliberate or undetermined. Natural causes of fire include all the actions of nature that can cause a fire, such as lightning from the sky or lava from a volcano. Accidental fires include both fires that are caused by a negligent human intervention or by accidental occurrence without the necessary presence of a human being. Deliberate fires are caused by the intentional intervention of a human being. However, not all deliberate fires are arsons; for example, if one sets fire to backyard debris, it is deliberate but may not constitute arson. Arson is a legal term that can greatly vary from one country to another or from one state to another. In many instances, fire investigators will not be able to determine where and/or why the fire started, and the cause is classified as undetermined.

The determination of the origin of a fire is made based on observations of smoke, heat, and burn patterns at the fire scene. Fire evolves following the laws of physics and chemistry. While combustion is a complicated phenomenon that can be random in some instances, it is most often possible to determine the direction of fires. By tracing the direction backward, it is possible to find the origin of the fire. Once the origin of a fire is found, it is necessary to determine the cause.

One of the most important objectives in fire investigation is determining if a crime occurred in connection with the fire. If the fire is due to arson, it is extremely important to quickly determine that a crime occurred and gather evidence, so that an arrest may be made. If an accidental or natural fire occurred, it is important to determine how it started, so that the proper measures can be taken to prevent similar fires and to protect lives and property from future damage. In addition, in the case of accidental fire, it is important to determine the exact cause of the fire, because people or companies might bear a responsibility in the loss. The responsibility might be civil or criminal and carry an important financial burden. Many criminal laws also allow charges to be brought against people who accidentally created a fire.

Fires are investigated by fire investigators or criminalists. Fire investigators come from many different backgrounds. In some European countries, fire investigators are commonly part of the police department, usually the crime scene unit. Fire investigation is a harsh job, as it consists of working in or dangerous conditions around burned structures or vehicles and in atmospheres containing many contaminants that are detrimental to the lungs and health. Fire investigators must often dig through debris from fire scenes in order to see burn patterns. Often it is necessary to reconstruct the fire scene in order to determine the pre-fire conditions.

SELF-ASSESSMENT EXERCISE 1

Explain the role of a fire investigator in a fire related incident.

3.2 Classification of Fires by Types

What are the various classes of fires?

In the united kingdom, fires in the past have been unofficially classified into four types, namely A, B, C and D denoting respectively carbonaceous fires, flammable liquids fires, electrical fires and metal fires. Agreement has now been reached between European nations on a new classification which forms the subject of British standard BS-EN 2: Classification of fires, are as follows:

Class 'A'

These are fires involving solid materials normally of an organic nature (compounds of carbon), in which combustion generally occurs with the formation of glowing embers. Class 'A' fires are the most common and the most effective extinguishing agent is generally water in the form of a jet or spray.

Class 'B'

These are fires involving liquids or liquefiable solids. For the purpose of choosing effective extinguishing agents, flammable liquids may be divided into two groups:

- (i) those that are miscible with water and
 - (ii) those that are immiscible with water
- depending on (i) and (ii), the extinguishing agents include water spray, foam, light water, vaporising liquids, carbon (iv) oxide and dry chemical powders.

Class 'C'

These are fires involving gases or liquefied gases in the form of a liquid spillage, or a liquid or gas leak, and these include methane, propane, butane, etc, foam or dry chemical powder can be used to control fires involving shallow liquid spill (water in the form of spray is generally used to cool the container).

Class 'D'

These are fires involving metals, extinguishing agents containing water are ineffective and even dangerous, carbon (IV) oxide and the bicarbonate classes of dry chemical powders may also be hazardous if applied to most metal fires. Powdered graphite, powdered talc, soda ash, limestone and dry sand are normally suitable for class 'D' fires. Special fusing powders have been developed for fires involving some metals, especially the radioactive ones.

Electrical Fires

It is not considered, according to present day ideas, that electrical fires constitute a class since any fire involving, or started by, electrical equipment must, in fact, be a fire of class A, B, C or D. The normal procedure of electricity and the use of an extinguishing method appropriate to what is burning. Only when this cannot be done with certainty will special extinguishing agents be required which are non-conductors of electricity and vaporising liquids, dry powders and Carbon IV oxide, although the latter's cooling and condensation effects may affect sensitive electronic equipments.

Classification of Fires by Size

To describe the size of a fire, the central fire Brigades Advisory council has made the following recommendation:

- Major fire 20 + jets
- Large fire 8 – 9jets
- Medium fire 3 - 7jets
- Small fire 1-2jets, or 3 + hose reels
- Minor fire 2-1 hose reels or hand extinguishers

SELF-ASSESSMENT EXERCISE 2

List the various classes of fires and discuss on two of them:

3.3 Conducting Fire Investigation

Fire investigators conduct their investigations using a systematic approach. The approach endorsed by the (NFPA), National Fire Protection Association is that of a scientific method.

There are five components that create a methodology with which fires are investigated using a systematic approach.

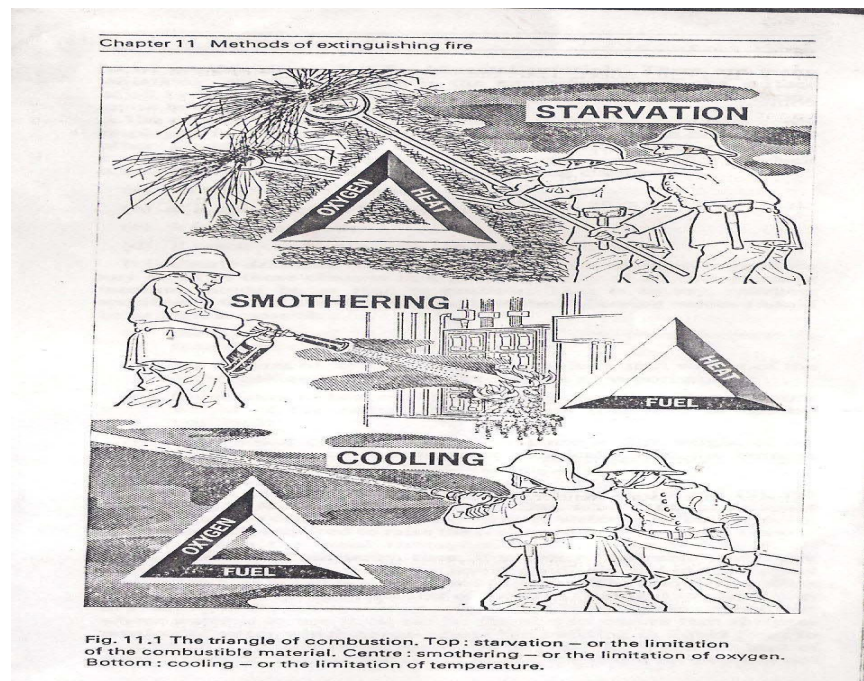
- The assignment is received and the investigator is notified of his/her responsibilities.
- The investigator plans the investigation and assembles tools, equipment, and personnel.
- The scene is examined and data is collected.
- Physical evidence is collected, document tested and evaluated.
- The scientific method is used to analyse the information obtained.

SELF-ASSESSMENT EXERCISE 3

Mention the steps involved in carrying out a fire investigation.

3.4 Methods of Extinguishing Fire

It has been shown from the triangle of combustion, (see diagram)



- Those three factors are essential to combustion, namely
- the presence of a fuel, or combustion substance
- the presence of oxygen (usually as air) or other support of combustion
- the attainment and maintenance of a certain minimum temperature.

Fire extinction, in principle, consists in the limitation of one or more of these factors, and the methods of extinguishing fire may therefore be classified conveniently under the following headings.

1. Starvation or the Limitation of Fuel
2. Smothering or the Limitation of Oxygen
3. Cooling or the Limitation of Temperature.

In practice, specific methods of fire extinction often embody more than one of these principles, but it will be convenient to consider them according to the main principle listed.

Starvation

The extinction of fire by starvation fig 1 above is applied in three ways, i.e. by:

- removing combustible material from the neighbourhood of the fire. Examples of this are the drainage of fuel from burning oil tanks, the working out of cargo at a ship fire, the cutting of trenches in peat, heath and forest fires, the demolition of buildings to create a fire-stop, counter-burning in forest fires.
- removing the fire from the neighbourhood of combustible material as, for instance, pulling apart a burning haystack or a thatched roof.
- subdividing the burning material, when the smaller fires produced may be left to burn out or to be extinguished more easily by other means. A typical example is the emulsification of the surface of burning oil, whilst the beating out of a heath fire owes much of its effectiveness to this.

Smothering

If oxygen content of the atmosphere in the immediate neighbourhood of burning material can be sufficiently reduced, combustion will cease. The general procedure in methods of this type is to prevent or impede the access of fresh air to the seat of the fire, and allow the combustion to reduce the oxygen content in the confined atmosphere until it extinguishes itself. This principle is, of course, ineffective where, as in the case of celluloid, the burning material contains within itself, in a chemically combined form, the oxygen it requires for combustion.

The principle of smothering is employed on small scale in snuffing a candle, and on large scale, in capping a burning oil well. These two processes are precisely analogous. The battening down of a ship's hold when a fire breaks out below decks will often hold the flames in check until port is reached. Small fires, such as those involving a person's

clothing can be smothered with a rug, blanket, etc while the use of sand or earth on a small metal is a further instance of the same principle.

An important practical application of the smothering method is the use of foam. This forms a viscous coating over the burning material and limit, in so far as it is complete, the supply of air. It also tends to prevent the formation of flammable vapour. Another method of smothering is by the application of a cloud of finely divided particles of dry powder, usually sodium bicarbonate, from a pressurised extinguisher. Research has been made into this method and it is not certain that the action is solely related to smothering. Trioxocarbonates will absorb heat and when they are finely divided, as is the powder, their specific heat is very much greater. It may therefore, be more accurate to say that the powder has a cooling effect in addition to its smothering effect.

A further development in the smothering method has been the discovery of a powdered compound for use on metal fires, such as uranium and plutonium, thorium and magnesium. This powder (tertiary eutectic chloride) is applied by means of a gas cartridge pressurised extinguisher. As the fusing temperature of the powder is in the region of 580°C , it is intended that it shall form a crust over the burning metal and thus exclude the oxygen of the air.

Another class of smothering agent may be described as temporary in its blanketing effect. Thus, the vigorous discharge of an inert gas in the immediate vicinity of the fire may so reduce the oxygen content of the atmosphere for the time being that combustion cannot be maintained. Carbon IV oxide and nitrogen are familiar examples of this. With fires of any magnitude, however, the convection currents set up are sufficiently powerful to dissipate the inert atmosphere formed by the application of the gas blanket before the extinguishing action can take effect. The same thing happens if this method is used out of doors with a strong wind blowing. The application of these media in liquid form, which is thus vaporised by the fire thus forming the required inert atmosphere, is more likely to be effective, particularly as a cooling effect is also operative.

Experiments over recent years have produced a group of extinguishants consisting of volatile liquids based on the halogenated hydrocarbons. The first and probably the simplest of these was carbon tetrachloride, but owing to its toxic effects, its use has been discontinued and a number of others of lesser toxicity have found favour. The best known is bromo chlorodifluoromethane (known as BCF).

One other method of fire extinction is the separation of the fuel from the flame by blasting it away. On a small scale the blowing out of a candle

is an obvious example, while on the larger scale the extinguishing of an oil well fire by the blast from exploding dynamite is a practical use of the method. Such a technique does, of course, also involve to a considerable extent the cooling principle.

Cooling

If the rate at which heat is generated by combustion is less than the rate at which it is dissipated through various agencies, the combustion cannot persist. In applying this principle of fire extinction, the first step is to accelerate the speed with which heat is removed from the fire, thus reducing the temperature of the burning mass and as a consequence the rate at which heat is produced. In due course the rate at which heat is lost from the fire exceeds the rate of heat production and the fire dies away.

The application of a jet or spray of water to a fire is invariably based on this simple but fundamental principle. There are many variations. Another example is the emulsification of the surface of oil by means of the emulsifying type of sprinkler heat producing an oil-in-water or water-in-oil emulsion. The cooling principle on fire extinction is the one most commonly employed, forming as it does the basis of the application of water and other liquids to burning materials. The extinguishing medium operates by absorbing heat from the fire, as a consequence of which it may undergo one or more of the following changes:

- (a) its temperature is raised
- (b) it is converted to the vapour state
- (c) it is decomposed
- (d) it reacts chemically with the burning material.

It is clearly desirable that the quantity of heat required to produce any or all of these changes in a given quantity of an extinguishing medium should be as high as possible. That is to say, referring specifically to the above headings, that the following values should be as high as possible:

- (i) the amount of heat absorbed for any given increase in temperature (the thermal capacity).
- (ii) the amount of heat required to vaporise a unit weight of the extinguishing medium (the latent heat of vaporisation).
- (iii) the amount of heat required to cause decomposition of a unit weight of the extinguishing medium (the heat of decomposition)
- (iv) the amount of heat required to cause a unit weight of the extinguishing medium to react chemically with the burning material (the heat of reaction).

The action of water depends predominantly on (i) and (ii) the latter being by far the more important. Thus, it takes about six times as much heat to convert a certain weight of water at its boiling point into steam as is required to raise the temperature of the same amount of water from the usual atmospheric value to its boiling point.

In the interests of efficiency, then it is clearly desirable that the liquid condition is maintained, and in if possible is converted to steam. The smothering effect of the steam produced at the seat of the fire is thought to play a part in assisting in the extinguishing process. In all fire-fighting operations where water is in use it should be the aim to ensure that the proportion of water which escapes from the building in liquid form to that which is applied should be as low as possible. When the heat of a fire is considerable, as in its early stages, the steam formed will not be visible, but as the temperature falls the steam will condense above the fire. These officers ensure that a fire is being brought under control.

SELF-ASSESSMENT EXERCISE 4

State three factors essential for combustion to take place. Describe smothering method of extinguishing fire outbreak

3.5 Fire Extinguishing Media

Here we will discuss the various media which are used for particular types of fire. These will depend upon the nature of the materials involved and the size and intensity of the fire.

Water

Despite the many new techniques which have come to the assistance of firemen, water is still the most efficient, cheapest and most readily available medium for extinguishing fires of a general nature. It is used by fire brigades for the majority of fires, although the methods of application have undergone a number of improvements. If more water is applied than is actually required to contain and extinguish the fire, the surplus will drain off, or will seep through floors and perhaps cause more damage to goods and property than that caused by the fire itself. Accordingly, the method of applying water to a fire varies according to the size of the fire.

If small quantities only are required the use of necessary force may be obtained by the use of portable extinguishers expelling water, or by the use of hand pumps where the fire is larger than can be dealt with by hand appliances, then hose reels are used instead. The water for this is contained in a tank incorporated on the appliance and is pumped through

the tubing on the reels by means of a built-in pump. For major fires, greater quantities of water are necessary, and the built in pumps driven by the vehicles engine are often capable of pumping up to 1000 gallons (4500 litres) per minute, giving the necessary energy to the water to provide adequate striking power

Steam

Steam in large quantities can be used to smother a fire and in situations where it is readily available, it can be used on fired installation compartmentation is obviously a help and ships are frequently adapted to be able to fill holds with steam under pressure.

Foam and Foam-Making Compounds

Some of the most hazardous substances so far as fire risk is concerned, are liquids having a specific gravity lower than that of water. When water is applied to the burning surface of such a liquid, it lowers the temperature momentarily and then sinks below the surface where any further effect is lost, except in the case of liquids such as methylated spirits which mix freely with water, and where dilution may therefore occur to the point where combustion cannot be maintained.

We know that one of the methods which can be employed for fire extinction is smothering foam, which is relatively insoluble in most liquids and because of its light weight floats on the surface of the liquid, forms a blanket capable of covering the surface of the burning liquid and so extinguishes the fire. It also forms a radiant heat barrier which is of importance in extinction of oil and petrol fires. Foam as used by fire brigades is usually generated by the mechanical agitation of diluted foam compounds include soaps, glue and wetting agent mixtures and hydrolyzed protein concentrates. This type of foam compound produces foam with the most suitable characteristics for general use by fire brigades for fighting large fires in oil and petrol tanks, and is the standard compound used in this counting. It is manufactured by the meal or animal blood.

Vaporising Liquid

The halogenated hydrocarbons used for extinguishing fires have the property of vaporising readily when heated and are, therefore, generally known as vaporising liquid. They form a dense, heavier than-air, cloud of non-flammable vapour which not only blankets a fire by the displacement of air, but also has the property of interfering with the chemical reaction of flame propagation on the burning material.

Vaporising liquids have an exceptional use for extinguishing fires involving electrical equipment, as they are also non-injurious to delicate electronic equipment. Vaporising liquid extinguishers are also excellent for dealing with fires involving laboratory equipment, or for extinguishing fires in the engines and inert gases.

Carbon IV Oxide and Inert Gases

At normal temperatures, carbon iv oxide is a gas 1.5 times as dense as air, it is easily liquefied and bottled, where it is contained under a pressure of approximately 750 ft/in² (51 bars). As a fire extinguishant it acts in a similar manner to vaporising liquids, and when a Co₂ extinguisher is discharged, the liquid boils off rapidly as a gas, extracting heat from the surrounding atmosphere. The gas, however, extinguishes by smothering, or reducing the oxygen content of the air and about 20 to 30 percent is necessary to completely extinguish, according to the nature of the burning material. In fact, materials which supply their own oxygen will continue to burn, as will any material that tends to decompose the Carbon IV Oxide, such as burning magnesium. Apart from these considerations, Carbon IV Oxide is quick and clean, non-conductive of electricity, non-toxic and does not harm most fabrics.

For fire situations, such as in transformer chambers, where complete flooding of the compartment is desirable, fixed Carbon IV Oxide installations may be built. As an alternative to Carbon IV Oxide, liquid nitrogen in bulk or in cylinders containing the gas will also produce the inerting or smothering effect necessary for successful extinction.

Dry Chemical Powders

New problems have been produced for the fireman by the use in industry of an ever widening range of materials. Plastics are one example of this, and the fabrication of titanium zirconium, beryllium and other metals is another. Water can often not be used, on most fires involving burning metals, the result of applying water can be explosively disastrous, and so new methods of extraction have been evolved, chief among these are powdered chemicals which are stored in cylinders under pressure, or which can be ejected by the release of gas under pressure.

The basis of most chemical powders is sodium bicarbonate. This, with the addition of a metallic stearate as a water proofing agent, is widely used as an extinguishant, not only in portable extinguishers, but also for general application in large quantities. Apart from stearates, other additives are sometimes used to decrease the bulk density and to reduce packing in the cylinders by gas pressure and, by means of specially

designed nozzles, is directed at the fire in a concentrated cloud. This cloud also screens the operation from the flames and enables a relatively close attack to be made. Dry chemical powder can also be supplied in polythene bags for metal fires, as it is more effective to bury the fire under a pile of bags which melt and allow the contents to smother the fire.

Sand: Some burning materials, such as metals, which cannot be extinguished by the use of water, may be dealt with by means of dry earth, dry sand, powdered graphite, powdered talc, soda ash or limestone, all of which act as a smothering agent. Dry sand may also be used to prevent burning liquids, such as paints and oils, from flowing down drains, basements lights, etc. and for confining shallow layers of such liquids, thus permitting the use of foam or spray branches; on no account should sand be used for extinguishing fires in machinery such as electric motors, since its use may well necessitate dismantling the entire machine for cleaning, even though the fire damage is negligible.

Blanketing

Another method, by which fire may be extinguished, especially for persons whose clothing is on fire, is by blanketing. The person should be laid down and covered or rolled in a rug, coat, jacket, woollen blanket, etc. for dealing with fires in small utensils, such as those containing cooking fats, the best method is to smother the fire with an asbestos blanket, or similar material, such as a dormant which has been wetted first.

Beating Out

Small fires in material such as textiles, etc. may often be extinguished by beating them out, or by rolling and screwing up the burning material tightly to exclude the air. Beating is also the method normally employed to extinguish heath, crop and other similar fires in rural areas when water is not readily available.

SELF-ASSESSMENT EXERCISE 5

List and describe three types of extinguishing media you know.

3.6 Principles of Fire Protection

What is fire protection?

Fire protection is the study and practice of mitigating the unwanted effects of fires. It involves the study of the behaviour, compartmentalisation, suppression and investigation of fire and its

related emergencies, as well as the research and development, protection, testing and application of mitigating systems. In structures, be they land-based, offshore or even ships, the owners and operators are responsible to maintain their facilities in accordance with a design-basis that is noted in laws, including the local building code and fire code, which are enforced by the authority having jurisdiction. Buildings must be constructed in accordance with the version of the building code that is in effect when an application for a building permit is made. Building inspectors check on compliance of a building under construction with the building code, once maintained in accordance with the current fire code, which is enforced by the fire prevention officers of a local fire department. In the event of fire emergencies, fire fighters, fire investigators, and other fire prevention personnel called to mitigate, investigate and learn from the damage of a fire.

Goals of Fire Protection

Fire protection has three major goals:

Continuity of Operations

On a public scale, this is intended to prevent the interruption of critical services necessary for the public welfare.

Property Protection

On a public scale, this is intended to prevent area wide conflagration. As an insurance consideration

Life Safety

Minimum standard used in fire and building codes.

SELF-ASSESSMENT EXERCISE 6

What are the major goals of fire protection?

4.0 CONCLUSION

We have discussed and explained that fire investigation is a field of forensic science that determines the origin of fire, where and why did the fire start also learnt that fires are classified into 'A', 'B', 'C' and 'D' and methods of extinguishing fire include starvation, smothering and cooling. Finally the goals of fire protection include continuity of operations, property protection and life safely.

5.0 SUMMARY

In this unit, we have dealt with the concept of fire investigation by looking at the following aspects: meaning, classification, how to conduct fire investigation, methods of extinguishing fire, fire extinguishing media and principles of fire protection.

6.0 TUTOR-MARKED ASSIGNMENT

1. As a fire officer, describe how you will conduct a fire investigation.
2. List methods of extinguishing fire and describe two of them.
3. State the goals of fire protection.

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UNIT 2 SIGNATURE FORGERIES

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- 1.0 Introduction
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1.0 INTRODUCTION

Forgery is a non violent crime that involves the alteration of legal and financial documents or instruments or otherwise altering with the attempt to defraud. Forgery can include bonds, deeds, titles, cheques, money orders, wills, court documents, and other types of falsification. Forgery is also any instrument, document or human effort that has been presented as one author's work when it is in reality another's. In most cases, benefit is gained by the individual or institution presenting the falsity. The various issues that will be examined in this unit, so as to introduce you to the concept of forgery include: Meaning, Types of Signature Forgery, Forged and Disputed Signatures, How Forgers Reproduce Signature, Signature Forgery Prevention Tips, Methods of Detecting Signature Forgery and Comparison of four Ordinary Signatures with Description.

2.0 OBJECTIVES

At the of this unit, you should be able to:

- explain the concept forgery
- state the various types of signature forgeries
- mention ways of preventing signature forgery
- discuss methods of detecting signature forgery.

3.0 MAIN CONTENT

3.1 Meaning of Forgery

Before discussing signature forgery, let us explain the meaning of forgery, or what is forgery all about?

The act of criminally making or altering a written instrument for the purpose of fraud or deceit; for example, signing another person's name to a cheque. To write payee's endorsement or signature on a cheque without the 'payee' of a cheque is the true owner or person to whom the cheque was payable. Forgery is also defined as an illegal modification or reproduction of an instrument, document, signature, or legal tender, or any other means of recording information. An item is also considered forged if it is claimed that it was made by someone who did not make it. The making, drawing, or altering a document with the intent to defraud. A signature made without the person knowing of or consenting to it.

Forgery at common law has been held to be 'the fraudulent making and alteration of a writing to the prejudice of another man's right false modern writer defined it as, 'a written instrument, for the purpose of fraud and deceit. The making of a whole written instrument on the name of another with a fraudulent intent is undoubtedly a sufficient making but a fraudulent insertion, alteration or erasure, even of a letter, in any material part of the instrument, whereby a new operation is given to it, will amount to a forgery, Although it may be executed by a person ignorant of the deceit. The fraudulent application for which it was not intended or vice versa, will also be a forgery. For example, it is forgery in an individual who is affixed to the paper without revealing to him the legacies thus fraudulently inserted. It has even been intimated that a party who makes a copy of a receipt and adds to such copy material words not in the original and then offers it in evidence on the ground that the original has been lost, may be prosecuted for forgery.

Making an instrument in a fictitious name or name of a non-existing person, is equally a forgery as making it in the name of an existing person and although a man may make the instrument in his own name if he represents it as the instrument of another, of the same person when in fact there is no such person, it will be a forgery in the name of a non-existing person but the correctness of this decision has been doubted.

Today a person's identity is comprised of numbers, data and files. One might say that individuality has gone by the boards, but no, signature is still the standard for contacts, cheques and other important financial transactions, not to mention wills and other legal documents. It may be observed that the offence of forgery may be complete without a

publication of the forged instrument with regard to the thing being held to be forgery at common law fraudulently to falsely make records and other matters of a public nature. Also with regard to private writings it is forgery fraudulently to falsify or falsely to make a deed or will or any private document whereby another person may be prejudiced.

Typically the main focus of a forgery case is determining (1) whether there was intent to defraud and (2) what the financial value of the resulting forgery amounted to. The greater the financial value, the heavier the sentencing may be if you are convicted.

SELF-ASSESSMENT EXERCISE 1

Explain the term forgery.

3.2 Types of Signature Forgeries

In a cryptographic digital signature or MAC system, forging a signature is the ability to create a pair consisting of a message M and a signature (or MAC) σ that is valid for M , where ‘ M ’ has not been signed in the past by the legitimate signer. There are three types of signature forgeries:

- Existential Signature Forgery
- Selective Signature Forgery
- Universal Signature Forgery.

Existential Signature Forgery

Existential forgery is the creation (by an adversary) of any message/signature pair (M, σ) , where σ was not produced by the legitimate signer. The adversary need not have any control over M , M need not have any particular meaning, and indeed it may even be gibberish – as long as the pair (M, σ) is valid, the adversary has succeeded in constructing an existential forgery.

Existential forgery is essentially the weakest adversarial goal; therefore the strongest schemes are those which are “existentially unforgivable”.

Selective Signature Forgery

Selective forgery is the creation (by an adversary) of a message/signature pair (M, σ) where M has been chosen by the adversary prior to the attack. M may be chosen to have interesting mathematical properties with respect to the signature algorithm, however, in selective forgery; M must be fixed before the start of the

attack. The ability to successfully conduct a selective forgery attack implies the ability to successfully conduct an existential forgery attack.

Universal Signature Forgery

Universal Forgery is the creation (by an adversary) of a valid signature for any given message M . An adversary capable of universal forgery is able to sign the message he choose himself (as in selective forgery).

Generally, there are two main types of forgeries: Forgery by reproduction and forgery by imitation.

Forgery by Reproduction

It consists in imitating an object as exactly the same. Most of the time, those reproduced items are the best sealers of famous brands.

Forgery by Imitation

It aims at imitating a brand, its signature, its style. It focuses on the brand and not on the product (compared to forgery by reproduction). It concerns well known brands and items are various (from cell phone case to travel bag). In fact, the intent is only to fool the gullible who may not look at the label and doesn't know what the real thing looks like.

SELF-ASSESSMENT EXERCISE 2

List and describe the types of signature forgery.

3.3 Forged and Disputed Signatures

The title to money and property of all kinds depends so lately upon the geniuses of signatures, that no study or inquiry can be more interesting than one relating to the degree of certainty with which genuine writings can be distinguished from those which are counterfeited.

When comparing a disputed signature with a series of admittedly genuine signatures of the same person whose signature is being disputed, the general appearance and pictorial effect of the writing will suggest, as the measure of resemblances or differences predominates, an impression upon the mind of the examiner as to the genuine or forged character of the signature in question. When it is understood that to make a forgery available for the purposes of its production it must resemble in general appearance the writing of the person whose signature it purports to represent. It follows as a reasonable conclusion that resemblances in general appearances alone must be secondary

factors in establishing the genuineness of a signature by comparison – and the fact that two signatures look alike is not always evidence that they were written by the same person.

There are many conditions affecting the production of signatures, habitually and uniformly apart from the causes which prevent a person from writing signatures twice precisely alike, under the influence of normal conditions of execution. The effect of fatigue, excitement, haste, or the use of a different pen from that which the standards were written, are well known conditions operating to materially affect the general appearance of the writing, and may have been, in one form or another, an attendant cause when the questioned signature was produced, and thus have given to the latter some variation from the signatures of the same person, executed under the influence of normal surroundings.

In the process of evolving a signature, which must again and again repeated from an early age till death, new ideas occur from time to time, are tried, modified, improved, and finally embodied in the design. The idea finally worked out may be merely a short method of writing the necessary sequence of characters, or it may present some novelty to the eye. Signatures consisting almost exclusively of straight up-and-down strokes, looking at a short distance like a row of needles with very light hair-lines to indicate the separate letters, signature begun at the beginning or the end and written without removing the pen from the paper, signatures which are entirely illegible and whose component parts convey only the mutilated rudiments of letters, are not uncommon. All such signatures strike the eye and arrest attention, and thus accomplish the object of their authors. The French signature frequently runs upward from left to right, ending with a strong down flourish in the opposite direction. All these, even the most illegible examples, give evidence of experience in handling or mishandling the pen. The signature most difficult to read is frequently the production of the hand which writes most frequently, and it is very much harder to decipher than the worst specimens of an untrained hand. The characteristics of the latter are usually an evident painstaking desire to imitate faulty ideals of the letters one after the other, without any attempt to attain a particular effect by the signature as a whole. In very extreme cases, the separate letters of the words constituting the signature are not even joined together.

A simulation of such a signature by an expert penman will usually leave enough traces of his ability in handling the pen to piece his disguise. Even a short, straight stroke, into which he is likely to relapse against his will, gives evidence against the pretended difficulties of the act which he intends to convey. It is nearly as difficult for a master of the pen to imitate an untrained hand as for the untrained to write like an

expert penman. The difference between an untrained signature and tracing of his signature by an experienced writer who is ill or feeble, is that in the former may be seen abundant instances of ill-directed strength, and in the latter equally abundant instances of well-concerned design, with a failure of the power to execute it.

SELF-ASSESSMENT EXERCISE 3

List the features of a forged signature.

3.4 How Forgers Reproduce Their Signatures

How do signature forgers perpetuate their act?

As forgers differ in their capability as to accuracy in simulation, all grades of its proficiency come up in the experience of those who, as experts, are called upon to make such matters a study. At one extreme will be found to occur, signatures written with but little effort to imitate the genuine signature they purport to represent, with all the intermediate grades of imitation extending to the other extreme, wherein a skilful forger will, by practice simulate the signature of a person and with such close resemblance that the very individual whose name is imitated cannot independently or at any circumstance, tell the forgery from the signature which he knows he has written.

Among the most common forgeries of signatures are those which have been traced from genuine ones, and these are produced in various ways; the most common method being to place the genuine signature over a plate of glass horizontally arranged, with a strong light behind it, or against the window frame, and then to place over the signature so positioned the paper on which forgery is to be made. When this has been done the papers are held in contact firmly, the pen is dipped-in ink and moved over the paper, guided by the lines of the genuine signature beneath, which show through the superimposed paper, and by means of which the form of the signature is transferred to the paper, which is exteriorly placed.

While the process of tracing procedures very nearly the proper form of the matter thus copied, and if well done by the forger, the copy will in general appearance and to a certain extent resemble in outline the signature thus traced, there are usually apparent in all reproduced signatures thus made, peculiarities and earmarks indicating the manner in which they were produced and by which they can be identified as such. One of the prominent features of reproduced signatures is the general sameness of the writing as appearing in the uniform width of the lines, and the omission of the usual shading emphasis. The cause of this appearance is the absence of habitual pen pressure, and the necessitated

slow movement of the pen held closely in contact with the paper and by which a uniform and steady flow of ink is deposited thereon; thus, making what should be the heavier and lighter links of one width and density as to shading. This method of tracing and reproducing signatures is that usually resorted to by novices, but is seldom employed by expert forgers.

Another condition appearing in all traced signatures is the absence of all evidence of pen pressure when examined as a transparency, this deficiency occurring as consequent upon the signatures thus made may resemble the one from which they are copied, the only likeness they have is that of pictorial resemblance and it will be found to be destitute of all the appearances and indications of habitual writing in other respects.

Another method of tracing signatures is frequently resorted to by persons adept in the art, and this consist in making lead-pencil copy of the genuine signature holding the paper on which the forgery is to be produced, tracing the outline of the signature by means of a pencil, and then with ink to write over the pencil copy. But as the method necessitates the use of an Indian rubber to remove the surplus black lead which was not covered by the ink, and evidences of the use of the rubber will be found to occur, and trace of the black lead can be found by the microscope. While the appearances and conditions are common traced signatures, there are in addition to their presence generally found evidences of pauses made in the writing, the effect of which will appear not as shading of the lines, but as irregularities produced thereon by resting the hand in its movement, and by which at intervals more ink flowed from the pen than would occur when the latter was being moved habitually over the paper.

Reproduced signatures often show a copying effort that is manifested in the details of their production. These evidences generally appear, in some instances, as pauses made in the lines connecting the letters of the signature, where the pen rested while the eye of the forger was directed from the writing being done to the copy, that the writer could fix in the mind the form of a succeeding letter. Another characteristic of forged signatures that are not traced from a genuine signature is that they are written with greater length in proportion to the width and height of the letters, than occurs in the genuine signature from which they are copied in imitation. This want of proportion occurs generally from making the lines connecting the letters of the signature longer than those of the copy.

As earlier stated, one of the commonest and easiest means of reproducing a signature is to put the genuine signature on a piece of

glass, lay another glass on top of it and fasten the piece of paper that is to receive forgery on top of that. Then by holding the glass strips to a bright light, the original signature casts a shadow through, which may be traced in pencil. From the tracing the ink forgery is completed.

SELF-ASSESSMENT EXERCISE 4

Enumerate the various methods signature forgers can adopt to carry out their act.

3.5 Signature Forgery Prevention Tips

How can signature forgery be prevented or minimised? The following are the tips:

1. Whenever you dictate something anytime – make sure you have a copy for your files. Just don't walk out of any establishment without at least a photocopy of the document that you signed.
2. Keep your receipt: Keep it in a safe, easily accessible place. The best evidence is always the original (signature in ink is considered an original). Many firms have photocopied or printed contracts which are used instead of typing or printing out the terms each time and simply have the buyer or client sign that copy.
3. Do not sign a blank sheet of paper: Do not sign a form in which the blanks have not been filled in. If there are necessary blanks, initial those parts to show that they are intentionally left incomplete.
4. Do not do business when you are ill, under stress and/or under the influence: The courts do not take kindly to those excuses. Your signature is your signature and it is the one of the last strongholds of individuality in this century and the next. Therefore, if your name is inscribed, unless you can prove it's a forgery, you must take responsibility.
5. Devise a signature that is particularly yours: It may resemble the rest of your writing with a few variations that people will find hard to copy. Legibility is not the key here, individuality is. Some people make their capital letters larger, or place them in a particular sequence. Often there is a flourish built into the final stroke. The more your signature looks like your regular script, the easier it is for people to copy. Practice subtle differences: the size/shape/angle of the capitals, the punctuations, the spacing

between your first and last name, and/initial. There are as many variations in writing as there are people – make up your own and you will have a signature that is difficult to forge.

6. Practice making your signature completely individual: How do you do it? Simple: write your name as if you were going to be marked on your penmanship. Then, write it again and again, changing the writing to your most comfortable style. Vary some aspects of the letter formation so it does not copy your regular script.

Forgers will reproduce a passable image of your capital letters, the size and maybe the slant of a signature. But it is impossible for them to copy all the aspects of your writing.

7. Never sign a document or paper in blank: People frequently bring lawsuits against professionals in today's litigious society. Fortunately for both the professional and the client, records are kept of visits and procedures both at the office visits and hospitals stay in most instances. Those records are used to refresh the professional's memory. Often these records are crucial to proving the specialist's reasons for acting as he or she did.
8. Keep samples of your writing through the years: Cancelled cheques are excellent. If you are one of those people that have different signatures for different instances such as one signature for cheques and regular business, another for formal documents such as wills, contracts, etc. and perhaps a third for friends and family, keep representative copies of them all at least a dozen of each. Mark them for the year in which they were written. This will help if someone tries to copy a 2009 signature in 2010.

SELF-ASSESSMENT EXERCISE 5

Describe how you will prevent your signature from being forged.

3.6 Methods For Detecting Signature Forgery

In the past, signatures were verified by comparing a signature in question with a collection of samples of a valid signature. After the signature was normalised to a particular scale, the overall shape of the signature was compared with the stored samples or templates. Unfortunately, this type of comparison was susceptible to forgeries made by tracing or copying a valid signature.

An embodiment of the present invention provides a method for detecting forged signatures that were made by methods such as tracing a valid signature. As a signature is traced, it typically includes jitter. Jitter results from the many small corrections a person makes in the process of tracing a signature.

Forgeries are detected by curve fitting the signature in question. The length of the curve fitted signature and the length of the signature in question are compared. If the signature in question is a traced forgery, it will tend to have a significant amount of jitter which results in a significant longer length than the curve fitted signature.

In another embodiment of the present invention, samples of valid signatures are collected and the amount of jitter in each valid signature is measured. Then when a signature in question is checked for authenticity, the amount of jitter can be compared with the amount of jitter included in valid signatures. This helps to prevent the rejection of valid signatures produced by the people with jittery signatures.

Signature forgeries are also detected by curve fitting the signature in question. The length of the curve fitted signature and the length of the signature in question are compared. If the signature in question is a traced or copied forgery, it will tend to have a significant amount of jitter which results in a significantly longer length than the curve fitted signature.

A method for detecting forgery in a traced signature by measuring an amount of jitter in the traced signature, comprising the following steps:

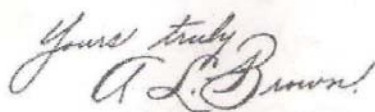
- Collecting at least one valid signature.
- Taking a first plurality of samples of the valid signature.
- Forming a first sum of distances between consecutive samples belonging to the first plurality of the samples.
- Fitting a first curve to the valid signature.
- Measuring a first length of the first curve.
- Determining the threshold by forming a first ratio using the first sum of distances and the first length of the first curve.
- Taking a second plurality of samples of the traced signature.
- Forming a second sum of distances between consecutive samples belonging to the second plurality samples
- Fitting a second curve to the traced signature.
- Measuring a second length of the second curve.
- Forming a second ratio using the second sum of distances and the second length of the second curve, and detecting forgery in the traced signature by comparing the second ratio and the threshold

Imitations of signatures are usually written in a laborious and painstaking manner. They are, therefore, decidedly unlike a man's natural signature which is usually written in an easy fashion. The imitations show frequent pauses, irregularities in pen pressure and in the distribution of ink, and contain other evidences of hesitation. Not frequently the forger tries to improve on his work by retouching some of the letters after he has completed a word. Microscopic examination brings out all of these things and makes them tell-tale witnesses.

3.7 Comparison of Four Ordinary Signatures with Description

INTERESTING WRITINGS OF VARIOUS KINDS FOR STUDY AND COMPARISON

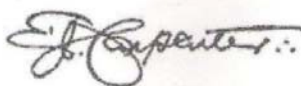
FOUR ORDINARY SIGNATURES WITH DESCRIPTIONS



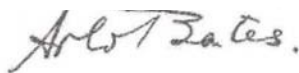
A mechanical or artificial hand in copy-book style, lightly and delicately traced.



A restrained hand, letters slowly and deliberately traced, indicating a slow intelligence and perception.



Characteristic signature, connected and rapidly traced letters expressing great animation and mental activity.



A natural hand, letters vary in size, written with great spontaneity and expression.

4.0 CONCLUSION

We have explained signature forgery as an illegal modification or reproduction of an instrument, document, signature, or legal tender, or any other means of recording information. An item is also considered forged if it is claimed that it was made by someone who did not make it. We also learnt that signature forgery is made up of three types, selective, universal and existential. Also one of the commonest and easiest means of reproducing a signature is to put the genuine signature on a piece of glass and traced with a pencil. We also advise top ranking officers to sign unique signatures to avoid forgery.

5.0 SUMMARY

In this unit, we have discussed signature forgery by looking at the following aspects: Meaning, Types, Forged and Disputed Signatures, How forgers reproduce signatures, How to prevent signature forgeries and methods of detecting signature forgery.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define the term forgery.
2. How will you prevent your signature from being forged?
3. List three types of forged signatures.

7.0 REFERENCES/FURTHER READING

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UNIT 3 COUNTERFEIT CURRENCIES

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
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- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

1.0 INTRODUCTION

Counterfeiting currencies is an interesting study and touches on both economic and political facets of the society. Counterfeit is generally defined as, representing by imitation, or likeness, having a resemblance to something else, portrayed or fabricated in imitation of something else, with a view to defraud by passing the false copy for genuine or original, as counterfeit antiques, counterfeit coin. The various issues that will be examined in this unit that will introduce you to the concept of counterfeiting currencies are the meaning, history, spotting a counterfeit, counterfeit money detector and combating counterfeiting.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of counterfeit currency
- describe how to spot a counterfeit
- mention various ways of detecting counterfeit currency
- state measures of combating counterfeiting
- trace the history of counterfeiting currency.

3.0 MAIN CONTENT

3.1 Meaning of Counterfeit Currency

Counterfeit money is currency that is produced without the legal sanction of the state or government to resemble some official form of

currency closely enough that it may be confused for genuine currency. Producing or using counterfeit money is a form of fraud. Roman coins were struck using a minting process, not cast, so the coin moulds were created for forgery.

Counterfeiting is probably as old as money itself before the introduction of paper money, the most prevalent method of counterfeiting involved mixing base metals with pure gold or silver. A form of counterfeiting is the production of documents by legitimate printers in response to fraudulent instructions. During World War II, the Nazis attempted to forge British pounds and American dollars. Today some of the finest counterfeit banknotes are called super-dollars because of their high quality and likeness to the real US dollar. There has been a rapid growth in the counterfeiting of Euro banknotes and coins since the launch of the currency in 2002.

The crime of counterfeiting currency is as old as money itself. In the past, nations had used counterfeiting as a means of warfare such as in the War Between the States in the USA in the mid 1800s and the Bernhard operation in Europe during the Second World War. The idea was to overflow the enemy's economy with fake banknotes, so that the real value of the said money was reduced, therefore, attacking the economy and general welfare of a society. Today, the crime of counterfeiting continues to present a potential danger to national economies and financial losses to consumers. Recent developments in photographic and computer technology, as well as printing devices, have made the production of counterfeit money relatively easy, thereby increasing the potential threat.

Some of the ill-effects that counterfeit money has on society are: a reduction in the value of real money, and increase in prices (inflation) due to more money getting circulated in the economy – an unauthorised artificial increase in the money supply, a decrease in the acceptability of paper money, and losses, because companies are not reimbursed for counterfeits. Traditionally, anti-counterfeiting measures involved include fine detail with raised intaglio printing on bills which would allow non-experts to easily spot forgeries on coins, milled or reeded (marked with parallel grooves) edges are used to show that none of the valuable metal has been scrapped off.

SELF-ASSESSMENT EXERCISE 1

Define the term counterfeiting in relation to currencies.

3.2 History of Counterfeit Currency

Was counterfeiting existing in olden times? Counterfeiting is as old as money itself. Coinage of money began in the Greek city of Lydia around 6 B. C. Before the introduction of paper money, the most prevalent method of counterfeiting involved mixing base metals with pure gold or silver. Also, individuals would “shave” the edges of a coin. This was known as “clipping”. While not itself counterfeiting, the exponents were able to use these precious metal shavings to create counterfeits. A *fouillée* is an ancient type of counterfeit coin, in which a base metal core has been plated with a precious metal to resemble its solid metal counterpart. Rulers often dealt very harshly with the perpetrators of such deeds. In 1162, Emperor Gaozong of Song had promulgated a decree to punish the counterfeiter of Huizi to death and to reward the informant. The English couple, Thomas and Anne Rogers, were convicted on 15 October, 1690 for “clipping 40 pieces of silver”. Thomas Rogers was hanged, drawn and quartered while Anne Royer was burnt alive. The extreme forms of punishment were due to the pair’s acts being construed as treason, rather than simple crime.

In the United States, counterfeiting was once punishable by death. Paper currency printed by Benjamin Franklin often bore the phrase to counterfeit is death. The theory behind such harsh punishments was that one who had the skills to counterfeit currency was considered a threat to the safety of the state, and had to be eliminated-another explanation is the fact that issuing money that people could trust was both an economic imperative, as well as a royal prerogative-therefore counterfeiting was a crime against the state or ruler itself, rather than against the person who received fake money.

Modern counterfeiting begins with paper money. Nations have used counterfeiting as a means of warfare. The idea is to overflow the enemy’s economy with fake bank notes, so that the real value of the money plummets. Great Britain did this during the revolutionary war to reduce the value of the Continental Dollar. Although this tactic was also employed by the United States during the American Civil War, the fake Confederate currency it produced was of superior quality to the real thing.

A form of counterfeiting is the production of documents by legitimate printers in response to fraudulent instructions. An example of this is the Portuguese Bank Note Crises of 1925, when the British banknote printers Waterlow and Sons produced *Banco de Portugal* notes equivalent in value to 0.88% of the Portuguese nominal Gross Domestic Product, with identical serial numbers to existing banknotes, in response to a fraud perpetrated by Alves dos Reis.

In 1926 a high-profile counterfeit scandal came to light in Hungary, when several people were arrested in the Netherlands while attempting to procure 10 million francs worth of Fake French 1000-franc bills which had been produced in Hungary, after 3 years, the state sponsored industrial scale counterfeit operation had finally collapsed.

Today, some of the finest counterfeit bank notes are called super-dollars because of their dollar. The source of the super-notes is disputed, with North Korea being vocally accused by U.S authorities. Recently, on May 23, 2007, the Swiss government has raised some doubt as to the ability of North Korea to produce the “super dollars”. Bulgaria and Colombia are also significant sources of counterfeit currency. There has been a rapid growth in the counterfeiting of Euro banknotes and coins since the launch of the currency in 2002. In 2003 551, 287 fake euro notes and 26, 191 bogus euro coins were removed in circulation and in 2004, French Police seized fake 10 euro and 20 euro notes worth a total of around €1.8 million from two laboratories and estimated that 145,000 notes had already entered circulation.

In the early years of the 21st century, the United States Secret Service has noted a substantial reduction in the quantity of forged U.S. currency, as counterfeiters turn their attention towards the Euro. In 2006, a Pakistani government printing press in the city of Quetta was accused of churning out large quantities of counterfeit Indian currency. The times of India, reported this based on central Bureau of intelligence investigation. The rupee notes are then smuggled into India as part of Pakistanis agenda of destabilising (the) Indian economy through fake currency, the daily said. The notes are supplied by the Pakistan government press (at Quetta) free of cost to Dubai-based counterfeiters who, in turn smuggle it into India using various means, the report said. This money is allegedly used to fund terrorist activities inside India. The recent blasts in Mumbai were allegedly funded using fake currency printed in Pakistan.

SELF-ASSESSMENT EXERCISE 2

Trace the origin of counterfeiting currencies to the modern times.

3.3 How to Spot a Counterfeit Currency

It used to be that spotting a “good” counterfeit bill was impossible for ordinary people. If it was good enough to pass the “look and feel” test, then it was going to take an ultra-violet light or a magnetic ink detector. By now you should know a little bit about bank notes, the way they are printed and the types of feature that they have on them. You even know about the methods that are used to counterfeit them. The best chance you

have of detecting a counterfeit is knowing your currency. Many countries, on issuing newly designed notes, will also publicise many of the security features present on them, so that the general public can verify that they have the genuine article.

So what is the plan of action for assessing whether a note is counterfeit? If possible view the suspicious note alongside one that you know is genuine, e.g. one you have just got out of an ATM machine.

	Action	Genuine	Counterfeit
1.	feel the paper	a new genuine note has very crisp paper with a distinctive feel	The paper is often the initial give away for a counterfeit note, it tends to be a lot floppy than the real thing. We are all used to handling cash on an everyday basis and know the feel of a real note even if we are not aware of it.
2.	Feel the paper	The print on a bank note also produces a very distinctive feel with intaglio areas being raised compared to the rest. This effect is most pronounced on brand new notes.	
	Hold the note up to the light	When you will be able to see depends upon the features present but generally most bank notes carry a watermark and thread. A thread will always appear as a solid line when viewed in this way and good watermark detail should be seen. If a see through feature is present the front and back	Some counterfeiters will attempt to simulate a watermark but it will be locking in the fine detail seen in an original and the image may be visible when not held up to the light. Some also attempt to reproduce the effect of the thread but again it is more likely to be visible when not looking at the note using transmitted light. The register of a see through feature is likely to be imprecise so that a composite image is not produced.

		images should produce the composite.	
3.	Print Quality	A genuine note has very crisp well define print with plenty of tonal range in the intaglio areas.	The print quality of counterfeits is very inferior, fine details are lot and areas can sometimes appear blurred.
4.	Magnifying Glass	Now we are getting serious, if you have once take a magnifying glass and have a really close look at the note. Under magnification the print quality will still look crisp. You should be able to read any microtext message present.	What you see under magnification will depend on how the note has been counterfeited. The presence of cyan yellow magenta and black dots, a raster line (often seen on colour copy counterfeits) or poorly defined line are indicators.
5.	U V Lamp	Not something we all have lying around the house but if you do have access to an ultra violet lamp, it is a useful viewing tool. Any ultra violet feature will show up and the paper will appear dull.	Counterfeiters will not always counterfeit what can't be seen in normal light and may have omitted a simulation of an ultra violet feature very often the paper they use is UV bright, meaning that it glows more than banknote paper under UV light.
6.	Colour	The colours on a genuine note are clear and well defined and metallic ink areas has sheen.	The colours seen on a counterfeit note can sometime appear washed out or off gamut. Colour copies sometime copy both light greens and oranges as yellows. Metallic areas often do not have sheen.
7.	Feature cheques	The cheques you entirely have on, knowing how	Can perform depending on its present look.

		<p>genuine the currency is.</p> <p>Latent Images: when viewed obliquely a hidden image should emerge.</p> <p>Optically Variable Ink: A colour shift should be seen from this feature as the angle of viewing is changed.</p> <p>Hologram: The feature produces multi colours and different images depending upon the angle of viewing.</p> <p>Foil: A particular design is not blocked onto a note. Extra security is provided by over printing with intaglio design. The feature is seen in a variety of colours and has a very high sheen.</p> <p>Anti Copy Tints: These are very flat</p>	<p>Because the mechanism which produces a latent image is a result of the tactile nature of intaglio, this effect will not be seen on a counterfeit unless some simulation of intaglio has been attempted. This alone will not ensure that a latent image effect will be produced.</p> <p>A very difficult effect to stimulate, the colour shift effect will generally not be seen on a counterfeit note.</p> <p>Extremely difficult to reproduce but the counterfeiter may stimulate it by a plain shiny foil.</p> <p>The feature will appear as a black area on a colour copier counterfeit. Some counterfeiters will attempt to simulate it but printing on top of it will be difficult.</p> <p>These features can be activated depending on the</p>
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		unassuming features revealing nothing.	method used to counterfeit the note, a half tone separation method will produce a visual disturbance within the area either producing interference fringes, patterns which pop out or words that emerge.
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SELF-ASSESSMENT EXERCISE 3

List the various steps you will follow in spotting a counterfeit.

3.4 Counterfeit Money Detection

How are counterfeit currencies detected? Counterfeiting is no longer the realm of the skilled engraver. Digital technology, high quality printing and computer scanning have made it possible for even a student with reasonable expertise to print currency notes. Monetary half from anti-government agencies have given a much needed boost to counterfeiters.

Detecting a fake is not easy. Because the days when counterfeit money was printed in a local printing press are long gone. Today, the best equipment, the best technology and people with expertise behind manufacturing American dollars are being roped in to make fake currency notes. The notes have all the features of an American bank note (the red and blue security fibres, the security thread, and the watermark). And some of these notes are so perfect, that they can even fool an expert. We all know that counterfeit money detector detect a fake currency note and sound an alarm when it spots one.

It has been a cat and mouse game of sorts between counterfeiters and security agencies. Whenever a new method of counterfeiting is detected, a new method of authenticating the note is also developed by security agencies. Yea, there are different types of counterfeit money detectors available in the market today.

Let us take a look at some of them.

The Counterfeit Money Detector Pen

This is undoubtedly the most popular counterfeit money detection system in the market today. It looks like an ordinary pen but it can quickly detect a counterfeit currency note. The counterfeit money detector is based on a simple but quite an effective concept. Ordinary wood based paper contains starch and the counterfeit money detector

pen contains an iodine solution that reacts with the starch. This reaction creates a black stain on the paper indicating that the currency note is a fake. When the ink is used on genuine fibre based paper that is used in actual currency notes, there is no discoloration or stain. All that you have to do is create a small mark on the currency note to authenticate whether the note is fake. While the counterfeit money detector pen cannot be used on high end notes like the super dollar, it is quite effective in detecting fake notes printed on ordinary paper.

The Counterfeit Currency VU Detector

Try scanning a \$20 bill using a scanner at home and ensure that you set the scanner to its highest resolution. The scanned image of the \$20 bill is a perfect replica of the original. If you use the zoom function and look closely, you will find that the entire bill has a hexagonal pattern of fine lines imprinted on it. These lines are invisible to the naked eye. But it is these lines that give different tints to different parts of the note. Other than this, there are tiny intricate details on parts of the note. There is micro-printing, there are watermarks and other security features. The scanner is able to capture the image with remarkable clarity. But when you try to print it, the printer is not able to do the same. And don't forget the colour shifting ink. In most fake currency notes, the printer has merely created a superficial image of the note on the paper. And it can quickly be detected using an ultra violet light money detector.

This detector uses UV technology and a band of UV light is shone on the note. Apart from easily detecting the superficial image, a printer toner has several tiny particles also known as bleed that a UV detector can detect. A UV counterfeit money detector may also include other methods of detecting counterfeit money.

Magnetic Currency Detection

Magnetic detection or MG detection is one of the methods of detecting counterfeit currency that is included in most currency detectors now. Most UV currency detectors have built in support for MG detection. Several countries use magnetic particles in the ink used for printing currency notes and these particles provide a way of validating currency. The magnetic fields used in these particles are smaller than the magnetic field of the earth. However, these fields produce signatures that can be used to detect denominations of currency. A magnetic currency detector detects the presence of these magnetic particles in the ink.

Magnifying Currency Detection

You can always rely on the good old eyes to help you spot a fake. While you can use an ordinary magnifying glass to have a detailed look at a note, most counterfeit currency detectors use magnifying detection technology. The note is magnified using magnifying paver more than 5x and the result can be seen on a computer screen. This helps users verify the security features like the micro-printing, the security thread that runs vertically with the pertinent text legibly printed on it, the high quality portrait, the presence of the visual aid and watermark.

Watermark Detection

A watermark is a security feature that is added to security notes and other important documents to prevent counterfeiting. The watermark will only appear when the note is held against a black background or at a certain angle. Depending on the country and the denomination of the note, the watermark may either be a true watermark (applied during paper manufacture) or an artificial watermark (applied during printing). The watermark on US dollar note can be easily detected when it is held against fluorescent light and hence, most counterfeiting currency detections use watermark detection.

The Lighted Reflection

Currencies of most countries including the United States have a metallic colour changing emblem printed on it. For example, the US \$100 bill that has the black green colour changing emblem in the lower right hand corner.

SELF-ASSESSMENT EXERCISE 4

Describe three methods used in detecting counterfeit currency.

3.5 Combating Counterfeiting

Traditionally, anti-counterfeiting measures involves including fine details with raised intaglio printing on bills which would allow non-experts to easily spot forgeries. On coins milled or reeded (marked with parallel grooves) edges are used to show that none of the valuable metal has been scraped off. This detects the shaving or clipping (paring off) of the rim of the coin. However, it does not detect sweating, or shaking coins in a bag and collecting the resulting dust. Since this technique removes a smaller amount, it is primarily used on the most valuable coins, such as gold. In early paper money in colonial North America, one creative means of detecting counterfeiters was to print the patterns

found in a leaf that were unique and complex, they were nearly impossible to reproduce.

In the late twentieth century advances in computer and photocopy technology made it possible for people without sophisticated training to copy currency easily. In response, national engraving bureaus began to include new more sophisticated anti-counterfeiting systems such as holograms, multi-coloured bills, embedded devices such as strips, micro printing and inks whose colours changed depending on the angle of the light, and the use of design features such as the “EURION constellation which disables modern photocopiers. Software programmes such as Adobe Photoshop have been modified by their manufacturers to obstruct manipulation of scanned images of banknotes.

The following are other measures taken globally to combat the crime of counterfeit currencies.

Cooperation, Communication, and Contacts

The INTERPOL Counterfeits and Security Documents Branch (CSDB) is responsible for establishing programmes that provide forensic support, operational assistance, and technical databases in order to assist the 188 member countries of INTERPOL regarding counterfeit currency. With this responsibility, INTERPOL CSDB continuously assess existing measures, with the goal of implementing new ones that may provide an “added value” to the international community addressing counterfeit currency on a global scale.

The major challenge to protect currencies from counterfeiters has increasingly become more dependent on partnership between law enforcement agencies, financial institutions and central banks, as well as with the security printing industry and high-grade supplier community. These partnerships bridge geographic, jurisdictional, cultural and organisational divisions, which were once impediments toward providing comprehensive and co-ordinate solutions for combating financial crimes.

Therefore, INTERPOL, through its Counterfeits and Security Documents Branch (CSDB), recognises and fosters cooperation with other official law enforcement entities, such as the Unified States Secret Service (USSS) and Europol, as well as with international Organisations and Central Banks, such as the European Anti-Fraud Office (OLAF), European Central Bank (ECB), the US Federal Reserve Bank (FRB) and the Central Bank Counterfeit Deterrence Group (CBCDG) and with innovative leaders in private industry.

The INTERPOL CSDB philosophy is that through partnerships-and increased cooperation, communication, and contacts – we can better serve the needs of the community and reduce duplicity of effort, while combating the particular crime.

INTERPOL Assistance in the Prevention of Currency Counterfeiting

Since the 1929 General convention, which recognised the ICPO-General Secretariat as the international central office for the suppression of counterfeit currency, INTERPOL member countries have been able to call upon the General Secretariat for the following services:

- Classifying, analyzing and storing genuine currency specimens and counterfeit banknotes.
- Circulating analytical reports among INTERPOL member countries.
- Determining whether suspect specimens are genuine or counterfeit.
- Allocating international indicatives to newly discovered counterfeits, (except for USD and Euro).
- Publishing descriptions of new counterfeit banknotes.
- Preparing and circulating tables of statistic on worldwide counterfeit currency trends.
- Organising and/or participating in international counterfeit currency, in order to stay abreast of latest technologies and to share best practices.

Public–Private Outreach

In an effort to address new trends in the area of counterfeit currency, as well as encourage the international spirit of cooperation representatives of INTERPOL, CSDB routinely participate in public events and private training seminars, with partners from law enforcement, the central banking community, and the security printing industry.

CSDB Web-Based Tools

In addition to ‘public-private’ outreach activities, representatives of INTERPOL CSDB are also continuously developing web-based tools in order to address concerns within the 188 members of the ICPO community. Over recent years, CSDB has developed the following web-based tools, which are available via the INTERPOL secure communication network.

- **Currency Bulletins:** A publication posted monthly with the assistance of CPO members and their respective national central banks which provides current trends and specific details about the genuine currencies within the ICPO community.
- **Currency List:** An electronic listing of all 188 members of the community with direct links to the respective national central banks.
- **Early Warning Messages:** A monthly publication posted in conjunction with the Europol and the ECB in order to provide relevant trends involving counterfeit Euro currency.
- **Counterfeit Alerts:** A posting of newly discovered counterfeit currencies.. Non US Dollar and non Euro... along with a detailed forensic analysis to warn specific region of the ICPO community about potential impact.
- **Counterfeit Currency List (CCL) :** To disseminate information on known counterfeits regarding the other currencies of the ICPO community ... non US-Dollar and non Euro... which have also exhibited a global impact as well as global circulation.
- **CSDB New:** A web-based product to inform the ICPO Community about recent activities of the CSDB Counterfeit Currency Team.

SELF-ASSESSMENT EXERCISE 5

List Measures of combating counterfeit currencies.

4.0 CONCLUSION

We have explained that counterfeiting generally refers to imitation or likeness, having a resemblance to something else portrayed, while counterfeit money as currency that is produced without the legal sanction of the state or government to resemble some official form of currency closely enough that it may be confused for genuine currency. Producing or using counterfeit money is a form of fraud. We also discussed ways of spotting a counterfeit and counterfeit money detectors. Finally measures of combating counterfeit currencies were also listed.

5.0 SUMMARY

In the unit, we have dealt with the concept of counterfeiting currencies by looking at the following area: Meaning, History, how to spot a counterfeit, counterfeit money detectors and measures of combating counterfeiting.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is counterfeiting currencies?
2. List and explain 3 ways of detecting counterfeit currency.
3. How can you spot a counterfeit?

7.0 REFERENCES/FURTHER READING

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UNIT 4 QUESTIONED DOCUMENTS AND CRIMINAL LABORATORIES

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
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 - 3.2 Scope of Questioned Document Examination
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1.0 INTRODUCTION

What is a questioned document? A “questioned” document is any signature, handwriting, type writing, or other mark whose source or authenticity is in dispute or doubtful. Letters, cheques, driver licenses, contracts, wills, voter registrations, passports, petitions, threatening letters, suicide notes, and lottery tickets are the most common questioned documents, although marks on doors, walls, windows, or boards would also be included by definition. Also discussed are criminal laboratories where evidences are analysed using scientific procedures. The various issues that will be examined in this unit, so as to introduce you to questioned document examination and criminal laboratories are the meaning, scope or type of documents FBI and ATF crime laboratories.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define a questioned document
- explain questioned document examination (ODE)
- discuss the scope of questioned document examination
- list the types of documents to be examined
- mention at least two major criminal laboratories and their functions.

3.0 MAIN CONTENT

3.1 Meaning of Questioned Document

What is the difference between a questioned document and questioned document examination (ODE)? A “questioned” document is any signature, handwriting, type writing, or other mark whose source or authenticity is in dispute or doubtful. Letters, cheques, driver licenses, contracts, wills, voter registrations, passports, petitions, threatening letters, suicide notes, and lottery tickets are the most common questioned documents, although marks on door, walls, windows, or boards would also be included by definition.

Questioned document examination (ODE) is the forensic science discipline pertaining to documents that are (or may be) in dispute in a court of law. The primary purpose of questioned/forensic document examination is to answer questions about a disputed document using a variety of scientific processes and methods. Many examinations involve a comparison of the questioned document, or components of the document, to a set of known standards. The most common type of examination involves handwriting wherein the examiner tries to address concerns about potential authorship.

A document examiner is often asked to determine if a questioned item originated from the same source as the known item(s), then present their opinion on the matter in court as an expert witness. Other common tasks include determining what has happened to a document, determining when a document was produced, or deciphering information on the document that has been obscured, obliterated or erased.

The discipline is known by many names including forensic document examination, diplomatic, handwriting examination, or sometimes handwriting analysis although the latter term is not often used as it may be confused with graphology. Likewise, a forensic document examiner (FDE) is not to be confused with a graphologist, and vice versa. Many forensic document examiners receive extensive training in all of the different aspects of the discipline. As a result they are competent to address a wide variety of questions about document evidence, however, this “broad specialisation approach has not been universally adopted.

In some locales, a clear distinction is made between the term forensic document examiner and a forensic handwriting expert) examiner. In such cases, the former term refers to examiners who focus on non-handwriting examination types while the latter refers to those trained exclusively to do handwriting examinations. Even in places where the more general meaning is common, such as North America or Australia,

there are many individuals who have specialised training only in certain relatively limited areas. As the terminology varies from jurisdiction to jurisdiction, it is important to clarify the meaning of the title used by any given individuals professing to be a “forensic document examiner”.

Question document examination is frequently found in cases of forgery, counterfeiting, mail fraud, kidnapping, con games, embezzlement, gambling, organised crime, white colour crime, art crime, theft, robbery, arson, burglary, homicide, serial murder, psychological profiling and deviant sex crime. A number of famous cases over the years, some involving wrongful conviction ... the Dreyfus affair, Bruno Hauptman and the Lindbergh kidnapping, the Hitler Diary profiling controversy, and the Clifford Irving’s forgery of Howard Hughes signature and Mormon documents ... were showcases for the talents of various experts at questioned documents examination. Its strength drawn from civil law, is that expert opinion can overturn (alleged) eyewitness opinion.

SELF-ASSESSMENT EXERCISE 1

Differentiate between questioned documents and questioned document examination.

3.2 Scope of Questioned Document Examination

A forensic document examiner is intimately linked to the legal system as a forensic scientist. Forensic science is the application of science to address issues under consideration in the legal system.

Common criminal charges involved in a document examination case fall into the “white-collar crime” category. These include identity theft, forgery, counterfeiting, fraud, or altering a forged document. Questioned documents are often important in other contexts simply because documents are used in so many different contexts and for so many different purposes. For example, a person may commit murder and forge a suicide note. This is an example wherein a document is produced directly as a fundamental part of a crime. More often a questioned document is simply the by-product of normal day-to-day business or personal activities.

Forensic document examiners, examine items that form part of a case which may or may not come before a court of law. The many types of possible examinations include the following:

- Handwriting (cursive/printing) and signatures
- Typewriters, photocopiers, laser printers, ink jet printer, fax machines

- Cheque writers, rubber stamps, price markers, label markers
- Printing processes
- Ink, pencil, paper
- Alterations, additions, erasures, obliterations
- Indentations
- Sequence of strokes
- Physical matching.

Questioned document examiners follow a standard guide for scope work of a forensic document examiner. It states that an examiner “makes scientific examinations, comparisons, and analyses of documents in order to:

1. Establish genuineness or non-genuineness, or to expose forgery or to reveal alterations, additions or deletions.
2. Identify or eliminate persons as the source of handwriting.
3. Identify or eliminate the source of typewriting or other impression, marks, or relative evidence.
4. Write reports or give testimony, when needed, to aid the users of the examiner’s services in understanding the examiner’s limit. Their work is not only the examination and comparison of handwriting but most inspect and examine the whole document in accordance with the guide standards. i.e. standard Guide for Minimum Training Requirements for Forensic Document Examiners.

What Sorts of Documents are Examined?

Documents feature prominently in all manner of business and personal affairs. Almost any type of document may become disputed in an investigation or litigation. For example, a questioned document may be a sheet of paper bearing handwriting or mechanically produced text such as a ransom note, a forged cheque or a business contract. Or it may be some material not normally thought of as a ‘document’. Forensic document examiners define the word “document” in a very broad sense as being any material bearing marks, signs or symbols intended to convey a message or meaning to someone. This encompasses traditional paper documents but also includes things like graffiti on a wall, stamp hidden in a written letter, among other things.

Specific Document Examinations

Identification

The traditional approach in the discipline of questioned document examination is best expressed as follows:

“when any two items possesses a combination of independent discriminating elements (characteristics) that are similar and/or correspond in their relationships to one another, of such number and significance as to produce or preclude the possibility of their occurrence by pure coincidence, and there are no inexplicable disparities, it may be concluded that they are the same in nature or are related to a common source (the principle of identification).

The evaluation of such characteristics at the present time is predominantly subjective in nature though efforts to quantify this type of information in a meaningful manner are ongoing. It should be noted that subjective evaluation does not mean the results of properly conducted comparisons will be either unreliable or inaccurate. To the contrary, scientific testing has shown that professional document examiners (as a group) out-perform lay-persons when comparing handwriting or signatures to assess authorship.

However, this type of ‘subjective’ analysis depends greatly upon the competency of an individual examiner. It follows that (1) an examiner should follow appropriate case examination protocols carefully and evaluate all possible propositions, (2) an examiner should be properly trained and their training should include adequate testing of their abilities, (3) the formal case examination procedure should incorporate some form of secondary review (ideally, independent in nature) and (4) every examiner should make every effort to demonstrate and maintain that competency through professional certification and ongoing competency testing.

Handwriting Examinations

The examination of handwriting to assess potential authorship proceeds from the above principle of identification by applying it to a comparison of samples of handwritten material. Generally, there are three stages in the process of examination.

In brief, they are:

1. Analysis: The questioned and known items are analysed and broken down to direct perceptible characteristics.
2. Comparison: The characteristics of the questioned item are then compared against the known standard.
3. Evaluation: Similarities and/or differences in the compared properties are evaluated and this determines which ones are valuable for a conclusion. This depends on the uniqueness and frequency of occurrence in the items.

4. Optionally, the procedure may involve a fourth step consisting of verification/validation or peer review.

SELF-ASSESSMENT EXERCISE 2

List the essence of questioned document examination, and the sort of documents to be examined.

3.3 Types of Questioned Documents Examined

Historically questioned document examination has been somewhat of an inclusive profession, even to the point where so-called pseudo-experts (in palmistry and fortune-telling) were sometimes welcome, and even today, it suffers from a bit of identity crises in that at least eight different or related, areas can be identified.

Questioned Document Examiners

A document examiner analyses any questioned document and is capable of more than just questions of authorship limited only by their access to laboratory equipment.

Historical Dating

These is work involving the verification of age and worth of a document or object, sometimes done by a document examiner, and can get as complicated as Carbon-14 dating.

Fraud Investigators

This is work that often overlaps with that of the document examiner and focuses on the money trail and criminal intent.

Paper & Ink Specialist

These are public or private experts who date, type, source, and/or catalogue various types of paper, watermarks, ink, printing/copy/fax machines, computer cartridges, etc. using chemical methods.

Forge Specialists

These are public or private experts who analyse altered, obliterated, change or doctored documents and photos using infrared lighting, expensive spectrography equipment or digital enhancement techniques.

Handwriting Analysts

These are usually psychology experts who assess personality traits from handwriting samples, also called graphologists or graphoanalysts.

Forensic Stylists

This refers to the same purpose but by looking at semantics, spelling, word choice, syntax, and phraseology.

Typewriting Analysts

These are experts on the origin, make, and model used in typewritten material.

Computer Crime Investigators

This is an emerging group that relates to questioned document examination through some common investigative and testimonial procedures.

It is probably a futile effort to rigidly demarcate and delimit the various areas of question document examination as there will always be overlap, evolution, and perhaps, controversy. One of the things important to understand is what the question document examiner expert is looking for. This deals with the issues of class characteristics versus individual characteristics. In a nutshell, Class characteristics, which are commonly found at crime scenes, describe evidence which can only be associated with certain personality traits) and not a single source.

Among question document examination experts, the use is made of many different scientific principles from a variety of disciplines, and one of the first attempts at basic principles appeared in Albert Osborn's *Questioned Documents* in 1910, grounded in handwriting comparison as evidence of individual characteristics (paraphrased below):

1. The most identifying characteristics are those which are most divergent from the regular system or national average.
2. Repeated characteristics which are inconspicuous should be sought first and given the most weight.
3. Regular or national system similarities are not alone sufficient to base judgments.
4. It is the combination of particulars, common and uncommon, that identifies.
5. It is impossible to discover how all strange and peculiar characteristics came to be developed.

6. People do wholly unaccountable things in their speech, gestures, and writing.
7. An individual characteristic may be the survival of an error overlooked by a teacher.
8. Many characteristics are outgrowths or copies of an at one time admired design.

The psychological theory of handwriting comparison is developmental. Children learn to write by copying whatever style of writing is fashionable at the time and taught to them by teachers from textbooks. This style is known as the regular or national system. And for most of the twentieth century, it was either the palmer system or the Zaner-Blosser system for cursive. Today, there are many systems, or no system. As the child grows, the act of writing becomes a sub conscious effort and begins to pick up habitual shapes and patterns that distinguish it from all others. This is most evident with capital letters and numerals. Handwriting has individual characteristics due to it being largely unconscious behaviour. The unconscious handwriting of two different individuals is never identical.

SELF-ASSESSMENT EXERCISE 3

Describe four major areas that could be examined by a questioned document examiner expert.

3.4 Criminal Laboratories

What are criminal laboratories?

A criminal-laboratory often shortened to crime lab is a scientific laboratory, using primarily forensic science for the purpose of examining evidence for criminal cases.

A typical crime lab has two sets of personnel:

Field Analyst

Investigators that go to crime scenes, collect evidence, and process the scene Job titles include – Forensic evidence technician, crime scene investigator and scenes of crime officer.

Laboratory Analysts

Scientific or other personnel who run tests on the evidence once it is brought to the lab (i.e. DNA tests, or bullet striations). Job titles include forensic technician (performs support functions such as making reagents).

Forensic scientific/criminalist (performs scientific analyses on evidence)

- fingerprint analyst
- forensic photograph.

Forensic Document Examination

In the United State, crime labs may be public or privately operated, although private laboratories typically do not respond to crime scenes to collect evidence. Public labs are organised at the city, country, state or national level. A law enforcement agency that does not operate its own crime lab usually has free access to a higher level laboratory for analysis of their evidence.

SELF-ASSESSMENT EXERCISE 4

What is a criminal laboratory, discuss its components.

3.5 FBI Crime Laboratory

The FBI's crime lab, as one of the premier forensic research and analysis facilities, offers its expertise to law enforcement agencies across United States and, at times across the world. It offers services at no cost to the requesting entities, and teams of special agents, administrative staff offer on-site forensic and technical support, nationally and globally, even in the event of disasters involving mass casualties or wide-ranging investigations. Among the services currently provided by the lab, both within its facilities and off-site, are analysis of blood, tissue, and other biological evidence, analysis of legal and illegal drugs and courtroom expert witness testimony for cases involving FBI crime laboratory forensic investigations.

At present, the FBI crime laboratory has two primary operating branches: Forensic Analysis and Operational Support. The forensic analysis branch includes the forensic analysis and scientific analysis sections. The operations support branch is comprised of the forensic science support, operational response, and operational support sections.

The forensic analysis section contains several units, including the cryptanalysis and racketeering records unit, tasked with examination of writer communication and records related to terrorist and criminal organisations. This unit has four programme areas: The first is cryptanalysis, which involves examination, analysis, and decryption of ciphers and codes embedded in all manner of written and electronic communications. Secondly, the drugs programme area analysis, examines records related to illegal drug-trafficking operations. The third

area, racketeering, examines and analyses records pertaining to all forms of gambling, loan-laundering area analyses a broad-range of suspected financial records pertaining to the illegal movement of money both within and outside U.S borders.

Also within the forensic analysis section is the firearms and toolmarks unit, which is charged with examining all aspects of the mechanical condition of serious firearms and ballistic materials, as well as the examination of evidence toolmarks for identification of recovered or suspected tools.

The latent print unit examines and analyses latent prints. On submitted evidence. Latent prints occur when the friction ridge skin of human palms, fingers, or the soles of the feet make contact with a surface and leave physical impressions thereon.

The Questioned Document Unit is staffed with experts in the examination of printing, handwriting, typewriting, printing by hand, obliterated impressions, erasures, and alterations of written communications. Examiners in this unit are also proficient in the identification of edges, imprints, stamp, water-marks, fibres, and other components of writing surfaces, as well as analysis and identification of the media used to mark on them, such as photocopying and facsimile machines, and the media used therein (ribbons, cartridges, etc.).

The scientific analysis section contain six functional units, the first of which is the chem. Bio science unit, involved in extremely high-quality, standardised forensic examination of hazardous chemical, biological, and nuclear evidence, along with related materials. Another functional unit is the chemistry unit, which contains six programme areas the general chemistry, toxicology, paints and polymers, metallurgy, glass and instrumentation operations. Other units include the scientific analysis section (CODIS) Combines DNA Index system, the explosive unit, trace evidence, quality assurance and training unit.

The special photographic unit houses the FBI's entire forensic imaging and photographic continuum, from camera and equipment maintenance and repair, to technical assistance on concealment operations, to aerial and surveillance filming. The operational response section is comprised of the Bomb Data Centre, in which specially trained forensic scientists create and implement advanced technologies designed to increase safety for those involved in bomb disarmament and disposal.

The FBI lab specially handles violent crime, works exclusively for the prosecution and is considered the world's largest lab.

ATF Crime Laboratory

The ATF crime lab handles explosives, bombs, arsons (and does firearms ownership and usage: Disaster response teams (kind of like FEMA). Also field support and some intelligence record keeping. ATF labs are typically very high-tech and have always been accredited.

SELF-ASSESSMENT EXERCISE 5

Discuss the operations of FBI and ATF crime labs.

4.0 CONCLUSION

We have explained that a “questioned” document is any signature, handwriting, typewriting, or other mark whose source or authenticity is in dispute or doubtful. We also learnt that Question Document Examination (QDE) is the forensic science discipline pertaining to documents that are or may be in dispute in a court of law. The essence of examination is to identify or eliminate persons as the source of handwriting, identify or eliminate the source of typewriting or other impression, marks or relative evidence. We also defined a crime lab as a scientific laboratory, using primarily forensic science for the purpose of examining evidence from criminal cases. The two major crime labs are the FBI and ATF laboratories.

5.0 SUMMARY

In this unit, we have successfully discussed the following: meaning, scope, types of questioned documents, and also criminal laboratories especially the FBI and ATF as typical examples.

6.0 TUTOR-MARKED ASSIGNMENT

1. Differentiate between question document, and questioned document examination.
2. Discuss two types of document examined.
3. Describe the units of FBI crime lab.

7.0 REFERENCES/FURTHER READING

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