# 17BTU501BBASICS OF FORENSIC SCIENCESEMESTER VTotal hours/week: L:3 T:0 P:0Marks: Internal; 40 External: 60 Total: 100

Scope: This course gives the fundamentals ideas of forensic science.

Objective: The objective of the course is to introduce fundamental concepts in forensic science.

## UNIT-I

Introduction and principles of forensic science: Forensic science laboratory and its organization and service, tools and techniques in forensic science, branches of forensic science, causes of crime, role of modus operand in criminal investigation. Classification of injuries and their medico-legal aspects, method of assessing various types of deaths.

## UNIT-II

**Classification of fire arms and explosives:** Introduction to internal, external and terminal ballistics. Chemical evidence for explosives. General and individual characteristics of handwriting, examination and comparison of handwritings and analysis of ink various samples.

## UNIT-III

**Toxicology and Finger printing:** Role of the toxicologist, significance of toxicological findings, Fundamental principles of fingerprinting, classification of fingerprints.

## **UNIT-IV**

**DNA finger printing:** Principle of DNA fingerprinting, application of DNA profiling in forensic medicine, Investigation Tools, eDiscovery, Evidence Preservation, Search and Seizure of Computers,

### UNIT-V

Cyber security: Introduction to Cyber security and recent techniques. development of finger print as science for personal identification,

## References

- 1. Bernard J. Glick, Jack J. Pasternak, & Cheryl L. Patten. (2010). *Molecular Biotechnology-Principles and Applications of recombinant DNA* (4th ed.). Washington: ASM Press.
- Nanda, B.B., & Tiwari, R.K. (2001). Forensic Science in India: A Vision for the Twenty First Century. New Delhi :Select Publishers.
- Bhasin, M.K., & Nath S. (2002). Role of Forensic Science in the New Millennium. Delhi: University of Delhi.
- 4. James, S.H., & Nordby J.J. (2005). Forensic Science: An Introduction to Scientific and Investigative Techniques (2<sup>nd</sup> ed.). CRC Press, Boca Raton.
- Investigative rechniques (2 cd.). Cite riss, Both ration.
  5. Eckert, W.G., & Wright, R.K. (1997). An Introduction to Forensic Sciences (2nd ed.). CRC Press, Boca Raton (1997).
- 6. Saferstein R., (2015). Criminalistics: An Introduction to Forensic Science (11<sup>th</sup> ed.). New Jersey: Prentice Hall.



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## LECTURE PLAN DEPARTMENT OF BIOTECHNOLOGY

#### STAFF NAME: Dr. A.A. ARUNKUMAR SUBJECT NAME: BASICS OF FORENSIC SCIENCE SUB.CODE: 17BTU501B SEMESTER: V

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S.No	Lecture Duration Period	Topics to be Covered	Support Material/Page Nos
		UNIT-I	
1	1	Introduction and principles of forensic science	T1:15-16
2	1	Forensic sciences laboratory and its organization and services	W1: R1 28-3
3	1	Tools and techniques in forensic science	
4	1	Branches of forensic sciences	W1
5	1	Causes of crime, role of modus	W1
6	1	Operand in criminal investigation	W1
7	1	Classification of injuries and their medico-legal aspects	
8	1	Methods of assessing, various types of death	
9	1	Revision of Unit-I	
10	1	Class test Unit-I	
	Total No of Hou	rs Planned For Unit 1=10	
		UNIT-II	
1	1	Classification of firearms and explosives	R1:73-81
2	1	Introduction of internal, external and terminal ballistics	T121-24

3	1	Chemical evidence for explosives	T121-24
4	1	General and individual	R1:106-119
~	1		1171
5	1	Examination and comparison of	W I
		hand writings	
6	1	Analysis of ink various samples	R1:106-119
7	1	Case study about ballistics	R1:106-119
8	1	Case study about handwriting	R1120-123
9	1	Revision of Unit-II	W1
10	1	Class test Unit-II	W1
	Total No of Hou	urs Planned For Unit II=10	
		UNIT-III	
1	1	Role of toxicologist	R1:93-95
2	1	Significance of toxicological	R195:T1:36-54
_	-	findings	
2	1		T1. 526 542
3	1	Fundamental principles of finger	11: 536-542
		printing	
4	1	Classification of finger prints	T1: 536-542
5	1	Case study on toxicology	
6	1	Case study on finger prints	
7	1	Case study on history of finger	T1: 536-542
		print	
8	1	Revision of unit III	
0	1		
9	1	Class test for unit III	
	Total No of Hours Planned For Unit III=09		
		UNIT-IV	
1	1	Principles of DNA fingerprinting	T1 167-176
2	1	Applications of DNA profiling in	R1:214-215
		forensic medicine	-
3	1	Investigation tools	T1·167-176
5		mvesugation tools	11.10/-1/0
4	1	e-Discovery, Evidence	T1:167-176
	<b>1</b>	nreservation	1110/ 1/0
F	1	Course and actions of comment	D1.010 014 W1
5		Search and seizure of computers	K1:212-214; W1

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6	1	Case study on DNA	R1:212-214
		fingerprinting	
7	1	Case study on forensic medicine	R1:212; W1
8	1	Revision of unit IV	
9	1	Class test for unit IV	
	Total No of H	ours Planned For Unit IV=09	
		UNIT-V	
1	1	Introduction of cyber security	T1:317-318 W1
2	1	Recent techniques in cyber security	T1:318-319
3	1	Development of fingerprint as science for personal identification	T1:427-428
4	1	Case study of cyber security	T1:428-429
5	1	Case study of recent techniques in cyber security	T1:429-432
6	1	Case study of fingerprint as science for personal identification	T1:440-441
7	1	Revision of unit IV	T1:459,460
8	1	Class test for unit IV	T1:463-466,R2
9	1	Previous year ESE question paper revision	T1:490
	Total No of	f Hours Planned for unit V=09	
Total Planned Hours	47		

#### **TEXT BOOK**

1. Gardener, G.,2001, principles of genetics john wiley and sons Inc, New york

(Page Nos. : 24-54, 56-77, 80-92, 103-118, 204-215, 236-256, 427-443, 458-463, 490-495, 502-505)

#### REFERENCES

- 1. P.S.Verma and V.K aggarwal., 2000 Genetics, S.chand and company ltd New Delhi.
- 2. Monoroe w.stricberger, 1985, genetics 3<sup>rd</sup> edition, macmillan

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#### UNIT-I

#### **SYLLABUS**

Introduction and principles of forensic science, Forensic sciences laboratory and its organization and services, Tools and techniques in forensic science, Branches of forensic sciences, Causes of crime, role of modus, Operand in criminal investigation, Classification of injuries and their medico-legal aspects, Methods of assessing, various types of death

#### Unit – I

#### **INTRODUCTION**

**Forensic science** is the application of science to criminal and civil laws, mainly—on the criminal side—during criminal investigation, as governed by the legal standards of admissible evidence and criminal procedure.

Forensic scientists collect, preserve, and analyze scientific evidence during the course of an investigation. While some forensic scientists travel to the scene of the crime to collect the evidence themselves, others occupy a laboratory role, performing analysis on objects brought to them by other individuals.

In addition to their laboratory role, forensic scientists testify as expert witnesses in both criminal and civil cases and can work for either the prosecution or the defense. While any field could technically be *forensic*, certain sections have developed over time to encompass the majority of forensically related cases. Forensic science is the combination of two different Latin words: forensis and science. The former, forensic, relates to a discussion or examination performed in public. Because trials in the ancient world were typically held in public, it carries a strong judicial connotation. The second is science, which is derived from the Latin word for knowledge and is today closely tied to the scientific method, a systematic way of acquiring knowledge. Taken together, then, forensic science can be seen as the use of the scientific methods and processes in crime solving.

#### Etomology

The word *forensic* comes from the Latin term *forensis*, meaning "of or before the forum". The history of the term originates from Roman times, during which a criminal charge meant presenting the case before a group of public individuals in the forum. Both the person accused of the crime and the accuser would give speeches based on their sides of the story. The case would be decided in favor of the individual with the best argument and delivery. This origin is the source of the two modern usages of the word *forensic* – as a form of legal evidence and as

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category of public presentation. In modern use, the term *forensics* in the place of *forensic science* can be considered correct, 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*.

#### **Principles of forensic science**

Forensics is a universal science, traversing the entire spectrum of various diverse fields. As a profession, in the 21<sup>st</sup> century, it has taken root in today's society though with different levels of advancement, protocols and policies in different jurisdictions. May the listed principles serve as a curtain raiser or some sort of refresher for the new and the old guard in the forensics field.

- *Law of individuality*: Every object, artificial or otherwise is unique. Although from a distance, objects of the same morphology, class etc. may seem the same, the devil is always in the details. Fingerprints, nDNA may all be similar but they are distinctly unique.
- *The exchange principle*: Commonly known as Edmond Locard's maxim on interchange "that a person or persons at a scene where a crime has been committed will almost always leave or take something away"
- *Law of progressive change*: You've probably heard of the saying "Change is inevitable". Well this also applies to objects although it may take different objects different time spans. Samples will degrade with time (e.g. nDNA), bodies decompose, tire tracks & bite-marks fade and the list goes on and on...
- *Law of comparison*: Samples can only be compared to like samples; be it reference, questioned or control samples. A questioned hair can only be compared to another hair sample, same with tool marks, bite marks, DNA...
- *Law of analysis*: An analysis can be no better than the sample under analysis, its chain of custody, its handling and the person analyzing it.
- *Law of probability*: Forensics is all about percentage chance. All conclusions derived after an analysis are dependent on method used and their accompanying advantages & shortcomings which are all factored in the end result.
- *Law of circumstantial facts*: Man (Eye witnesses, victims) when giving evidence may not always be accurate. They may intentionally lie or many have shortcomings e.g. poor senses (sight, hearing...), exaggeration and assumptions. However, evidence which in

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turn provides a factual account has a higher percentage chance of accuracy and therefore highly reliable.*True belief only becomes knowledge when backed by some kind of investigation and evidence (Karl Marx)* 

#### Forensic science laboratories and its organization and service

This is a specific issue identified in ISO accreditation standards - potential conflicts of interest. The answer is that it is not the nature of the host agency, but the nature of the responsibility and accountability of the laboratory staff and management which counts. If it is an issue, it is not a very serious one in practice as hardly any forensic science laboratories have been set up specifically to deal with the matter of operational independence. An example is the Swedish National Laboratory of Forensic Science in Linkoping. It is housed in a University and its budget and operations are controlled by an independent board. Another example is the State Forensic Science Centre in Adelaide, Australia, which was established by legislation which required it to be free from control by police or other legal service agency. **The main problem with forensic science laboratories and location within a police agency is that of resources.** 

Although some of the finest and best-resourced laboratories in the world are found within police agencies (the former Metropolitan Police Laboratory in London, UK; the FBI Laboratory in Washington DC; and the Forensic Science Center at Chicago, for example), there are very many examples where the police host has not been able to understand the level of resources needed to establish, maintain and develop a quality forensic science laboratory. In general, the commitment is seen by the level of reporting relationship enjoyed by the laboratory director. Agencies which take their laboratories seriously have the director reporting to someone very senior in the hierarchy.

## Financial organization of forensic science laboratories One of the largest forensic science organizations in the world,

The Home Office Forensic Science Service (FSS) in England, is currently organized as a government agency. This brings with it certain financial freedoms and disciplines, as it requires the FSS to operate as a business and recover its costs through the sale of services to customers.

This mode of operation was established for some services in Australia and New Zealand several years before its adoption by the FSS. It is a strange amalgamation of what most would regard as a core public service (administration of justice) being delivered by a public entity operating to (some) private sector business standards, and has not been adopted in the US or other countries.

The rationale behind the Australian and New Zealand initiatives was that governments wished to identify the true costs of delivering public services. They thus required indirect costs such as

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capital depreciation, accommodation rental, leave and other staff benefits, and insurances to be quantified and included in the cost of providing the service.

The next step was to make the customer agencies responsible for meeting the costs of the service. The rationale here was that they would purchase only what they needed and could afford. The final step was to define a series of policy-purchaser-provider relationships, in which the government set policy and funded purchasers who sought the best value from available providers.

In some cases, where providers were government agencies, they were required to provide a return on capital to the government equivalent to the shareholder's return on the investment of a similar private industry.

In theory, commercialization of services should also introduce competition. Competition in turn should mean that providers have to focus on providing only timely, necessary services which meet the standards of the customer. However, one of the customer's standards will be to get the best return for the limited budget available. The consequences of quality failure in forensic science are too dramatic for it to operate in a price-driven market. Also one of the expressed concerns about existing service structures is that forensic services provided from police agencies may suffer from unconscious bias due to their close affiliation with the prosecution. A commercial service with a strong customer service ethic will have the same problem. Finally, discontinuing laboratory investigations which are not cost effective raises concerns at the long-term loss of analytical and interpretative skills in areas such as hair examination, and therefore possibly significant evidence not being available.

Probably the two main difficulties with public sector commercial services are that those who are devoting resources to quality assurance and who are honest with their costing will suffer as they are undercut by providers – especially other public sector providers – who either bid at marginal rates which do not reflect the true operational costs, or cut corners in quality to lower costs. The second difficulty is that police investigators and the laboratory do not have the normal purchaser-provider relationship that applies to the purchase of goods or services. Agencies such as prosecutor, defense and judiciary all have a major stake in the services and can influence service delivery without having to carry any fiscal responsibility. As an example, one of the earliest commercial services was established and developed in South Australia in the period 1984-87, and still in operation there. In that time the single greatest influence on the service was the decision by the Chief Justice to impose a 6-week maximum time period from charge to first hearing at which time evidence had to be ready for scrutiny by the defense. The provider laboratory and purchaser police department were left to deal with the mandate from within existing resources.

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#### **Forensic Science Tools and Technology**

Forensic Science is the key to solving crimes all over the world. Without it, we would be stuck in the days of Sherlock Holmes, relying on less reliable evidence to reach conclusions about life and death situations.

With advances in forensic technology, law enforcement has more tools and resources at its disposal, making it harder for criminals to get away with their actions. As a result, the demand for forensics technology has only increased over time.

Along with that, public interest in forensics has also increased, especially with the popularity of crime based television shows. Series and movies such as Hannibal, Making a Murderer, CSI, and the perennial favorite Law and Order, do a great deal to expand interest in forensics, but they don't always accurately represent the science.

#### Massively Parallel Sequencing (MPS)

This may be the "most advanced tool in the field of Forensic Biology," according to Sheree Hughes-Stamm, who will investigate this research at Sam Houston University. Basically, MPS gives more information about DNA evidence than ever before, which will be critical in helping to solve missing persons cases, or situations where there has been a large disaster with many deaths.

#### Hair Bacteria Assessment

It sounds yucky – and it might be, but forensic biologists are now using analysis of crime suspects' hair bacteria to match sexual criminal suspects to the victims of their crimes. Scientists realized that hair samples have microbe populations that are mixed when people engage in sexual behavior. This makes it easier to prove that an offender committed an act if there is a match in their microbe population to the victim.

#### Rapid DNA

This new forensic technology, developed by the Department of Homeland Security can use DNA to make family connections in times of crisis. The Department of Immigration Services also wants to use it to connect families that are coming into the country. And of course, forensic analysts can use this tech to help solve crimes. Unlike other breakthroughs, this technology is fairly easy to use, and requires little training.

#### Time-Tracing Fingerprint Technology

We have all seen the detective dust for prints to see if a suspect's fingerprints are present at the scene of a crime. Now, we can dig even deeper into this process with advanced fingerprint technology that reveals *when* a fingerprint was left behind. This can help eliminate innocent

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suspects from suspicion, and identify prints that were left at the scene long before crimes were committed.

#### 3-D Models to Help Examine Victims

Photographs from crimes scenes and the morgue can often be hard for jurors and others to examine or understand. With new 3-D photography technology that uses image layering, investigators can learn and share more about the evidence they find. Intricate details revealed on a corpse, like relevant internal damage that may show signs of old or repeated injuries, but that can't be seen with regular photography, will now be available.

#### **Branches of Forensic science**

**1. Forensic Anthropology:** It deals with the identification of human body remains on the basis of osteology, osteometry and superimposition techniques. It also involves blood grouping, red cell enzyme and serum protein typing from blood and other body fluids which is called specifically as Forensic Serology.

**2. Forensic Biology:** It deals with the identification of biological evidences whether plant or animal in origin, through mutual comparison and identification.

**3. Ballistics:** It deals with the study of projectiles, firearms, their ammunition for detecting range of fire, angle of fire and trajectory of projectiles etc. etc.

**4. Explosives:** It deals with the identification of explosives and their remanants from the site of explosion or confiscated suspected material. Nowadays, explosive detectors and sniffer dogs are pressed into service for locating the explosives. The Mine detectors metal detectors also detect the networking of explosives.

**5. Physics:** It identifies metal, precious metals from their physical properties and also examines building materials, toolmarks, glass and paints, etc. for quality in different crime cases and for identification of the source.

**6.** Chemistry: It deals with the identification of substances of all types by chemical tests for their constitution and chemical properties. Mutual chemical comparison of the substances permits opinions whether they are from the same source or otherwise.

**7. Toxicology:** It is the study of poisons under which forensic science indicates symptomatically as well as on the basis of chemical and instrumental analysis for the identification of poisons, narcotics, drugs and other psychotropic substances.

**8.** Documents: Authorship of manuscripts, typed materials, printed materials and signatures, etc. are examined and source/authorship is established by forensic documents examiners. They are

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also engaged in so many other problems concerning white—collar crimes like fake currency notes, fake lottery tickets, credit cards, passports, forgery and frauds in the banks and other Govt. departments.

9. Lie Detector: Polygraph is an instrument with the help of which peaks/ graphs concerning blood pressure, palpitation rate, perspiration rate and skin twitching etc. are recorded and a person can be interrogated scientifically as to whether he is speaking the truth or telling a lie.

**10. Photography:** Macrophotography at the scene of crime, whether is still photography or video-photography is of utmost help in recording the evidence. Likewise, photomicrography and micro—photography in the laboratory permits recording of minute physical clues from the crime case exhibits.

**11. Footprints and tyremarks:** It was treated to be rudimentary science in 60's, has developed as a scientific study and is treated to be an authentic evidence for the identification of persons from their foot/footwear's and vehicles from their tyremarks.' It is a reliable corroborative evidence at present.

**12. Odonotology:** It is the study of the teeth, the alignment of teeth, their eruption, falling, malformations, wear and tear and other surgical artifacts used for the restoration of the teeth, which permit identification of a person. Moreover, teeth also permit estimation of age.

13. **Medical jurisprudence:** At the time of autopsy of a deadbody and medico— legal examinations of the persons the reports are prepared by the medical experts which are of utmost help in finding out the cause of death and also help in ascertaining the extent of injury to the person. It involves internal examination of organs, injuries and symptoms.

**14. Instrumentation:** It is emerging branch of forensic sciences under which duplicacy of different equipments which may be mechanical, electrical, electronic are examined and identified.

**15. Engineering:** Forensic engineering deals with the cases of development of cracks in buildings, dams and other structures before the specified time or before their fixed up age. They also deal with whether the material used has been as per specification or otherwise. The engineering defects are also studied in the process.

**16. Geology:** It deals with the analysis Of oars, gems, and other precious stones recovered from the earth crust. Geologists also identify such materials in co—relation to a particular sitè/ area. The precious fossil forms are also identified and co—related to the important sites.

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**17. Archaeology:** The articles of antiquity recovered in excavation and precious idols when stolen have to be identified by Forensic Archaeologists with respect to their Originality and age by dating methods.

**18. Computer:** We are passing through the age of computers today We are using computer for data storage, data processing for speedy transmission of data. However, more networking of computer upto Police stations and Police post level is still needed. Computers can be used for portrait building of suspects and criminals on the basis of the descriptions given by the victims of crime. Computer graphics are of utmost help in this process. With all these important branches of forensic science in service today still it is hot mandatory for the police to keep forensic reports on the file which is a must if we really have to take help from science in the investigation of crime and for giving justice to a common man.

#### CAUSES OF CRIME

There are various causes of crime. Which are described officially are stated below -

- 1. Social Causes of Crime
- 2. Economic Causes
- 3. Mental abnormality causes of crime
- 4. Geographical Causes
- 5. Political Causes of Crime

#### **Social Causes of Crime**

There are various social causes of crime. These are such as -

- Broken Homes
- Child Abuse
- Spouse Abuse
- Fights and quarrels in Family
- Negligence of Parents
- Dowry Deaths
- Bigamy- Marrying another while the first wife or husband is alive.
- Female Feticide
- Inequality amongst Sons and Daughters
- Alcoholism
- Narcotic Drugs
- Defective Education
- Casteism

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- White Collar Crimes
- Unemployment

#### Economic Causes of Crime -

- Poverty
- Over Population
- Unemployment
- White Collar Crimes
- Industrialization and Urbanization
- Prostitution
- Bad Government Policies
- Prisons

#### Mental Abnormality Cause of Crime -

- Abnormality
- Psychoses
- Mental Deficiency
- Antisocial People ,etc..

#### Political Causes of Crime -

- Corruption
- Corrupt Politicians
- Religions vs Politicians
- Inequality

#### **Modus Operandi**

#### **Influences on Modus Operandi**

A criminal's MO behavior is learned, and therefore dynamic and malleable. This is because MO behavior is affected by time, and can change as the criminal discovers that some of the things done during a crime are more effective than others. Criminals can subsequently recognize these effective actions, repeat them in future offenses, and become more skillful, refining their overall MO. However, behavior may also change due to a criminal's deteriorating mental state, due to the influence of controlled substances, and/or due to increased confidence that law enforcement will not successfully apprehend them. These things may cause a criminal's MO to become less skillful, less competent and more careless.

Common ways that criminals can learn how to commit crime more skillfully are by gaining more experience, building confidence through success and/ or having more contact with the

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criminal justice system. Being arrested just once may teach an offender an invaluable lesson about how to avoid detection by law enforcement in the future. Further still, and with some great irony, a prison term in the United States is referred to by some, in both law enforcement and the criminal population, as 'going to college'. This is because younger and less experienced offenders have the opportunity in prison to network with older and more experienced offenders who have already accumulated a great deal of criminal knowledge. Subsequently, a prison term of only a few years has the potential to advance an offender's skill level far beyond their original MO. Once released, such offenders may take their 'education' and embark on criminal enterprises that before would have been beyond their ability.

**Criminals can also seek out knowledge directly,** just like anyone else, without having to spend time with other, more experienced, criminals. They can learn from the things that they see or read, which include items ranging from those in the media to educational and technical materials. For example, a rapist may commit five different attacks in a single region. The attacks may go unconnected until DNA results come back and demonstrate that the rapes were more than likely committed by the same offender. If the media publishes a headline that reads 'Serial rapist linked to five attacks by DNA!', the rapist may alter his MO behavior to prevent law enforcement from linking future cases. He may do so by making temporary changes, such as using a condom during any future rapes, or he may decide to make a more permanent change and undergo a vasectomy. Either way, the rapist may make a conscious attempt to prevent the transfer of a particular type of evidence, based on what he has learned from the media coverage of the case or other similar cases.

#### MEDICOLEGAL CLASSIFICATION OF WOUNDS: INDIAN PERSPECTIVE

#### Simple wounds

These wounds are those which commonly occur in day to day life and when caused by other, heal rapidly without incapacitating a person from his work for more than two weeks.

#### **Dangerous Wounds**

Wounds are larger in size and more severe than Simple wounds. Generally, they are often fatal wounds, and in all cases, there is apprehension of danger to life. This fact should be at once intimated to the local Magistrate through local police station and arrangements made for recording – Dying Declaration. Danger to life should be considered imminent in compound fracture of the skull, wounds involving a large artery, rupture of internal organs etc. Injuries

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which prove fatal by causing inter current diseases or complication like Tetanus, Gas Gangrene etc. are not considered as immediately dangerous.

#### **Grievous Hurt**

It is a special type of dangerous wound. These are the injuries or bodily pain, which commonly cause the sufferer to have either permanent damage or loss of a part of the body or incapacitates him from doing his normal work (i.e., attending nature's call, etc.) for more than 20 days. It may be mentioned that all dangerous wounds may also be grievous in nature but all grievous hurts may not be dangerous wounds.

#### Conditions

1. Emasculation – Injuries to the testis, deprivation of masculinity of a person by castration or cutting off of the male organ (cutting off of Pudendum also comes under this heading). Injury to the spinal cord involving Lumbar segments which may result in impotency is also important.

2. Permanent privation of sight of one or both eyes.

3. Permanent privation of hearing of one or both ears.

4. Permanent privation of any member of joint.

5. Permanent impairment or destruction of the power of any joint or any member of joint.

6. Permanent disfigurement of the head or face.

7. Fracture of a bone or dislocation of tooth.

Whether Cutting off of a bone is a grievous hurt, with cut not extending up to the medullary canal and with cut not extending up to the medullary canal and separation of suture between the skull bones (dislocation between two cranial bones) is a grievous hurt or not is a critical legal question.

8. Any hurt, which endangers life or causes the sufferer to be during the space of 20 days in severe bodily pain that render him unable to follow his ordinary pursuits. (Ordinary pursuits, i.e., ordinary work to which he is accustomed during his day to day life).

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#### **Important Questions**

#### 2 Marks

- **1.** Define forensic Science.
- 2. Write short note on principles of forensic Science.
- **3.** Give outline on forensic Science organization here in India.
- 4. Write short note on tools and techniques in forensic Science.
- 5. What are the operands in criminal investigation?
- 6. What is the role of modus in forensic Science?
- 7. List of names of various branches of forensic Science here in India
- 8. List out the possible causes of crime carried here in India.

#### **08 Marks**

- 1. Define forensic Science in brief and also explain in details about its various organization followed here in India.
- 2. Explain briefly about the various branches of forensic Science followed here in Indian and also explain in brief about the function of each branch.
- 3. Explain in the detail regarding the possible causes of crime, role of modus and operand in criminal investigation.
- 4. Write all different manners of assessing various types of deaths.
- 5. Write in brief about the classification of injuries and their medico-legal aspects.
- 6. Write assay on the forensic Science laboratory and services here in India

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### UNIT-II

#### **SYLLABUS**

Classification of firearms and explosives, Introduction of internal, external and terminal ballistics, Chemical evidence for explosives, General and individual characteristics of handwriting, Examination and comparison of hand writings, Analysis of ink various samples,

#### Unit – II

#### **CLASSIFICATION OF FIRE ALARMS**

#### The Categories: Automatic versus Manual Fire Alarms

There are two distinct types of fire alarms you can have in your commercial space. The first is an automatic fire alarm. When these alarms detect heat or smoke, they send an audio-visual alert throughout the building to alert the occupants of danger. The next type of fire alarm is a manual alarm. These fire alarms have pull stations stationed around your building. When a fire is seen or smelled by one of your employees, they simply pull the leveler and alert the occupants. Manual alarms come in a variety of designs and colors.

#### **Types of Commercial Fire Alarms**

Just as there are different categories of fire alarms, there are also different types. Let's take a look at the types of fire alarms and the features they offer.

#### **Conventional Fire Alarms**

Conventional fire alarms include a number of different "zones" that are hardwired to your central control panel. These systems allow you to be able to put separate fire alarms in each section of your building and helps to monitor if an alarm is broken.

#### Addressable Fire Alarms

These fire alarms are also called "intelligent systems" as they monitor the fire alarms in your building. Addressable alarms allow you to choose between automatic and manual alarms. Each alarm installed in this system has its own address, which allows you to see which alarm is working and which are failing. Addressable fire alarms are more expensive because of the monitoring features.

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#### Hybrid Fire Alarms

Hybrid alarms combine the hardwired zone features of conventional fire alarms with the addressable loops of the addressable fire alarms into a single panel. This combined technology fits some of the settings better than either the addressable or the conventional alarm.

When choosing a new commercial fire alarm, it is important to choose the alarm that is right for your space. For more information on installing a commercial fire alarm, call Fireline today!

#### **Commercial Fire Alarms with Fireline**

At Fireline, we offer an array of portable fire extinguishers, fire alarms, and sprinkler systems to keep commercial kitchens safe. **Fireline** offers the highest quality alarm systems to keep your business safe from fires and carbon monoxide poisoning. We also offer fire suppression systems as well to help keep commercial fires controlled should they break out. Our trained technicians will work with you to determine which air sampling smoke detection system is best for your business. We will also help install and maintain the system for your commercial building.



#### CLASSIFICATION OF EXPLOSIVES

**1. Propellants** or **low explosives** are combustible materials, containing within themselves all oxygen needful for their combustion, which burn but do not explode, and function by producing gas which produces an explosion. Under normal conditions, low explosives

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undergo deflagration at rates that vary from a few centimeters per second to approximately 400 metres per second. It is possible for them to deflagrate very quickly, producing an effect similar to a detonation. This usually occurs when ignited in a confined space. Explosives of this class differ widely among themselves in the rate at which they deliver their energy. There are slow powders and fast powders for different uses. *Examples*: black powder, smokeless powder.

**2. Primary explosives** or **initiators** explode or detonate when they are heated or subjected to shock. They do not burn; sometimes they do not even contain the elements necessary for combustion. The materials themselves explode, and the explosion results whether they are confined or not. They differ considerably in their sensitivity to heat, in the amount of heat which they give off, and in their "brisance", that is, in the shock which they produce when they explode. Not all of them are brisant enough to initiate the explosion of a high explosive. *Examples*: mercury fulminate, lead azide, the lead salts of picric acid and trinitroresorcinol, mnitrophenyldiazonium perchlorate, tetracene, nitrogen sulfide, copper acetylide, fulminating gold, nitrosoguanidine, mixtures of potassium chlorate with red phosphorus or with various other substances, the tartarates and oxalates of mercury and silver

**3. High explosives** detonate under the influence of the shock of the explosion of a suitable primary explosive. They do not function by burning; in fact, not all of them are combustible, but most of them can be ignited by a flame and in small amount generally burn tranquilly and can be extinguished easily. If heated to a high temperature by external heat or by their own combustion, they sometimes explode. They differ from primary explosives in not being exploded readily by heat or by shock, and generally in being more brisant and powerful. They exert a mechanical effect upon whatever is near them when they explode, whether they are confined or not. A high explosive compound detonates at rates ranging from 1,000 to 9,000 meters per second, and are, conventionally, subdivided into two explosives classes, differentiated by sensitivity:

- **Primary high explosives** are extremely sensitive to mechanical shock, friction, and heat, to which they will respond by burning rapidly or detonating.
- Secondary high explosives, also called base explosives, are relatively insensitive to shock, friction, and heat. They may burn when exposed to heat or flame in small, unconfined quantities, but detonation can occur. These are sometimes added in small amounts to blasting caps to boost their power.

Some definitions add a third category:

• **Tertiary high explosives** or blasting agents, are insensitive to shock, they cannot be reliably detonated with practical quantities of primary explosive, and, instead, require an intermediate explosive booster, of secondary explosive,

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e.g. ammonium nitrate/fuel oil mixture (ANFO) and slurry (wet bag) explosives that are primarily used in large-scale mining and construction.

*Examples*: dynamite, trinitrotoluene, tetryl, picric acid, nitrocellulose, nitroglycerin, liquid oxygen mixed with wood pulp, fuming nitric acid mixed with nitrobenzene, compressed acetylene and cyanogen, ammonium nitrate and perchlorate, nitroguanidine.

#### INTRODUCTION TO INTERNAL, EXTERNAL AND TERMINAL BALLISTICS

Ballistics is the study of a projectile in motion. TC 3-22.9 defines it as "Ballistics is the science of the processes that occur from the time a firearm is fired to the time when the bullet impacts its target [and ceases movement]." Put simply, Ballistics is everything that happens the moment the firing pin comes in contact with the primer, to just before the projectile ceases movement in its target.

There are three major categories of ballistics: Internal, External, and Terminal. Internal ballistics are everything that happens to the projectile from the moment the trigger is squeezed to the moment before it exits the barrel. External ballistics is everything that happens to the projectile from the moment it exits the barrel to just before it impacts on its target (whatever it happens to be), and Terminal ballistics are what happens to the projectile from the moment it enters its target, to the moment before it comes to rest.

Knowledge of Ballistics is traditionally associated with Snipers and Squad Designated Marksmen, with the subject considered too advanced for the common Paratrooper to understand. However, it is just as important for Leaders and Paratroopers to understand the different categories of ballistics. It can help a Paratrooper to diagnose what malfunction is taking place with the weapon in the case of internal ballistics. It can help to ensure a probability of hit based off an adjusted point of aim off Center of Visible Mass, also known as a hold in the case of external ballistics. And it can help to ensure the highest probability of placement into an area that will incapacitate the enemy by switches and timers, in the case of terminal ballistics.

The category that has the greatest impact on whether the projectile will hit or miss the Paratrooper's intended target is External Ballistics. External Ballistics is comprised of Gravity, Drag, Wind, Altitude, Humidity, and Temperature. Some of these factors, such as gravity, are constants, and thus have a consistent effect on the projectile. Many of these factors are variable. Altitude, drag, humidity, temperature, and wind, all vary from shot to shot, so it is important that the Paratrooper understand what kind of an effect this has on their projectile so that they can account for it.

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So to sum up, Ballistics is the study of projectiles in motion. There are three major categories of ballistics: Internal, External, and Terminal. It is important for Paratroopers and leaders to understand ballistics, so that they can compensate for the various effects they have on either the projectile or the weapon. And the Category that has the greatest effect on the projectile's intended path is External Ballistics

#### CHEMICAL EVIDENCE FOR EXPLOSIVES

A detailed investigation of a blast site will reveal crucial clues to lead the investigation. By thoroughly documenting the condition of the scene, including any structural damage and injuries or fatalities, investigators can slowly piece together what occurred.

Fragments of an exploded device will often be left intact, including switches, wiring, timers and circuit boards. If the timer was made from a unique type of watch, for instance, that information could help narrow the search for who created the device or where it may have come from.

After an explosion, residue from the explosive that was used will be left behind. To identify the type of explosive used, investigators may use an ion mobility spectrometer (IMS), a handheld chemical detection device, to identify residues that may be present around the blast site.

For large-scale incidents, the area of investigation may be expansive. The bombing of the Pan Am Flight 103 over Lockerbie, Scotland in 1988 created the largest crime scene in the world. It stretched for more than 1,200 square miles. By painstakingly piecing together the wreckage that was found in this area, investigators identified trace amounts of explosives that helped confirm the incident was indeed caused by a terrorist attack. Two hundred seventy people died that day—259 on the plane and 11 residents of Lockerbie.

In addition to collecting physical evidence, video footage may be available from security cameras or from witnesses' cell phones. Investigators will also interview witnesses and victims to gather crucial details.

#### How the Evidence Is Collected

If an undetonated device is located, it must first be rendered safe. A bomb should never be moved from where it was found because it could detonate. This should only be conducted by a qualified bomb technician. Safety is the primary consideration; damage to a structure can be repaired, but injury to a person could be life-altering or fatal.

To examine the type of explosive, bomb technicians use remote robotic equipment to take pictures of the device, or even to detonate the bomb. Robots are commonly fitted with a device

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that can shoot a high velocity jet of water into the device, disrupting it. The bomb squad technician can then move in to confirm the area is safe and law enforcement can begin an investigation.

A bomb squad technician may also use a portable X-ray tool to examine a suspicious package to determine if it contains an explosive. X-rays are commonly used in airports to examine luggage to ensure baggage does not contain explosive devices.

Before being transported from the scene, all physical evidence is photographed, packaged, placed into containers, labeled and secured. Evidence could even be lodged in the bodies of victims or a suicide bomber. The body can be examined via X-ray images and the evidence retrieved if necessary.

If a community doesn't have its own specialized unit to handle explosives, it will have an agreement with a nearby bomb squad to handle these types of situations.

#### Who Conducts the Analysis

Several professionals may be involved in examining explosives evidence or a destructive device. A chemist who is specially trained examines items for explosive residues. This practitioner may work in concert with explosive device specialists who have knowledge of electrical components, expertise in device reconstruction and an understanding of post-blast damage.

In circumstances involving terrorist IEDs, the devices are analyzed by the FBI's Terrorist Explosive Device Analytical Center (**TEDAC**). TEDAC is located at the FBI Laboratory in Quantico, Virginia. IEDs collected from around the world are sent to TEDAC for forensic examination.

#### How and Where the Analysis is Performed

Once a device is rendered safe, it can be analyzed like any other piece of evidence to search for leads regarding who was responsible for creating and deploying the device. If large fragments of the device are retrieved, DNA or fingerprints may be present that analysts can attempt to match to a suspect. DNA profiles are compared to records in the FBI's national Combined DNA Index System database, "CODIS". Learn more about DNA >

Post-blast explosive residues can be analyzed using a variety of techniques such as infrared spectroscopy, gas chromatography/mass spectrometry, energy dispersive X-ray analysis, Raman spectroscopy and other techniques. Learn more about drug chemistry >

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Explosive devices can be searched against several national databases that are maintained to identify trends in the manufacture of explosives, and track bomb and device designs employed by serial bombers and terrorist groups. These databases include the FBI's Terrorist Explosive Device Analytical Center, the ATF's Arson and Explosives National Repository and the National Fire Incident Reporting System.

#### GENERAL AND INDIVIDUAL CHARACTERISTICS OF HANDWRITING

As considered in the discussion of the learning process, individual characteristics, unlike class characteristics, are thought of as unique to a specific writer. This is not quite true; it requires a combination of individual characteristics and frequency of occurrence to make an individual's handwriting unique to him. Just as one number to a safe combination lock can be found in numerous other safes, a large enough series of numbers in a specific order will be unique to only one safe.

The following handwriting characteristics are some of those that tend to lend themselves to individualization and as such, are closely scrutinized by the examiner during a handwriting comparison.

#### Skill Level

Skill level can best be described as an appreciation of beauty as applied to handwriting. An individual with a **high skill level** produces writing that is fluid, rhythmic, perhaps artistically embellished and, in short, aesthetically pleasing to the eye. An individual with a **low skill level** produces a product that is hesitating, slowly executed, may contain grotesque, although repeated letter formations, and in general, is not very pleasing to the eye.

Skill level, by itself may be one of the more important characteristics of identification or non-identification. One of the basic concepts of handwriting identification is that a person with a low skill level cannot write above that level, while a person with a high skill level can write to a lower level, or generally produce writing of a lesser quality than what is his norm. This concept will, at times, allow for the disassociation (if not elimination) of a suspect from a questioned body of writing. If the questioned writing displays an extremely high skill level, the writer that can only produce a much lower quality of writing could not have written the questioned material. A person with a lower skill level attempting to produce a higher level of writing is for the most part abandoning his own handwriting and is attempting to fashion an artistic form of an imagined handwriting style. This is, in fact, a disguised form of writing.

#### Slant or Inclination

**Slant** refers to the angle of inclination of writing or a letter of writing from the base line of that writing. It may be forward and leaning to the right, or "backhand" if it leans to the left.

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The slant of a writing may change from the beginning of a word to the end of a word, or from the beginning of a sentence, paragraph, or page to the end of that sentence, paragraph, or page. If this change in slant is reproduced habitually, it may be of itself an identifying characteristic. Often a forward or a backhand slant is thought of as indicative of a right-handed or left-handed writer. This is far from definitive. Although many left-handed individuals do maintain a backhand slant to their writing, this is not specific to just "lefties".

Writing slant, as an individual identifying characteristic, does not normally carry the weight that many other areas of examination would. However, a questioned body of writing that maintains a forward slant is obviously quite dissimilar from another body of writing that maintains a backhand slant.

Many graphologists actually attempt to quantitate slant by physically measuring the angles and putting the results into report form. They may then draw conclusions that slight differences are indicative of one writer because they are, after all, only slight differences, or different writers because there are differences. This is patently absurd.

#### Form

This is probably the most basic of individual characteristics. **Form** is the pictorial representation of a letter or writing movement. A highly visible dissimilarity in the form of the same letter found in both the questioned and standard material is an inherent difference in handwriting.

Form is the first of the individual characteristics that will receive the document examiner's close scrutiny. It is the lamppost that lights the way for the rest of the handwriting comparison.

#### Movement

This is the manner in which the pen moves in order to form a letter. Some parts of movement have been historically referred to as "Garland" if the pen moves overhand, or clockwise, producing rounded letter formations, or "Arcade" if the pen moves underhand, or counter-clockwise, producing saw-toothed letter formations. While correct these terms are often found in the speech patterns and report language of graphologists.

The importance of **movement** is readily apparent. Two letters that are correct in form and pictorially similar, can be quite different when it comes to the direction that the pen was moving when they were produced. Two similar appearing lower-case "t's" may have the crossing strokes made with the pen going left to right in one, and right to left in the other. While appearing similar, these two "t's" are, in fact, fundamentally different.

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Direction of movement of the writing implement can often be determined by low-power microscopic observation of the ink or pencil line. A majority of ballpoint pens, because of normally occurring defects in the ball housing, leave behind striae in the ink line. During changes in pen direction these striae will move from the inside of the ink line to the outside. The shorter "leg" of the striation indicates where the pen came from, and the longer portion of the striation, where it is going.

Determining pencil direction is quite different but again relatively simplistic. While the surface of writing paper appears to be very smooth to the touch and naked eye, it is in reality made of fibrous material that has definite texture, albeit microscopic. These randomly crisscrossing fibers remove portions of the pencil "lead" as the pencil scrapes across the paper's surface. Microscopically, a buildup of the lead will be observed to be thicker on the trailing edges of the fibers than on the leading edges. This will indicate direction, the pencil moving from the direction of the heavy deposited sides of the fibers to the sides of lesser deposits.

#### **Proportions**

**Proportions** generally refers to the symmetry of an individual letter. Using the letter "B" as an example, is the top "bulb" the same size as the bottom "bulb?" Is one portion of the letter thinner than another? This concept usually develops a relationship between one portion of a letter to another portion of that same letter.

#### Height Ratios

**Height ratios** are a comparison or correlation of the height of one letter or letter segment to another letter, usually within the same word or signature. One would expect all capital letters in the same writing system to maintain the same height throughout a body of writing. However, the heights of capital letters in an individual's writing may vary from one letter to another. A capital "K" may always maintain a slight height advantage over a capital "L", or "Z" or other letter. The same concept is likewise utilized in a comparison of lower case letters, or in a comparison of lower case letters to upper case letters. Thus, combinations of various height ratios are often uniquely individual and habitual to a specific writer.

Of all individual characteristics, height ratios seem to be the most difficult characteristic for a forger to accurately reproduce.

#### The "i" dot

A portion of writing as small and as innocuous as an "i" dot may at times become a prominent identifying characteristic. "I" dots come in all sizes and shapes. They may be horseshoe shaped with the open end to the right, up, down or left, or be simply dots, circles, or dashes inclined up or down. In many teenage girls, they may be made in the shape of hearts.

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#### The "t" crossing

"T" crossings occupy much the same weight, or more, for the document examiner as the "i" dot does. A "t" crossing may go from right to left, left to right, it may incline up, incline down, or be perfectly horizontal. It may be heavily shaded on the right or heavily shaded on the left. The "t" may be crossed at the top of the letter, near the bottom, or in the middle. It may be connected to an exit stroke from a terminal letter of a word in a hasty attempt by the individual to cross the "t" without lifting the pen from the paper.

#### Loops

**Loops** found in a cursively written letter may be symmetrical or may be flat on one side and therefore be asymmetrical. They may be thin or bulbous. They may be rounded at the apex or may be sharply pointed like a needle.

#### Pressure/Shading

This concept is the study of changing width of a line as pen pressure varies. It may indicate the direction of movement.

#### Alignment To Baseline

This is simply the relationship of the questioned writing to a baseline. It is the adherence of the writing to either a preformed (printed) or imaginary **baseline**. The writing may slant upward, downward, be concave or convex, or have a pattern of changes for different words, word portions, or signatures. It may follow the baseline, or go through the baseline, or be irregular with regard to the baseline.

#### Pen Lifts

Here we note where the writing implement lifts from the paper, usually interior to a word or signature. It may be a natural occurrence for a specific writer to lift the pen at an unusual point in the writing or it may be an indicator of spuriousness if it is in the form of patching or not found in the standard material.

#### Speed

Pen **speed** is often an essential element of the examination process. As will be discussed elsewhere, fast, fluid pen movement is difficult to duplicate by a forger. The following comparison depicts many of the indicators of fast or slow writing:

#### Fast

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Smooth Writing Movements Elongated & misplaced "i" dots & "t" crossings Words or initials connected A "flattened" appearance. Lessened legibility

#### Slow

Hesitation, tremor, more angular writing "i" dots & "t" crossings in corrrect position Sharp delineation between separate pen movements Blunt starts and stops Writing is made of individual letters and legible Movements may be ornamental

#### **Embellishments**

**Embellishments** are most often located at the beginning of a letter, but may be throughout the written material. They usually take the form of an added movement that decorates the writing, such as swirls, added loops, concentric circles, flourishes, etc.

#### Entry/Exit Strokes

The entry and exit strokes of a letter may repeat themselves in similar letter formations such as "U's" and "V's" or perhaps "M's" and "N's". However, they may be in the form of a beginning or ending embellishment or a continuation from one letter to the next. Entry and exit strokes can be habitual movements and therefore identifying characteristics. The same may be said for connecting strokes from one letter to another in cursive writing. Some connecting strokes may be similarly found in hand printing where letters are quickly written creating a bridge between them. Connecting strokes tend to allow the individual to be more creative while developing individual characteristics as they may not have been emphasized to any great extent during the learning process.

#### Retracing

Retracing is the process wherein the pen reinks a written portion of the line, usually in the opposite direction, such as a downward movement followed by un upward movement over the existing line. While it usually is a natural part of the writing experience, if it occurs as a form of patching to correct the form of a letter, it may be indicative of forgery.

#### Spelling/Spacing

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The simple act of misspelling words can, of themselves, be individual, in combination, to a specific individual. Take for example the actual case of a Lithuanian seaman who in the body of one questioned document spelled: "because"-"b'cause", "shoes"-"schoes, "tennis"-"tenis", "sweater"-"sweather", and "pajamas"-"pygemas". These same spelling errors were found in standard material that had been dictated to the suspect. Without looking any further the examiner already had a pretty firm grasp on who the writer of the disputed document was just from the similar misspellings.

Likewise, there are those writers who will put pen lifts and breaks between specific letter combinations. **Spacing** between adjacent letters or even words in a questioned writing may again display habitual characteristics of a specific writer.

#### Format

The **format** of a disputed document may additionally be an identifying characteristic. Using a personal check as an example, one individual may use the term "no cents", another may use "00/xxx" or perhaps "00/100." Ampersands, if used, also tend to be unique.

In much the same manner, dates appearing on checks may be in the form of numeral days, months, and years separated by dashes or diagonal lines. Abbreviations of the months of the year, or spelling the months out in their entirety may be habitual. Each of these different date formats may be the habitual characteristic of a specific writer. A writer asked to write exemplar material when the questioned document is a check, may disguise his writing admirably, perhaps even to the extent that a viable handwriting comparison is precluded, but he may then slip and duplicate the questioned format. While this in itself may not be enough for an identification, it may be enough to couch an opinion in probability.

#### Case

On occasion, a writer will use an upper case form of a letter in a place usually reserved for the lower case form, or vice versa. These characteristics, if found in both questioned and standard material may be highly significant.

# EXAMINATION AND COMPARISON OF HANDWRITINGS AND ANALYSIS OF INK VARIOUS SAMPLES

#### Ink and paper analysis

Apart from the microscopic examination and the use of optical methods to examine various items (exhibits) that may reveal evidence about the document source or whether or not a nexus exits between various documents, there may be a need to chemically analyse the materials used in the document production.

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This may involve analysis of the substrate (paper, film, etc.,) or the types of inks used on the documents which would include, writing, rubber stamp, seal pad ink, printing and any other substances that may be applied to the document surface (adhesive, correction fluids, lip stick).

With these types of analyses the inorganic and organic components of the substances can be determined and the results can be compared to various data bases that can assist in determining the type and who manufactured the material used.

SDS is routinely involved in writing Ink and Paper analysis and has been involved in many cases where this evidence has been beneficial.

#### Writing inks:

The analysis of the writing inks used on a document can produce useful information such as; type of ink used and who manufactured that ink, how many different types of inks have been used, have ink entries on a document been altered, added or substituted, could certain entries be written contemporaneously or at different times and when could the document have been signed or written?

Non destructive techniques are used in the first instance and involve microscopic, variable wavelength light source illumination techniques (Polilight etc.,) and lasers to examine the inks on the documents. The use of different wavelengths of the electromagnetic spectrum provides an examiner with a large number of different techniques to determine the optical properties and some of these techniques are used routinely to reveal, faded, erased and obliterated entries (pencil and ink ) or used to examine damaged documents which have been burnt, water or solvent affected or even digested!

In situations where the inks have similar optical properties, and appear indistinguishable there will be a need to resort to further non destructive analysis (microspectrophotometry etc.,) or destructive techniques were inks samples are removed from the substrate and the dyes of the inks are chemically extracted and analysed using a variety of methods although different techniques are utilised for Gel inks.

SDS has access to a Writing Ink Library of over 8000 writing ink samples and this library can be used to identify the manufacturer of the ink and provide information concerning the use of this ink by various writing ink manufacturers.

These techniques are used and have been used in a number of prominent cases including the War Crimes Cases, Homicide Cases, Fraud cases and Pharmaceutical Extortion Cases (Panadol/Herron extortion case).

#### Paper examination and analysis:

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A complete analysis of the substrate used to produce a document can be important aspect of an investigation into Extortion, Kidnapping, Terrorism, Counterfeiting and Product Tampering and Copyright issues.

Also this type of analysis can be used in paper document dating cases where changes in paper furnish formulation may determine whether or not a document could have been in existence at a particular time. Also the change in acid sizing to alkaline sizing at the various mills can be used for this purpose.

Initially, the examination will involve non-destructive testing whereby the physical and optical properties of one or more paper samples can be determined. Also the use of Beta Rays and X-rays can provide a great deal of information about watermarks, fibre distribution and sheet formation characteristics. An analysis of the organic and inorganic components can also be undertaken and a furnish analysis, although destructive; a small sample is required and can reveal a great deal about the pulps present and the method of paper production.

Information may be obtained that can determine the manufacturer of the substrate, whether or not two or more papers are different chemically and physically or are indistinguishable.

These techniques are used and have been used in a number of prominent cases including the Australian \$50 note counterfeit currency case, major cases involving counterfeit US Currency and Traveller Cheques etc.

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#### **Important Questions**

#### 2 Marks

- 1. What are classifications of fire arms?
- 2. Define Ballistics.
- 3. Explain in short about the characteristics of handwriting.
- 4. How do you classify explosives
- 5. How do you examine handwriting?
- 6. Enumerate the situation where hand writing is compared.
- 7. What is ink analysis?
- 8. Comparison internal and external Ballistics.

#### **08 Marks**

- 1. Explain in details about explosives.
- 2. How do chemicals provide a clue for explosive analysis?
- 3. Explain the basis of ascertaining individual characteristics of handwriting.
- 4. Examination and comparison of handwriting and analysis of ink various samples.

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#### UNIT-III

#### **SYLLABUS**

Role of the toxicologist, significance of toxicological findings, Fundamental principle of fingerprinting, Classification of fingerprints

#### UNIT III

Forensic toxicology is a discipline of forensic science concerned with the study of toxic substances or poisons, of which there are many thousands. Toxicology encompasses theoretical considerations, methods and procedures from many disciplines including analytical chemistry, biochemistry, epidemiology, pharmacodynamics, pathology, and physiology.

Forensic toxicologists are scientists who are responsible for testing bodily fluids and tissue samples during autopsies looking for the presence of chemicals. Toxicologists work in laboratories to perform tests on samples collected by crime scene investigators.

Their jobs involve testing for the presence of: gases (e.g., carbon monoxide); illicit drugs; prescription drugs; poisons; alcohol; metals; and other poisons when poisoning or drug overdoses are expected. Their work may help solve criminal cases, and they are often called in to testify in a court of law on the findings of their investigations.

Through specialized tests and methodologies and through the use of highly specialized equipment and chemical reagents, forensic toxicologists are called upon to determine either the presence of the absence of chemicals while documenting each step of the process.

The majority of forensic toxicologists are employed by law enforcement agencies, private drug testing facilities, and government medical examiners.

The job duties of a forensic toxicologist include:

- Evaluating determinants or contributory factors in the cause and manner of death
- Performing human-performance forensic toxicology, determining the absence or presence of drugs and chemicals in the blood, hair, tissue, breath, etc.
- Working with medical examiners and coroners to help establish the role of alcohol, drugs and poisons related to the cause of death

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- Using state-of-the-art chemical and biomedical instrumentation
- Providing expert witness testimony
- Complying with safety, quality control, and other administrative criteria

#### Significance of toxicological findings

Forensic toxicology is used extensively in many different cases. A few examples would be:

- Postmortem forensic toxicology (death investigation)
- Human performance (affected behavior)
- Doping control (sports performance tests)
- Workplace drug tests
- Environmental toxin tests

The tests that make up the main components of forensic toxicology fall under the following areas:

#### Alcohol:

One of the major uses of forensic toxicology lies in the area of alcohol testing. Forensic toxicologists will determine true alcohol blood levels by analyzing blood samples of suspects in cases like "Driving Under the Influence", murders, suicides, etc. Forensic toxicology tests will determine to what extent the alcohol affected the suspect's actions, intentions, and the outcome by analyzing blood samples, for example whether alcohol levels were high enough to cause an irresponsible action such as a murder.

#### **Drugs:**

Drugs can be both good and bad – good being medication aimed to heal, and bad being addictive drugs which impair various bodily functions, such as heroine or cocaine. Drugs can thus be involved in numerous cases of murder, insanity, suicide and other crimes. Forensic toxicological tests will try and determine which drugs caused various effects involved in the crime or incident. This is especially useful in blurred cases of death where there may be confusion about whether a death was a staged suicide, and thus a murder, or a real suicide. The lab tests can determine how the drugs entered the system (for example through the mouth or a needle), whether the dosage was enough to be deadly, or if conditions of death match up to effects of the ingested drug.

#### **Toxins:**

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A toxin is any substance which is poisonous to an organism and causes immediate harm to said organism, such as poison injected with the intention of harm. Forensic toxicologists will analyze these toxins in order to interpret things like what the source of poison was, or where it could have been obtained etc. Toxin analysis is often used in assessing the effects of environmental toxins caused by chemical spills, such as chemicals that filter through to water supplies and affect resident's health.

Forensic toxicological tests are carried out in laboratories. The forensic toxicologist will have to be familiar with different instruments, methods, procedures, and know which is best suited to different chemicals. They will also need to be familiar with conditions like time sensitivity of chemicals and how a chemical enters the organisms system. They will also need to be able to work well under pressure.

Forensic toxicology is an extremely useful field which is continually developing. With time it will become even more advanced, making it easier to reach investigative conclusions. If you ever need chemicals like drugs, alcohol, or toxins analyzed or their effects determined, or find yourself wrongfully convicted in cases like those mentioned above, it would do you well to contact forensic toxicologists such as *Okorie Okorocha*.

#### **Fundamental principles of fingerprinting**

#### **First principle**

A fingerprint is an individual characteristic because no two fingerprints have yet been found to posses identical ridge characteristics

#### Second principle

A fingerprint will remained unchanged during an individuals lifetime

#### Third principle

Fingerprints have general ridge patterns that permit them to be systematically classified

#### Classification of fingerprints

The oldest models for classifying fingerprint types were probably presented at the end of the 18th century. But the significance of the so-called 'deltas' (triridii) was first described by Galton in the late 19th century. Below follows an overview of some milestones in fingerprint type classification.

The works presented by Purkinje, Galton, Midlo, and the F.B.I. represent milestones in the history of fingerprint type classification.

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### - Purkinje's 9 Fingerprint Groups -

Jan Evangelista Purkinje (1787-1869), a Czech physiologist and professor of anatomy at the University of Breslau, published in 1823 athesis discussing 9 fingerprint pattern types.



### Galton's 3 Basic Fingerprint Types -

Sir Francis Galton (1822-1911), an English polymath and anthropologist, published a detailed statistical model of fingerprint analysis and identification and encouraged its use in forensic science in his book '*Finger Prints*'.

Galton was the first who defined the three basic fingerprint types in terms of the number of 'deltas' - discriminating whorls (2 deltas) from: loops (1 delta), and arches (no deltas).

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#### A 'family tree' of Fingerprint Types -

Dr. Harold Cummins (1894-1976) achieved world recognition as the "Father of Dermatoglyphics" or the scientific study of skin ridge patterns found on the palms of human hands. The findings of his lifetime studies and the techniques he developed, known as the Cummins Methodology, are accepted as important tools in tracing genetic and evolutionary relationships. The methodology has gained common usage in diagnosis of some types of mental retardation, schizophrenia, cleft palate and even heart disease.

In the book '*Finger Prints, Palms and Soles*' (1943) he e.g. presented a 'family tree' of 39 fingerprint types (click on the image in order to see the details of this 'family tree').


#### The F.B.I. uses 8 Fingerprint Sub-Groups -

The American F.B.I. (Federal Bureau of Investigation) presented in 1985 the book '*The Science of Fingerprints*', which describes 8 sub-groups of fingerprint types (based on Galton's 3 large general groups of ingerprint patterns). By 1946, the F.B.I. had processed 100 million fingerprint cards in manually maintained files; and by 1971, 200 million cards.

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Advanced approach involving 18 pattern types! -

In 2016 a brand new approach became available which e.g. makes it possible to discriminate various types of radial patterns from ulnar patterns.

Some of the principles may appear to look new at first sight, but the detailed principles used to discriminate 'distal whorls' (most common) from 'proximal whorls' have actually been known since the days of Francis Galton when he presented his classic work 'Finger Prints' in 1892.

The details involved with the new advanced approach featuring 18 different fingerprintpatterntypesareoutlinedinsidethearticle:'Fingerprints & Behavior:Advanced Explorations involving Personality & Temperament!'.

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#### **Important Questions**

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#### 2 Marks

- 1. What is the role of toxicologist
- 2. Define toxicolology
- 3. Explain in short about the fundamental of finger print
- 4. How do you classify finger printing
- 5. How do you examine finger prints
- 6. Enumerate the situation where hand writing is compared.
- 7. Significances of toxicology.

#### 08 Marks

- 1. Define the following terms: latent print, plastic print, and visible print. Give two examples of chemical methods used to enhance latent prints.
- 2. Briefly describe the principles of fingerprints.
- 3. What is the role of toxicologist and write about the significance of toxicological findings.
- 4. Explain the basis of ascertaining individual characteristics of handwriting.
- 5. What is dermatoglyphics and various patterns involved in the dermatoglyphics

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#### Unit III

#### 2 Marks

- **1.** What is toxicology
- 2. What are the types of fingerprints
- **3.** How are the evidence are preserved

#### **08** Marks

- 1. Write assay on cyber security and recent techniques followed in cyber security.
- 2. What is the role of toxicologist and write about the significance of toxicological findings.
- 3. Describe fundamental principle of fingerprinting and briefly write about classification of fingerprint
- 4. Write assay on the application of DNA profiling in forensic medicine and also describe various investigation tools used.

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COURSE NAME: BASICS OF FORENSIC SCIENCE UNIT: IV BATCH-2017-2020

#### UNIT-IV

#### **SYLLABUS**

Principles of DNA fingerprinting, application of DNA profiling in forensic medicine, Investigation Tools, eDiscovery, Evidence Preservation, Search and Seizure of Computer

#### UNIT IV

#### Introduction

DNA fingerprinting or DNA profiling is a process which is used to determine the nucleotide sequence at a certain part of the DNA that is unique in all human being. Out of 66,000,000,000 base pairs of nucleotides, 99.9% of the nucleotide sequence of the DNA is same in all human being but 0.1% of the sequence differs in all human being and the main purpose of DNA fingerprinting is to find out the genetic difference between the compared individuals. DNA fingerprinting is the most efficient and fastest way to compare the DNA sequence of any two individuals. **Alex Jeffreys** discovered the process of DNA fingerprinting in 1985 and for this he is also known as the father of DNA fingerprinting. In India, Lajit Singh is known as the father of Indian DNA fingerprinting.

#### **Principle of DNA fingerprinting**

3,000,000 base pairs of nucleotide that is 0.1% of the genomes are unique in all human being. This uniqueness in the base sequence doesn't only occur in genes but also in repetitive DNA also known as satellite DNA. Due to density gradient configuration in the satellite DNA, various small peaks are formed on the DNA which gives rise to polymorphism. One of the main satellite DNA having high degree of polymorphism is **variable number tandem repeats** (VNTR). Since a child receive 50% of the DNA from its father and the other 50% from his mother, so the number VNTRs at a particular area of the DNA of the child will be different may be due to insertion, deletion or mutation in the base pairs. As a result, every individual has a distinct composition of VNTRs and this is the main principle of DNA fingerprinting.

#### **Technique of DNA fingerprinting**

DNA Fingerprinting is a very complex multi-step process and it was first developed by Alex Jeffreys.

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- At first, the source of DNA fingerprinting is taken, which can be white blood corpuscle, blood, saliva, semen etc.
- Then the source of the DNA is exposed to very high speed refrigerated ultracentrifugation which separates the nuclei and isolates the DNA. If the extracted DNA is small then it is amplified through **polymerase chain reaction** (**PCR**) to obtain multiple copies of the small DNA.
- After DNA amplification, the whole DNA is digested or broken down into various fragments of variable lengths using an enzyme which is known as restriction endonuclease. Fragmentation of DNA is actually done to separate the VNTRs from the DNA.
- The fragments of the DNA are then exposed to electrophoresis over polymer gel to further separate the VNTRs from the fragmented DNA. Gel electrophoresis is a technique which was discovered by Tiselius in 1937 to separate biomolecules when they are placed in gel matrix. Since DNA fragments are not clearly visible under normal light, so the VNTRs are usually recognised by staining the fragments with ethedium bromine and the VNTRs become florescent when they are exposed under UV radiations.
- The separated VNTRs are blotted or shifted to a synthetic membrane, such as nylon and this process is known as Southern Blotting. This process was invented by E.M Southern.
- The synthetic membranes are hybridised by immersing them in a bath where labelled DNA probes are added. DNA probes are synthetic radioactive DNA fragments having known sequences of nitrogenous base pairs. These synthetic probes get connected to the VNTRs strands in the bath.
- X-rays are passed through the synthetic membranes which contain both the radioactive DNA probes and VNTRs. Dark bands are observed in the radioactive hybridised VNTRs and these provide us a DNA profile of the given sample of DNA.

#### **Applications of DNA Fingerprinting:**

#### (i) Individuality:

Like skin finger printing (der- matoglyphics), DNA finger printing can help to distinguish one human being from another with exception of monozygotic twins,

#### (ii) Paternity/Maternity Disputes:

DNA finger printing can identify the real genetic mother, father and the offspring,

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#### (iii) Human Lineage:

DNA from various probables is being studied to find out human lineage,

#### (iv) Hereditary Diseases:

The technique is being used to identify genes connected with hereditary diseases,

#### (v) Forensics:

DNA finger printing is very useful in the detection of crime and legal pursuits. DNA fingerprinting has proved that Dhanu, the human bomb, was the real murderer of Shri Rajiv Gandhi, the former Prime Minister of India,

#### (vi) Sociology:

It can identify racial groups, their origin, historical migration and invasions. Genography is the study of migratory history of human species.

#### Applications of DNA Fingerprinting in criminal investigation

The DNA molecule, present in every cell in our bodies, is a chain of molecules, sugars, and phosphates. The order in which these components arrange themselves in the chain is, statistically speaking, unique to every individual (except for identical twins). The DNA molecule is the same in every cell, and remains constant (with slight, rare variations) during an individual's life. Scientists can harvest a person's DNA molecule from any cell, be it tissue, blood, sweat, semen, bone, saliva, and so on. Once the DNA ladder is analyzed, it can be compared to another molecule's DNA. Forensic scientists perform such comparisons in order to:

- Link a suspect to a crime or exonerate someone, where biological evidence has been left at the crime, by comparing the suspect's DNA to that left at the scene
- Determine parentage, for purposes of paternity, immigration, and other cases, and
- Identify human remains, when visual or dental determinations are not possible or conclusive.

DNA identification is extraordinarily reliable, though it can be challenged, as explained below.

#### How is DNA Tested and Compared?

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In the lab, scientists extract an amount of DNA from each biological sample, which must be sufficiently large—a quarter-size blood stain, or a dime-sized semen stain. The DNA molecule itself must be intact, not in pieces that are too small to analyze. Then, each sample's band pattern (its sequence) is compared to the other. If the bands match, scientists consult a national database of band patterns, and determine the statistical chances that the match is a coincidence. In court, you'll hear the scientist testify that the odds of the match being coincidental are, for instance, many millions-to-one, leaving the jury with the evidence it needs to accept the match as correct. (Another type of analysis can be performed on a smaller sample, such as a single hair, with results that may be less convincing.)

#### Advantages of DNA profiling

Some of the advantages of DNA profiling include:

- DNA tests can be applied to any human sample that contains cells with nuclei, such as saliva, semen, urine and hair.
- DNA tests are extremely sensitive, and can be conducted using samples that would be too small for other serological tests.
- DNA is hardy, and resists degeneration even after contamination with chemicals or bacteria.
- The ability of DNA profiling to exclude a suspect means the police are able to confidently drop that line of enquiry and continue their investigation down other avenues.

#### Limitations of DNA profiling

Contrary to public belief, DNA profiling isn't infallible. Critics point out various problems and limitations, including:

- New DNA profiling technologies can give incorrect results, due to errors such as crosscontamination of samples.
- Older DNA profiling technologies are more prone to errors, which could give falsenegative or false-positive results.
- DNA profiles can only offer statistical probability (for example, one in a million), rather than absolute certainty.
- The more people tested, the lower the statistical probability. For example, the probability of one in a million may nosedive to one in 10,000 if enough people are profiled for a single test.

- DNA databases stored on computer are vulnerable to exploitation via hackers.
- Some critics point out that holding a person's DNA profile on record is, in a sense, a violation of that person's DNA 'ownership'.
- DNA evidence is easily planted at a crime scene.

#### **Important Questions**

#### 2 Marks

- 1. What are classifications of fire arms?
- 2. Define Ballistics.
- 3. Explain in short about the characteristics of handwriting.
- 4. How do you classify explosives
- 5. How do you examine handwriting?
- 6. Enumerate the situation where hand writing is compared.
- 7. What is ink analysis?
- 8. Comparison internal and external Ballistics.

#### **08 Marks**

- 1. Explain in details about explosives.
- 2. How do chemicals provide a clue for explosive analysis?
- 3. Explain the basis of ascertaining individual characteristics of handwriting.
- 4. Examination and comparison of handwriting and analysis of ink various samples.

#### Unit IV

#### 2 Marks

- **1.** What is ediscovery
- 2. What are the types of investigation tools in cyber crime
- 3. Write about the procedure in search and Seizure of computer in forensic science.
- 4. How are the evidence are preserved
- **5.** What is DNA profiling

#### 08 Marks

- 1. Write assay on cyber security and recent techniques followed in cyber security.
- 2. What is the role of toxicologist and write about the significance of toxicological findings.
- 3. Describe fundamental principle of fingerprinting and briefly write about classification of fingerprint
- 4. Write assay on the application of DNA profiling in forensic medicine and also describe various investigation tools used.

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#### UNIT-V

#### **SYLLABUS**

Introduction to cyber security and recent techniques, development of finger print as science for personal identification

#### UNIT V

#### INTRODUCTION TO CYBER SECURITY AND ITS RECENT TECHNIQUES

#### INTRODUCTION

Internet is among the most important inventions of the 21st century which have affected our life. Today internet have crosses every barrier and have changed the way we use to talk, play games, work, shop, make friends, listen music, see movies, order food, pay bill, greet your friend on his birthday/ anniversary, etc. You name it, and we have an app in place for that. It has facilitated our life by making it comfortable. Gone are the days when we have to stand in a long queue for paying our telephone and electricity bills. Now we can pay it at a click of a button from our home or office. The technology have reached to an extent that we don't even require a computer for using internet. Now we have internet enabled smartphone, palmtops, etc. through which we can remain connected to our friends, family and office 24x7. Not only internet has simplified our life but also it has brought many things within the reach of the middle class by making them cost effective. It was not long back, while making an ISD or even a STD call, the eyes were stricken on the pulse meter. The calls were very costly. ISD and STD were used to pass on urgent messages only and the rest of the routine communication was done using letters since it was a relatively very cheap. Now internet have made it possible to not only talk but use video conference using popular applications like skype, gtalk etc. at a very low price to a level where a one hour video chat using internet is cheaper that the cost of sending a one page document from Delhi to Bangalore using speedpost or courier service. Not only this, internet has changed the use of the typical devices that were used by us. Television can be used not only for watching popular tv shows and movies but can be used for calling/video chatting with friend using internet. Mobile phone is not only used for making a call but viewing a latest movie. We can remain connected to everyone, no matter what our location is. Working parents from office can keep eve on their children at home and help them in their homework. A businessman can keep eye on his staff, office, shop, etc with a click of a button. It has facilitated our life in more than one way. Have you ever wondered from where this internet came? Let us discuss the brief

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history of internet and learn how this internet was invented and how it evolved to an extent that now we cannot think of our lives without it.

#### **History of Internet**

I don"t know what the cold war between USA and Russia gave to the world, but defiantly the internet is one of those very useful inventions whose foundation was laid during cold war 9days. Russia Launched the world"s first satellite, SPUTNIK into the space on 4th October, 1957. This was clearly the victory of Russia over the cyber space and as a counter step, Advanced Research Projects Agency, the research arm of Department of Defence, United States, declared the launch of ARPANET(Advanced Research Projects Agency NETwork) in early 1960"s. Soon after, in 1986 NSF(national Science Foundation) backbone was created to and five US universities" computing centres were connected to form NSFnet. The participating Universities were:

- Princeton University -- John von Neumann National Supercomputer Center, JvNC
- Cornell University -- Cornell Theory Center, CTC
- University of Illinois at Urbana-Champaign -- National Center for Supercomputing Applications, NCSA
- Carnegie Mellon University -- Pittsburgh Supercomputer Center, PSC
- General Atomics -- San Diego Supercomputer Center, SDSC

#### Internet Addresses

With so many devices connected to the internet, we require some mechanism to uniquely identify every device that is connected to the internet. Also we require some centralized 11 system which takes care of this mechanism so that the signs which are used to identify each device are not duplicate; else the whole purpose is defeated. To take care of this, we have a centralized authority known as Internet Assigned Numbers Authority (IANA), which is responsible for assigning a unique number known as IP(Internet Protocol) address. An IP address is a 32-bit binary number which is divided into four octets and each octet consists of 8 binary digits and these octet are separated by a dot(.). An example of an IP address is 11110110.0101100.1101100.1111100 Each 8-bits in an octet can have two binary values i.e. 0 and 1. Therefore, each octet can have minimum value 0. i.e. 00000000 to maximum value 256 i.e. 11111111 and in total have 28 = 256 different combinations.

IANA decentralises that task of assigning the IP addresses by allocating the large chunk of IP addresses to five Regional Internet Registries (RIRs), which are further responsible to 12 allocate the IP addresses in their zone. These RIRs along with their area of operations are listed below:  $\neg$  APNIC- This RIR is responsible for serving the Asia Pacific region  $\neg$  AfriNIC- This RIR is responsible for serving the African region  $\neg$  ARIN- This RIR is responsible for serving

North America and several Caribbean and North Atlantic islands  $\neg$  LACNIC- This RIR is responsible for serving Latin America and the Caribbean, and  $\neg$  RIPE NCC- This RIR is responsible for serving Europe, the Middle East, and parts of Central Asia.

#### DNS

Whenever we browse any website in the internet, we type name something like www.uou.ac.in and we rarely deal with IP address like 104.28.2.92 but the fact is even if we type http:// 104.28.2.92 in the URL, it will land us to the same webpage. The fact is we are very comfortable using and remembering the names instead of a number. Moreover, these IP address changes over time and some of the sites have multiple IP address.

#### **INTRODUCTION TO CYBER CRIME:**

The internet was born around 1960"s where its access was limited to few scientist, researchers and the defence only. Internet user base have evolved expontinanly. Initially the computer crime was only confined to making a physical damage to the computer and related infrastructure. Around 1980"s the trend changed from causing the physical damaging to computers to making a computer malfunction using a malicious code called virus. Till then the effect was not so widespread beacouse internet was only comfined to defence setups, large international companies and research communities. In 1996, when internet was launched for the public, it immeditly became populer among the masses and they slowly became dependent on it to an extent that it have changed their lifestyle.

The GUIs were written so well that the user don"t have to bother how the internet was functioning. They have to simply make few click over the hyber links or type the desired information at the desired place without bothering where this data is stored and how it is sent over the internet or wether the data can accessed by another person who is conneted to the internet or wether the data packet sent over the internet can be snoofed and tempered. The focus of the computer crime shifted from marely damaging the computer or destroying or manipulating data for personal benefit to financial crime. These computer attacks are increasing at a rapid pase. Every second around 25 computer became victim to cyber attack and around 800 million individuals are effected by it till 2013. CERT-India have reported around 308371 Indian websites to be hacked between 2011-2013. It is also estimated that around \$160 million are lost per year due to cyber crime. This figure is very conservative as most of the cases are never reported. Accoring to the 2013-14 report of the standing committee on Information Technology to the 15th Lok Sabha by ministry of communication and information technology, India is a third largest number do Intrernet users throughout the world with an estimated 100 million internet users as on June, 2011 and the numbers are growing rapidly. There are around 22 million broadband connections in India till date operated by around 134 major Internet Service Providers(ISPs).

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The term cyber crime is used to describe a unlawful activity in which computer or computing devices such as smartphones, tablets, Personal Digital Assistants(PDAs), etc. which are stand alone or a part of a network are used as a tool or/and target of criminal acitivity. It is often 16 commited by the people of destructive and criminal mindset either for revenge, greed or adventure.

#### **Classification of Cyber Crimes**

The cyber criminal could be internal or external to the organization facing the cyber attack. Based on this fact, the cyber crime could be categorized into two types:

- **Insider Attack**: An attack to the network or the computer system by some person with authorized system access is known as insider attack. It is generally performed by dissatisfied or unhappy inside employees or contractors. The motive of the insider attack could be revenge or greed. It is comparitively easy for an insider to perform a cyber attack as he is well aware of the policies, processes, IT architecture and wealness of the security system. Moreover, the attacker have an access to the network. Therefore it is comparatively easy for a insider attacker to steel sensitive information, crash the network, etc. In most of the cases the reason for insider attack is when a employee is fired or assigned new roles in an organization, and the role is not reflected in the IT policies. This opens a vernability window for the attacker. The insider attack could be prevented by planning and installing an Internal intrusion detection systems (IDS) in the organization.
- External Attack: When the attacker is either hired by an insider or an external entity to the organization, it is known as external attack. The organization which is a victim of cyber attack not only faces financial loss but also the loss of reputation. Since the attacker is external to the organization, so these attackers usually scan and gathering information. An expreicend network/security administrator keeps regual eye on the log generated by the firewalls as external attacks can be traced out by carefully analysinig these firewall logs. Also, Intrusion Detection Systems are installed to keep an eye on external attacks.
- Unstructured attacks: These attacks are generally performed by amatures who don't have any predefined motives to perform the cyber attack. Usually these amatures try to test a tool readily available over the internet on the network of a random company.
- **Structure Attack**: These types of attacks are performed by highly skilled and experienced people and the motives of these attacks are clear in their mind. They have access to sophisticated tools and technologies to gain access to other networks without being noticed by their Intrusion Detection Systems(IDSs). Moreover, these attacker have the necessary expertise to develop or modify the existing tools to

satisfy their purpose. These types of attacks are usually performed by professional criminals, by a country on other rival countries, politicians to damage the image of the rival person or the country, terrorists, rival companies, etc.



#### Hierarchical Organisational Structure

#### **Reasons for Commission of Cyber Crimes**

There are many reasons which act as a catalyst in the growth of cyber crime. Some of the prominent reasons are:

a. Money: People are motivated towards committing cyber crime is to make quick and easy money.

b. Revenge: Some people try to take revenge with other person/organization/society/ caste

- or religion by defaming its reputation or bringing economical or physical loss. This comes under the category of cyber terrorism.
- c. Fun: The amateur do cyber crime for fun. They just want to test the latest tool they have encountered.
- d. Recognition: It is considered to be pride if someone hack the highly secured networks like defense sites or networks.
- e. Anonymity- Many time the anonymity that a cyber space provide motivates the person to commit cyber crime as it is much easy to commit a cyber crime over the cyber space and remain anonymous as compared to real world. It is much easier to get away with criminal activity in a cyber world than in the real world. There is a strong sense of anonymity than can draw otherwise respectable citizens to abandon their ethics in pursuit personal gain.

f. Cyber Espionage: At times the government itself is involved in cyber trespassing to keep eye on other person/network/country. The reason could be politically, economically socially motivated.

#### MALWARE AND ITS TYPE

Malware stands for "Malicious Software" and it is designed to gain access or installed into the computer without the consent of the user. They perform unwanted tasks in the host computer for the benefit of a third party. There is a full range of malwares which can seriously degrade the performance of the host machine. There is a full range of malwares which are simply written to distract/annoy the user, to the complex ones which captures the sensitive data from the host machine and send it to remote servers.

There are various types of malwares present in the Internet. Some of the popular ones are:

#### Adware

It is a special type of malware which is used for forced advertising. They either redirect the page to some advertising page or pop-up an additional page which promotes some product or event. These adware are financially supported by the organizations whose products are advertised.

#### Spyware

It is a special type of which is installed in the target computer with or without the user permission and is designed to steal sensitive information from the target machine. Mostly it gathers the browsing habits of the user and the send it to the remote server without the knowledge of the owner of the computer. Most of the time they are downloaded in to the host computer while downloading freeware i.e. free application programmes from the internet. Spywares may be of various types; It can keeps track of the cookies of the host computer, it can act as a keyloggers to sniff the banking passwords and sensitive information, etc.

#### Browser hijacking software

There is some malicious software which are downloaded along with the free software offered over the internet and installed in the host computer without the knowledge of the user. This software modifies the browsers setting and redirect links to other unintentional sites.

#### Virus

A virus is a malicious code written to damage/harm the host computer by deleting or appending a file, occupy memory space of the computer by replicating the copy of the code, slow down the performance of the computer, format the host machine, etc. It can be spread via email

attachment, pen drives, digital images, e-greeting, audio or video clips, etc. A virus may be present in a computer but it cannot activate itself without the human intervention. 20 Until and unless the executable file(.exe) is execute, a virus cannot be activated in the host machine.

#### Worms

They are a class of virus which can replicate themselves. They are different from the virus by the fact that they does not require human intervention to travel over the network and spread from the infected machine to the whole network. Worms can spread either through network, using the loopholes of the Operating System or via email. The replication and spreading of the worm over the network consumes the network resources like space and bandwidth and force the network to choke.

#### Trojan Horse

Trojan horse is a malicious code that is installed in the host machine by pretending to be useful software. The user clicks on the link or download the file which pretends to be a useful file or software from legitimate source. It not only damages the host computer by manipulating the data but also it creates a backdoor in the host computer so that it could be controlled by a remote computer. It can become a part of botnet(robot-network), a network of computers which are infected by malicious code and controlled by central controller. The computers of this network which are infected by malicious code are known as zombies. Trojens neither infect the other computers in the network nor do they replicate.



#### **CYBER SECURITY TECHNIQUES**

There are many cyber security techniques to combat the cyber security attacks. The next section discusses some of the popular techniques to counter the cyber attacks.

#### AUTHENTICATION

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It is a process of identifying an individual and ensuring that the individual is the same who he/she claims to be. A typical method for authentication over internet is via username and password. With the increase in the reported cases of cyber crime by identity theft over internet, the organizations have made some additional arrangements for authentication like One Time Password(OTP), as the name suggest it is a password which can be used one time only and is sent to the user as an SMS or an email at the mobile number/email address that he have specified during the registration process. It is known as two-factor authentication method and requires two type of evidence to authentication an individual to provide an extra layer of security for authentication. Some other popular techniques for two-way authentication are: biometric data, physical token, etc. which are used in conjunction with username and password.

#### ENCRYPTION

It is a technique to convert the data in unreadable form before transmitting it over the internet. Only the person who have the access to the key and convert it in the readable form and read it. Formally encryption can be defined as a technique to lock the data by converting it to complex codes using mathematical algorithms. The code is so complex that it even the most powerful computer will take several years to break the code. This secure code can safely be transmitted over internet to the destination. The receiver, after receiving the data can decode it using the key. The decoding of the complex code to original text using key is known as decryption. If the same key is used to lock and unlock the data, it is known as symmetric key encryption.

#### DIGITAL SIGNATURES

It is a technique for validation of data. Validation is a process of certifying the content of a document. The digital signatures not only validate the data but also used for authentication. The digital signature is created by encrypting the data with the private key of the sender. The encrypted data is attached along with the original message and sent over the internet to the destination. The receiver can decrypt the signature with the public key of the sender. Now the decrypted message is compared with the original message. If both are same, it signifies that the data is not tempered and also the authenticity of the sender is verified as someone with the private key(which is known to the owner only) can encrypt the data which was then decrypted by his public key. If the data is tempered while transmission, it is easily detected by the receiver as the data will not be verified. Moreover, the massage cannot be re-encrypted after tempering as the private key, which is posses only by the original sender, is required for this purpose.

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Figure 5: Digital signature<sup>3</sup>

#### ANTIVIRUS

There are verities of malicious programs like virus, worms, trojan horse, etc that are spread over internet to compromise the security of a computer either to destroy data stored into the computer or gain financial benefits by sniffing passwords etc. To prevent these malicious codes to enter to your system, a special program called an anti-virus is used which is designed to protect the system against virus. It not only prevents the malicious code to enter the system but also detects and destroys the malicious code that is already installed into the system. There are lots of new viruses coming every day. The antivirus program regularly updates its database and provides immunity to the system against these new viruses, worms, etc.



Figure 6: Different anvirus available on the market<sup>4</sup>

#### FIREWALL

It is a hardware/software which acts as a shield between an organization"s network and the internet and protects it from the threats like virus, malware, hackers, etc. It can be used to limit the persons who can have access to your network and send information to you.

There are two type of traffic in an organization viz. inbound traffic and outbound traffic. Using firewall, it is possible to configure and monitor the traffic of the ports. Only the packets from trusted source address can enter the organization's network and the sources which are blacklisted and unauthorized address are denied access to the network. It is important to have firewalls to prevent the network from unauthorized access, but firewall does not guarantee this until and unless it is configured correctly. A firewall can be implemented using hardware as well as software or the combination of both.

- Hardware Firewalls: example of hardware firewalls are routers through which the network is connected to the network outside the organization i.e. Internet.
- Software Firewalls: These firewalls are installed and installed on the server and client machines and it acts as a gateway to the organizations" network.
- The firewalls can be configured to follow "rules" and "policies" and based on these defined rules the firewalls can follow the following filtering mechanisms.
- Proxy- all the outbound traffic is routed through proxies for monitoring and controlling the packet that are routed out of the organization.
- Packet Filtering- based on the rules defined in the policies each packet is filtered by their type, port information, and source & destination information. The example of such characteristics is IP address, Domain names, port numbers, protocols etc. Basic packet filtering can be performed by routers.
- Stateful Inspection: rather than going through all the field of a packet, key features are defined. The outgoing/incoming packets are judged based on those defined characteristics only.

#### STEGANOGRAPHY

It is a technique of hiding secret messages in a document file, image file, and program or protocol etc. such that the embedded message is invisible and can be retrieved using special software. Only the sender and the receiver know about the existence of the secret message in the image. The advantage of this technique is that these files are not easily suspected.



Figure 8: Steganography<sup>6</sup>

#### DEVELOPMENT OF FINGER PRINT AS SCIENCE FOR PERSONAL IDENTIFICATION

The "Science of Fingerprint Identification" begins at the point where material known as a matrix is transferred from an area of friction ridge skin to an object or surface. The "Science" continues on to detection, development, and recovery of the latent print, then to comparison with existing exemplars. The comparison process proceeds until a match or no match conclusion is reached and, ideally, culminates in individualization.

#### **TYPES OF FINGERPRINTS**

The million dollar question... What types of surfaces can you get fingerprints off of? The answer is pretty much everything: hard surfaces, soft surfaces, porous surfaces (paper), cloth, rock, even human skin. The key here is that a fingerprint is an imprint (reproduction) of a finger or a portion of friction ridge skin and is produced by the transference of whatever was present on the surface of that finger or portion of friction ridge skin. This could be anything from perspiration to paint to body oils or food residue.

The length of time that a fingerprint will remain is dependent on the makeup of the transferred material. Fingerprints fall into different categories:

1. Latent fingerprints (hidden).

2. Patent fingerprints (visible).

3. Plastic fingerprints (3D).

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#### WHY FINGERPRINTS ARE USED FOR IDENTIFICATION ?

- Friction ridge skin on the palmer and plantar surfaces of the hands and feet are unique to an individual person.
- The fingerprint patterns and ridge details are permanent.
- Developing in the womb at about the 12th week after conception, fingerprints do not naturally change, except in size, during the life of an individual.

#### HOW FINGERPRINTS ARE PRODUCED

Transfer of contaminants (Matrix)—this is the primary process that produces a fingerprint on a piece of evidence. Normally, a fingertip will contain little more than a small amount of perspiration. This particular perspiration does not contain oils. The fingers coming in contact with various objects or surfaces pick up other forms of contaminants. When an object is touched, some of the contaminants will transfer to the object, leaving a "print" of the fingers.

Examples of Matrix: Body oils found in the hairy areas (from sebaceous glands) Perspiration (eccrine glands on palmer and plantar surfaces) Grease Blood Paint.

**Plastic deformation**—the fingers will often leave an impression in a soft material, such as tacky paint or drying blood, soil, and candle wax (etc.). Material removal-additionally, fingers coming in contact with a dirty or dusty surface may remove that material, resulting in a clean fingerprint surrounded by the dirt or dust.

#### **DETECTION AND DEVELOPMENT**

- First and foremost in the process of fingerprint identification for the purposes of solving crimes is the detection and development of a latent fingerprint of sufficient quality to affect a fingerprint comparison.
- Second to this is the taking of good quality inked fingerprints for this latent to be compared to.
- Different surfaces and materials require different process techniques in order to develop that "hidden" fingerprint. Basically, there are two types of surfaces, nonporous (nonabsorbent) like glass, metal, or plastic and porous (absorbent) like paper. Like the composition of the matrix, the substrate can also be hard to group into a specific category.
- The basic categories, nonporous or porous, can actually be a widespread combination of the two. An example of this would be paper. The first reaction might be to place paper into the porous category, but paper can range in density from tissue to high-gloss magazine covers and, as such, must be processed differently.
- The Forensic Science of Fingerprints

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- Nonporous surfaces are usually identified with the more commonly known dusting process using fine powders and a fingerprint brush, followed by applying transparent tape over the developed fingerprint and lifting it. These surfaces can also be treated by exposing the subject item to super glue fumes, which polymerize (adhere) to the latent fingerprint.
- Subsequently, these cyanoacrylate-treated prints can by powdered and lifted or treated with chemical dye stains, which results with them fluorescing when observed under a particular color of light supplied by an alternate light source. I Porous surfaces usually require the use of a chemical reagent to develop fingerprints so that we may recover and compare them.
- Chemical reagents react with the contaminant, which has been transferred from the fingertip to the object. This reaction can take two forms: it either makes the latent fingerprint visible under normal lighting conditions or causes the fingerprint to fluoresce under the illumination of the alternate light source. The recovery of these fingerprints requires that they be photographed.

#### **RECOVERY AND PRESERVATION**

#### The use of photography:

It is wise to photograph all latents as they are located or developed, as additional recovery processes may alter or destroy the previously developed latent, rendering it useless. In some cases, as with forensic light source detection, iodine fuming, and silver nitrate, the results are not permanent and must be photographed, or they will eventually be lost.

Photography is a permanent record, which can be reproduced many times and can be enhanced by using different types of development (dark room) techniques and software.

When photographing latents, include an item in the frame, such as a coin or preferably a small stick-on scale, so that the photo can be reproduced life size when printing.

#### Lifting:

latents developed with powder can be preserved by placing a piece of clear cellophane tape over the dusted latent, causing the dust to adhere to the adhesive side of the tape. This tape is then lifted from the object and placed on a card or backer, which has a contrasting color to the powder used, resulting in a print that is in the same alignment as an inked fingerprint.

#### **Casting:**

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fingerprints left in soft putty, drying paint, or blood can be cast using tool mark recovery methods, such as commercial silicone rubber casting material, which may include, but is not limited to, Duplicast<sup>TM</sup>, Mikrosil<sup>TM</sup>, or Accutrans<sup>TM</sup> (polyvinylsiloxane).

#### FINGERPRINT IDENTIFICATION

To identify a fingerprint is to say that a particular unknown fingerprint matches a second known or unknown fingerprint in all details. Upon identification, the examiner is affirming that two fingerprints have been produced by the same individual. Latent Print Processing Guide

An example of the method to complete this process is as follows:

#### • Identify class characteristics

This involves determining the shape, ridge flow, and pattern type of a fingerprint. These are called level 1 details. Being able to determine the class characteristics can immediately eliminate a fingerprint as a possible candidate. Knowing that your subject fingerprint is a particular pattern type can eliminate all other pattern types from consideration.

#### • Pattern identification

Shape and ridge flow can be a strong indicator of pattern type and even right or left hand or palm. Subtle ridge flow curvature can sometimes be enough to identify the source of the questioned friction ridge.

#### • Identify ridge details

Once it has been determined that the class characteristics of two fingerprints are similar, an examination for identical ridge detail is performed. Ridge or "Galton" details, level 2 details, are located in one fingerprint.

Usually a pair of prominent details is chosen to make the search easier, and the location and ridge spacing is carefully noted. An attempt is then made to locate these details on the second fingerprint. They must be the same in both fingerprints in order to proceed. After concluding they are identical, a third detail is located and compared, then a fourth, and so on. Sometimes level 3 details are present in both the latent and inked fingerprint and can also be used to affect identification. Level 3 details consist of pore detail and individual ridge shape.

When the examiner is satisfied that a sufficient quantity of matching detail is present, a positive identification is declared. No minimum number of points has been set by US authorities.

#### AFIS (Automated Fingerprint Identification System)

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A computer system that has the ability to sort through thousands of fingerprint cards and retrieve exemplar, or known, fingerprints that are similar to the questioned fingerprint. The system should be more accurately referred to as a computer-aided fingerprint identification system, as AFIS does not automatically identify fingerprints; the identification is done by a latent fingerprint examiner. I Upon the arrest of an individual, the fingerprints are searched against a database containing the fingerprints of persons previously arrested. Many times people give false information at the time of arrest, and with the AFIS system, these incidents are detected and the arrested party is found to have an arrest warrant or is in violation of their probation. I Additionally, latent fingerprints are entered into the AFIS system and are searched against the database. The computer generates a list of possible candidates and displays the fingerprints associated with that list. This affords us the ability to solve crimes when there is not an initial suspect

#### **Important Questions**

#### 2 Marks

- 1. What are classifications of cyber security
- 2. Define cyber security
- 3. Explain in short about the characteristics of cyber security
- 4. How do you classify finger print
- 5. How do you examine finger print

#### 08 Marks

- 1. Explain in details about cyber security and its recent techniques
- 2. What is cyber crime and how it is carried out
- 3. Explain the basis of cyber security carried to protect the individual from cyber attack
- 4. Explain the various role of forensic expert in the development of finger print as science for personal identification.

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#### UNIT I

Who was the	Sherlock Holmes	Leon Lattes	Alphonse Bertillion	Francis Galton	Sherlock Holmes
Who was the first	Calvin Goddard	Albert S. Osborne	Walter C. McCrone	Alphonse Bertillion	Alphonse Bertillion
scientist to bring					
into account the idea					
Which of the	Establishing that a	Providing a link	Tracing the original	Providing	Tracing the original
following would	crime has been	between a crime and	manufactures for the	investigative leads	manufactures for the
most likely Not A	committed	its victim or a crime	weapons present at a	for a case	weapons present at a
purpose of phycial		and its perpetrator	crime scene		crime scene
Which of the	Note-taking	Sketching the crime	Note taking and	Having a witness	Note taking and
following would be		scene	Sketching	describe the scene to	Sketching
When taking photos	The scene should be	he scene should be	The points of	Close ups of injured	The scene should be
of a crime scene, the	photographed in an	photographed in	entrance and exit	victims should be	photographed in an
most important	unaltered condition	color	should be	taken	unaltered condition
Whatis the method	The triangulation	The fixed distance	The Pythagorean	Direct Standard	The triangulation
that is used when	method	method	Theorem	Comparison	method
Which of the	The FDA	The FB	The DEA	The ATF	The FDA
following is NOT an	<b>D</b>	a			<b>a</b>
On the State level,	Provide services to	Service state and	Are financed by the	Must be put under	Service state and
crime labs	county and	local law	local government	the direction of an	local law
	municipal agencies	enforcement		official crime scene	enforcement
Which of the	The Latent	The Evidence	The Toxicology Unit	The Physical	The Physical
following is a basic	Fingerprint Unit	Collection Unit	<b>T</b>	sciences unit	sciences unit
he Biology Unit of a	DNA and body fluids	Hairs and fibers	The presence of	More than one of the	More than one of the
crime lab Analyzes			scene	above	above
The Document	Determine the	Check for	Use paper and ink	Source of Evidence	Use paper and ink
Examination Unit of	authenticity	handwriting	analysis to analyze		analysis to analyze
a Crime Lab Will do			the documents		the documents
Which of the	The Firearms Unit	The Polygraph Unit	The Latent	The Voiceprint	The Latent
following units at a			Fingerprint Unit	Analysis Uni	Fingerprint Unit
crime lab would					

most likely be used

Which of the	The Spiral Search	The Quadrant or	The Strip or Line	The Geometric	The Geometric
following is NOT a	Method	Zone Search method	Search method	layout method	layout method
method when		<b></b>			<b>-</b>
Which of the	Hairs	Blood	Fibers	Glass fragments	Blood
following could be					
removed at the	The ended of	The second to success t	A	Mana than an a f	Mana than and af
following would	The existence of	the immediate loss	A search made by	whore than one of	the above
qualify as a legal	circumstances	or destruction of	parties involved	the above	the above
Which of the	The names of all	All victims that	The continuity of	The particular type	The particular type
following needs to	potential suspects	were harmed as a	possessio	of test that was used	of test that was used
established if any	involved in the crime	result of the crime		when testing	when testing
Conventional	Species	Analyzing the	Identifying the type	Identifying the type	Species
serology would	identification and	direction	of vehicle	of vehicle	identification and
For toxicological	Drugs of abuse and	Arsenic	Ethanol, methanol,	Strychnine, cyanide	Ethanol, methanol,
analysis, which of	pharmaceuticals		isopropanol		isopropano
the following is					
The first step of	Packaging,	Exhibit it to the	Collecting,	Discovering and	Discovering and
gathering physical	conveying and	lead investigator	recording and	Analysing	Analysing
Rope and Cordage	Composition,	The presence of	The presence of	The presence of	The presence of
Identification	construction, color	burn patterns	burn patterns	burn patterns and	burn patterns and
(specifically)	and diameter of it	Damates	Cup Divisional	Composition,	Composition,
A lady died due to	Forensic medicine	Deputy Superintendent of	Sub-Divisional Magistrat	Coroner	Sud-Divisional Magiatrat
within seven years	expert	Police	Magistiat		wagistiat
after her marriage		1 once			
The ideal place to	Axilla	Groin	Rectum	Rectum	Rectum
record temperature	1 Anna	Grom	Rectum	Reetum	Reetuin
Diffusion of oxvgen	Carbon monoxide	Curare	Phosgene	Cyanides	Curare
at the tissue level is			6	5	

affected in all the

n methyl alcohol poisoning there is CNS depression,	Formaldehyde and formic acid	Acetaldehyde	Pyridine	Acetic acid	Formaldehyde and formic acid
cardiac depression					
In chronic arsenic	Nail clippings	Nail clippings	Bone biopsy	Blood sample	Blood sample
poisoning the					
following samples					
In India, magistrate	Exhumation cases	Dowry deaths within	Murder cases	Death of a person in	Murder cases
inquest is done in		5 years of marriage		police custody	
At autopsy, the	Characteristic bitter	Congested organs	The skin may be	Erosion and	Characteristic bitter
cyanide poisoning	lemon smel		pinkish or cherry red	haemorrhages in	lemon smel
case will show the	_	1.6	in colour	oesophagus and	_
The minimum age at	7 years	16 years	12years	20 years	7 years
which an individual					
is responsible for his	Destales as the	C	A 41	II	Destales and has
The most renable	Dactylography	Scars	Anthropometry	Handwriting	Dactylography
Dula of Hosso is	The ere of fetue	Height of an adult	Deep of a noncon	Identification	The age of fetus
Kule of Hasse is	The age of fetus	Brostoto	Race of a person	Stomach	The age of fetus
following tissue	Dialli	Flostate	FIOState	Stomach	Flostale
n a suspected asso of	Land	Arconio	Maraum	Connor	Arconio
death due to	Leau	Aisenic	Mercury	Copper	Alsenic
noisoning where					
cadaveric rigidity is					
Contre-coup injuries	Brain	Heart	Liver	Pancreas	Brain
A dead body is	Hydrocyanic acid	Hydrogen sulphide	Oleander	Sodium nitrite	Hydrogen sulphide
having cadaveric	11 jui o e juille uela	ngarogen sarpmae			ngarogen sarpinae
lividity of bluish					
green colour. The					
When a surgeon	50 % glycerin	10 % formalin	Rectified spirit	Saturated solution of	50 % glycerin
wants to send the			±	common salt	
autopsy specimen					
for virological					

The ideal place to record body	Rectum	Axilla	Mouth	Groin	Rectum
A child has 24 teeth all of them are	9 years	10 years	11 years	13 years	11 years
The commonest cause of death in	Fat embolism	Air embolism	infection	Hemorrhage.	infection
postmortem rigidity, select the correct Which of the following is not normally a With reference to the investigation of	It involves the smooth muscles only Laboratory analysis of trace evidence from crime scenes. Emergency first aid, protection,	It is not sure sign of death Laboratory enhancement and comparison of Protection, search, documentation,	It does not involve the cardiac muscle. Lifting fingerprints from crime scenes. Emergency first aid, documentation,	It is due to chemical process Photographing crime scenes. Protection, emergency first aid,	It is due to chemical process Laboratory analysis of trace evidence from crime scenes. Protection, search, documentation,
a crime scene, what would normally be One of the following is a sure external sign of drowning	documentation, search. Goose skin	Washer woman's hands	Peeling of the skin	documentation, search. Fine froth at the mouth and nostrils	Fine froth at the mouth and nostrils
On the State level, crime labs	Provide services to county and municipal agencies	Service state and local law enforcement	Are financed by the local government	Must be put under the direction of an official crime scene	Service state and local law enforcement
Which of the following is a basic	The Latent Fingerprint Unit	The Evidence Collection Unit	The Toxicology Unit	The Physical sciences unit	The Physical sciences unit
he Biology Unit of a crime lab Analyzes	DNA and body fluids	Hairs and fibers	The presence of poisons at a crime scene	More than one of the above	More than one of the above
The Document Examination Unit of a Crime Lab Will do	Determine the authenticity	Check for handwriting	Use paper and ink analysis to analyze the documents	Source of Evidence	Use paper and ink analysis to analyze the documents
Which of the following units at a crime lab would most likely be used	The Firearms Unit	The Polygraph Unit	The Latent Fingerprint Unit	The Voiceprint Analysis Uni	The Latent Fingerprint Unit

Which of the	The Spiral Search	The Quadrant or	The Strip or Line	The Geometric	The Geometric
following is NOT a method when	Method	Zone Search method	Search method	layout method	layout method
Which of the	Hairs	Blood	Fibers	Glass fragments	Blood
following could be					
removed at the					
Which of the	The existence of	The need to prevent	A search made by	More than one of	More than one of
following would	emergency	the immediate loss	the consent of the	the above	the above
quality as a legal	circumstances	or destruction of	parties involved		
Which of the	The names of all	All victims that	The continuity of	The particular type	The particular type
established if any	involved in the crime	result of the crime	possessio	when testing	oj lesi indi was used
The commonest	Fat embolism	Air embolism	infection	Hemorrhage	infection
cause of death in				Tiemormage.	million
postmortem rigidity,	It involves the	It is not sure sign of	It does not involve	It is due to chemical	It is due to chemical
select the correct	smooth muscles only	death	the cardiac muscle.	process	process
Which of the	Establishing that a	Providing a link	Tracing the original	Providing	Tracing the original
following would	crime has been	between a crime and	manufactures for the	investigative leads	manufactures for the
most likely Not A	committed	its victim or a crime	weapons present at a	for a case	weapons present at a
purpose of phycial		and its perpetrator	crime scene	<b></b>	crime scene
Which of the	Note-taking	Sketching the crime	Note taking and	Having a witness	Note taking and
Iollowing would be	The seens should be	scene	Sketching The points of	describe the scene to	Sketching The seens should be
of a crime scene, the	The scene should be	ne scene should be	antrance and exit	victime should be	The scene should be
most important	unaltered condition	color	should be	taken	unaltered condition
Whatis the method	The triangulation	The fixed distance	The Pythagorean	Direct Standard	The triangulation
that is used when	method	method	Theorem	Comparison	method
At autopsy, the	Characteristic bitter	Congested organs	The skin may be	Erosion and	Characteristic bitter
cyanide poisoning	lemon smel	0 0	pinkish or cherry red	haemorrhages in	lemon smel
case will show the			in colour	oesophagus and	
The minimum age at	7 years	16 years	12years	20 years	7 years
which an individual					
is responsible for his					

The most reliable method of UNIT II	Dactylography	Scars	Anthropometry	Handwriting	Dactylography
In a blast injury, which of the following organ is	G.I. Tract	Lungs	Lungs	Ear drum	
Cheiloscopy is the	Foot	Finger	Foot	Lips	
Patterned" abrasion	Linear abrasion	Pressure abrasion	Sliding abrasion	Superficial bruise	
The most common partern of	Arch	Loop	Whorl	Composite	
In Which of the following weapons empty cartridge case	Shot gun	Revolver	Pistol	Rifle	
Exhumation is	Night	Early morning	Daytime	Any time during the	
In India, the time	within 7 days	within 30 days	within 6 months	no time limit	
limit for exhumation					
The fingerprint pattern may be	Eczema	Scalds	Scabies	Leprosy	
The three basic	arches, loops and	whorls, accidentals	whorls, arches and	loops, arches and	
Which of the	A core	A minimum ridge	A single delta	A ridge ending	
following is not one of the features that must be present in	A cole.	count of one.	A single delta.	A huge chung.	
In the comparison of	when a minimum	when a minimum	at the discretion of	when a minimum	
a scene fingerprint	number of 8	number of 16	the fingerprint	number of 10	
with one held on the	matching	matching	expert, who may	matching	
IDENT1 database, a	characteristics are	characteristics are	later have to defend	characteristics are	
full identification is	found.	found.	his or her decision	found.	
Which of the	Plastic fingerprints	Latent fingerprints	Plastic fingerprints	Latent fingerprints	
following statements	are three	require development	involve the	are invisible to the	
is not true?	dimensional.	in order to make them visible.	deposition of material onto a	naked eye.	

Which of the following fingerprint visualisation techniques is	Physical developer	Superglue fuming.	Gentian Violet	Sudan Black
The technique of	bite marks, footwear	bite marks, footwear	footwear, tyres and	tyres, bite marks and
casting may be used	and latent	and tyres.	visible fingerprints.	impressions on
In the comparison of test impressions and scene impressions of footwear, which of	Random damage marks.	Sole pattern.	Size of the shoe.	Type of shoe
Tyre prints	transfer prints.	latent prints.	plastic prints	plastic prints
The average	75	150	) 225	300
fingerprint has	10	100		200
approximately how				
What is the basis for	the presence or	the presence or	the presence or	the presence or
the determination of	absence of arch	absence of whorl	absence of loop	absence of minutiae
the primary	patterns	patterns	patterns	
For most fingerprint examiners, the chemical method of	ninhydrin	iodine	silver nitrate	chlorate
Handwriting which is joined up and in	graphic.	cursive.	disconnected.	script.
Which of the	An individual's	The handwriting of	The influence of	The handwriting of
following statements is not true?	handwriting may show variation as a result of stress or	an individual is unaffected by advancing years.	alcohol or drugs may cause variation in an individual's	an individual shows natural variation.
Which of the	Pen strokes with	Evidence of	Unnatural pen lifts.	Pen strokes with
following is characteristic of	blunt ends.	retouching		tapering ends.
The traditional printing method of	letterpress	gravure	intaglio	lithography

Which of the following is not a true meaning of the word 'bullet'?	A small sphere	One of those small arms projectiles fired one at a time from the barrel of a gun	The complete assembly of cartridge case, primer, propellant and projectile that is to be fired in a gun	A projectile used for a small calibre gun
The term 'self- loading pistol' is strictly synonymous	Double-action revolver	Single-action revolver	Semi-automatic pistol	Automatic pistol
Which of the following is not a term that is used to	Wadcutter	Round nose	Round nose	Cannelure
Which of the following are individualising characteristics that	The calibre of the spent cartridge case(s).	The exact relative positions of extractor and ejector marks on the spent	The twist direction of any rifling marks found on bullet(s) recovered from the	The pattern of minute parallel striations that make up the mark made
Which one of the following is used to analyse for the presence of gunshot	Scanning electron microscopy used in conjunction with energy dispersive X-	Microspectrophotom etry	Refractive index measurements	Polarized light microscopy
An explosive that normally detonates	a high explosive	a primary explosive	a secondary explosive	a low explosive
A secondary explosive is, by definition	the main charge of an explosive device that is set off by a small quantity of explosive that is relatively easier to	a low explosive.	a dispersed explosive.	a deflagrating explosive.
In Which of the following weapons empty cartridge case	Shot gun	Revolver	Pistol	Rifle
Exhumation is	Night	Early morning	Daytime	Any time during the

In India, the time limit for exhumation	within 7 days	within 30 days	within 6 months	no time limit
The fingerprint pattern may be	Eczema	Scalds	Scabies	Leprosy
The three basic types of fingerprint	arches, loops and rings.	whorls, accidentals and loops.	whorls, arches and accidenta	loops, arches and whorls.
Which of the following is not one of the features that must be present in	A core.	A minimum ridge count of one.	A single delta.	A ridge ending.
In the comparison of a scene fingerprint with one held on the IDENT1 database, a full identification is Which of the following statements is not true? Which of the following fingerprint visualisation	<pre>when a minimum number of 8 matching characteristics are found. Plastic fingerprints are three dimensional. Physical developer</pre>	when a minimum number of 16 matching characteristics are found. Latent fingerprints require development in order to make them visible. Superglue fuming.	at the discretion of the fingerprint expert, who may later have to defend his or her decision Plastic fingerprints involve the deposition of material onto a Gentian Violet	when a minimum number of 10 matching characteristics are found. Latent fingerprints are invisible to the naked eye. Sudan Black
techniques is The technique of casting may be used In the comparison of test impressions and scene impressions of footwear, which of	bite marks, footwear and latent Random damage marks.	bite marks, footwear and tyres. Sole pattern.	footwear, tyres and visible fingerprints. Size of the shoe.	tyres, bite marks and impressions on Type of shoe
The traditional printing method of	letterpress	gravure	intaglio	lithography
Which of the following is not a true meaning of the word 'bullet'?	A small sphere	One of those small arms projectiles fired one at a time from the barrel of a gun	The complete assembly of cartridge case, primer, propellant and projectile that is to be fired in a gun	A projectile used for a small calibre gun
------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------
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Which one of the following is used to analyse for the presence of gunshot	Scanning electron microscopy used in conjunction with energy dispersive X-	Microspectrophotom etry	Refractive index measurements	Polarized light microscopy
The first step of	Packaging,	Exhibit it to the	Collecting,	Discovering and
gathering physical Rope and Cordage	Composition	The presence of	The presence of	Analysing The presence of
Identification (specifically)	construction, color and diameter of it	burn patterns	burn patterns	burn patterns and Composition,
A lady died due to unnatural death within seven years after her marriage.	Forensic medicine expert	Deputy Superintendent of Police	Sub-Divisional Magistrat	Coroner
The ideal place to record temperature	Axilla	Groin	Rectum	Rectum

Diffusion of oxygen at the tissue level is affected in all the	Carbon monoxide	Curare	Phosgene	Cyanides	
n methyl alcohol poisoning there is	Formaldehyde and formic acid	Acetaldehyde	Pyridine	Acetic acid	
cnS depression, cardiac depression					
In chronic arsenic poisoning the	Nail clippings	Nail clippings	Bone biopsy	Blood sample	
following samples	Exhumation cases	Dowry deaths within	Murder cases	Death of a person in	
inquest is done in	Exitemation cases	5 years of marriage	White Cuses	police custody	
At autopsy, the	Characteristic bitter	Congested organs	The skin may be	Erosion and	
cyanide poisoning case will show the	lemon smel		in colour	haemorrhages in oesophagus and	
The minimum age at	7 years	16 years	12years	20 years	
which an individual					
The most reliable	Dactylography	Scars	Anthropometry	Handwriting	
method of	, , , , ,		1 5	C	
The technique of	bite marks, footwear	bite marks, footwear	footwear, tyres and	tyres, bite marks and	
Rule of Hasse is	The age of fetus	Height of an adult	Race of a person	Identification	
UNIT III		8	F		
Which of the	An alkaloid is any of	A pesticide is a	Cyanide is one of	A corrosive poison	An alkaloid is any of
following statements	a group of nitrogen-	chemical agent that	the most toxic	is one that causes	a group of nitrogen-
is not true?	containing organic bases that occur in	is used to kill pest organisms.	anions.	destruction of the body tissues upon	containing organic bases that occur in
Which of the	Strychnine.	Ricin	Digitalin.	Atropine.	Ricin
following toxins					

The term 'controlled drug' is applied to:	any drug that is subject to the Misuse of Drugs Act 1971.	any drug that is available only on prescription.	any prescription drug that is diverted to the black market for illegal usage.	any drug that is subject to the Intoxicating Substance (Supply)	any drug that is subject to the Misuse of Drugs Act 1971.
A drug that induces alterations in perception and mood (without	an hallucinogen	a cutting agent	a stimulant	a depressant	an hallucinogen
Which of the following is commonly known as	Amphetamine.	Methamphetamine.	3,4- methylenedioxyamph etamine (MDA).	3,4- methylenedioxymeth amphetamine	3,4- methylenedioxymeth amphetamine
pH of seminal fluid	6	7	7.4	8.2	7.4
Poroscopy is	Counting pores of sweat glands only	Counting pores of both sweat and	Counting number of ridges	Counting number of ridges and sweat	Counting pores of sweat glands only
attoo marks destroyed, their presence can be	Deep dermis	Subcutaneous tissue	Lymph nodes Regiona	Underlying Muscle	Lymph nodes Regiona
Bluish discolouration of	Cyanosis	Bismuth	Copper	Nicotine	Nicotine
Pathological	Cocaine intoxication	Cannabis	Alcoholic	Tobacco intoxication	Alcoholic
In case of acute CO	10-2.0%	20-30%	30-40%	50- 60 %	50- 60 %
poisoning, coma and death with lively red colour occur at a	10 20/0	20 20 /0			
One of the following manifestations is an indication of severa	Euphoria and sense of well-being	Marked muscular incoordination	Increased confidence	Aggressive behaviour	Marked muscular incoordination
MAcEwen's sign is a manifestation of	Atropine	Opium	Methanol	Ethanol	Ethanol
In case of foodborne botulism, the toxin	Formed in the duodenum	Formed in the colon	Formed in the intestine	Formed in the canned food before	Formed in the canned food before
Benzodiazepines act on the CNS through	Increasing catecholamines	Increasing serotonin	Increasing the activity of GABA	Decreasing the activity of GABA	Increasing the activity of GABA

Which of the following is specific antidote for acute	BAL	Mucomyst	EDTA	DMSA	Mucomyst
The second stage of acute acetaminophen	Abnormalities of liver function tests	Bleeding tendencies due to coagulation defect	Nausea and malaise	Right upper quadrant pain and tenderness	Abnormalities of liver function tests
Prolonged prothrombin time	Parathion	Warfarin	Paraquat	Zinc sulphide	Warfarin
What is the basis for the determination of the primary For most fingerprint examiners, the chemical method of	the presence or absence of arch patterns <i>ninhydrin</i>	the presence or absence of whorl patterns iodine	the presence or absence of loop patterns silver nitrate	the presence or absence of minutiae chlorate	the presence or absence of whorl patterns ninhydrin
Handwriting which is joined up and in	graphic.	cursive.	disconnected.	script.	cursive.
Which of the following statements is not true?	An individual's handwriting may show variation as a result of stress or	The handwriting of an individual is unaffected by advancing years.	The influence of alcohol or drugs may cause variation in an individual's	The handwriting of an individual shows natural variation.	The handwriting of an individual is unaffected by advancing years.
Which of the following is characteristic of	Pen strokes with blunt ends.	Evidence of retouching	Unnatural pen lifts.	Pen strokes with tapering ends.	Pen strokes with tapering ends.
The traditional printing method of	letterpress	gravure	intaglio	lithography	letterpress.
Which of the following is not a true meaning of the word 'bullet'?	A small sphere	One of those small arms projectiles fired one at a time from the barrel of a gun	The complete assembly of cartridge case, primer, propellant and projectile that is to be fired in a gun	A projectile used for a small calibre gun	The complete assembly of cartridge case, primer, propellant and projectile that is to be fired in a gun

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Which one of the following is used to analyse for the presence of gunshot	Scanning electron microscopy used in conjunction with energy dispersive X-	Microspectrophotom etry	Refractive index measurements	Polarized light microscopy	Scanning electron microscopy used in conjunction with energy dispersive X-
An explosive that normally detonates	a high explosive	a primary explosive	a secondary explosive	a low explosive	a high explosive
A secondary explosive is, by definition	the main charge of an explosive device that is set off by a small quantity of explosive that is relatively easier to	a low explosive.	a dispersed explosive.	a deflagrating explosive.	the main charge of an explosive device that is set off by a small quantity of explosive that is relatively easier to
Which of the following statements is not true?	Plastic fingerprints are three dimensional.	Latent fingerprints require development in order to make them visible.	Plastic fingerprints involve the deposition of material onto a	Latent fingerprints are invisible to the naked eye.	Plastic fingerprints involve the deposition of material onto a
Which of the following fingerprint visualisation techniques is	Physical developer	Superglue fuming.	Gentian Violet	Sudan Black	Physical developer
The technique of casting may be used	bite marks, footwear and latent	bite marks, footwear and tyres.	footwear, tyres and visible fingerprints.	tyres, bite marks and impressions on	bite marks, footwear and latent

In the comparison of test impressions and scene impressions of footwear which of	Random damage marks.	Sole pattern.	Size of the shoe.	Type of shoe	Random damage marks.
The three basic types of fingerprint Which of the following is not one of the features that must be present in	arches, loops and rings. A core.	whorls, accidentals and loops. A minimum ridge count of one.	whorls, arches and accidenta A single delta.	loops, arches and whorls. A ridge ending.	whorls, accidentals and loops. A ridge ending.
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Rope and Cordage Identification (specifically)	Composition, construction, color and diameter of it	The presence of burn patterns	The presence of burn patterns	The presence of burn patterns and Composition,	The presence of burn patterns and Composition,

A lady died due to unnatural death within seven years	Forensic medicine expert	Deputy Superintendent of Police	Sub-Divisional Magistrat	Coroner	Sub-Divisional Magistrat
after her marriage. The ideal place to record temperature	Axilla	Groin	Rectum	Rectum	Rectum
Diffusion of oxygen at the tissue level is affected in all the	Carbon monoxide	Curare	Phosgene	Cyanides	Curare
n methyl alcohol poisoning there is CNS depression, cardiac depression	Formaldehyde and formic acid	Acetaldehyde	Pyridine	Acetic acid	Formaldehyde and formic acid
In chronic arsenic poisoning the following samples	Nail clippings	Nail clippings	Bone biopsy	Blood sample	Blood sample
In India, magistrate inquest is done in	Exhumation cases	Dowry deaths within 5 years of marriage	Murder cases	Death of a person in police custody	Murder cases
At autopsy, the cyanide poisoning case will show the	Characteristic bitter lemon smel	Congested organs	The skin may be pinkish or cherry red in colour	Erosion and haemorrhages in oesophagus and	Characteristic bitter lemon smel
The minimum age at which an individual is responsible for his	7 years	16 years	12years	20 years	7 years
The most reliable method of	Dactylography	Scars	Anthropometry	Handwriting	Dactylography
Rule of Hasse is Which of the following tissue	The age of fetus Brain	Height of an adult Prostate	Race of a person Prostate	Identification Stomach	The age of fetus Prostate
n a suspected case of death due to poisoning where cadaveric rigidity is	Lead	Arsenic	Mercury	Copper	Arsenic

Contre-coup injuries	Brain	Heart	Liver	Pancreas	Brain
A dead body is	Hydrocyanic acid	Hydrogen sulphide	Oleander	Sodium nitrite	Hydrogen sulphide
having cadaveric					
lividity of bluish					
green colour. The					
MAcEwen's sign is	Atropine	Opium	Methanol	Ethanol	Ethanol
a manifestation of					
In case of foodborne	Formed in the	Formed in the colon	Formed in the	Formed in the	Formed in the
botulism, the toxin	duodenum		intestine	canned food before	canned food before
Benzodiazepines act	Increasing	Increasing serotonin	Increasing the	Decreasing the	Increasing the
on the CNS through	catecholamines		activity of GABA	activity of GABA	activity of GABA
UNIT IV					
Which of the	STRs are the same	It is usually	Tandem means two	VNTRs are not a	STRs are the same
following statements	as microsatellite	classified according	repeats next to each	type of minisatellite	as microsatellite
about tandem	DNA.	to the number of	other.	DNA.	DNA.
For the	All the loci have	It is based on	All the loci are on	All the loci are	It is based on
SGM+ system,	many alleles (are	multiplex PCR.	the different	STRs.	multiplex PCR.
Most of the loci in	the alleles being	the genotypes at	the phenotype of the	the genotype having	the phenotype of the
the SGM+ system	selectively neutral.	these loci not	person not being	no health	person not being
are present in		indicating anything	influenced by the	implications for the	influenced by the
regions of "junk"		about the physical	genotype.	carrier	genotype.
In the	The locus examined	Two peaks in the	The allele on the Y	Two peaks in the	Two peaks in the
SGM+ system,	is an STR	analysis indicate that	chromosome is	analysis indicate the	analysis indicate that
regarding the		the sample probably	shorter than that on	sample probably	the sample probably
Amelogenin locus,		originated from a	the X chromosome.	originated from a	originated from a
Which of the	It is not based on	It increases the	It decreases the	It is used to analyse	It decreases the
following points are	STR analysis	sensitivity of the	amount of evidence	mtDNA.	amount of evidence
correct for LCN		DNA profiling	needed to generate a		needed to generate a
DNA analysis?			profile.		profile.

Using SGM+, a profile which is found in evidence and a suspect is calculated to have a	It is $2 \times 10^8$ times more likely that the evidence originated from the suspect than another	One person in two- hundred million is expected to show the profile.	The likelihood ratio is $5 \ge 10^{-9}$ .	The match probability is 1 in 2 x 10 <sup>8</sup> .	The m 2 probab x 10 <sup>8</sup> .	atch pility is 1 in 2
A child has the genotype 12, 15 at the THO1 STR locus, which of the	Woman 12, 15; man 8, 14	Woman 12, 12; man 8, 15	Woman 12, 10; man 8, 15.	Woman 3, 5; man 12, 10	Woma 8, 14	ın 12, 15; man
Which of the following statements about mtDNA are true? Comparing the HV1 and HV2 mtDNA sequences from a person to members	Individuals carry maternal and paternal mtDNAs. Sisters would show identical sequences but brothers' sequences would be	Analysis is carried out using the SGM <sup>+</sup> system. The mother's sequences would be identical.	Genetic differences between individuals are mainly point mutations. All siblings would show the same sequence.	Genes on the mtDNA are present in multi-copies whereas genes in The sequences would be identical to the father's	Geneti at betwee are ma mutati The m sequer identic	ic differences en individuals unly point ons. other's nces would be cal.
What is the	12	2		4	20	4
A particular SNP locus can be A, C or T. How many	3	6		9	12	9
genotypes can be For the SNP above, the allele frequencies for A, C and T are 0.03, 0.68 and 0.29,	300	900			6	9
respectively. In a						

Comparing SNP markers to STR based analysis, which of the	There are many more SNP markers in the human genome than STR	There are many more STR loci in the genome.	SNP loci generally have more alleles than STR loci.	The number of SNP loci is about the same as the number of STR loci in the	There are many more SNP markers in the human genome than STR
Comparing SNP markers to STR based analysis, which of the following are true?	For a given number of STR loci, it would require the same number of SNP loci to achieve	SNP loci could not be used for DNA profiling.	For a given number of STR loci, it would require a higher number of SNP loci to achieve	For a given number of STR loci, it would require a lower number of SNP loci to achieve	For a given number of STR loci, it would require a lower number of SNP loci to achieve
	the same		the same	the same	the same
Acute toxicity of organophosphates	Urine retention	Oliguria	Urine incontinence	Anuria	Urine incontinence
The specific antidote in case of	DMSA	Deferoxamine	EDTA.	Penicillamine	Deferoxamine
Blue line in the gingival margin in case of lead	Lead chromate	Lead sulphide	Lead subacetate	Lead iodide	Lead sulphide
The dose of Na thiosulphate for treatment of cyanide	112.5 mg/kg IV over 10-20 min.	412.5 mg/kg IV over 10-20 min	412.5 mg/kg IV over 2 min	412.5 mg/kg IV over 5 min	412.5 mg/kg IV over 10-20 min
In poisoning with hydrocyanic acid,	Reduce cyanide	Induce vasodilatation	Produce methaemoglobin	Oxidise cyanide	Produce methaemoglobin
One of the following solvents is not	Isopropanol	Nitroprusside	Acetonitrile	Acrylonitrile	Isopropanol
Dry burn is caused by	Hot liquid or steam	Flame or hot metals	Deep x-ray or UV- rays	Strong acids or alkalies	Flame or hot metals
The presence of tache noire is suggestive that the	One hour	2 hours	3 hours	8 hours	3 hours
The age of full criminal	7 years	18 years			18 years

Using SGM+, a profile which is found in evidence and a suspect is calculated to have a	It is $2 \times 10^8$ times more likely that the evidence originated from the suspect than another	One person in two- hundred million is expected to show the profile.	The likelihood ratio is $5 \ge 10^{-9}$ .	The match probability is 1 in 2 $\times 10^8$ .	The match probability is 1 in 2 x 10 <sup>8</sup> .
A child has the genotype 12, 15 at the THO1 STR locus, which of the	Woman 12, 15; man 8, 14	Woman 12, 12; man 8, 15	Woman 12, 10; man 8, 15.	Woman 3, 5; man 12, 10	Woman 12, 15; man 8, 14
Which of the following statements about mtDNA are true? Comparing the HV1 and HV2 mtDNA	Individuals carry maternal and paternal mtDNAs. Sisters would show identical sequences	Analysis is carried out using the SGM <sup>+</sup> system. The mother's sequences would be	Genetic differences between individuals are mainly point mutations. All siblings would show the same	Genes on the mtDNA are present in multi-copies whereas genes in The sequences would be identical	Genetic differences between individuals are mainly point mutations. The mother's sequences would be
sequences from a person to members In India, the time	but brothers' sequences would be within 7 days	identical. within 30 days	sequence. within 6 months	to the father's	identical.
limit for exhumation The fingerprint pattern may be	Eczema	Scalds	Scabies	Leprosy	Leprosy
The three basic types of fingerprint	arches, loops and rings.	whorls, accidentals and loops.	whorls, arches and accidenta	loops, arches and whorls.	whorls, accidentals and loops.
Which of the following is not one of the features that must be present in	A core.	A minimum ridge count of one.	A single delta.	A ridge ending.	A ridge ending.
In the comparison of a scene fingerprint with one held on the IDENT1 database, a full identification is	when a minimum number of 8 matching characteristics are found.	when a minimum number of 16 matching characteristics are found.	at the discretion of the fingerprint expert, who may later have to defend his or her decision	when a minimum number of 10 matching characteristics are found.	at the discretion of the fingerprint expert, who may later have to defend his or her decision

Which of the following statements is not true?	Plastic fingerprints are three dimensional.	Latent fingerprints require development in order to make them visible.	Plastic fingerprints involve the deposition of material onto a	Latent fingerprints are invisible to the naked eye.	Plastic fingerprints involve the deposition of material onto a
Which of the following fingerprint visualisation techniques is	Physical developer	Superglue fuming.	Gentian Violet	Sudan Black	Physical developer
The technique of casting may be used	bite marks, footwear and latent	bite marks, footwear	footwear, tyres and visible fingerprints	tyres, bite marks and impressions on	bite marks, footwear and latent
In the comparison of test impressions and scene impressions of footwear, which of	Random damage marks.	Sole pattern.	Size of the shoe.	Type of shoe	Random damage marks.
Tyre prints impressed into deep	transfer prints.	latent prints.	plastic prints	plastic prints	plastic prints
Conventional serology would For toxicological analysis, which of the following is	Species identification and Drugs of abuse and pharmaceuticals	Analyzing the direction Arsenic	Identifying the type of vehicle Ethanol, methanol, isopropanol	Identifying the type of vehicle Strychnine, cyanide	Species identification and Ethanol, methanol, isopropano
The first step of gathering physical Rope and Cordage Identification (specifically) A lady died due to unnatural death within seven years after her marriage.	Packaging, conveying and Composition, construction, color and diameter of it Forensic medicine expert	Exhibit it to the lead investigator The presence of burn patterns Deputy Superintendent of Police	Collecting, recording and The presence of burn patterns Sub-Divisional Magistrat	Discovering and Analysing The presence of burn patterns and Composition, Coroner	Discovering and Analysing The presence of burn patterns and Composition, Sub-Divisional Magistrat
The ideal place to record temperature	Axilla	Groin	Rectum	Rectum	Rectum

Diffusion of oxygen at the tissue level is affected in all the	Carbon monoxide	Curare	Phosgene	Cyanides	Curare
n methyl alcohol poisoning there is CNS depression, cardiac depression	Formaldehyde and formic acid	Acetaldehyde	Pyridine	Acetic acid	Formaldehyde and formic acid
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The minimum age at which an individual is responsible for his	7 years	16 years	12years	20 years	7 years
The most reliable method of	Dactylography	Scars	Anthropometry	Handwriting	Dactylography
Rule of Hasse is The three basic types of fingerprint	The age of fetus arches, loops and rings.	Height of an adult whorls, accidentals and loops.	Race of a person whorls, arches and accidenta	Identification loops, arches and whorls.	The age of fetus whorls, accidentals and loops.
Which of the following is not one of the features that must be present in	A core.	A minimum ridge count of one.	A single delta.	A ridge ending.	A ridge ending.
In the comparison of a scene fingerprint with one held on the IDENT1 database, a full identification is	when a minimum number of 8 matching characteristics are found.	when a minimum number of 16 matching characteristics are found.	at the discretion of the fingerprint expert, who may later have to defend his or her decision	when a minimum number of 10 matching characteristics are found.	at the discretion of the fingerprint expert, who may later have to defend his or her decision

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In poisoning with hydrocyanic acid,	Reduce cyanide	Induce vasodilatation	Produce methaemoglobin	Oxidise cyanide	Produce methaemoglobin
One of the following solvents is not	Isopropanol	Nitroprusside	Acetonitrile	Acrylonitrile	Isopropanol
Dry burn is caused by UNIT V	Hot liquid or steam	Flame or hot metals	Deep x-ray or UV- rays	Strong acids or alkalies	Flame or hot metals
Why would a hacker use a proxy server? What type of symmetric key algorithm using a	To create a stronger connection with the RC4	To create a ghost server on the Blowfish	To obtain a remote access connection. SHA	To hide malicious activity on the MD5	s To hide malicious activity on the RC4
Which of the following is not a factor in securing	The education of the attacker	The system configuration	The network architecture	The business strategy of the company	MITM
What type of attack uses a fraudulent server with a relav	NTLM	MITM	NetBIOS	SMB	SMB
What port is used to connect to the	80	445	139	)	389 389

To hide information inside a picture.	Rootkits	Bitmapping	Steganography	Image Rendering	Steganography
Which phase of	Reconnaissance	Maintaining Access	Scanning	Gaining Access	Gaining Access
hacking performs		6	8	6	C
actual attack on a					
Attempting to gain	Local networking	Social engineering	Physical entry	Remote networking	Local networking
access to a network					
using an employee's credentials is called					
the					
Which Federal Code	Electronic	18 U.S.C. § 1029	Cyber Security	18 U.S.C. § 1030	Cyber Security
applies the	Communications		Enhancement Act		Enhancement Act
consequences of	Interception of Oral		2002		2002
hacking activities	Communications				
Which of the	Excellent	Understands the	Patience, persistence	Has the highest level	Has the highest level
following is not a	knowledge of	process of	and perseverance.	of security for the	of security for the
typical characteristic	Windows.	exploiting network		organization.	organization.
What is the proper	nmap -sX -sneaky	nmap -sX -paranoid	nmap -sX -	nmap -sX -polite	nmap -sX -sneaky
command to			aggressive		
perform an Nmap					
What type of rootkit	Library level rootkits	Kernel level rootkits	System level rootkits	Application level	Library level rootkits
will patch, hook, or				rootkits	
replace the version					
of system call in					
What is the purpose	Exploit a weakness	To execute a Trojan	To overload a	To shutdown	To overload a
of a Denial of	in the TCP/IP stack	on a system	system so it is no	services by turning	system so it is no
Service attack?			longer operational	them off	longer operational
What is the	SYN-ACK-FIN	SYN-SYN ACK-	SYN-ACK	SYN-SYN-ACK	SYN-SYN ACK-
sequence of a TCP		ACK			ACK
What tool can be	DNSlookup	Whois	Nslookup	IP Network Browser	IP Network Browser
used to perform					
Which ports should	Ports 120 and 445	Ports 135 and 136	Ports 110 and 137	Ports 135 and 139	Ports 135 and 139
be blocked to					

The first phase of hacking an IT system is	Availability	Confidentiality	Integrity	Authentication	Confidentiality
How is IP address spoofing detected?	Installing and configuring a IDS that can read the IP	Comparing the TTL values of the actual and spoofed	Implementing a firewall to the network	Identify all TCP sessions that are initiated but does	Comparing the TTL values of the actual and spoofed
Why would a ping What are the port states determined by	To identify live Active, inactive, standby	To locate live Open, half-open, closed	To identify open Open, filtered, unfiltered	To locate firewalls Active, closed, unused	To identify live Open, filtered, unfiltered
What port does	22	80	) 20	) 23	23
Which of the following will allow	PingSweep	Traceroute	War Dialers	ARIN	ARIN
footprinting to be					TT 1
activities with the	Cracking	Analysis	Hacktivism	Exploitation	Hacktivism
intent on gaining					
What is the most	Information	Cracking passwords	Escalating privileges	Escalating privileges	Cracking passwords
important activity in	gathering				
A packet with no flags set is which	TCP	XMAS	IDLE	NULL	NULL
For toxicological analysis, which of the following is	Drugs of abuse and pharmaceuticals	Arsenic	Ethanol, methanol, isopropanol	Strychnine, cyanide	Ethanol, methanol, isopropano
The first step of gathering physical	Packaging,	Exhibit it to the	Collecting,	Discovering and	Discovering and
Rope and Cordage Identification (specifically)	Composition, construction, color and diameter of it	The presence of burn patterns	The presence of burn patterns	The presence of burn patterns and Composition	The presence of burn patterns and Composition
A lady died due to unnatural death within seven years after her marriage.	Forensic medicine expert	Deputy Superintendent of Police	Sub-Divisional Magistrat	Coroner	Sub-Divisional Magistrat

The ideal place to	Axilla	Groin	Rectum	Rectum	Rectum
record temperature		_			_
Diffusion of oxygen	Carbon monoxide	Curare	Phosgene	Cyanides	Curare
at the tissue level is					
affected in all the			~		
n methyl alcohol	Formaldehyde and	Acetaldehyde	Pyridine	Acetic acid	Formaldehyde and
poisoning there is	formic acid				formic acid
CNS depression,					
cardiac depression					
In chronic arsenic	Nail clippings	Nail clippings	Bone biopsy	Blood sample	Blood sample
poisoning the					
following samples		<b>D</b>			
In India, magistrate	Exhumation cases	Dowry deaths within	Murder cases	Death of a person in	Murder cases
inquest is done in	~	5 years of marriage		police custody	~
At autopsy, the	Characteristic bitter	Congested organs	The skin may be	Erosion and	Characteristic bitter
cyanide poisoning	lemon smel		pinkish or cherry red	haemorrhages in	lemon smel
case will show the	_	1.4	in colour	oesophagus and	_
The minimum age at	7 years	16 years	12years	20 years	7 years
which an individual					
is responsible for his	~	~			~
The most reliable	Dactylography	Scars	Anthropometry	Handwriting	Dactylography
method of			<b>D</b>		
Rule of Hasse is	The age of fetus	Height of an adult	Race of a person	Identification	The age of fetus
The three basic	arches, loops and	whorls, accidentals	whorls, arches and	loops, arches and	whorls, accidentals
types of fingerprint	rings.	and loops.	accidenta	whorls.	and loops.
Which of the	A core.	A minimum ridge	A single delta.	A ridge ending.	A ridge ending.
following is not one		count of one.			
of the features that					
must be present in					

In the comparison of	when a minimum	when a minimum	at the discretion of	when a minimum	at the discretion of
with one held on the	matching	matching	expert who may	matching	expert who may
IDENT1 database a	characteristics are	characteristics are	later have to defend	characteristics are	later have to defend
full identification is	found	found	his or her decision	found	his or her decision
Which of the	Plastic fingerprints	I atent fingerprints	Plastic fingerprints	I atent fingerprints	Plastic fingerprints
following statements	are three	require development	involve the	are invisible to the	involve the
is not true?	dimensional.	in order to make them visible.	deposition of material onto a	naked eye.	deposition of material onto a
attoo marks	Deep dermis	Subcutaneous tissue	Lymph nodes	Underlying Muscle	Lymph nodes
destroyed, their			Regiona		Regiona
presence can be					
Bluish	Cyanosis	Bismuth	Copper	Nicotine	Nicotine
discolouration of					
Pathological	Cocaine intoxication	Cannabis	Alcoholic	Tobacco intoxication	Alcoholic
In case of acute CO	10-20%	20-30%	30-40%	50-60 %	50-60 %
poisoning, coma and					
death with lively red					
colour occur at a					
One of the following	Euphoria and sense	Marked muscular	Increased confidence	Aggressive	Marked muscular
manifestations is an	of well-being	incoordination		behaviour	incoordination
indication of severe					
MAcEwen's sign is	Atropine	Opium	Methanol	Ethanol	Ethanol
a manifestation of					
Which of the	It is not based on	It increases the	It decreases the	It is used to analyse	It decreases the
following points are	STR analysis	sensitivity of the	amount of evidence	mtDNA.	amount of evidence
correct for LCN		DNA profiling	needed to generate a		needed to generate a
DNA analysis?			profile.		profile.

Using SGM+, a profile which is found in evidence and a suspect is calculated to have a	It is $2 \times 10^8$ times more likely that the evidence originated from the suspect than another	One person in two- hundred million is expected to show the profile.	The likelihood ratio is $5 \ge 10^{-9}$ .	The match probability is 1 in 2 x 10 <sup>8</sup> .	The match probability is 1 in 2 x $10^8$ .
A child has the genotype 12, 15 at the THO1 STR locus, which of the	Woman 12, 15; man 8, 14	Woman 12, 12; man 8, 15	Woman 12, 10; man 8, 15.	Woman 3, 5; man 12, 10	Woman 12, 15; man 8, 14
Which of the following statements about mtDNA are true?	Individuals carry maternal and paternal mtDNAs.	Analysis is carried out using the SGM <sup>+</sup> system.	Genetic differences between individuals are mainly point mutations.	Genes on the mtDNA are present in multi-copies whereas genes in	Genetic differences between individuals are mainly point mutations.
Comparing the HV1 and HV2 mtDNA sequences from a person to members	Sisters would show identical sequences but brothers' sequences would be	The mother's sequences would be identical.	All siblings would show the same sequence.	The sequences would be identical to the father's	The mother's sequences would be identical.
Which of the following would most likely Not A purpose of phycial	Establishing that a crime has been committed	Providing a link between a crime and its victim or a crime and its perpetrator	Tracing the original manufactures for the weapons present at a crime scene	Providing investigative leads for a case	Tracing the original manufactures for the weapons present at a crime scene
Which of the following would be	Note-taking	Sketching the crime scene	Note taking and Sketching	Having a witness describe the scene to	Note taking and Sketching
When taking photos of a crime scene, the most important Whatis the method that is used when To hide information	The scene should be photographed in an unaltered condition The triangulation method Rootkits	he scene should be photographed in color The fixed distance method Bitmapping	The points of entrance and exit should be The Pythagorean Theorem Steganography	Close ups of injured victims should be taken Direct Standard Comparison Image Rendering	The scene should be photographed in an unaltered condition The triangulation method Steganography
inside a picture,					

Which phase of	Reconnaissance	Maintaining Access	Scanning	Gaining Access	Gaining Access
hacking performs					
actual attack on a					
Which Federal Code	Electronic	18 U.S.C. § 1029	Cyber Security	18 U.S.C. § 1030	Cyber Security
applies the	Communications		Enhancement Act		Enhancement Act
consequences of	Interception of Oral		2002		2002
hacking activities	Communications				