

**Sri Guru Tegh Bahadur Khalsa College**  
**University of Delhi**  
**Delhi-110007**



**Syllabus and Examination Scheme**  
**for**  
**PG Diploma in Forensic Science**

Revised after incorporation of suggestions proposed by  
peer review

March 2009

## **Working Group**

1. **DR. JASWINDER SINGH** *Principal*
2. **DR. G.S. SODHI**, *Department of Chemistry*
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4. **DR. VIMAL RARH**, *Department of Chemistry*

## **PG DIPLOMA IN FORENSIC SCIENCE**

### **Objectives**

The Universal Declaration of Human Rights directs the member nations to create such conditions under which the ideals of free human beings, enjoying civil and political freedom from fear and want, can be achieved. The Constitution of India, through its various articles, strives to ensure security and safety of citizens in accordance with the principles of Universal Declaration of Human Rights. However, crime is a violation of these principles. In a country like India, where majority of population is uneducated, social set up is heterogeneous, public-police relations are not very cordial, poverty is rampant and unemployment widespread, it is not surprising that crime rate is increasing exponentially.

If we have to create conditions conducive to harmonious development, we must mitigate the crime rate. This can best be achieved by relying on the support of forensic science system. Unfortunately, in our country, forensic science is not viewed as a core investigative skill in crime detection. In fact, there is a lack of understanding of the forensic process itself. It is for this reason that less than 10% of the police cases are, at present, being referred for forensic examination. Less than 5% are solved by the application of forensic science. The rest are solved by third degree method – a practice which the human rights organizations will not allow in days to come.

In majority of serious crime cases, hi-tech measures are being adopted by perpetrators of crime. The counter measures have to be more sophisticated to surpass them. This calls for strengthening the foundations of forensic science at national level. It is with this aim that we wish to initiate a PG Diploma Course in Forensic Science courses in our college.

The following are the objectives of this course.

1. To emphasize the importance of scientific methods in crime detection.
2. To disseminate information on the advancements in the field of forensic science.
3. To highlight the importance of forensic science for perseverance of the society.
4. To review the steps necessary for achieving highest excellence in forensic science.
5. To generate talented human resource, commensurating with latest requirements of forensic science.
6. To provide a platform for students and forensic scientists to exchange views, chalk-out collaborative programs and work in a holistic manner for the advancement of forensic science.

## Semester I

### Paper I: Criminalistic Unit (32 lectures)

#### Section A: Functions of Forensic Science

Definitions and concepts in forensic science. Scope of forensic science. Need of forensic science. Basic principles of forensic science. Tools and techniques in forensic science. Branches of forensic science. Data depiction. Report writing. Expert witness. Forensic science in India: Organizational set up of forensic science laboratories. Narcotic Drugs and Psychotropic Substances Act. Drugs and Cosmetics Act. Explosive Substances Act. Dowry Prohibition Act. Prevention of Food Adulteration Act. Prevention of Corruption Act. Arms Act. Wildlife Protection Act. I.T. Act. Problem of proof, presentation of evidence and evidentiary clues.

#### Section B: Criminology

Concept and definition of crime. Causes of crime. Social changes and crime. Aim and scope of criminology and criminal anthropology. Theory of criminal behavior. Organized crime and public disorder. Control and prevention of crime. Criminal profiling. Understanding modus operandi. Investigative strategy. Police's power of investigation. Filing of criminal charges.

#### Section C: Crime Scene Management

Crime scene investigations. Protecting and isolating the crime scene. Documentation of crime scene by photography, sketching and field notes. Types, significance and classification of physical and trace evidence. Collection and care of evidence. Submission of evidence. Chain of evidence. Reconstruction of crime scene. Significance of density, conductivity, refractive index and particle size in analyzing the trace evidence. Evidence pertaining to tool marks, glass, paint, fibre and soil. Fundamental principles of fingerprinting. Classification of fingerprints. Plain and rolled fingerprints. Latent fingerprints and their development.

### **Suggested Readings**

1. B.B. Nanda and R.K. Tiwari, *Forensic Science in India: A Vision for the Twenty First Century*, Select Publishers, New Delhi (2001).
2. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2<sup>nd</sup> Edition, CRC Press, Boca Raton (2005).
3. C.R. Swanson, Jr., N.C. Chamelin and L. Territo, *Criminal Investigation*, Goodyear Publishing Company, Inc., California (1977).
4. M.K. Bhasin and S. Nath, *Role of Forensic Science in the New Millennium*, University of Delhi, Delhi (2002).
5. J. Dix, *Handbook for Death Scene Investigations*, CRC Press, Boca Raton (1999).
6. R. Saferstein, *Criminalistics*, 8<sup>th</sup> Edition, Prentice Hall, New Jersey (2004).
7. V. P. Sarthi, *Law of Evidence*, 6<sup>th</sup> Edition, Eastern Book Co., Lucknow (2006).
8. W.G. Eckert and R.K. Wright in *Introduction to Forensic Sciences*, 2<sup>nd</sup> Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).
9. T.J. Gardener and T.M. Anderson, *Criminal Evidence*, 4<sup>th</sup> Ed., Wadsworth, Belmont (2001).

## **Paper II: Physical Science Unit (32 lectures)**

### **Section A: Questioned Documents**

Scope, development, definition and nature of Questioned documents.

General and individual characteristics of handwriting. Development of individuality in handwriting. Examination and comparison of handwritings. Natural variations and fundamental divergences in handwritings. Foregeries and line quality defects.

Alterations in documents, including erasures, additions, overwritings and obliterations.

Anonymous letters, disguised handwriting, type scripts, charred/burnt documents and standard for comparison. Age of documents. Money laundering and credit card frauds.

### **Section B: Forensic Ballistics**

Classification of firearms. Principle of firearms identification. Firing mechanisms of different firearms. Range of fire. Introduction to internal, external and terminal ballistics.

Matching of bullets and cartridges. Mechanisms of formation of gunshot residues.

Methods of analysis of gunshot residues from shooting hands and targets, with special reference to clothings. Identification and nature of firearms injuries.

### **Section C: Digital Forensic**

Computer and cyber crimes. Printing of counterfeit currency. Computer scanners.

Software piracy. Data recovery. Authenticity of images and videos.

Network computer crimes and their types. Unauthorized access and interception.

Hacking. Computer viruses and security.

Speaker identification and audio-video authentication; Voice production theory; Acoustic characteristics of speech; Analogue and digital tape recording; Voice spectrograph and image processing.

### **Suggested Readings**

1. O. Hilton, *Scientific Examination of Questioned Documents*, CRC Press, Boca Raton (1982).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4<sup>th</sup> Edition, Foundation Press, New York (1995).
3. Directorate of Forensic Science Manual.
4. B.J. Heard, *Handbook of Firearms and Ballistics*, Wiley and Sons, Chichester (1997).
5. W.F. Rowe, Firearms identification, *Forensic Science Handbook*, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).
6. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, *Computer Crimes and Computer Forensics*, Select Publishers, New Delhi (2003).
7. C.B. Leshin, *Internet Investigations in Criminal Justice*, Prentice Hall, New Jersey (1997).
8. E. Casey, *Digital Evidence and Computer Crime*, Academic Press, London (2000).

**Practicals (30 periods)**

1. To prepare a report on evaluation of crime scene.
2. To compare soil samples by density gradient method.
3. To compare paint samples by physical matching method.
4. To compare glass samples by refractive index method.
5. To compare cloth samples.
6. To lift footprints.
7. To investigate methods for developing fingerprints.
8. To identify handwriting characters and compare handwriting samples.
9. To carry out comparison of bullets and cartridges.
10. To compare voice samples.

**Suggested Readings**

1. B.A.J. Fisher, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2000).
2. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
3. E. David, *The Scientific Examination of Documents – Methods and Techniques*, 2<sup>nd</sup> Edition, Taylor & Francis, Hants (1997).
4. A.J. Schwoeble and D.L. Exline, *Current Methods in Forensic Gunshot Residue Analysis*, CRC Press, Boca Raton (2000).

**Semester I: Scheme of Examination**

<b>Paper</b>	<b>Time Allowed</b>	<b>Max Marks</b>	<b>Internal Assessment</b>	<b>Aggregate Marks</b>
Paper I Criminalistic Unit	3 Hours	75	25	100
Paper II Physical Science Unit	3 Hours	75	25	100
Practical	6 Hours	40	10 (Practical record)	50

## Semester II

### Paper III: Chemical Science Unit (32 lectures)

#### Section A: Forensic Chemistry

Sampling of chemical evidence. Types of forensic cases which require chemical analysis. Types of analysis.

Arson. Chemistry of fire. Searching the fire scene. Collection and preservation of arson evidence. Scientific investigation and evaluation of clue materials.

Explosives. Classification of explosives. Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Blast waves. Searching the scene of explosion. Post blast residue collection and analysis. Blast injuries. Detection of hidden explosives.

Adulteration of petroleum products. Analysis of alcoholic beverages.

Detective dyes; Analysis of phenolphthalein in trap cases.

#### Section B: Forensic Toxicology

Significance of toxicological findings. Techniques used in toxicology.

Poisons. Classification of poisons. Physico-chemical and mode of action of poisons.

Accidental, suicidal and homicidal poisonings.

Collection and preservation of viscera, blood and urine for various poison cases.

Identification of biocides and metal salts in body fluids.

Metabolism and excretion of poisons.

#### Section C: Drugs of Abuse

Natural and synthetic drugs of abuse. Drug dependence. Classification of drugs of abuse: Narcotics, hallucinogens, depressants, stimulants and anabolic steroids. Field and laboratory tests of drugs of abuse. Instrumental methods of drug analysis; Collection and preservation of drug evidence.

### **Suggested Readings**

1. J.D. DeHaan, *Kirk's Fire Investigation*, 3<sup>rd</sup> Edition, Prentice Hall, New Jersey (1991).
2. R. Saferstein, *Criminalistics*, 8<sup>th</sup> Edition, Prentice Hall, New Jersey (2004).
3. J.C. DeLadurantey and D.R. Sullivan, *Criminal Investigation Standards*, Harper & Row, New York (1980).
4. D.M. Benjamin, Forensic pharmacology in, *Forensic Science Handbook*, Vol. 3, R. Saferstein (Ed.), Prentice Hall, New Jersey (1993).
5. A. Poklis, Forensic toxicology in, *Introduction to Forensic Sciences*, 2<sup>nd</sup> Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
6. A.W. Jones, Enforcement of drink-driving laws by use of per se legal alcohol limits: Blood and/or breath concentration as evidence of impairment, *Alcohol, Drug and Driving*, **4**, 99 (1988).

## **Paper IV: Life Science Unit (32 lectures)**

### **Section A: Forensic Biology**

Biological evidence. Importance, nature, location, collection and evaluation of biological evidence.

Hair examination. Structure of hair. Growth and replacement of hair. Collection and preservation of hair evidence. Identification from hair.

Wildlife forensic. Significance of wildlife forensic. Protected and endangered species of animals and plants. Illegal trading in wildlife items, such as skin, fur, bone, horn, teeth, flowers and plants. Identification of physical evidence pertaining to wildlife forensics.

Forensic entomology. Insects of forensic importance. Collection of entomological evidence during death investigations.

Blood and blood groups. Forensic characterization of bloodstains. Bloodstain patterns.

Forensic significance of semen, saliva, sweat, milk and urine.

Scientific basis of DNA typing. Collection of DNA evidence. Applications of DNA typing in criminal and civil cases.

### **Section B: Forensic Anthropology**

Definition, scope and problems of forensic anthropology. Determination of age, sex, stature and race from skeletal material. Facial reconstruction. Facial superimposition techniques.

Use of somatometry and somatoscopy observations in personal identification. Racial variations with respect to these measurements.

Genetic and congenital anomalies. Causes, types, identification and their forensic significance.

### **Section C: Forensic Medicine**

Forensic odontology. Development, scope and role of forensic odontology in mass disaster. Determination of age from teeth.

Bite marks. Forensic significance of bite marks. Collection, preservation and photography of bite marks evidence. Individualization from teeth and bite marks.

Forensic pathology. Autopsy. Medico-legal aspects of death. Causes of death.

Determination of time since death. Investigation of sexual offences.

Injuries. Types and classification of injuries. Ante mortem and post mortem injuries.

Aging of injuries. Artificial injuries.

Forensic psychology. Types of behavioral disorders. Psychology of lying. Principle of lie detection.

Concept and significance of brain fingerprinting, hypnosis and narco analysis.

### **Suggested Readings**

1. J.H. Byrd and J.L. Castner, *Forensic Entomology*, CRC Press, Boca Raton (2001).
2. R. Saferstein, *Forensic Science Handbook*, Vol. III, Prentice Hall, New Jersey (1993).
3. W.G. Eckert and S.H. James, *Interpretation of Bloodstain Evidence at Crime Scenes*, CRC Press, Boca Raton (1989).
4. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, *Introduction to Forensic Sciences*, 2<sup>nd</sup> Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
5. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, *Introduction to Forensic Sciences*, 2<sup>nd</sup> Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
6. M.K. Bhasin and S. Nath, *Advances in Forensic Science*, University of Delhi, Delhi (2001).
7. K. Smyth, *The Cause of Death*, Van Nostrand and Company, New York (1982).
8. M. Bernstein, Forensic Odontology in, *Introduction to Forensic Sciences*, 2<sup>nd</sup> Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
9. W.G. Eckert and R.K. Wright, Forensic Pathology in, *Introduction to Forensic Sciences*, 2<sup>nd</sup> Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
10. J. Niehaus, *Investigative Forensic Hypnosis*, CRC Press, Boca Raton (1999).

**Practicals (30 periods)**

1. To study the separation of metal ions by TLC method.
2. To identify heavy metal ions by spot tests.
3. To perform TLC of ink samples.
4. To carry out separation of amino acids.
5. To carry out identification of drugs of abuse by TLC.
6. To identify drugs of abuse by spot tests.
7. To detect explosive powders.
8. To examine hair morphology and determine origin of species.
9. To determine blood group from fresh blood samples.
10. To determine age from skull.

**Suggested Readings**

1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, *Scientific Evidence in Civil and Criminal Cases*, 4<sup>th</sup> Edition, The Foundation Press, Inc., New York (1995).
2. F.G. Hofmann, *A Handbook on Drug and Alcohol Abuse*, 2<sup>nd</sup> Edition, Oxford University Press, New York (1983).
3. S.B. Karch, *The Pathology of Drug Abuse*, CRC Press, Boca Raton (1996).
4. R. Saferstein, *Criminalistics*, 8<sup>th</sup> Edition, Prentice Hall, New Jersey (2004).

**Dissertation**

Each student is required to submit a dissertation based on a special topic assigned to him/her. The students would be judged on the basis of the contents of their report and its presentation.

**Semester II: Scheme of Examination**

<b>Paper</b>	<b>Time Allowed</b>	<b>Max Marks</b>	<b>Internal Assessment</b>	<b>Aggregate Marks</b>
Paper III Chemical Science Unit	3 Hours	75	25	100
Paper IV Life Science Unit	3 Hours	75	25	100
Practical	6 Hours	40	10 (Practical record)	50
Dissertation	-	50 (contents)	50 (presentation)	100

## **TERMS AND CONDITIONS**

### **Duration of Semesters**

Semester I: From July 16 to November 30

Semester II: From December 8 to April 30

### **Number of Seats**

Thirty. Reservation as per Delhi University rules.

### **Eligibility**

Students who have successfully completed either of the following course (or equivalent) with at least 55% marks.

- B.Sc. (Honors) Chemistry
- B.Sc. (Honors) Physics
- B.Sc. (Honors) Botany
- B.Sc. (Honors) Zoology
- B.Sc. Program in Physical Sciences
- B.Sc. Program in Life Sciences
- B.Sc. Program in Applied Sciences

The admission will be done on merit basis.

### **Fee Structure**

Rs. 10,000/- per annum, payable in two installments.