Centurion
UNIVERSITY
Shaping Lives...
Empowering Communities...

Centurion University of Technology & Management, Odisha

B. Sc. Forensic Science

(Three Years Programme)

School of Forensic Sciences

2019

Programme Objective

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 B.Sc. Course in Forensic Science.

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**.**

CORE COURSES

Code	Course Title	Type of course	Credit	Prerequisite
BSFS0401	Basics of Forensic Science	Theory + Practice	4+2+0 (06)	Nil
BSFS0402	Crime and Society	Theory + Practice	4+2+0 (06)	Nil
BSFS0403	Criminal Law	Theory + Practice	4+2+0 (06)	Nil
BSFS0404	Forensic Psychology	Theory + Practice	4+2+0 (06)	Nil
BSFS0405	Forensic Dermatoglyphics	Theory + Practice	4+2+0 (06)	Nil
BSFS0406	Technological Methods in Forensic Science	Theory + Practice	4+2+0 (06)	Nil
BSFS0407	Criminalistics	Theory + Practice	4+2+0 (06)	Nil
BSFS0408	Forensic Chemistry	Theory + Practice	4+2+0 (06)	Nil
BSFS0409	Questioned Documents	Theory + Practice	4+2+0 (06)	Nil
BSFS0410	Forensic Biology	Theory + Practice	4+2+0 (06)	Nil
BSFS0411	Forensics Ballistics	Theory + Practice	4+2+0 (06)	Nil
BSFS0412	Forensic Toxicology	Theory + Practice	4+2+0 (06)	Nil
BSFS0413	Forensic Anthropology	Theory + Practice	4+2+0 (06)	Nil
BSFS0414	Forensic Medicine	Theory + Practice	4+2+0 (06)	Nil

ABILITY ENHANCEMENT COURSE

Code	Course Title	Type of Course	Credit	Prerequisite
BSFL1101 OR FCBS0101	English Or Environmental Science	Theory	2-0-0 (02)	Nil

ABILITY ENHANCEMENT ELECTIVE (SKILL BASED) COURSE

Sl.No	Code	Course Title	Type of Course	Credit	Prerequisite
1.	BSSE0201	Introduction to Biometry	Practice	0-2-0 (02)	Nil
2.	BSSE0202	Handwriting Identification and Recognition	Practice	0-2-0 (02)	Nil

DISCIPLINE SPECIFIC ELECTIVE (DSE COURSES)

Sl.No	Code	Course Title	Type of Course	Credit	Prerequisite
1.	DEFS0401	Digital Forensics	Theory + Practice	4+2+0 (06)	Computer as one of the subject in 10+2
2.	DEFS0402	Economic Offences	Theory + Practice	4+2+0 (06)	Nil
3.	DEFS0403	Forensic Serology	Theory + Practice	4+2+0 (06)	Biology as one of the subject in 10+2
4.	DEFS0404	Accident Investigations	Theory + Practice	4+2+0 (06)	Nil
5.	DEFS0405	DNA Forensics	Theory + Practice	4+2+0 (06)	Biology as one of the subject in 10+2
6.	DEFS0406	Audio Recognition and Video Analysis	Theory + Practice	4+2+0 (06)	Knowledge about basic concepts of physics is required
7.	DEFS0407	Explosive Analysis and	Theory + Practice	4+2+0 (06)	Student should have

		Post Blast Investigation			knowledge regarding basic concepts of chemistry
8.	DEFS0408	Quality control and Quality Assurance	Theory + Practice	4+2+0 (06)	Student should have knowledge regarding basic concepts of chemistry

GENERIC ELECTIVE (GE)
Subjects From other Disciplines (One each in Semester I, II, III, IV)

Code	Course Title	Type of Course	Credit	Prerequisite
		Theory + Practice	4+2+0 (06)	Nil

One each in semester 1, 2, 3 and 4, to be chosen from the following:

1.	**Chemistry**
2.	**Physics**
3.	**Zoology**
4.	**Botany**

SEMESTER-I

Sl. No.	Course Code	Course	Type of Course	T-P-Pj (credit)
1	BSFS0401	Basics of Forensic Science	Theory + Practice	4-2-0 (06)
2	BSFS0402	Crime and Society	Theory + Practice	4-2-0 (06)
3		Generic Elective	Theory + Practice	4-2-0 (06)
4	FCBS0101	Ability Enhancement Compulsory Course : FCBS0101 Environmental science	Theory	2-0-0 (02)
				20

SEMESTER-II

Sl. No.	Course Code	Course	Type of Course	T-P-Pj (credit)
1	BSFS0403	Criminal Law	Theory + Practice	4-2-0 (06)
2	BSFS0404	Forensic Psychology	Theory + Practice	4-2-0 (06)
3		Generic Elective	Theory + Practice	4-2-0 (06)
4	BSFL1101	Ability Enhancement Compulsory Course BSFL1101: English	Theory	2-0-0 (02)
				20

SEMESTER- III

Sl. No.	Course Code	Course	Type of Course	T-P-Pj (credit)
1	BSFS0405	Forensic Dermatoglyphics	Theory + Practice	4-2-0 (06)
2	BSFS0406	Technological Methods in Forensic Science	Theory + Practice	4-2-0 (06)
3	BSFS0407	Criminalistics	Theory + Practice	4-2-0 (06)
4		Generic Elective	Theory + Practice	4-2-0 (06)
5		Ability Enhancement Elective (Skill Based) course	Practice	0-2-0 (02)
				26

SEMESTER-IV

Sl. No.	Course Code	Course	Type of Course	T-P-Pj (credit)
1	BSFS0408	Forensic Chemistry	Theory + Practice	4-2-0 (06)
2	BSFS0409	Questioned Documents	Theory + Practice	4-2-0 (06)
3	BSFS0410	Forensic Biology	Theory + Practice	4-2-0 (06)
4		Generic Elective	Theory + Practice	4-2-0 (06)
5		Ability Enhancement Elective (Skill Based) course	Practice	0-2-0 (02)
				26

SEMESTER-V

Sl. No.	Course Code	Course	Type of Course	T-P-Pj (credit)
1	BSFS0411	Forensics Ballistics	Theory + Practice	4-2-0 (06)
2	BSFS0412	Forensic Toxicology	Theory + Practice	4-2-0 (06)
3		Discipline Specific Elective	Theory + Practice	4-2-0 (06)
4		Discipline Specific Elective	Theory + Practice	4-2-0 (06)
				24

SEMESTER-VI

Sl. No.	Course Code	Course	Type of Course	T-P-Pj (credit)
1	BSFS0413	Forensic Anthropology	Theory + Practice	4-2-0 (06)
2	BSFS0414	Forensic Medicine	Theory + Practice	4-2-0 (06)
3		Discipline Specific Elective	Theory + Practice	4-2-0 (06)
4		Discipline Specific Elective	Theory + Practice	4-2-0 (06)
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Course Contents

Basics of Forensic Science

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Basics of Forensic Science	BSFS0401	Theory + Practice	4-2-0	Nil

Objective

- This course will cover in depth knowledge of forensic science, it's disciplines and importance and working of FSL.

Learning outcome

- The significance of forensic science to human society.
- The fundamental principles and functions of forensic science.
- The divisions in a forensic science laboratory.
- The working of the forensic establishments in India and abroad.

Evaluation Systems

	Component	% of Marks	Method of Assessment
Internal Examination	Midterm Test	20	Written examination
	Experiments	30	Lab work, report, viva
External Examination	Semester Examination	30	Written examination
	Experiments	20	Lab work, report, viva
Total		100	

Course outline

Module I: (06 hrs)

Basics of Forensic Science: Introduction Global History and Scope, Need and Development Principles, emphasizing on Specific contribution of Scientists in the field of Forensic Science.

Module II: (08 hrs)

Domains in Forensic Science: Branches of Forensic Science, Police officers, Prosecution, Judicial Officers and Medico legal expert etc. Role and Qualifications of forensic scientists. Code of conduct for forensic scientists, Ethical issue in Forensic Science, professional standards for practice of Criminalistics

Module III: (06 hrs)

Tools and Techniques in Forensic Science

Branches of forensic science. Forensic science in international perspectives, including set up of INTERPOL and FBI.

Duties of forensic scientists. Code of conduct for forensic scientists. Qualifications of forensic scientists.
Data depiction. Report writing

Module IV: (10 hrs)

Organization set up of Forensic Science Laboratory: Structure and function of State and regional Forensic Science Laboratory, Central Forensic Science Laboratory and facility provided, Mobile Forensic Science Laboratory. Directorate of Forensic Science Service. Police and Forensic scientist relationship, role of FSL in criminal investigation, relationship between forensic expert and judiciary officer, Importance of FSL, National and International scenario of FSL, facilities provided in forensic science laboratory.

Basics Of Forensic Science Lab

- To study the history of crime cases from forensic science perspective.
- To write report on different type of crime cases.
- To perform mock homicide crime scene investigation.
- Case studies and write report

Text Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. B.R. Sharma, Forensic science in criminal investigation and trials

Reference Books:

1. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton
2. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
3. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).

Crime and Society

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Crime and society	BSFS0402	Theory + Practice	4-2-0	Nil

Objective

- To obtain knowledge about criminology i.e. crime and its causes, its impact on society and basic elements of justice delivery system.

Learning outcome

- The importance of criminology.
- The causes of criminal behavior.
- The significance of criminal profiling to mitigate crime.
- The consequences of crime in society.
- The elements of criminal justice system.

Course outline

Module I: (08 hrs)

Basics of Criminology

Definition, aims and scope. Theories of criminal behavior – classical, positivist, sociological.
Criminal anthropology.
Criminal profiling. Understanding modus operandi. Investigative strategy.
Role of media.

Module II: (12 hrs)

Crime

Elements, nature, causes and consequences of crime. Deviant behavior. Hate crimes, organized crimes and public disorder, domestic violence and workplace violence.
White collar crimes
Victimology. Juvenile delinquency. Social change and crime.
Psychological Disorders and Criminality. Situational crime prevention.

Module III: **(10 hrs)**

Criminal Justice System

Broad components of criminal justice system. Policing styles and principles. Police's power of investigation.

Filing of criminal charges. Community policing. Policing a heterogeneous society.

Correctional measures and rehabilitation of offenders.

Human rights and criminal justice system in India.

Crime and society Lab

- To review past criminal cases and elucidate which theory best explains the criminal behavior of the accused.
- To review crime cases where criminal profiling assisted the police to apprehend the accused.
- To cite examples of crime cases in which the media acted as a pressure group.
- To examine a case of juvenile delinquency and suggest remedial measures

Text Books:

1. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
2. D.E. Zulawski and D.E. Wicklander, Practical Aspects of Interview and Interrogation, CRC Press, Boca Raton (2002).

Reference Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. J.L. Jackson and E. Barkley, Offender Profiling: Theory, Research and Practice, Wiley, Chichester (1997).
3. R. Gupta, Sexual Harassment at Workplace, LexisNexis, Gurgaon (2014).

Criminal Law

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Criminal Law	BSFS0403	Theory + Practice	4-2-0	Nil

1. Objective

- To obtain knowledge about basic law which governs our society

2. Learning outcome

- Elements of Criminal Procedure Code related to forensic science.
- Acts and provisions of the Constitution of India related to forensic science.
- Acts governing socio-economic crimes.
- Acts governing environmental crimes.

Course outline

Module I: **(08 hrs)**

Law to Combat Crime

Classification – civil, criminal cases. Essential elements of criminal law. Constitution and hierarchy of criminal courts.
Criminal Procedure Code. Cognizable and non-cognizable offences.
Bailable and non-bailable offences.
Sentences which the court of Chief Judicial Magistrate may pass.
Summary trials – Section 260(2).
Judgements in abridged forms – Section 355.

Module II: **(06 hrs)**

Indian Penal Code pertaining to offences against persons – Sections 121A, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362.
Sections 375 & 377 and their amendments.
Indian Penal Code pertaining to offences against property Sections – 378, 383, 390, 391, 405, 415, 420, 441, 463, 489A, 497, 499, 503, 511.

Module III: **(06 hrs)**

Indian Evidence Act – Evidence and rules of relevancy in brief. Expert witness. Cross examination and re-examination of witnesses.
Sections 32, 45, 46, 47, 57, 58, 60, 73, 135, 136, 137, 138, 141.
Section 293 in the code of criminal procedure.

Module IV: **(06 hrs)**

Constitution of India

Preamble, Fundamental Rights, Directive Principles of State Policy. – Articles 14, 15, 20, 21, 22, 51A.

Module V: **(10hrs)**

Acts Pertaining to Socio-economic and Environmental Crimes

Narcotic, Drugs and Psychotropic Substances Act. Essential Commodity Act.
Drugs and Cosmetics Act. Explosive Substances Act. Arms Act.
Dowry Prohibition Act.
Prevention of Food Adulteration Act. Prevention of Corruption Act.
Wildlife Protection Act. I.T. Act. Environment Protection Act. Untouchability Offences Act

Criminal Law Lab

- To prepare a schedule of five cognizable and five non-cognizable offences.
- To study the powers and limitations of the Court of Judicial Magistrate of First Class.
- To prepare a schedule of the offences which may be tried under Section 260(2) of Criminal Procedure Code.
- To study a crime case in which an accused was punished on charge of murder under Section 302.
- To study a crime case in which an accused was punished on charge of rape under Section 375.
- To cite example of a case in which the opinion of an expert was called for under Section 45 of the Indian Evidence Act.

Text Books:

1. A.S. Pillia, Criminal Law, 6th Edition, N.M. Tripathi Pvt Ltd., Mumbai (1983).
2. R.C. Nigam, Law of Crimes in India, Volume I, Asia Publishing House, New Delhi (1965).

Reference Books:

1. D.A. Bronstein, Law for the Expert Witness, CRC Press, Boca Raton (1999).
2. Vipa P. Sarthi, Law of Evidence, 6th Edition, Eastern Book Co., Lucknow (2006).

Forensic Psychology

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Forensic Psychology	BSFS0404	Theory + Practice	4-2-0	Nil

Objective

- To obtain knowledge about forensic psychology and various psychological investigative tools.

Learning outcome

- The overview of forensic psychology and its applications.
- The legal aspects of forensic psychology.
- The significance of criminal profiling.
- The importance of psychological assessment in gauging criminal behavior.
- The tools and techniques required for detection of deception.
- The critical assessment of advanced forensic techniques like polygraphy, narco analysis and brain electrical oscillation signatures.

Course outline

Module I: (08 hrs)

Basics of Forensic Psychology

Definition and fundamental concepts of forensic psychology and forensic psychiatry. Psychology and law. Ethical issues in forensic psychology.
Assessment of mental competency. Mental disorders and forensic psychology.
Psychology of evidence – eyewitness testimony, confession evidence. Criminal profiling.
Psychology in the courtroom, with special reference to Section 84 IPC.

Module II: (10 hrs)

Psychology and Criminal Behaviour

Psychopathology and personality disorder. Psychological assessment and its importance.
Serial murderers. Psychology of terrorism.
Biological factors and crime – social learning theories, psycho-social factors, abuse.
Juvenile delinquency – theories of offending (social cognition, moral reasoning),
Child abuse (physical, sexual, emotional), juvenile sex offenders, legal controversies.

Module III: **(12 hrs)**

Detection of Deception

Tools for detection of deception – interviews, non-verbal detection, statement analysis, voice stress analyzer, hypnosis.

Polygraphy – operational and question formulation techniques, ethical and legal aspects, the guilty knowledge test.

Narco analysis and brain electrical oscillation signatures – principle and theory, ethical and legal issues.

Forensic Psychology Lab

- To cite a crime case where legal procedures pertaining to psychic behavior had to be invoked.
- To prepare a report on relationship between mental disorders and forensic psychology.
- To review a crime case involving serial murders. Comment on the psychological traits of the accused.
- To cite a crime case involving a juvenile and argue for and against lowering the age for categorizing an individual as juvenile.
- To study a criminal case in which hypnosis was used as a means to detect deception.

Text Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).

Reference Books:

1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).
2. E. Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).

Forensic Dermatoglyphics

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Forensic dermatoglyphics	BSFS0405	Theory + Practice	4-2-0	Nil

Objective

- To study fingerprints and its fundamental principles, its role in linking a person to the crime scene, techniques to develop prints

Learning outcome

- The fundamental principles on which the science of fingerprinting is based.
- Fingerprints are the most infallible means of identification.
- The world's first fingerprint bureau was established in India.
- The method of classifying criminal record by fingerprints was worked out in India, and by Indians.
- The physical and chemical techniques of developing fingerprints on crime scene evidence.
- The significance of foot, palm, ear and lip prints.

Course outline

Module I: (10 hrs)

Basics of Fingerprinting

Introduction and history, with special reference to India.
Biological basis of fingerprints. Formation of ridges. Fundamental principles of fingerprinting. Types of fingerprints. Fingerprint patterns. Fingerprint characters/minutiae. Plain and rolled fingerprints.
Classification and cataloguing of fingerprint record. Automated Fingerprint Identification System.
Significance of poroscopy and edgeoscopy.

Module II: **(12 hrs)**

Development of Fingerprints

Latent prints. Constituents of sweat residue. Latent fingerprints' detection by physical and chemical techniques.
Mechanism of detection of fingerprints by different developing reagents.
Application of light sources in fingerprint detection.
Preservation of developed fingerprints.
Digital imaging for fingerprint enhancement.
Fingerprinting the deceased. Developing fingerprints on gloves.

Module III: **(10 hrs)**

Other Impressions

Importance of footprints. Casting of foot prints, Electrostatic lifting of latent foot prints.
Palm prnts.
Lip prints - Nature, location, collection and examination of lip prints. Ear prints and their significance.
Palm prints and their historical importance.

Forensic Dermatoglyphics Lab

- To record plain and rolled fingerprints.
- To carry out ten digit classification of fingerprints.
- To identify different fingerprint patterns.
- To identify core and delta.
- To carry out ridge tracing and ridge counting.
- To investigate physical methods of fingerprint detection.

Text Books:

1. Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

Reference Books:

1. J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983).
2. D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton (2000).
3. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).

Technological Methods in Forensic Science

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Technological Methods in Forensic Science	BSFS0406	Theory + Practice	4-2-0	Nil

Objective

- To gain knowledge about various instruments and techniques used in analysis and examination of evidences.

Learning outcome

- The importance of chromatographic and spectroscopic techniques in processing crime scene evidence.
- The utility of colorimetry, electrophoresis and neutron activation analysis in identifying chemical and biological materials.
- The significance of microscopy in visualizing trace evidence and comparing it with control samples.
- The usefulness of photography and videography for recording the crime scenes.

Course outline

Module I: **(12 hrs)**

Instrumentation

Sample preparation for chromatographic and spectroscopic evidence.

Chromatographic methods. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography.

Spectroscopic methods. Fundamental principles and forensic applications of Ultraviolet-visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy, atomic emission spectroscopy and mass spectroscopy. X-ray spectrometry. Colorimetric analysis and Lambert-Beer law.

Electrophoresis – fundamental principles and forensic applications.

Neutron activation analysis – fundamental principles and forensic applications.

Module II: **(12 hrs)**

Microscopy

Fundamental principles. Different types of microscopes. Electron microscope. Comparison Microscope.

Forensic applications of microscopy

Module III: **(10 hrs)**

Forensic photography

Basic principles and applications of photography in forensic science.

3D photography. Photographic evidence. Infrared and ultraviolet photography. Digital photography. Videography. Crime scene and laboratory photography.

Technological Methods Used In Forensic Science Lab

- To determine the concentration of a colored compound by colorimetry analysis.
- To carry out thin layer chromatography of ink samples.
- To carry out separation of organic compounds by paper chromatography.
- To identify drug samples using UV-Visible spectroscopy.
- To take photographs using different filters.
- To take photographs of crime scene exhibits at different angles

Text Books:

1. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6th Edition, Saunders College Publishing, Fort Worth (1992).

Reference Books:

1. W. Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, Hampshire (1991).
2. J.W. Robinson, Undergraduate Instrumental Analysis, 5th Edition, Marcel Dekker, Inc., New York (1995).
3. D.R. Redsicker, The Practical Methodology of Forensic Photography, 2nd Edition, CRC Press, Boca Raton (2000).

Criminalistics

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Criminalistics	BSFS0407	Theory + Practice	4-2-0	Nil

Objective

- To gain knowledge about crime scene and its processing including securing, searching and documentation as well as collection and packaging of evidences.

Learning outcome

- The methods of securing, searching and documenting crime scenes.
- The art of collecting, packaging and preserving different types of physical and trace evidence at crime scenes.
- The legal importance of chain of custody.
- The tools and techniques for analysis of different types of crime scene evidence.

Course outline

Module I: (12 hrs)

Crime Scene Management

Types of crime scenes – indoor and outdoor. Securing and isolating the crime scene.
Crime scene search methods. Safety measures at crime scenes. Documentation of crime scenes – photography, videography, sketching and recording notes.
Duties of first responders at crime scenes. Coordination between police personnel and forensic scientists at crime scenes. The evaluation of 5Ws (who?, what?, when?, where?, why?) and 1H (how?). Crime scene logs.

Module II: (10 hrs)

Crime Scene Evidence

Classification of crime scene evidence – physical and trace evidence. Locard principle.
Collection, labeling, sealing of evidence. Hazardous evidence. Preservation of evidence.
Chain of custody. Reconstruction of crime scene.

Module III: **(15 hrs)**

Forensic Physics

Glass evidence – collection, packaging, analysis. Matching of glass samples by mechanical fit and refractive index measurements. Analysis by spectroscopic methods. Fracture analysis and direction of impact.

Paint evidence – collection, packaging and preservation. Analysis by destructive and non-destructive methods. Importance of paint evidence in hit and run cases.

Fibre evidence – artificial and man-made fibres. Collection of fibre evidence. Identification and comparison of fibres.

Soil evidence – importance, location, collection and comparison of soil samples.

Cloth evidence – importance, collection, analysis of adhering material. Matching of pieces.

Toolmark evidence. Classification of toolmarks. Forensic importance of toolmarks. Collection, preservation and matching of toolmarks. Restoration of erased serial numbers and engraved marks. Forensic gemmology.

Criminalistics Lab

- To prepare a report on evaluation of crime scene.
- To reconstruct a crime scene (outdoor and indoor).
- To compare soil samples by density gradient method.
- To compare paint samples by physical matching method.
- To compare paint samples by thin layer chromatography method.
- To compare glass samples by refractive index method.

Text Books:

1. M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001).

Reference Books:

1. T.J. Gardener and T.M. Anderson, Criminal Evidence, 4th Ed., Wadsworth, Belmont (2001).
2. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
3. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

Forensic Chemistry

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Forensic Chemistry	BSFS0408	Theory + Practice	4-2-0	Nil

Objective

- The study enhances ability of investigating officer in arson cases. Scientific study to analyse the explosives and Petroleum product and investigation in cases of IED.

Learning outcome

- The methods of analyzing trace amounts of petroleum products in crime scene evidence.
- The methods of analyzing contaminants in petroleum products.
- The method of searching, collecting, preserving and analyzing arson evidence.
- The classification of explosives, including the synthesis and characterization of representative analogs.
- The significance of bomb scene management.
- The techniques of locating hidden explosives.

Course outline

Module I: Petroleum and Petroleum Products (10 hrs.)

Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions.
Analysis of petroleum products. Analysis of traces of petroleum products in forensic exhibits.
Comparison of petroleum products. Adulteration of petroleum products.

Module II: Cases Involving Arson (10 hrs.)

Chemistry of fire. Conditions for fire. Fire scene patterns. Location of point of ignition. Recognition of type of fire. Searching the fire scene. Collection and preservation of arson evidence.
Analysis of fire debris. Analysis of ignitable liquid residue. Post-flashover burning. Scientific investigation and evaluation of clue materials. Information from smoke staining.

Module III: Explosives **(10 hrs)**

Classification of explosives – low explosives and high explosives. Homemade explosives. Military explosives. Blasting agents.
Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Blast waves. Bomb scene management.
Searching the scene of explosion. Mechanism of explosion. Post blast residue collection and analysis.
Blast injuries. Detection of hidden explosives.

Forensic Chemistry Lab

- To analyze arson accelerators.
- To prepare a case report on a case involving arson.
- To carry out analysis of explosive substances.
- To separate explosive substances using thin layer chromatography.
- To prepare a case report on bomb scene management.

Text Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004)

Reference Books:

1. J.D. DeHaan, Kirk's Fire Investigation, 3rd Edition, Prentice Hall, New Jersey (1991).
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995)
3. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
4. S. Ballou, M. Houck, J.A. Siegel, C.A. Crouse, J.J. Lentini and S. Palenik in Forensic Science, D.H. Ubelaker (Ed.), Wiley-Blackwell, Chichester (2013).Online Resources: (Viewed on dtd.)

Questioned Documents

Course Structure	Code	Type of course	T-P-PJ	Prerequisite
Questioned Documents	BSFS0409	Theory + Practice	4-2-0	Nil

Objective

- This study helps in understanding nature of paper and some other characteristics of written as well printed document with respect to class and individual characteristics and helps to examine fraud cases.

Learning outcome

- The importance of examining questioned documents in crime cases.
- The tools required for examination of questioned documents.
- The significance of comparing hand writing samples.
- d. The importance of detecting frauds and forgeries by analyzing questioned documents.

Course outline

Module I: Nature and Scope of Questioned Documents (10 hrs.)

Definition of questioned documents. Types of questioned documents. Preliminary examination of documents. Basic tools needed for forensic documents' examination – ultraviolet, visible, infrared and fluorescence spectroscopy, photomicrography, microphotography, visible spectral comparator, electrostatic detection apparatus. Determining the age and relative age of documents.

Module II: Comparison of Documents (10 hrs.)

Comparison of handwriting. Development of individuality in handwriting. Natural variations and fundamental divergences in handwritings. Class and individual characterstics. Merits and demerits of exemplar and non-exemplar samples during comparison of handwriting. Standards for comparison of handwriting. Comparison of paper, ink, printed documents, typed documents, Xeroxed documents.

Module III: Forgeries (08 hrs)

Alterations in documents, including erasures, additions, over-writings and obliterations. Indented and invisible writings. Charred documents.
Examination of counterfeit Indian currency notes, passports, visas and stamp papers.
Disguised writing and anonymous letters.

Questioned Documents Lab

- To identify handwriting characters.
- To study natural variations in handwriting.
- To compare handwriting samples.
- To detect simulated forgery.
- To detect traced forgery.

Text Books:

1. O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (1982)
2. E. David, The Scientific Examination of Documents – Methods and Techniques, 2nd Edition, Taylor & Francis, Hants (1997).

Reference Books:

1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, Foundation Press, New York (1995).
2. 3. R.N. Morris, Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2000).

Forensic Biology

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Forensic Biology	BSFS0410	Theory + Practice	4-2-0	Nil

Objective

- A biological fluid helps to determine source origin among the individuals. Hair evidence distinguishes between human and animal. Study of wild life forensic science enhances skill and knowledge of investigator in investigation smuggling cases.

Learning outcome

- The significance of biological and serological evidence.
- The forensic importance of hair evidence.
- The importance of biological fluids – blood, urine, semen, saliva, sweat and milk – in crime investigations.
- How wildlife forensics aid in conserving natural resources.
- e. How forensic entomology assists in death investigations.

Course outline

Module I: Biological Evidence (10 hrs.)

Nature and importance of biological evidence. Significance of hair evidence. Transfer, persistence and recovery of hair evidence. Structure of human hair. Comparison of hair samples. Morphology and biochemistry of human hair. Comparison of human and animal hair. Types and identification of microbial organisms of forensic significance. Identification of wood, leaves, pollens and juices as botanical evidence. Diatoms and their forensic significance.

Module II: Wildlife Forensics (14 hrs.)

Fundamentals of 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. Identification of pug marks of various animals.

Module III: Forensic Entomology (10 hrs)

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

Forensic Biology Lab

- To examine hair morphology and determine the species to which the hair belongs.
- To examine human hair for cortex and medulla.
- To carry out microscopic examination of pollen grains.
- To carry out microscopic examination of diatoms.
- To cite a crime case in which diatoms have served as forensic evidence.
- To prepare a case report on forensic entomology.

Text Books:

1. R. Saferstein, Forensic Science Handbook, Vol. III, Prentice Hall, New Jersey (1993).
2. S. Chowdhuri, Forensic Biology, BPRD, New Delhi (1971).

Reference Books:

1. L. Stryer, Biochemistry, 3rd Edition, W.H. Freeman and Company, New York (1988).
2. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, Harper's Biochemistry, APPLETON & Lange, Norwalk (1993).
3. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

Forensic Ballistics

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Forensic Ballistics	BSFS0411	Theory + Practice	4-2-0	Nil

Objective

- It helps to identify class and individual characteristics of firearm and ammunition. Enhance the skill and knowledge of investigating officer.

Learning outcome

- The classification of firearms and their firing mechanisms.
- The methods of identifying firearms.
- The characteristics of ammunition.
- The importance of firearm evidence.
- The nature of firearm injuries.
- The methods for characterization of gunshot residue.

Course outline

Module I: Firearms (06 hrs.)

History and development of firearms. Classification of firearms. Weapon types and their operation. Firing mechanisms of different firearms.

Module II: **Internal ballistics**

Definition, ignition of propellants, shape and size of propellants, manner of burning, and various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting.

Module III: External Ballistics (06 hrs.)

Vacuum trajectory, effect of air resistance on trajectory, base drag, drop, drift, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistic data.

Module IV: Terminal Ballistics (06 hrs.)

Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range. Ricochet and its effects, stopping power.

Module V: Ammunition (08 hrs.)

Types of ammunition. Constructional features and characteristics of different types of cartridges and bullets. Primers and priming compounds. Projectiles. Headstamp markings on ammunitions. Different types of marks produced during firing process on cartridge – firing pin marks, breech face marks, chamber marks, extractor and ejector marks.

Module VI: Title: Firearm Evidence (10 hrs)

Matching of bullets and cartridge cases in regular firearms. Identification of bullets, pellets and wads fired from improvised, country made firearms. Automated method of bullet and cartridge case comparison. Determination of range of fire and time of fire. 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. Reconstruction with respect to accident, suicide, murder and self-defence.

FORENSIC BALLISTICS LAB

- To describe, with the aid of diagrams, the firing mechanisms of different types of firearms.
- To correlate the velocity of bullet with the impact it produces on the target.
- To correlate the striking angle of the bullet with the impact on the target.
- To carry out the comparison of fired bullets.
- To carry out the comparison of fired cartridge cases.
- To differentiate, with the aid of diagram, contact wounds, close range wounds and distant wounds.

Text Books:

1. B.J. Heard, Handbook of Firearms and Ballistics, Wiley and Sons, Chichester (1997).

Reference Books:

1. W.F. Rowe, Firearms identification, Forensic Science Handbook, Vol. 2, R. Saferstein (Ed.), Prentice Hall, New Jersey (1988).
2. A.J. Schwoeble and D.L. Exline, Current Methods in Forensic Gunshot Residue Analysis, CRC Press, Boca Raton (2000).
3. E. Elaad in Encyclopedia of Forensic Science, Volume 2, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000)

Forensic Toxicology

Course Title	Code	Type of course	T-P-PJ	Prerequisite
forensic toxicology	BSFS0412	Theory + Practice	4-2-0	Nil

Objective

- Study emphasize on qualitative and quantitative analysis of poison in body fluids. It also helps understanding mode of administration of poison and their absorption.

Learning outcome

- The significance of toxicological studies in forensic science.
- The classification of poisons and their modes of actions.
- The absorption of poisons in body fluids.
- The forensic identification of illicit liquors.
- The classification and characteristics of the narcotics, drugs and psychotropic substances.
- The menace of designer drugs.

Course outline

Module I: Basics of Toxicology (08 hrs.)

Significance of toxicological findings. Techniques used in toxicology. Toxicological analysis and chemical intoxication tests. Postmortem Toxicology. Human performance toxicology. Dose-response relationship. Lethal dose 50 and effective dose 50.

Module II: Poisons (12 hrs.)

Classification of poisons. Physico-chemical characteristics and mode of action of poisons. Accidental, suicidal and homicidal poisonings. Signs and symptoms of common poisoning and their antidotes. 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. Application of immunoassays in forensic work. Animal poisons. Snake venom. Mode of action. Carbon monoxide poisoning.Vegetable poisons. Poisonous seeds, fruits, roots and mushrooms.

Module III: Narcotics, Drugs and Psychotropic Substances (14 hrs.)

Definition of narcotics, drugs and psychotropic substances. Broad classification – Narcotics, stimulants, depressants and hallucinogens. General characteristics and common example of each classification. Natural, synthetic and semi-synthetic narcotics, drugs and psychotropic substances.

Designer drugs. Tolerance, addiction and withdrawal symptoms of narcotics, drugs and psychotropic substances Crime scene search for narcotics, drugs and psychotropic substances – searching a suspect, searching a dwelling, searching a vehicle. Clandestine drug laboratories. Collection and preservation of drug evidence. Testing of narcotics, drugs and psychotropic substances. Presumptive and screening tests for narcotics, drugs and psychotropic substances. Microcrystalline testing of drugs of abuse. Drugs and driving. Dope tests.

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Forensic Toxicology Lab

- To identify biocides.
- To identify metallic poisons.
- To identify organic poisons.
- To identify drugs of abuse by spot tests.
- To perform color tests for barbiturates.
- To separate drugs of abuse by thin layer chromatography.

Text Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. F.G. Hofmann, A Handbook on Drug and Alcohol Abuse, 2nd Edition, Oxford University Press, New York (1983).

Reference Books:

1. S.B. Karch, The Pathology of Drug Abuse, CRC Press, Boca Raton (1996).
2. A. Poklis, Forensic toxicology in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
3. 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).

Forensic Anthropology

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Forensic Anthropology	BSFS0413	Theory + Practice	4-2-0	Nil

Objective

- Study focuses on skeletal parts and their significance in determining identification of person, characteristics that helps in identifying missing person as well facial reconstruction through sketching of individual characteristics.

Learning outcome

- Importance of forensic anthropology in identification of persons.
- Different techniques of facial reconstruction and their forensic importance.
- c. Significance of somatoscopy and somatometry.

Course outline

Module I: Significance of Forensic Anthropology (10 hrs.)

Scope of forensic anthropology. Study of human skeleton. Nature, formation, and identification of human bones. Determination of age, sex, stature from skeletal material.

Module II: Personal Identification – Somatoscopy and Somatometry (12 hrs.)

Somatoscopy – observation of hair on head, forehead, eyes, root of nose, nasal bridge, nasal tip, chin, Darwin's tubercle, ear lobes, supra-orbital ridges, physiognomic ear breadth, circumference of head. Scar marks and occupational marks.

Somatometry – measurements of head, face, nose, cheek, ear, hand and foot, body weight, height.

Indices - cephalic index, nasal index, cranial index, upper facial index.

Module III: Facial Reconstruction (12 hrs)

Portrait Parle/ Bertillon system. Photofit/identi kit. Facial superimposition techniques.

Cranio facial super imposition techniques – photographic super imposition, videosuperimposition, Roentgenographic superimposition. Use of somatoscopic and craniometric methods in reconstruction. Importance of tissue depth in facial reconstruction.

Genetic and congenital anomalies – causes, types, identification and their forensic significance

Forensic Anthropology Lab

- To determine age from skull and teeth.
- To determine sex from skull.
- To determine sex from pelvis.
- To study identification and description of bones and their measurements.
- To investigate the differences between animal and human bones.

Text Books:

1. M.Y. Iscan and S.R. Loth, The scope of forensic anthropology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

Reference Books:

1. D. Ubelaker and H. Scammell, Bones, M. Evans & Co., New York (2000).
2. S.Rhine, Bone Voyage: A Journey in Forensic Anthropology, University of Mexico Press, Mexico (1998).

Forensic Medicine

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Forensic Medicine	BSFS0414	Theory + Practice	4-2-0	

Objective

- Study helps to distinguish between postmortem and anti-mortem characteristics of corpus delicti. Age and sex can also be determined by forensic odontology.

Learning outcome

- The duties of the first responding officer who receives a call on homicide or suicide case.
- The steps involved in processing the death scene.
- The importance of ascertaining whether the crime was staged to appear as suicide or accident.
- The importance of bloodstain patterns in reconstructing the crime scene.
- The importance of autopsy.
- The importance of forensic odontology

Course outline

Module I: Death Investigations (14 hrs.)

Fundamental aspects and scope of forensic medicine.
Approaching the crime scene of death. Obtaining first-hand information from the caller.
Rendering medical assistance to the victim, if alive. Protecting life. Recording dying declaration.
Identifying witnesses and, if possible, suspect. Interviewing onlookers and segregating possible witnesses. Suspect in custody – initial interrogation and searching for evidence. Miranda warning card. Assessing the crime scene. Request for forensic team. Importance of command post and log book. Management of crowd and media. Importance of taking notes. Items to be a part of noting.
Documenting the death scene. Processing evidence. Evaluation of injuries. Importance of canvass form. Indexing the death investigation. Handling buried body cases – search for buried bodies, methods of exhumation. Suicide cases – evaluating the type of injuries, gauging the psychological state of victim, suicide notes

Module II: Autopsy (10 hrs.)

Forensic pathology. Medico-legal aspects of death. Causes of death. Determination of time since death. Investigation of sexual offences. Death by drowning.

Injuries. Types and classification of injuries. Antemortem and post mortem injuries. Aging of injuries. Artificial injuries.

Module III: Forensic Odontology (10 hrs.)

Development, scope and role of forensic odontology in mass disaster and anthropology. Types of teeth and their comparative anatomy.

Bite marks. Forensic significance of bite marks. Collection, preservation and photography of bite marks evidence. Legal aspects of bite marks. Estimation of age from teeth.

Forensic Medicine Lab

- To design a questionnaire for the first responder to the death scene.
- To design a protocol to deal with the media at the crime scene.
- To design a checklist for the forensic scientists at the death scene.
- To design a canvass form giving description of an unidentified victim.
- To analyse and preserve bite marks.

Text Books:

1. H.B. Baldwin and C.P. May in, Encyclopedia in Forensic Science, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).
2. J. Dix, Handbook for Death Scene Investigations, CRC Press, Boca Raton (1999)

Reference Books:

1. K. Smyth, the Cause of Death, Van Nostrand and Company, New York (1982).
2. M. Bernstein, Forensic odontology in, Introduction to Forensic Sciences, 2nd Ed., W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
3. C. Knupfer (Eds.), Academic Press, London (2000).
4. V.J. Geberth, Practical Homicide Investigation, CRC Press, Boca Raton (2006).
5. T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).
6. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013)

Ability Enhancement Elective Course

English

Course Title	Code	Type of course	T-P-PJ	Prerequisite
English	BSFL1101	Theory	2-0-0	Nil

Objective

- To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
- To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
- To maintain good linguistic -through accuracy in grammar, pronunciation and vocabulary

Learning outcome

- Ability to communicate fluently in different business situation
- Effective oral and written communication
- Appropriate word usage with correct pronunciation
- Clarity of word stress and intonation.

Course outline

Module-I: Communication Skill Communication:

Definition, concept Channels of Communication: Sender, receiver, channel, message, encoding, decoding, context, feedback Verbal & Non-Verbal Communication: Spoken & written-advantages & disadvantages, Bias free English, Formal & informal style.

Module-II: Communicative Grammar
Time, Tense & Aspect Verbs of state & events Modality Active & Passive voice Antonyms, Synonyms, Homonyms, one word substitutions & correction of errors

Module-III: Sounds of English
Length of vowels:
Long vowels as in the words feel, food, shoot, card etc.
Short vowels as in the words pen, sun, cut, shut, etc.
Consonants
Stress pattern
Intonation: Rising & Falling.

Text Book:
1. Effective technical communication by M.A.Rizvi

Reference Books:
1. Communicative English & Business Communication by R.K.Panda, J.Khuntia, M.Pati, Alok Publication.
2. Communicative Grammar of English Geoffery Leech

Environmental Science

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Environmental Science	FCBS0101	Theory	2-0-0	Nil

1. Objective

- To understand the concept of multi-disciplinary nature of Environmental Science where different aspects are dealt with a holistic approach.
- Students will develop a sense of community responsibility by becoming aware of environmental issues in the larger social context.
- One must be environmentally educated.

2. Learning outcome

- Understand the natural environment and its relationships with human activities.
- Characterize and analyze human impacts on the environment.
- Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
- Design and evaluate strategies, technologies and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

3. Evaluation Systems

	Component	% of Marks	Method of Assessment
Internal Examination	Midterm Test	30	Written examination
	Assignment	5	Report and Presentation
	Attendance	5	Attendance percentages
External Examination	External Theory	60	Written examination
Total		**100**	

Course outline

Module-I
Environment and its multidisciplinary nature of environmental science; Need for public awareness

Module-II
Renewable and non -renewable resources–forest, water, mineral, land, food and energy resources;

Structure and function of ecosystems of forest, grass land, desert and aquatic types.

Module -III
Biodiversity and its conservation: Biodiversity at global, national and local levels; Threats to biodiversity - Habitat loss; wild life poaching and man - wildlife conflicts

Module -IV
IUCN: Rear, Endangered and endemic species; conservation measures. Causes, effects and control measures of pollution, air, water and noise pollution; Nuclear hazards

Module -V
Solid-waste management–Causes, effects and control measures; Management of disasters due to natural causes of floods, earthquakes, cyclones and landslides.

Module-VI
Social issues and the environment; Sustainable environment, Water conservation measures; Rain water harvesting; Resettlement and rehabilitation of people; Climate change and global warming; Acid rain; Ozone layer depletion; water land reclamation; Consumerism and waste products

Module-VII
Features of Environment Protection Act, Air pollution and Control of Pollution Acts; Water Pollution and its Control Act. Effects of Pollution explosion on environment and public health; Need for value education to Protect environment and resources.

Text Book:

1. Anubhav Kaushik & C.P. Kaushik: Environmental Studies-New age International Publishers.

Reference Book:

1. Benny Joseph: Environmental Studies-Tata Mac Graw Hill
2. E. Bharucha: Text book of Environmental Studies for under graduate courses– Universities Press. (Book prepared by UGC Committee).

Ability Enhancement Elective (Skill Based) course

Introduction to Biometry

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Introduction to biometry	BSSE0201	Practice	0-2-0	Nil

1. Objective

- To understand the concept of biometry and its role in identification and various kinds of biometrics

2. Learning outcome

- The basis of biometry.
- The classification of biometric processes.
- The importance of behavioral biometry

Course outline

Module-I : Fundamental Aspects (10hr)

Definition, characteristics and operation of biometric system. Classification of biometric systems – physiological and behavioral. Strength and weakness of physiological and behavioral biometrics. Multimodal biometrics. Key biometric processes – enrollment, identification and verification. Positive and negative identification. Performance measures used in biometric systems – FAR, FRR, GAR, FTA, FTE and ATV. Biometric versus traditional technologies.

Module-II : Physiological Biometrics (08 hr)

Fingerprints, palm prints, iris, retina, geometry of hand and face.

Module -III : Behavioral Biometrics (06 hr)

Handwriting, signatures, keystrokes, gait and voice.

Text Book:

1. S. Nanavati, M. Thieme and R. Nanavati, Biometrics, Wiley India Pvt. Ltd. (2002).

Reference Book:

1. P. Reid, Biometrics for Network Security, New Delhi (2004).
2. J.R. Vacca, Biometric Technologies and Verification Systems, Butterworth-Heinemann, Oxford (2007).

Handwriting Identification and Recognition

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Handwriting Identification and Recognition	BSSE0202	Practice	0-2-0	Nil

Objective

- To understand the important features of handwriting identification and perform detection of document forgery or alteration.

1. Learning outcome

- Important features in handwriting identification.
- Basis of handwriting characteristics.
- Significance of forensic documentation.

Course outline

Module-I : Handwriting Identification (10hr)

Basis of handwriting identification. Characteristics of handwriting – scope and application. Class and individual characteristics. Arrangement, alignment, margin, slant, speed, pressure, spacing, line quality, embellishments, movement and pen lifts. Factors influencing handwriting – physical, mechanical, genetic and physiological.

Module-II : Handwriting Examination (08 hr)

Basis of handwriting comparison. Collection of handwriting samples. Forgery detection. Counterfeiting. Examination of altered and erased documents. Tools used in handwriting examination.

Module -III : Handwriting Recognition (06 hr)

Basis of handwriting recognition. Off-line and on-line handwriting recognition. Steps involved in handwriting recognition – pre-processing, feature extraction and classification. Applications of handwriting recognition.

Text Book:

1. O. Hilton, Scientific Examination of Questioned Documents, CRC Press, Boca Raton (1982).

Reference Book:

1. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, Foundation Press, New York (1995).
2. R.N. Morris, Forensic Handwriting Identification: Fundamental Concepts and Principles, Academic Press, London (2000).
3. E. David, The Scientific Examination of Documents – Methods and Techniques, 2nd Edition, Taylor & Francis, Hants (1997).
4. Z. Liu, J.H. Cai and R. Buse, Handwriting Recognition: Soft Computing and Probabilistic Approach (Volume 133), Springer Science and Business Media (2003).

Discipline Specific Elective

Digital Forensics

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Digital Forensics	DEFS0401	Theory & Practice	4-2-0	Computer science as one of the subject in 10+2 or any other equivalent subject

Objective

- To understand the basic concepts of digital forensics and types of digital forensics, malwares and investigation methods applied in such cases

Learning outcome

- The basics of digital forensics.
- The cases which fall under the purview of digital crimes.
- The types of digital crimes.
- The elements involved in investigation of digital crimes.

Course outline

Module I: (12 hrs)

Fundamentals and Concepts

Fundamentals of computers Hardware and accessories – development of hard disk, physical construction, CHS and LBA addressing, encoding methods and formats.
Memory and processor. Methods of storing data. Operating system. Software.
Introduction to network, LAN, WAN and MAN

Module II: (12 hrs)

Computer Crimes

Definition and types of computer crimes. Distinction between computer crimes and conventional crimes. Reasons for commission of computer crimes. Breaching security and operation of digital systems.
Computer virus, and computer worm – Trojan horse, trap door, super zapping, logic bombs.
Types of computer crimes – computer stalking, pornography, hacking, and crimes related to intellectual property rights, computer terrorism, hate speech, private and national security in cyber space.
An overview of hacking, spamming, phishing and stalking.

Module III: (15 hrs)

Computer Forensics Investigations

Seizure of suspected computer. Preparation required prior to seizure.
Protocol to be taken at the scene. Extraction of information from the hard disk.
Treatment of exhibits. Creating bitstream of the original media. Collection and seizure of magnetic media. Legal and privacy issues. Examining forensically sterile media. Restoration

of deleted files. Password cracking and E-mail tracking. Encryption and decryption methods. Tracking users.

Digital Forensics Lab

- To identify, seize and preserve digital evidence from crime scenes.
- To detect deletions, obliterations and modifications of files using encase software.
- To identify encrypted files.
- To identify hidden files.
- To use digital signatures for securing e-mail and online transactions.
- To acquire data from PCs/laptops/HDDs/USBs, pen drives, memory cards and SIM cards

Text Books:

1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, Computer Crimes and Computer Forensics, Select Publishers, New Delhi (2003).

Reference Books:

1. C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey (1997).
2. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
3. E. Casey, Digital Evidence and Computer Crime, Academic Press, London (2000).

Economic Offences

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Economic Offences	DEFS0402	Theory & Practice	4-2-0	Nil

Objective

- Introduction to terminologies related to economic offences, some common economic offences and its impact on society.

Learning outcome

- Basic economic and financial terminology.
- Economic crimes in India are linked to several other crimes.
- Economic crimes often have a bearing on national security.
- Types of common economic offences and their consequences.
- Steps involved in mitigating economic crimes.

Course outline

Module I: (12 hrs)

Taxonomy of Economic Offences/Criminogenic Factors

Fundamentals of economics in economic offences.

Tax evasion. Excise duty evasion. Fraudulent bankruptcy. White collar crime. Economic exclusion. Black money.

Corruption and bribery of public servants. Money laundering and hawala transactions.

Insurance frauds. Corporate frauds. Bank frauds. Ponzi scheme. Pyramid scheme.

Illicit trafficking in contraband goods. Illicit trafficking in arms. Illicit trafficking in explosives. Illicit drug trafficking. Trafficking in human organs. Cultural objects trafficking.

Racketeering in employment. Racketeering in false travel documents.

Module II: (10 hrs)

Applied Economics in Processing Evidence

Forensic accountancy and forensic auditing.

Valuation of economic losses. Violation of Intellectual Property Rights.

Module III: **(15 hrs)**

Prevention of Economic Offences

Legislations to deal with different forms of economic offences. RBI Act. SEBI Act. Competition Commission of India Act.
Credit card frauds.
Enforcement agencies to deal with different forms of economic offences.
International perspectives – measures adopted by FBI and INTERPOL.
Case histories of economic offences.

Economic Offences Lab

- To prepare a draft on fraudulent bankruptcy.
- To cite a case of money laundering and hawala transactions in India and prepare a note on it.
- To cite a case involving bank fraud and suggest measures to prevent such crimes.
- To study a case involving illicit drug trafficking and trace the route by which the item was being smuggled.
- To prepare a report on trafficking of heritage artefacts, including religious deities in India.

Text Books:

1. R.V. Clarke, Situational Crime Prevention: Successful Case Studies, 2nd Edition, Criminal Justice Press, New York (1997).
2. S.P. Green, Lying, Cheating and Stealing: A Moral Theory of White Collar Crime, Oxford University Press, Oxford (2006).

Reference Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. G. Geis, R. Meier, L. Salinger (Eds.), White-Collar Crime: Classic & Contemporary Views, Free Press, New York (1995).
3. J. Reiman, The Rich get Richer and the Poor get Prison, Allyn & Bacon, Boston (1998).
4. Indian Audit and Accounts department, Audit of Fraud, Fraud Detection and Forensic Audit, 2007.
5. State Crime Branch, Haryana, Investigation of Economic Offences.

Forensic Serology

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Forensic Serology	DEFS0403	Theory & Practice	4-2-0	Biology as one of the subjects in 10+2

Objective

- To gain knowledge about serological evidences and their importance in crucial cases and methods of their detection.

Learning outcome

- The significance of serological evidence.
- The importance of biological fluids – blood, urine, semen, saliva, sweat and milk – in crime investigations.
- The usefulness of genetic markers in forensic investigations.
- The forensic importance of bloodstain patterns

Course outline

Module I: **(12 hrs)**

Forensic Importance of Body fluids

Common body fluids. Composition and functions of blood. Collection and preservation of blood evidence. Distinction between human and non-human blood. Determination of blood groups. Antigens and antibodies.

Forensic characterization of bloodstains. Typing of dried stains. Blood enzymes and proteins. Semen. Forensic significance of semen. Composition, functions and morphology of spermatozoa. Collection, evaluation and tests for identification of semen. Individualization on the basis of semen examination.

Composition, functions and forensic significance of saliva, sweat, milk and urine. Tests for their identifications.

Module II: **(10 hrs)**

Genetic Marker Analysis

Cellular antigens. ABO blood groups.
Extracellular proteins and intracellular enzymes.
Significance of genetic marker typing data. Sexual assault investigations.

Module III: **(15 hrs)**

Bloodstain Pattern Analysis

Bloodstain characteristics. Impact bloodstain patterns. Cast-off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails. Bloodstain drying times. Documentation of bloodstain pattern evidence. Crime scene reconstruction with the aid of bloodstain pattern analysis.

Forensic Serology Lab

- To determine blood group from fresh blood samples.
- To determine blood group from dried blood sample.
- To carry out the crystal test on a blood sample.
- To identify blood samples by chemical tests.
- To identify the given stain as saliva.
- To identify the given stain as urine.

Text Books:

1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. T. Bevel and R.M. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).

Reference Books:

1. W.G. Eckert and S.H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton (1989).
2. G.T. Duncan and M.I. Tracey in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

Accident Investigations

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Accident investigations	DEFS0404	Theory & Practice	4-2-0	Nil

Objective

- To study methods of investigation in accidental cases, types of injuries in accidents, documentation, collection and preservation of evidences and their analysis.

Learning outcome

- The significance of tiremark evidence.
- The importance of air bags and photography of accident cases
- The usefulness of trace evidences in forensic investigations.

Course outline

Module I: (10 hrs)

Motor Vehicle Accidents

Accident scene. Sources of forensic information. Eyewitness accounts. Extent of vehicle damage. Visibility conditions. Photographs of accident site. Estimation of speed. Tire marks, skid marks, scuff marks. Maintenance of vehicles. Abandoned vehicles. Importance of air bags. Railway accidents.

Module II: (10 hrs)

Accident Analysis

Pre-crash movement. Post-crash movement. Collision model. Gauging driver's reaction. Occupants's kinematics. Types of injuries resulting from accident. Biomechanics of injuries. Hit and run investigations. Trace evidence at accident sites.

Module III: (15 hrs)

Tachographs

Forensic significance of tachograph data. Tachograph charts. Principles of chart analysis. Accuracy of speed record. Tire slip effects. Falsification and diagnostic signals. Route tracing.

Accident Investigations Lab

- To lift tire marks.
- To study the pattern of skid marks.
- To study the pattern of scuff marks.
- To estimate the speed of the vehicle from skid marks.
- To prepare a report on a major road accident.
- To prepare a report on a major train accident.

Text Books:

1. T.S. Ferry, Modern Accident Investigation and Analysis, Wiley, New York (1988).

Reference Books:

1. D. Lowe, The Tachograph, 2nd Edition, Kogan Page, London (1989).
2. T.L. Bohan and A.C. Damask, Forensic Accident Investigation: Motor Vehicles, Michie Butterworth, Charlottesville (1995).
3. S.C. Batterman and S.D. Batterman in Encyclopedia of Forensic Sciences, Volume 1, J.A. Siegel, P.J. Saukko and G.C. Knupfer (Eds.), Academic Press, London (2000).

DNA Forensics

Course Title	Code	Type of course	T-P-PJ	Prerequisite
DNA Forensics	DEFS0405	Theory & Practice	4-2-0	Biology as one of the subject in 10+2

Objective

- Understanding basic concepts of DNA Analysis, DNA Typing, STR markers

Learning outcome

- The basic principle of DNA analysis.
- The forensic significance of DNA typing.
- The importance of short tandem repeats and restriction fragment length polymorphism in DNA technique.
- d. Role of DNA typing in parentage testing

Course outline

Module I: (12 hrs)

Basic Principles

DNA as biological blueprint of life. Extraction of DNA for analysis.
Quantitation of DNA – yield gel quantitation and slot blot quantitation.
Mitochondrial DNA – sequence analysis.

Module II: (12 hrs)

Forensic DNA Typing

Collection of specimens. Polymerase chain reaction – historical perspective, sequence polymorphisms, individualization of evidence.
Short tandem repeats (STR) – role of fluorescent dyes, nature of STR loci.
Restriction fragment length polymorphism (RFLP) – genetic markers used in RFLP, typing procedure and interpretation of results.
Touch DNA.

Module III: **(10 hrs)**

Parentage Testing

Principles of heredity. Genetics of paternity. DNA testing in disputed paternity. Mandelian laws of parentage testing. Mathematical basis of parentage identification.
Missing body cases. Reference populations and databases.

Module IV: **(04 hrs)**

Report Writing: Role of DNA typing in identifying unrecognizable bodies.
Allele frequency determination. Hardy-Weinberg law. Probability determination in a population database.

DNA Forensics Lab

- To carry out the separation of amino acids by thin layer chromatography.
- To carry out extraction of DNA from body fluids.
- To preparation of gel plates for electrophoresis.
- To carry out electrophoresis for separation of enzymes.
- To prepare a report on the role of DNA typing in solving paternity disputes.

Text Books:

1. J.M. Butler, Forensic DNA Typing, Elsevier, Burlington (2005).
2. K. Inman and N. Rudin, An Introduction to Forensic DNA Analysis, CRC Press, Boca Raton (1997).

Reference Books:

1. H. Coleman and E. Swenson, DNA in the Courtroom: A Trial Watcher's Guide, GeneLex Corporation, Washington (1994).
2. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

Audio Recognition and Video Analysis

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Audio recognition and video analysis	DEFS0406	Theory & Practice	4-2-0	Knowledge about basic concepts of physics

Objective

- Role of voice in forensic investigations, understanding speaker recognition and identification and their analysis.

Learning outcome

- The basic principle of voice production.
- The forensic significance speaker identification and recognition.
- The importance of audio recording evidences
- Role various software in audio recognition and video analysis,

Course outline

Module I: (08 hrs)

Basic Principles

Introduction to voice identification/speaker recognition and its forensic importance, History of voice analysis, Voice production theory, uniqueness in person's voice.

Module II: (10 hrs)

Handling of audio recording evidences & its physical examination, marking of speakers, Procedure for preparation of working copies

Speech signal processing and pattern recognition, acoustic parameters of sound, analogue to digital conversion, Frequency and time domain representation of speech signal, fast Fourier transform,

Module III: (10 hrs)

CSL & Linear predictive coding technique, Gold wave analysis, Forensic Video analysis, establishing the authenticity of video recordings, Processing of video media.

Audio Recognition and Video Analysis Lab

- Recording , editing, processing of Audio file with protocols
- To convert of audio files using Goldwave v 5.63 software.
- To Segregate of Audio file with Goldwave v 5.63 softwares
- Collection and preservation of Given exhibit .

Text Books:

1. Philip Rose; Forensic Speaker Identification; Taylor and Francis Forensic Sciences Series, London

Reference Books:

1. Bengold& Nelson Morgan; Speech and Audio Signal Processing; John Wiley and Sons, USA
2. Ray D. Kent and Charles Read; Acoustic analysis of speech

Explosives Analysis & Post Blast Investigation

Subject Name	Code	Type of course	T-P-PJ	Prerequisite
Explosives Analysis & Post Blast Investigation	DEFS0407	Theory & Practice	4-2-0	Student should have knowledge regarding basic concepts of chemistry

Objective

- To study the protocols followed for analysis of explosives and get in depth knowledge about post blast investigations.

Learning outcome

- History and development of explosives.
- Processing of crime scene.
- Clandestine Laboratories.

Course outline

Module -I
Introduction- History and Development of explosives- Oxygen balance-Explosive power and power index-Temperature-Force and pressure of explosion-Kinetics of explosive reactions

Module –II
Classification of explosive materials-High explosives (Commercial and military)-Initiating Devices Safety fuse- Detonators-Pyro- technics-Propellants shattering

Module -III
Initiation techniques-Combustion and deflagration- Detonation-Thermal decomposition-Mechanics of explosions- The generation of shock wave, The effect of fragmentation

Module -IV
Processing of explosion scene of crime - Role of Forensic scientist in Post blast investigation-Documentation of bomb scene and Collection of post blast residues-Evaluation and assessment of explosion site and reconstruction of sequence of events-Famous case studies in explosion and court testimony

UNIT -V

Clandestine explosive manufacturing.

Analysis of Post blast residues by chemical methods, microscopic method and various instrumental techniques including chromatographic, spectroscopic and electrophoresis methods.

Explosives Analysis & Post Blast Investigation Lab

- Analysis of low explosives
- Analysis of high explosives

- Analysis of residues using various instrumental techniques.

Text Books:

1. Beveridge, A: Forensic Investigation of Explosives, Taylor & Francis, 2000

Reference books:

1. Yallop, H. J: Explosion Investigation, Forensic Science Society & Scottish Academic Press, 1980.
2. Narayanan, T. V: Modern Techniques of Bomb Detection and Disposal, R. A. Security System, 1995.
3. Yinon, J. and Zitrin, S: The Analysis of Explosives, Oxford: Pergamon, 1981
4. Yinon Jitrin; Modern Methods & Application In Analysis Of Explosives, John Wiley & Sons, England
5. Working Procedure Manual – Explosives
6. C.A. Watson; Official And Standardized Methods Of Analysis, Royal Society Of Chemistry, UK
7. Feigl; Spot Test In Inorganic Analysis, Elsevier Pub. New Delhi
8. Feigl; Spot Test In Organic Analysis, Elsevier Pub. New Delhi
9. Silverman; Organic Chemistry Of Drug Design & Drug Action, Elserier Pub. New Delhi

Quality Control and Quality Assurance

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Quality control and quality assurance	DEFS0408	Theory & Practice	4-2-0	Student should have knowledge regarding basic concepts of chemistry

Objective

- To study the various aspects of quality control and assurance aspects of pharmaceutical industries.
- Understanding of important parameters such as cGMP, QC tests, documentation, Quality certifications, GLP and regulatory affairs.

Learning outcome

- The cGMP aspects in a pharmaceutical industry
- Importance of documentation
- Scope of quality certifications applicable to Pharmaceutical industries
- Responsibilities of QA & QC departments.

Course Outline

Module I : Introduction **12 Hrs**

Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines.
Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines

Module II : **12 Hrs**

cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice.

Module III : **12 Hrs**

Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents.

Submission documents for regulators DMFs, as Common Technical Document and Electronic Common Technical Documentation (CTD, eCTD). Concept of regulated and non regulated markets.

Module IV : Manufacturing operations and controls 12 Hrs

Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of waste and scrap disposal.
Introduction, scope and importance of intellectual property rights. Concept of trade mark, copyright and patents.

Quality Control And Quality Assurance Lab

- Estimation of multi-drug component containing formulations by UV spectrophotometry.
- Case studies on
- ✓ Total Quality Management
- ✓ Six Sigma
- ✓ Change Management/ Change control. Deviations,
- ✓ Out of Specifications (OOS)
- ✓ Out of Trend (OOT)
- ✓ Corrective & Preventive Actions (CAPA)
- ✓ Deviations
- To study the effect of pH on the solubility of drugs.
- Quality control tests for Primary and secondary packaging materials.
- Improved solubility of drugs using surfactant systems.
- Improved solubility of drugs using co-solvency method.
- Determination of Pka and Log p of drugs.

Text Books:

1. Quality Assurance Guide by organization of Pharmaceutical Procedures of India, 3rd revised edition, Volume I & II, Mumbai, 1996.

Reference books:

1. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69, Marcel Dekker Series, 1995.
2. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2nd edition, WHO Publications, 1999.
3. How to Practice GMP's – P P Sharma, Vandana Publications, Agra, 1991.

Generic elective (GE)

(Subjects from other Disciplines)

One each in semester 1, 2, 3 and 4, to be chosen from the following:

1.	**Chemistry**
2.	**Physics**
3.	**Zoology**
4.	**Botany**