

STUDY & EVALUATION SCHEMES
OF
BACHELOR OF SCIENCE IN FORENSIC SCIENCE
(BFS)
(BFS- IV-SEMESTER)

[Applicable w.e.f. Academic Session 2020-21]



INTEGRAL UNIVERSITY, LUCKNOW
DASAULI, P.O. BAS-HA KURSI ROAD, LUCKNOW – 226026

Website: www.iul.ac.in

Syllabus approved by Board of Study, Faculty Board, Academic Council,
Executive Council of the Integral University, Lucknow

INTEGRAL UNIVERSITY, LUCKNOW
INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH
DEPARTMENT OF PARAMEDICAL & HEALTH SCIENCES

STUDY & EVALUATION SCHEME
BACHELOR OF SCIENCE IN FORENSIC SCIENCE (BFS)
(w.e.f. July 2020)

II-Year

IV-Semester

S. No.	Code	Name of the Subject	Periods			Cred its	Evaluation Scheme				Subject Total
			L	T	P		Sessional		Exam		
							CT	TA	Tot al	ESE	
1.	FS 209	Forensic Anthropology	3	1	0	4	40	20	60	40	100
2.	CH227	Forensic Chemistry-II	3	1	0	4	40	20	60	40	100
3.	FS210	Forensic Physics-II	2	1	0	3	40	20	60	40	100
4.	FS211	Forensic Biology-II	2	1	0	3	40	20	60	40	100
5.	FS212	Digital and Cyber Forensic- I	2	1	0	3	40	20	60	40	100
6.	FS213	Quality management in Laboratory	2	1	0	3	40	20	60	40	100
7.	FS214	Forensic Anthropology-Lab	0	0	2	1	40	20	60	40	100
8.	CH228	Forensic Chemistry-II- Lab	0	0	2	1	40	20	60	40	100
9.	FS215	Forensic Physics II-Lab	0	0	2	1	40	20	60	40	100
10.	FS216	Forensic Biology –II- Lab	0	0	2	1	40	20	60	40	100
11	FS217	Digital and cyber forensic –I -Lab	0	0	2	1	40	20	60	40	100
		Total	14	06	10	25	440	220	660	440	1100

L: Lecture

T: Tutorials

P: Practical

C: Credit

CT: Class Test

TA: Teacher Assessment

ESE: End Semester Examination

Sessional Total: Class Test + Teacher Assessment

Subject Total: Sessional Total + End Semester Examination (ESE)

Subject- FORENSIC ANTHROPOLOGY

Subject Code- FS209

Learning Objectives: Forensic Anthropology is best described as the analysis of human remains for the medico legal purposes of establishing identity.

Unit-I

DEATH INVESTIGATIONS-

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

Unit-II

Forensic Odontology-Development, and role of forensic odontology in mass disaster
Types of teeth and their comparative anatomy. Estimation of age from teeth

Bite marks- Introduction, Forensic significance of bite marks. Collection, preservation and photography of bite marks evidence. Legal aspects of bite marks.

Unit-III

Personal Identification – Somatoscopy

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.

Unit-IV

Personal Identification –Somatometry

Somatometry – measurements of head, face, nose, cheek, ear, hand and foot, body weight, height. Indices - cephalic index, nasal index, cranial index, upper facial index.

Unit-V

Facial Reconstruction - 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.

Learning outcome: After studying this paper the students will know –

1. Importance of forensic anthropology *in* recovery of skeletal elements (surface, buried).
2. Assessments of species, ancestry, sex, age, physical characteristics and time since death
3. Different techniques of facial reconstruction and their forensic importance.
4. Significance of somatoscopy and somatometry.
5. The importance of forensic odontology in determining age of deceased and bite mark analysis.

SUGGESTED READINGS:

- 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).
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).
 3. Introduction to Forensic Anthropology, Steven N. Byers, Pearson/ Allyn & Bacon; 3rd edition edition (December 1, 2008)
 4. Forensic Anthropology Laboratory Manual, Steven N. Byers, Pearson Education, USA, 2011.
 5. Forensic Anthropology: Current Methods and Practice, Angi M. Academic Press; 1st edition (5 March 2014)
 6. Christensen, Nicholas V. Passalacqua and Eric J. Bartelink, Academic Press, USA, 2014.

Subject- FORENSIC CHEMISTRY-II

Subject Code- CH227

Learning Objectives: Understand and to appreciate the breadth and diversity of analytical science in respect of forensic science.

Unit-I

Petroleum and Petroleum Products- Commercial uses of different petroleum fractions. Analysis of traces of petroleum products in forensic exhibits. Adulteration of petroleum products.

Unit-II

Arson and Fire: Chemistry of fire, difference between Arson and Fire, cause of fire and origin of fire Material and Chemicals use in initiating fire and arson Examination of scene of fire/arson, recognition and collection of evidence, packing labelling and forwarding of exhibits, and forensic detection of arson cases.

Unit-III

Study of Analysis of Beverages-

Introduction, Definition of alcohol and illicit liquor, Alcoholic and non-alcoholic beverages and their composition, Proof spirit, absorption, detoxication and excretion of alcohol, problems in alcohol cases and difficulties in diagnosis, Alcohol and prohibition, Consequences of drunken driving, Analytical techniques used for the analysis of alcohol.

Unit-IV

Food adulteration: Introduction, Prevention of food adulteration, Analytical techniques for analysis of exhibits involved in food and other material.

Unit-V

Miscellaneous

Characteristics, examination and legal aspects of gold, silver, sugar, salts, fertilizers, Detective dyes- cases and importance in trap cases.

Learning Outcomes: After studying this paper the students will know –

1. The methods of analyzing trace amounts of petroleum products in crime scene evidence.
2. The method of searching, collecting, preserving and analyzing arson evidence. The classification of Alcoholic Beverages, and forensic analysis and their relation with law.
3. The significance of food adulteration analysis regarding their geographic origin.

SUGGESTED READING

1. Saferstein, R; Forensic Science Handbook. Vol. I, II, (Ed.), Prentice Hall, New Jersey, 1988.
2. Working Procedure Manual; Chemistry BPR&D Publication, 2000.
3. Sharma, B.R; Forensic Science in Criminal Investigation and Trials (3rd Ed.), Universal Law Publishing Co., New Delhi, 2001.
4. J.D. DeHaan, *Kirk's Fire Investigation*, 3rd Edition, Prentice Hall, New Jersey (1991).
5. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).
6. 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).

Subject- FORENSIC PHYSICS-II

Subject Code- FS210

Learning Objectives: The student will develop an understanding and importance of Physics in Forensic Science.

Unit-I

TOOL MARKS- Types of tool marks- compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks, Photographic examination of tool marks and cut marks on clothes and walls etc.

Unit-II

Impressions: Foot/Footwear/Tyre Impression, Collection, Tracing, Lifting, Casting of impressions, Enhancement of Footwear Impression, Analysis & comparison of foot impressions, Moulds, Gait Pattern and Identification characteristics.

Unit-III

Forensic Photography-Basic principles of Photography, Techniques of black & white and colour photography, cameras, lenses, shutters, depth of field, film; exposing, development and printing techniques; Different kinds of developers and fixers; UV, IR, fluorescence illumination guided photography; Modern development in photography- digital photography, working and basic principles of digital photography; Surveillance photography. Videography and Crime Scene &laboratory photography.

Unit- IV

Restoration of erased / obliterated marks- Method of making-cast, punch, engrave; methods of obliteration, method of restoration- etching (etchings for different metals), magnetic, electrolytic etc., recording of restored marks – restoration of marks on wood, leather, polymer etc.

UNIT -V

Principles, Working and Applications in Forensic Science

1. Electrostatic Dust Lifting Kit (DLK)
2. LUMA light
3. Video Spectral Comparator(VSC)
4. Electrostatic Developing Apparatus(ESDA)

Learning Outcomes: After studying this paper the students will know –

1. The methods of casting and impression tool marks in crime scene evidence.
2. The method of searching, collecting, preserving and analyzing photography evidence.
3. The analysis of erased numbers in identification of stolen vehicles etc.
4. The significance of portable forensic kit at crime scene.

SUGGESTED READINGS:

1. Houck, M.M& Siegel, J.A; Fundamentals of Forensic Science, Academic Press, London, 2ⁿ d Edit io n 2010
2. Sharma, B.R; Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi, Fifth edition 2016.
3. Nanda B.B and Tewari, R.K; Forensic Science in India- A vision for the Twenty First Century, Select Publisher, New Delhi, Select publishers (2014)
4. Robertson and Vignaux; Interpreting Evidence, John Wiley, New York, 1995.
5. H.L. Blitzer and J.Jacobia; Forensic Digital Imaging and Photography, 1st Edition Academic Press, London, 2002
6. Forensic Medical Investigation of Motor Vehicle Incidence By Michel P. Burke,CRC Press ,2016.

Subject- FORENSIC BIOLOGY-II

Subject Code- FS211

Learning Objectives: To demonstrate theoretical and practical training in different branches of Forensic Biology and their role in crime scene investigation.

Unit-I

Forensic Entomology -Basics of forensic entomology. Insects of forensic importance. Collection of entomological evidence during death investigations, Determining the age of blow fly life cycle stages Determination of PMI

Unit-II

1. **Forensic Botany:** botanical evidence encounter in forensic investigation. Forensic analysis of pollen grains, algae. Investigation of ornamental, imported, stolen, endangered plants.
2. **Dendrography** (sandal, teak, red sandal wood).
3. **Limnology** (collection of diatoms from drowned body, collection of control sample, extraction, digestion, examination, comparison and identification.
4. **Dendrochronology**, Application of plant ecology

Unit-III

Wildlife Forensics---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.

Unit-IV

Microbial Forensic ---Types and identification of microbial organisms of forensic significance. Identification of wood, leaves, pollens and juices as botanical evidence. Diatoms and their forensic significance. Bioterrorism

Unit-V

Forensic ornithology: Birds flight and means of locomotion, Strikes and collisions, Quarantine issues, Crime Scenes, Confiscated Bird Goods, Anthropological Arte facts, Applications of Forensic Ornithology, Feather structure and topography.

Learning Outcomes : After studying this paper the students will know –

1. The significance of various Botanical evidences in different crimes scene.
2. The forensic importance of Microbial Forensic.
3. The importance of forensic ornithology
4. How wildlife forensics aid in conserving natural resources.
5. How forensic entomology assists in death investigations.

SUGGESTED READING:

1. Forensic Biology by Richard Li CRC Press; 2 edition (27 April 2015)
2. A textbook of Medical jurisprudence and toxicology- Modi Lexis Nexis; First edition (22 April 2016)
3. Wildlife forensic investigation-Principles and practice: Cooper and Cooper, CRC press ,2013
4. Forensic Palynology in the United States of America (1990)- Bryant, V.M. Jr, Mildenhall, D.C. and Jones, J.G.14.PP.193-208
5. Microbial forensics -Roger Breeze, Bruce Budowle, Steven E. Schutzer, Elsevier

Subject- DIGITAL & CYBER FORENSIC-I

Subject Code- FS212

Learning Objectives: To provide insight of cyber forensic investigation and technical issues related to it. To learn about cyber security tools, possible security issues, cyber attacks and concealment techniques.

Unit- I

Cyber Forensics Investigation—Introduction to Cyber Forensic Investigation, Investigation Tools, Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers, Recovering deleted evidences, Password Cracking.

Unit-II

Technical issues – Security Technologies: Certification and key Distribution, Digital Signature Protocols for Transactions, SSLSecure Socket Layer, SET-Secure Electronic Transaction

Unit-III

Security Issues –Types of Attacks(Active and Passive) Stealing Passwords, Social Engineering, Bugs and Backdoors, Illegal accessing, Authentication Failures, Protocol Failures, Information Leakage, Viruses and Worms, Denial-of-Service, etc. – Firewalls, Packet Filters, Application-Level Filtering, Circuit- Level Gateways, Dynamic Packet Filters, Distributed Firewalls; Digging for Worms, Packet Filtering, Implementing policies (Default allow, Default Deny) on proxy, etc.

Unit-IV

Introduction to Cyber Security, Implementing Hardware Based Security, Software Based Firewalls, Security Standards, Threats, crimes, etc.; Why require a security? Picking a Security Policy, Strategies for a Secure Network, The Ethics of Computer Security, Security Threats, and levels, Security Plan (RFC 2196)

Unit-V

Cryptography Techniques

Introduction to Cryptography, Types of Cryptographic Algorithms(Secret Key Cryptography, Public Key Cryptography, Hash Function),Electronic Signature, Stegnography, Reversing the Stegnographic Process, Manipulating File System, Data Hiding on NTFS with Alternate data Streams.

Learning Outcomes: After studying this paper the students will know –

1. The significance of cyber forensic investigation process and when to conduct it.
2. The technical issues related to cyber forensic investigation.
3. The importance of cyber security and potential network threats.
4. Designing and implementation of security policies using software and hardware tools.
5. Importance of cryptography for data hiding.

SUGGESTED READINGS:

1. File System Forensic Analysis by Brian Carrier, Publisher: Addison-Wesley Professional
2. Cyber Law & Crimes (IT Act 2000 & Computer Crime Analysis) by Barkha & Ram Mohan, Publisher: Asian Law House, Hyderabad
3. Firewalls and Internet Security: Repelling the Wily Hacker , Second Edition ,Addison
4. E-Commerce: The Cutting Edge of Business by Kamlesh K. Bajaj & Debjani Nag, TataMcGraw Hill
5. Cyberlaw Simplified Vivek Sood, TMG
6. TataMcGraw Hill Reference Cyber Law and E-Commerce, David Baumer, J C Poindexter, TMG.

Subject- QUALITY MANAGEMENT IN LABORATORIES

Subject Code- FS213

Learning Objective The Objective of this course is to introduce the students with the Quality management system and requirements for the competence of testing and calibration, the technical requirements needed in a laboratory.

Unit- I

Quality Management (ISO/IEC 17025) General requirements for the competence of testing and calibration laboratories, Introduction, Scope, Management requirements: organization, Quality System, Document Control, Test and calibration methods and methods validation, Equipment, measurement traceability, Sampling, Handling of test and calibration items, Assuring the quality of test calibration results and reporting the results.

Unit- II

Laboratory Management, Laboratory information management system, validation and safety equipments.

Unit- III

Accreditation and certification - Accreditation and certification bodies- NABL, ISO, IEC, BIS, ASCLD/LAB, ABC, IAI

Unit- IV

Report Writing and Evidence Evaluation, Components of reports and Report formants in respect of Crime Scene and Laboratory findings. Court Testimony- admissibility of expert testimony, pre Court preparations & Court appearance, Examination in chief, cross examination and re examination, Ethics in Forensic Science.

Unit- V

Cases of Special Importance, Pertaining to forensic examination (Biology, serology, chemistry, toxicology) documents, fingerprints, ballistics, photography and physics, Voice identifications, Tape authentication & Computer frauds pertaining to forensic examination of cases.

Learning Outcome:

Upon completion of this course, graduates are able to describe the importance of total quality management system and the technical requirements required for a forensic science laboratory

SUGGESTED READINGS:

1. International Standard on General requirements for the competence of testing and calibration laboratories, 1st Ed., 1999-12-15, ISO/IEC 17025:1999(E).
2. Crime Laboratory by Osterburg.
3. William L. Duncan: Total Quality, Key Terms and Concepts.
4. Murray S. Cooper: Quality control in the Pharmaceutical Industry.
5. John T. Rabbitt, Peter A Bergh: The ISO 9000 Book.
6. NABL -113
7. NABL -113A

Subject- FORENSIC ANTHROPOLOGY- LAB

Subject Code- FS214

1. To determine of age and race from skull and teeth.
2. To determine of sex from skull.
3. To determine sex from pelvis.
4. To study identification and description of bones and their measurements.
5. To investigate the differences between animal and human bones.
6. To estimate stature from long bone length.
7. *To perform somatometric measurements on living subjects.*
8. *To carry out craniometric measurements of human skull.*
9. *To estimate stature from long bone length.*

SUGGESTED READINGS:

- 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).
7. D. Ubelaker and H. Scammell, *Bones*, M. Evans & Co., New York (2000).
 8. S. Rhine, *Bone Voyage: A Journey in Forensic Anthropology*, University of Mexico Press, Mexico (1998).
 9. Introduction to Forensic Anthropology, Steven N. Byers, Pearson/ Allyn & Bacon; 3rd edition edition (December 1, 2008)
 10. Forensic Anthropology Laboratory Manual, Steven N. Byers, Pearson Education, USA, 2011.

Subject- FORENSIC CHEMISTRY-II LAB

Subject Code- CH228

1. Analysis of residue material in fire and arson cases by TLC/, UV-spectrophotometric
2. Examination of chemicals used in Trap cases by UV-visible spectroscopy.
3. To carry out analysis of petroleum products.
4. To analyze arson accelerators.
5. To prepare a case report on a case involving arson
6. Identification of food adulteration.-vegetable oil, Cold drinks etc
7. Detection and determination of various adulterants in alcohol, by colour tests.
8. To identify ethyl / methyl alcohol.
9. Thin layer chromatography of Food adulterants

SUGGESTED READING

1. Saferstein, R; Forensic Science Handbook. Vol. I, II, (Ed.), Prentice Hall, New Jersey, 1988.
2. Working Procedure Manual; Chemistry BPR&D Publication, 2000.
3. Sharma, B.R; Forensic Science in Criminal Investigation and Trials (3rd Ed.), Universal Law Publishing Co., New Delhi, 2001.
4. J.D. DeHaan, *Kirk's Fire Investigation*, 3rd Edition, Prentice Hall, New Jersey (1991).
5. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).
6. 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).

Subject- FORENSIC PHYSICS- II

Subject Code- FS215

1. Restoration techniques of tool mark impressions and casting footprints.
2. To identify and compare tool marks. To take photographs using different filters.
3. To take photographs of crime scene exhibits at different angles.
4. To record videography of a crime scene
5. To carry out photography of indoor and outdoor crime scenes
6. Crime scene photographic processing and development in different light sources and using different filters.
7. To compare glass samples by refractive index method.

SUGGESTED READINGS:

1. Houck, M.M& Siegel, J.A; Fundamentals of Forensic Science, Academic Press, London, 2ⁿ^d Edit io n2010
2. Sharma, B.R; Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi, Fifth edition 2016.
3. Nanda B.B and Tewari, R.K; Forensic Science in India- A vision for the Twenty First Century, Select Publisher, New Delhi, Select publishers (2014)
4. Robertson and Vignaux; Interpreting Evidence, John Wiley, New York, 1995.
5. H.L. Blitzer and J.Jacobia; Forensic Digital Imaging and Photography,¹st Edition Academic Press, London, 2002
6. Forensic Medical Investigation of Motor Vehicle Incidence By Michel P. Burke,CRC Press ,2016.

Subject- FORENSIC BIOLOGY-II Lab

Subject Code- FS216

1. Identification and culture of bacteria of forensic significance.
2. Identification of birds from feathers.
3. Identification of orders of insects and other arthropods of forensic significance
4. To carry out microscopic examination of pollen grains.
5. To carry out microscopic examination of diatoms.
6. To cite a crime case in which diatoms have served as forensic evidence.
7. To prepare a case report on forensic entomology.
8. To prepare a case report on problems of wildlife forensics.
Identification of wild life materials, teeth, flowers and such as skin, fur, bones, nails, horn plant.

SUGGESTED READINGS:

1. Houck, M.M& Siegel, J.A; Fundamentals of Forensic Science, Academic Press, London, 2ⁿd Edit io n2010
2. Sharma, B.R; Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi, Fifth edition 2016.
3. Nanda B.B and Tewari, R.K; Forensic Science in India- A vision for the Twenty First Century, Select Publisher, New Delhi, Select publishers (2014)
4. Robertson and Vignaux; Interpreting Evidence, John Wiley, New York, 1995.

Subject- DIGITAL & CYBER FORENSIC-I Lab

Subject Code- FS217

1. Identification, Seizure, Search of Digital media
2. Evidence Collection
3. Demonstration of various Forensic tools like Partition magic, Encase etc.
4. Data Recovery, Deleted File Recovery viewing small Disk.
5. Demonstration of Concealment Techniques (Cryptography PGP)
6. Demonstration of Concealment Techniques (Steganography)
7. Demonstration of other Concealment Techniques
8. Case study of Biometric Techniques.

SUGGESTED READINGS:

1. File System Forensic Analysis by Brian Carrier, Publisher: Addison-Wesley Professional
2. Cyber Law & Crimes (IT Act 2000 & Computer Crime Analysis) by Barkha & Ram Mohan, Publisher: Asian Law House, Hyderabad
3. Firewalls and Internet Security: Repelling the Wily Hacker , Second Edition ,Addison
4. E-Commerce: The Cutting Edge of Business by Kamlesh K. Bajaj & Debjani Nag, TataMcGraw Hill
5. Cyberlaw Simplified Vivek Soo