

National Forensic Sciences University

An Institution of National Importance
(Ministry of Home Affairs, Government of India)
Gujarat Campus
Sector - 9, Gandhinagar, Gujarat - 382007



School of Forensic Science

B.Sc.-M.Sc. Forensic Science (Integrated) Program

(Syllabus, Teaching & Evaluation Schemes)
(W.E.F. Academic Year 2025-26)

Teaching Scheme

Semester I

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSC-MJ-101	Introduction to Forensic Science	Major1	3	0	0	3	3
2.	BSC-MJ-102	Crime Scene Management & Criminal Profiling	Major2	3	0	0	3	3
3.	BSC-MN-103	General Chemistry-I	Minor1	3	0	0	3	3
4.	BSC-MN-104	General Physics-I	Minor2	3	0	0	3	3
5.	BSC-AE-105	English Language Skills -I	AEC1	2	0	0	2	2
6.	BSC-SE-106	Basics of computers	SEC1	2	0	0	2	2
7.	BSC-VA-107	Environmental Studies	VAC1	2	0	0	2	2
8.	BSC-PR-108	Practical-I	Major3	0	0	8	4	8
Total Credit & Total Credit Hours							22	26

Semester II

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSC-MJ-201	Criminal and Evidence Law	Major4	3	0	0	3	3
2.	BSC-MJ-202	Fingerprint Science	Major5	3	0	0	3	3
3.	BSC-MN-203	General Biology-I	Minor3	3	0	0	3	3
4.	BSC-MN-204	General Physics-II	Minor4	3	0	0	3	3
5.	BSC-AE-205	English Language Skills -II	AEC2	2	0	0	2	2
6.	BSC-SE-206	Financial Literacy	SEC2	3	0	0	3	3
7.	BSC-VA-207	Indian Knowledge System	VAC2	2	0	0	2	2
8.	BSC-PR-208	Practical-II	Major6	0	0	6	3	6
Total Credit & Total Credit Hours							22	25

*Exit Policy at the end of 1st year (2-semesters): Students who opt to exit after completion of the first year and have secured 40 credits will be awarded a UG certificate provided, in addition, they complete one vocational course of 4 credits during the summer vacation 8-weeks) of the first year.



Semester III

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSC-MJ-301	Forensic Psychology	Major7	3	0	0	3	3
2.	BSC-MJ-302	Question Documents	Major8	3	0	0	3	3
3.	BSC-MN-303	General Chemistry-II	Minor5	3	0	0	3	3
4.	BSC-MN-304	General Biology-II	Minor6	3	0	0	3	3
5.	BSC-AE-305	Communication Skills	AEC3	2	0	0	2	2
6.	BSC-SE-306	Cyber Defence	SEC3	2	0	0	2	2
7.	BSC-VA-307	Yoga and Its benefits	VAC3	2	0	0	2	2
8.	BSC-PR-308	Practical-III	Major9	0	0	8	4	8
Total credit & Total Credit Hours							22	26

Semester IV

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSC-MJ-401	Fundamentals of Forensic Toxicology	Major10	3	0	0	3	3
2.	BSC-MJ-402	Forensic Physics	Major11	3	0	0	3	3
3.	BSC-MJ-403	Forensic Biology and Wildlife Forensics	Major12	3	0	0	3	3
4.	BSC-MN-404	Forensic Medicine	Minor7	3	0	0	3	3
Core Elective-I								
5.	BSC-EL1-405	Multimedia Forensics	Multidisciplinary1	2	0	0	2	2
	BSC-EL2-405	Immunology & Immunological Techniques						
6.	BSC-AE-406	Scientific Communication Skills	AEC4	2	0	0	2	2
7.	BSC-SE-407	Entrepreneurship	SEC4	2	0	0	2	2
8.	BSC-PR-408	Practical-IV	Major13	0	0	8	4	8
Total Credit & Total Credit Hours							22	26

***Exit Policy at the end of 2nd year (4-semesters):** Students who opt to exit after completion of the second year (4-semesters) and have secured 80 credits will be awarded the UG diploma provided, in addition, they complete one vocational course of 4 credits during the summer vacation (8-weeks) of the second year.

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Semester V								
Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSC-MJ-501	Digital Forensics and Cyber Law	Major14	3	1	0	4	4
2.	BSC-MJ-502	Forensic Chemistry	Major15	3	1	0	4	4
3.	BSC-MN-503	Forensic Anthropology	Minor8	3	0	0	3	3
4.	BSC-MN-504	Instrumental Techniques - I	Minor9	3	1	0	4	4
5.	Core Elective-II		Multidisciplinary2	2	0	0	2	2
	BSC-EL3-505	Incident Response Management						
	BSC-EL4-505	Forensic Statistics	Multidisciplinary3	2	0	0	2	2
6.	BSC-MD-506	Internship						
7.	BSC-PR-507	Practical-V	Major16	0	0	6	3	6
Total Credit & Total Credit Hours							22	26

Semester VI								
Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSC-MJ-601	Forensic Ballistics	Major17	3	1	0	4	4
2.	BSC-MJ-602	Basics of Immunology and Forensic Serology	Major18	3	1	0	4	4
3.	BSC-MN-603	Instrumental Techniques - II	Minor10	3	1	0	4	4
4.	BSC-MD-604	Information Security Audit and Compliance	Multidisciplinary4	3	1	0	4	4
5.	Core Elective-III		Multidisciplinary5	2	0	0	2	2
	BSC-EL5-605	Forensic DNA Analysis						
	BSC-EL6-605	Data Science & Artificial Intelligence						
6.	BSC-PR-606	Practical-VI	Major19	0	0	8	4	8
Total Credit & Total Credit Hours							22	26

Exit Policy at the end of 3rd year (6-semesters): Students who wish to undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 120 credits and satisfying the minimum credit requirement as given in Table 2, provided, in addition, they complete a **compulsory internship of 2-credits in Government organizations/Private companies/Industries/PSU Firms/Organizations/Offices as prescribed by the school during the summer vacation (8-weeks) of the "second/third year".*



SEMESTER -VII

Specialization-I: Forensic Physics and Ballistics

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSHN-SP1-MJ-701	Lasers & Spectroscopy	Major20	3	1	0	4	4
2.	BSHN-SP1-MJ-702	Advancement in Forensic Ballistics and Armour Material	Major21	3	1	0	4	4
3.	BSHN-SP1-MJ-703	Audio and Video Analysis	Major22	3	1	0	4	4
4.	BSHN-SP1-MN-704	Research Methodology	Minor11	3	1	0	4	4
5.	Core Elective-IV (Table1)		Multidisciplinary6	2	0	0	2	2
6.	BSHN-SP1-PR-706	Practical-VII	Major23	0	0	6	3	6
Total Credit & Total Credit Hours							21	24

SEMESTER -VII

Specialization-II: Fingerprints and Questioned Documents

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSHN-SP2-MJ-701	Advanced Fingerprint Technologies	Major20	3	1	0	4	4
2.	BSHN-SP2-MJ-702	Advances in Forensic Documents Examination	Major21	3	1	0	4	4
3.	BSHN-SP2-MJ-703	Forensic Accounting and Auditing	Major22	3	1	0	4	4
4.	BSHN-SP2-MN-704	Research Methodology	Minor11	3	1	0	4	4
5.	Core Elective-IV (Table1)		Multidisciplinary7	2	0	0	2	2
6.	BSHN-SP2-PR-706	Practical-VII	Major23	0	0	6	3	6
Total Credit & Total Credit Hours							21	24

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SEMESTER -VII

Specialization-III: Forensic Chemistry and Toxicology

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSHN-SP3-MJ-701	Forensic Pharmacy and Pharmacology of Controlled Drugs	Major20	3	1	0	4	4
2.	BSHN-SP3-MJ-702	Advanced Forensic Toxicology	Major21	3	1	0	4	4
3.	BSHN-SP3-MJ-703	Modern and Applied Analytical Forensic Chemistry	Major22	3	1	0	4	4
4.	BSHN-SP3-MN-704	Research Methodology	Minor11	3	1	0	4	4
5.	Core Elective-IV (Table1)		Multidisciplinary8	2	0	0	2	2
6.	BSHN-SP3-PR-706	Practical-VII	Major23	0	0	6	3	6
Total Credit & Total Credit Hours							21	24

SEMESTER -VII

Specialization-IV: Forensic Biology and Biotechnology

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSHN-SP4-MJ-701	Fundamentals of Biological Chemistry	Major20	3	1	0	4	4
2.	BSHN-SP4-MJ-702	Molecular Biology and rDNA technology	Major21	3	1	0	4	4
3.	BSHN-SP4-MJ-703	Forensics Genomics and DNA Profiling	Major22	3	1	0	4	4
4.	BSHN-SP4-MN-704	Research Methodology	Minor11	3	1	0	4	4
5.	Core Elective-IV (Table1)		Multidisciplinary9	2	0	0	2	2
6.	BSHN-SP4-PR-706	Practical-VII	Major23	0	0	6	3	6
Total Credit & Total Credit Hours							21	24



SEMESTER -VII

Specialization-V: Cyber Forensics

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1.	BSHN-SP5-MJ-701	Advanced Digital Forensics	Major20	3	1	0	4	4
2.	BSHN-SP5-MJ-702	Mobile and Network Forensics	Major21	3	1	0	4	4
3.	BSHN-SP5-MJ-703	Vulnerability Assessment and Penetration Testing	Major22	3	1	0	4	4
4.	BSHN-SP5-MN-704	Research Methodology	Minor11	3	1	0	4	4
5.	Core Elective-IV (Table1)		Multidisciplinary10	2	0	0	2	2
6.	BSHN-SP5-PR-706	Practical-VII	Major23	0	0	6	3	6
Total Credit & Total Credit Hours							21	24

Semester-VIII

Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
	BSHN-DS-801 [OR]	Dissertation [OR]	NA	0		24	12	24
1.	1) BSHN-MD-801 2) BSHN-MD-802 3) BSHN-MD-803	1) Disaster Victim Management 2) Ethics in Research & publication 3) Forensic Journalism	Multidisciplinary1 Multidisciplinary1 Multidisciplinary1	3 3 3	1 1 1		4 4 4	4 4 4
2.	BSHN-MJ-804	Research proposal writing	Major24	3	1		4	4
3.	BSHN-MN-805	IPR, copyright & Patents	Minor12	3	1		4	4
Total Credit & Total Credit Hours							20	32 OR 20

*Starting from semester VIII, courses will primarily be offered through the MOOC/NPTEL/SWAYAM portals. However, if no relevant courses are available on these platforms at the beginning of the semester, the school will conduct the courses online.

Semester-IX								
Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1	BSMS-MJ-901	Ethics in Science Education and Research	Major25	3	1	0	4	4
2	BSMS-DS-902	Dissertation	NA	0	0	36	18	36
Total Credit & Total Credit Hours								22 40

Semester-X								
Sr. No.	Course Code	Course Name	Category	L	T	P	C	TCH
1	BSMS-IN-1001	Internship at Forensic Science Laboratory	NA	0	0	40	20	40
Total Credit & Total Credit Hours								20 40

Table1: List of Core Electives for Semester VII

Sr. No.	Course Code	Course Name	L	T	P	Credits
1.	BSHN-EL7-705	CCTV Forensics	2	0	0	2
2.	BSHN-EL8-705	Accident Investigations	2	0	0	2
3.	BSHN-EL9-705	Forensic Photography	2	0	0	2
4.	BSHN-EL10-705	Forensic Linguistics	2	0	0	2
5.	BSHN-EL11-705	Anti-dope Forensics	2	0	0	2
6.	BSHN-EL12-705	Clinical Toxicology	2	0	0	2
7.	BSHN-EL13-705	Nano-Biotechnology	2	0	0	2
8.	BSHN-EL14-705	Forensic Proteomics	2	0	0	2
9.	BSHN-EL15-705	Applied Cryptography	2	0	0	2
10.	BSHN-EL16-705	Drone Forensics	2	0	0	2



Table2: List of Ability Enhancement Courses (AEC) for semester I to IV

Sr. No.	List of Ability Enhancement Courses (AEC)		
	Course Code	Course Name	Credits
1.	BSC-AE-105	English Language Skills-I	2
2.	BSC-AE-205	English Language Skills-II	2
3.	BSC-AE-305	Communication Skills	2
4.	BSC-AE-406	Scientific Communication Skills	2

Table3: List of Skill Enhancement Courses (SEC) for semester I to IV

Sr. No.	List of Skill Enhancement Courses (SEC)		
	Course Code	Course Name	Credits
1.	BSC-SE-106	Basics of computers	2
2.	BSC-SE-206	Financial Literacy	2
3.	BSC-SE-306	Cyber Defence	2
4.	BSC-SE-407	Entrepreneurship	2

Table4: List of Value-Added Courses (VAC) for semester I to III

Sr. No.	List of Value-Added Courses (VAC)		
	Course Code	Course Name	Credits
1.	BSC-VA-107	Environmental Studies	2
2.	BSC-VA-207	Indian Knowledge System	2
3.	BSC-VA-307	Yoga and Its benefits	2

Total Credits: 215

L: Lecture, T: Tutorial, P: Practical, TCH: Total Credit Hours

1 C = 1 Hour of Lecture / Tutorial, 1 C = 2 Hours of Practical / Project.

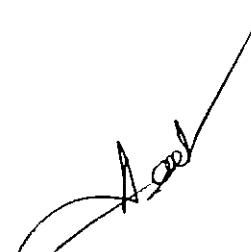
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Syllabus



Semester-I

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BSC-MJ-101: Introduction to Forensic Science

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme									
L	T	P	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
Marks	Hrs	Marks	Hrs											
3	0	0	3	3	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objective: The objectives of this course are to introduce students with:

1. Fundamental knowledge of the history, developments, and basic principles of Forensic Science.
2. Functional aspects of Forensic science and organizational setup of various institutes associated with Forensic investigation.

Learning Outcome: By the end of this course students will be able to:

1. Gain basic understanding of Forensic Science, its basic principles, and Scopes.
2. Understand the functioning, tools-techniques used in Forensic Science.
3. Learn and understand the various academic institutions and government agencies involved in criminal investigations, its organizational setup functioning and collaboration to international agencies.

MODULE-1 History and Basic principles of Forensic Science Teaching Hours: 15 Hours

History of Development of Forensic Science in India. Functions of forensic science. Historical aspects of forensic science. Definitions and concepts in Forensic Sciences. Scope of forensic science. Various contemporary disciplines of forensic sciences and their applications in different approaches with theoretical concepts. Need of forensic science. Basic principles of Forensic Science.

MODULE-2 Functional aspects of Forensic Science Teaching Hours: 15 Hours

Contemporary development in the academic and practices in forensic sciences-advantage of scientific investigations- Tools and Techniques in Forensic Science- Branches of forensic science. Forensic science in international perspectives, including set up of INTERPOL, and FBI. Code of Conduct and Qualifications of Forensic Scientists. Data depiction. Report writing.

MODULE-3 Organizational setup in Forensic Science Teaching Hours: 15 Hours

Academic institutions involvement, Organizational set up of Forensic Science Laboratories in India Hierarchical set up of Central Forensic Science Laboratories, State Forensic Science Laboratories, Government Examiners of Questioned Documents, Fingerprint Bureaus, National Crime Records Bureau, Police Academies & Detective Training Schools, National Investigation Agency (NIA). CCNTS, Bureau of Police Research & Development, Directorate of Forensic Science and Mobile Crime Laboratories, other agencies involved in the criminal investigations. Agencies referred for the additional information and requisite examinations.

Reference Books:



1. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
2. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).
3. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
4. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).
5. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
6. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

BSC-MJ-102: Crime Scene Management & Criminal Profiling

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams		University Exams		University Exams (LPW)			
					TA-1 & TA-2	MSE	Marks	Hrs	Marks	Hrs		
3	0	0	3	3	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

1. This course covers crime scene management and investigation, focusing on evaluation, processing, and documentation techniques.
2. Students will learn about physical evidence discovery, collection, preservation, and chain of custody.
3. Additionally, they will explore advanced photography, digital imaging, and 3-D scanning technologies.
4. The course also delves into crime detection devices, forensic tools, and tele forensic technology applications.
5. Through case studies, students will gain insight into national and international crime scene practices and behavioural evidence analysis.

Learning Outcomes: By the end of this course students will be able to:

1. Recognize and classify different types of crime scenes, understanding the importance of securing and evaluating the scene effectively.
2. Demonstrate proficiency in documenting crime scenes through note-taking, sketching, and utilizing searching techniques for evidence recovery.
3. Execute proper procedures for the collection, preservation, packaging, labelling, and forwarding of physical evidence, maintaining the chain of custody.
4. Utilize photography and videography techniques, including specialized methods like UV, IR, and 3-D scanning, for comprehensive documentation of crime scenes.
5. Analyze the role and significance of physical evidence in criminal investigations, familiarizing with crime detection devices and technology innovations in crime scene management.

MODULE-1 Crime Scene Evidence

Teaching Hours: 15 Hours

Introduction to the crime scene, Types of crime scene, Evaluation and processing of crime scene, securing the scene of crime, documenting the crime scene: Note making, sketching

Searching techniques of Crime scene, Processing of physical evidence-discovering, recognizing and examination of physical evidences

Collection, Safety measures for evidence collection, Preservation, Packaging, sealing, labelling and forwarding of physical evidences, maintaining the chain of custody, Probative value of physical evidences, Reconstruction of scene of crime





Photography: Photography (Cameras-SLR & DSLR, lenses, filters, films, exposing, development & printing, different kinds of developers and fixers. Specialized photography-UV, IR, close up. Photography using scientific equipment, role of the first arriving officer at the crime scene, Digital Imaging of Crime Scene, 3-D scanning technique, videography of crime scene

MODULE-2 Physical Evidences

Teaching Hours: 15 Hours

Introduction to physical evidences, Types of physical evidences, Classification and Role of physical evidences in Criminal Investigations & Trials.

Crime Detection Devices: UV, IR, X-Rays, their nature and applications, Detective Dyes, Neutron Radiography, Speed Detection Devices, Tools: Basic Kits, Investigator's Kit, Tools used in Mobile laboratory. Digital Imaging of Crime Scene, 3-D scanning technique, Tele forensic Technology for crime scene investigation, Information, Manpower, and logistics management of crime scene, Technology innovation in crime scene management, Case studies & report writing of crime scene visits. National and International scenario of crime scene management

MODULE-3 Criminal Profiling

Teaching Hours: 15 Hours

Introduction to Crime, Essentials of Crime (Actus reus and mens rea), Causes and consequences of crime, Crimes against Property and Person. Types of crime- traditional crimes, modern crimes white collar crimes, Economic crimes, Political crime, Cyber-crime, Terrorism and Insurgency, Crime and Politics. Hate crimes, Transnational crimes; Offences in CrPC and IPC.

History of Profiling, Behavioural Evidence Analysis, Criminal motivation, Crime scene investigation, Victim profiling, Psychological Autopsy, Sexual Offences, Geographical Profiling, Criminal behaviour on the internet, Case studies.

Reference Books:

1. J.Walls; Forensic Science-An Introduction to Scientific Crime Detection 2nd Ed.,Universal, 1st Indian Reprint (2002).
 2. Richard Saferstein; Criminalistics-An Introduction to Forensic Science 5th Ed., Prentice Hall (1995).
 3. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Kooupfer; Encyclopedia of Forensic Science, Academic Press (2000).
 4. E.R.Mengel; Forensic Physics in 2002 year book, McGraw hill Encyclopedia of Science & Technology.
 5. Jenkins and White; Fundamentals of Optics; Mc Graw Hill; Fourth Ed, [I] James, S.H. And Nordby, J. J.; Forensic Science; An Introduction to Scientific And Investigative Techniques, CRC Press USA
 6. M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001).
 7. T.J. Gardener and T.M. Anderson, Criminal Evidence, 4th Ed., Wadsworth, Belmont (2001).
 8. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
 9. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

BSC-MN-103: General Chemistry-I

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
Marks	Hrs	Marks	Hrs						Marks	Hrs		
3	0	0	3	3	50	00:45	50	01: 30	100	03: 00	-	200

Course objectives:

1. Students will understand fundamental concepts of atomic structure, including wave mechanics, quantum numbers, and molecular orbital theory.
2. They will gain knowledge of chemical bonding models, periodic trends, and properties of elements and compounds.
3. The course will also cover the classification and behaviour of organic compounds, the kinetic theory of gases, physical properties of liquids, and the thermodynamic principles to analyse chemical reactions.

Learning Outcomes: Upon successful completion of this course, students will be able to:

1. Gain a thorough understanding of atomic structure, including wave mechanics, quantum numbers, and MOT.
2. Analyze and apply principles of chemical bonding, VB and MO approaches, VSEPR theory, and periodic trends
3. Describe the kinetic theory of gases, behavior of real gases, liquids, through theoretical and experimental perspectives.
4. Describe thermodynamic concepts and the calculation of heat changes, energy transformations in chemical reactions.

MODULE-I

Structure and Bonding

Teaching Hours: 15 Hours

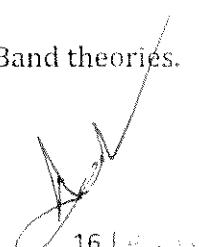
Atomic Structure: Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrodinger wave equation; for H atom; Radial and angular wave functions. Quantum numbers and their significance, Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number, shapes of s, p, d and f orbitals.

Chemical Bonding: VB approach of H₂ molecule; Molecular Orbital Theory, MO treatment of homonuclear and heteronuclear (CO & NO) diatomic molecules; Concept of HOMO and LUMO. VSEPR theory and Structure of simple molecules and ions of main group elements

Ionic Solids: Close packing, Radius ratio rule and crystal coordination number. Examples of MX and MX₂ type ionic solids (NaCl and TiO₂)

Metallic Bonding: theories of bonding in metals, Free electron, VB and Band theories.

Weak Interactions: Hydrogen bonding and van der Waal's interactions



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Periodic trends and properties: Size, Ionization Energy, Electron Affinity, Electronegativity, Lattice and Hydration Energies.

MODULE-2 Basics of Organic Chemistry Teaching Hours: 15 Hours

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Diastereoisomers, and meso-structures. Racemic mixture and resolution. Chemistry of aliphatic, aromatic hydrocarbons and Cycloalkanes. Aromaticity and Huckel rule - A general concept. Molecular orbital picture of benzene.

MODULE-3 Basics of Physical Chemistry Teaching Hours: 15 Hours

Gaseous State: Kinetic theory of gases, ideal gas laws based on kinetic theory. Collision in a gas-mean free path, collision diameter, collision number. Behaviour of real gases - the van der Waal's equation.

Liquid State: Surface tension of liquids - capillary action, experimental determination of surface tension, temperature effect on surface tension. Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature.

Thermodynamics: Enthalpy, heat changes at constant volume and constant pressure, heat capacities (CV , CP) and their relationship for ideal gases. Thermodynamic quantities (w , q , ΔU , ΔH) for isothermal and adiabatic reversible expansion of ideal gases and their comparison. Change in internal energy (ΔU) and enthalpy (ΔH) of chemical reactions, relation between ΔU and ΔH , variation of heat of reaction with temperature (Kirchhoff's equation).

Reference Books:

1. Basic Inorganic Chemistry, F. A Cotton, G. Wilkinson, and Paul L. Gaus, 3rd Edition (1995), John Wiley & Sons, New York.
2. Concise Inorganic Chemistry, J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
3. Physical Chemistry, P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.
4. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.
6. Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS.
7. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
8. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
9. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
10. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).

BSC-MN-104: General Physics-I

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	0	0	3	3	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

1. This course addresses the significance of physics as the bedrock of scientific inquiry, providing students with a robust understanding of its core concepts and applications.
2. Through the exploration of classical mechanics, thermodynamics, wave theory & optics, students will cultivate critical thinking skills essential for problem-solving in diverse scientific contexts.
3. By recognizing the overarching relevance of physics, learners will be equipped to tackle complex challenges and contribute meaningfully to advancements across interdisciplinary fields like Forensic Sciences.

Learning Outcomes: After completion of this course, students will:

1. Demonstrate a proficient understanding of classical mechanics principles, including Newton's laws, conservation laws, and motion dynamics, facilitating the application of these concepts to real-world scenarios.
2. Analyze oscillatory motion and elasticity phenomena, confidently solving differential equations governing simple harmonic oscillations and explaining energy dynamics in elastic systems and collision scenarios.
3. Apply thermodynamic principles to comprehend energy transfer, thermodynamic processes, and the operation of heat engines, alongside understanding the kinetic theory of gases and wave propagation.
4. Develop problem-solving skills through practical application of physics concepts, fostering critical thinking and analytical reasoning in addressing complex scientific challenges.
5. Apply the learnings to the Forensic sciences, and lay a solid foundation for further study and research.

MODULE-1

Mechanics

Teaching Hours: 15 Hours

Laws of motion: Motion and its physical interpretation, Newton's law of motion, Law of conservation of linear momentum and its applications. Static and kinetic friction, laws of friction. Circular motion: Centripetal and Centrifugal force, Projectile motions and its application.

Simple Harmonic Motion and Elasticity: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values.



Elastic and inelastic collisions between particles. Elasticity, stress, strain, and Relation between the Elastic constants.

MODULE-2

Thermal Physics

Teaching Hours: 15 Hours

First Law of Thermodynamics: Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, various thermodynamic processes, Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes.

Second Law of Thermodynamics: Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot engine & efficiency, Kelvin-Planck and Clausius Statements. Concept of entropy.

Kinetic theory of gases and Theory of Radiation: Real and Ideal gas, Maxwell-Boltzmann Law of Distribution of velocities. Mean, RMS and Most Probable Speeds. Mean Free Path. Blackbody radiation, Spectral distribution, Concept of Energy Density, Stefan Boltzmann Law and Wien's displacement law, Derivation of Planck's Radiation law, Derivation of Wien's distribution law, Rayleigh-Jeans Law using Planck's radiation law.

MODULE-3

Wave and Optics

Teaching Hours: 15 Hours

Wave: Wave motion, Wave equation, longitudinal and transverse waves, Plane Progressive (Travelling) Waves, Nature and properties of electromagnetic waves, Speed of sound wave in different media and their properties, Velocity of Transverse Vibrations of Stretched Strings, Newton's hypothesis, Laplace correction in speed of sound.

Optics: Electromagnetic spectrum, Interference, Reflection, refraction polarization and diffraction of light. Young's double slit experiment, Refractive index and total internal reflection of light. Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers. Spherical and Chromatic aberrations.

Reference books:

1. NCERT Physics Part 1 And part 2.
2. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
3. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
4. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
5. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
6. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill.
7. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
8. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill.

BSC-AE-105: English Language Skills -I



Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Mark s	Hrs	Mark s	Hrs				
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	200

Learning Objectives:

1. To develop English language proficiency to meet academic and professional needs.
2. To enhance students' reading comprehension and writing skills
3. To equip students with public speaking and presentation skills

Learning Outcomes: Upon successful completion of this course, students will be able to:

1. Demonstrate proficiency in grammatical structures and their appropriate usage
2. Critically analyze forensic texts and demonstrate reading comprehension skills
3. Effectively present forensic information using visual aids and exhibit clarity, engagement, and confidence in public speaking

MODULE-1 English Grammar and Word Formation Teaching Hours: 15 Hours

Parts of Speech, Articles, Tenses, Modal Auxiliaries, Subject Verb Agreement, Word Formation.

MODULE-2 Introduction to Reading and Writing Skills Teaching Hours: 15 Hours

Techniques and tips for effective Reading Comprehension, Sentence Structures for Paragraph Writing

Reference Books:

- Hewings, Martin. *Advanced Grammar in Use*. Cambridge University Press, 2015.
- Strunk, William Jr., and E.B. White. *The Elements of Style*. Pearson, 1999.
- Barber, Susan M. *Effective Reading Comprehension Strategies for Advanced Learners*. Academic Press, 2017.
- Doumont, Jean-Luc. *Presentation Skills for Scientists and Engineers*. Cambridge University Press, 2010.



BSC-SE-106: Basics of Computer

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme								
L	T	P	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	-	200

Course Objectives:

1. This course introduces computer science and network security, including number systems, conversions, binary operations, hardware, software, and operating systems (Windows and Linux).
2. It covers network fundamentals, topologies, protocols, and security measures.
3. Helps in exploration of biometric technologies and their performance against traditional security methods.

Learning Outcomes: Upon successful completion of this course, students will be able to:

1. This course aims to provide a comprehensive introduction to fundamental concepts in computer science and network security. Students will gain proficiency in various number systems (binary, octal, decimal, hexadecimal), including conversions and arithmetic operations.
2. The course covers the basics of computer hardware and software, operating systems, and the architecture of Windows and Linux. It delves into computer networks, including network components, topologies, protocols, and security measures such as firewalls and intrusion detection systems.
3. Additionally, students will explore biometric technologies, their applications, and performance measures in biometric systems, comparing these to traditional security techniques.

MODULE-1 Number Systems and Computer Fundamentals Teaching Hours: 15 Hours

Introduction to Binary, Octal, Decimal and Hexadecimal Number Systems; Conversion from Binary to Decimal, Decimal to Binary, Binary to Hexadecimal, Hexadecimal to Binary; Representation of signed and unsigned Binary Numbers; Arithmetic, Logical, Relational and Shift Operations on Binary Numbers; ASCII and UTF.

Definition of Computer, History, Key Terms, Hardware and Software, Primary and Secondary Storage Devices; Basics of Operating System, Introduction to Filesystems, Windows and Linux OS architectures; Introduction to Computer Related Crimes, MS Office (word, excel, power-point).



MODULE-2 Basics of Computer Networking and Internet Teaching Hours: 15 Hours

Definition of Computer Network, Components of Network, Topology and Types of networks, Introduction to OSI layer and TCP / IP protocol suite, Communication Devices, IP and MAC Addresses, Understanding Internet, Introduction to websites and webpages; understanding Firewall, IDS and IPS; Introduction to Network and Internet Related Crimes.

MODULE-3 Introduction to Biometrics

Teaching Hours: 15 Hours

Introduction - Biometric fundamentals – Biometric technologies – Biometrics vs traditional techniques – Characteristics of a good biometric system – Benefits of biometrics – Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems. Physiological and behavioural biometrics.

Reference Books:

1. Operating Systems | Internals and Design Principles, Ninth Edition by William Stallings
 2. Modern Operating Systems 4e by Tanenbaum
 3. Structured Computer Organization 6/e Paperback by Tanenbaum
 4. Computer Networks: A Top - Down Approach by FOROUZAN
 5. TCP/IP Protocol Suite E/4 by Behrouz A. Forouzan



BSC-VA-107: Environmental Studies

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs	University Exams (LPW)	
					Marks	Hrs	Marks	Hrs				
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	200

Course objectives:

1. This course aims to make students aware about the multidisciplinary concept of environmental studies and importance of natural resources.
2. It also intends to familiarise them with various aspects of ecosystem, environmental pollution, and its management.
3. This course introduces the concept of disaster management as well.

Learning Outcomes: By the end of this course students will be able to:

1. Appreciate the importance of environment and natural resources and their role in everyone's life.
2. Elaborate on concepts of ecosystem and its structure as well as functions.
3. Understand the causes of environmental pollution and suggest measures to control/manage it.
4. Take cognizance of various aspects of disaster management.

MODULE 1 Natural Resources and Ecosystem

Teaching Hours: 15 Hours

Environmental Studies: Introduction, Definition and Importance of Environmental Studies, Need for Public Awareness, Sensitization and Participation-- Case Studies.

Natural Resources: Types of Natural Resources, Natural Resource Conservation, Role of an Individual in Conservation of Natural Resources, Equitable Use of Resources for Sustainable Lifestyles, Case Studies (related to forest, water and mineral resources).

Ecosystems: Concept of an Ecosystem, Types of Ecosystems, Structure and Function of an Ecosystem, Producers, Consumers and Decomposers, Energy Flow in the Ecosystem, Food Chains, Food Webs and Ecological Pyramids, Ecological Succession.

MODULE 2 Environmental Pollution and Disaster Management Teaching Hours: 15 Hours

Environmental Pollution: Definition, Causes, Effects and Control Measures of: Air Pollution-- Case Studies; Role of an Individual in Prevention of Pollution.

Solid Waste Management: Causes, Effects and Control Measures/Management of Municipal and Hazardous Wastes.

Disaster Management: Types and their basic concepts, Mitigation strategies for-Floods, Earthquakes, Cyclones and Landslides.

Reference Books

1. Adams (1994), Environmental Science, Wiley, London.
2. Agarwal and Dubey (2000), Environment, Raj Publications, Delhi.
3. Kaushik and Kaushik, Perspectives in Environmental studies (2021), New Age International (P) Ltd, ISBN (13) : 978-8195175529
4. H.V. Jadhav and S.H. Purohit, Environmental Studies, HPH, Mumbai
5. Cunningham (2003), Environmental Science, Tata McGraw Hill, New Delhi.
6. De, A.K. (1996), Environmental Chemistry, New Age, New Delhi.
7. Basic Ecology, E.P. Odum, 1983, Holt-Saunders International Edition.
8. Sharma, A., Pollution in India, CSE, New Delhi.
9. H.V. Jadhav and S.H. Purohit, Environmental Concerns, HPH, Mumbai.
10. H.V. Jadhav and S.H. Purohit, Environmental Pollution Monitoring, HPH.
11. S.M. Khopkar, Environmental Pollution Analysis, Mumbai.
12. Ecology & Environment, P.D. Sharma, Ashish publications, 1994.
13. Introduction to Ecology, Paul Colinvaux, 1973. Wiley International Edition.
14. Freedman B. (1989). Environmental ecology, the impacts of pollution and other stresses on ecosystem structure and function. Academic Press, San Diego.
15. S.C. Sharma (2022) Disaster management, Khanna Publishing, ISBN (13):978-9355380340.
16. Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc.





BSC-PR-108: Practical-I

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme								
L	T	P	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams				
					TA-1 & TA-2		MSE		Marks	Hrs			
					Marks	Hrs	Marks	Hrs					
0	0	8	4	8	-	-	50	3:00	-	-	100	6:00	150

Course Objectives:

1. This course is designed with the objective to provide practical training for the concepts studied by the students during the entire semester with the help of various course papers.

Learning Outcomes: By the end of this course students will be able to gain practical training for aspects related to:

1. Introduction to Forensic Science
2. Crime Scene Management
3. General Physics-I
4. General Chemistry-I

MODULE-1 Introduction to Forensic Science

1. To study the history of crime cases from forensic science perspective.
2. To write report on different type of crime cases.
3. To review how the Central Fingerprint Bureau, New Delhi, coordinates the working of State Fingerprint Bureaus.
4. To examine the list of projects undertaken by the Bureau of Police Research and Development and suggest the thrust areas of research in Police Science.
5. To compare the code of conduct prescribed by different establishments for forensic scientists.

MODULE-2 Crime Scene Management

1. To prepare a report on evaluation of crime scene.
2. To establish chain of custody and note taking at crime scene.
3. To reconstruct an indoor crime scene.
4. To reconstruct an outdoor crime scene.
5. Collection, Packaging and Preservation of the evidences.

MODULE-3 General Physics-I

1. To determine force, velocity and acceleration of moving object.
2. To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation
3. To find the refractive index of a liquid by using convex lens and plane mirror.



4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To study the variation of Thermo-electric EMF with temperature using the thermocouple using the kit.

MODULE-4

General Chemistry-I

1. Determination of anions by chemical tests
2. Determination of cations of group 0, 1, & 2 by chemical tests.
3. Determination of melting point of organic solids.
4. Determination of viscosity of sugar solution
5. Determination of effect of temperature on viscosity of solution.



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SCHOOL OF FORENSIC SCIENCES

B.Sc.-M.Sc. Forensic Sciences

SEMESTER-II

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BSC-MJ-201: Criminal and Evidence Law

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)	
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	200

Course Objectives:

1. To develop concepts about law and legal procedures, courts, Bharatiya Nyay Sanhita, Bharatiya Nagarik Surakhsa Sanhita; Bharatiya Sakshya Adhiniyam.
2. To learn about police, police organizations at national and international levels.
3. To learn about special acts like NDPS Act, Explosives Act, Environment Protection Act, etc.

Learning outcomes: The student will able to:

1. Gain knowledge about the Constitutional Law, Substantive Law and Procedure Law.
2. Understand basic concept under - Bharatiya Nyay Sanhita (BNS), Bharatiya Nagarik Suraksha Sanhita (BNNS), Bharatiya Sakshya Adhiniyam (BSA).
3. Elaborate features of special laws - Arms Act, Explosive Act, Explosive Substance Act, Dowry Prohibition Act, Prevention of Corruption Act, Wild Life Act, NDPS Act etc.

MODULE-1 Law – Constitution of India

Teaching Hours: 15 Hours

Concept of Law and Branches of Law and structure of Courts

Under Art.13 of Constitution of India and by Jurist - John Austin, Bentham, Salmond. Remedies under Civil and Criminal and Family Laws, Kinds of Punishment under Bharatiya Nyay Sanhita, 2023, Structure of Courts in India - Constitution and trial courts and their jurisdiction and penal powers.

Salient Features of Bhartiya Nagarik Surksha Sanhita, 2023:

Complaint and Inquiry, First Information Report and Investigation, Classification of offences under Bharatiya Nagarik Suraksha Sanhita as Cognizable and non-cognizable offences. Bailable and nonbailable offences and Anticipatory Bail Concept. Trial – Summary, Summons and Warrant.

MODULE-2 Bharatiya Nyaya Sanhita, 2023

Teaching Hours: 15 Hours

Offences under Bharatiya Nyaya Sanhita, 2023 specific to Forensic Science:

Waging War against State, Culpable Homicide and Murder, Rash and Negligent act causing Death, Dowry Death, Attempt to Commit Suicide and Abetment, Attempt commit Murder and Attempt as



Offence, Hurt and Grievous Hurt and Punishment, Kidnapping and Abduction and Punishment, Outrage the modesty of woman and Stalking, Voyeurism, Rape and Custodial Rape, Gang Rape etc. and Sexual Offence by Public Servant and Punishment.

Bharatiya Sankhya Adhiniyam, 2023 –Basic Principles of Evidence (Best Evidence, Hearsay Evidence and Relevancy), Kind of Evidence- Direct- Circumstantial, Documentary, Primary and Secondary, Public Document and Private Document, Dying Declaration, Expert Opinion and its relevancy, Cross examination and re-examination of witnesses. Leading Question and Refreshing Memory.

Bharatiya Nyaya Sanhita, 2023: Procedure for Investigation (sec. 176), Deposition of Medical Witness (sec.326), Identification Report of Magistrate (sec.327), Evidence of Officers of Mint etc.(sec.328), Reports of Certain Govt. Scientific Experts (sec. 329) & No formal proof of certain documents (sec.330)

MODULE-3 Relevant Provision of Special Act or their Salient Features Teaching Hours: 15 Hours

Aim and Object, Definition, Regulatory Authority, Enforcement Authority, offences and punishments: 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.

Reference Books:

1. Bharatiya Nyaya Sanhita 2023,
2. Bharatiya Nagarik Surakhsa Sanhita, 2023
3. Bharatiya Sankhya Adhiniyam, 2023
4. Constitution of India, 1950 with latest Amendments.
5. Jurisprudence by Salmon
6. D.A. Bronstein, Law for the Expert Witness, CRC Press, Boca Raton (1999).
7. Vipa P. Sarthi, Law of Evidence, 6th Edition, Eastern Book Co., Lucknow (2006).
8. A.S. Pillia, Criminal Law, 6th Edition, N.M. TripathiPvt Ltd., Mumbai (1983).
9. R.C. Nigam, Law of Crimes in India, Volume I, Asia Publishing House, New Delhi (1965).
10. (Chief Justice) M. Monir, Law of Evidence, 6th Edition, Universal Law Publishing Co. Pvt. Ltd., New Delhi (2002)



BSC-MJ-202: Fingerprint Science

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme								
L	T	P	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks		
					Marks	Hrs	Marks	Hrs			Hrs		
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	-	200

Course Objectives:

1. The primary objective of the course is to provide an understanding of the importance of fingerprint science, its history and development.
2. The student will explore methods for fingerprint development, classification systems, Lifting techniques.

Learning Outcomes: The student will able to:

1. To learn about fingerprint science, its development and various aspects.
2. To learn about various classification systems of fingerprints.
3. To learn about development and analysis of fingerprints by various physical and chemical methods.

MODULE-1 History and Basics of Fingerprints Teaching Hours: 15 Hours

History of Fingerprint Science, main function of Fingerprint bureau, main function of Fingerprint bureau, Development of Fingerprint Science, Composition of sweat and secretion of sweat, Pattern types & Ridge characteristics, Ridge tracing, Ridge counting.

MODULE-2 Classification Methods of Fingerprints Teaching Hours: 15 Hours

Various systems for Fingerprint classification, Henry classification system, numerical value, symbol, primary classification, secondary classification, sub-secondary classification and final classification, NCIC classification, AFIS classification.

MODULE-3 Development and Analysis of Fingerprint Teaching Hours: 15 Hours

Development, Identification & Presentation of Fingerprint, known prints & Rolled impressions, Direct or Inked prints, Development of Latent Prints & Lifting techniques, Physical & chemical Methods: Powder techniques & Various chemical techniques, Processing of Post developed prints. Finger print comparison & Identification, Introduction to AFIS.



Reference Books:

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press
2. E. Roland Menzel; Fingerprint Detection, with Lasers, Second edition; Marcel, Dekker, Inc. USA.
3. James F. Cowger; Friction Ridge skin CRC Press London.
4. Mehta, M.K: Identification of Thumb Impression & Cross Examination of Finger Prints, N. M. Tripathi (P) Ltd, Bombay.
5. Moenssens: Finger Prints Techniques, Chitton Book Co. Philadelphia, New York.
6. Chatterjee S.K., Speculation in Finger print identification, Jantralekha, Printing Works, Kolkata.
7. Cowger, James F: Friction ridge skin: Comparison and Identification of Fingerprints; CRC Press, Boca Raton, New York.

BSC-MN-203: General Biology-I

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	200

Course Objectives: This course is designed with the objective to:

1. Familiarize the students with the cellular organisation and its ultrastructure
2. Develop their understanding about various cellular processes.
3. Enhance students' knowledge about Microbiology and its importance.
4. Explains the various concepts of Genetics by elaborating: Mendelian; Post-Mendelian inheritance and various processes like mutation, recombination etc.

Learning Outcome: By the end of this course the student should be able to:

1. Elaborate the cell's structure and processes like cell division.
2. Acquire basic knowledge of Microbiology and its applications.
3. Conceptualize various aspects of genetics.

MODULE-I Cellular Organisation Teaching Hours: 15 Hours

Cell and cellular organelles, The cell theory, Prokaryotic and Eukaryotic cells, Eukaryotic sub-cellular components: Nucleus, chromosomes, plasma membrane, endoplasmic reticulum, lysosomes, peroxisomes, Golgi apparatus, mitochondria, chloroplast, cytoskeleton. Cell cycle and its control; Cell division-amitosis, mitosis and meiosis.

MODULE-2 Introduction to Microbiology Teaching Hours: 15 Hours

Bacteria: General characteristics, cell structure of bacteria and their components, Classification of bacteria (Outline), mode of nutrition, mycoplasma, archaebacteria, cyanobacteria. Fungi: General characteristics and classification Viruses: General characteristics and classification.

MODULE-3 Basic of Genetics Teaching Hours: 15 Hours

Introduction to genetics, pre-Mendelian, Mendelian and non-Mendelian inheritance, genetic linkage, recombination and crossing over, chromosomal basis of inheritance, mutations and mutagenesis, genetic basis of sex determination, extra-nuclear inheritance, exchange of genetic material-Conjugation, Transformation and Transduction.

Reference Books:

1. Nelson DL, Cox MM (2017) Lehninger Principles of Biochemistry, 7th Edition. W. H. Freeman



2. Stryer L, Berg JM, Tymoczko JL, Gatto GJ. (2015) Biochemistry, 8th Edition. W. H. Freeman
3. Voet DV, Voet JG. (2011) Biochemistry, Wiley
4. Pelczar MJ, Chan, E.C.S., Krieg, NR, (2009). Microbiology, McGraw-Hill publisher
5. Satyanarayana U, (2013), Biochemistry Elsevier
6. Snustad DP, Simmons MJ. (2015) Principles of Genetics, 7th Edition, Wiley.
7. Alberts B, Johnson A, Lewis L, Morgan D, Raff M, Roberts K, Emeritus, Walter P (2014) Molecular Biology of the Cell. 6th Edition, Garland Science

BSC-MN-204: General Physics-II

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	200

Course Objectives: This course aims to:

1. Delve into the depths of atomic and nuclear physics, illuminating the indispensable role of physics in unravelling the mysteries of matter's structure and behaviour.
2. Navigate the complexities of laser technology, students will recognize its transformative potential across various sectors, showcasing the profound impact of physics-driven advancements in modern society.
3. Explore electrostatics, magnetism, and electromagnetic induction will underscore the universal applicability of physics principles.
4. Empowers learners to tackle complex problems and innovate solutions in interdisciplinary contexts.

Learning Outcomes: After completing the course, students will:

1. Attain a deep understanding of atomic and nuclear physics, encompassing atomic structure, different atomic models, concepts of electron's spin, quantization of energy levels, significance of quantum numbers, nuclear composition, and radioactivity.
2. Acquire proficiency in modern optical source-lasers, comprehending laser characteristics, operation principles, holography, and applications of lasers into forensic sciences, scientific research and technologies.
3. Learn principles of electrostatics and magnetostatics, including electric field, Gauss' law and its applications, magnetic field properties, and electromagnetic induction, for problem-solving in real life problems, engineering and scientific contexts.
4. Develop analytical and problem-solving skills through experimentation and theoretical exercises, enabling critical evaluation of complex physical phenomena.
5. Be able to apply the knowledge of electrostatics, magnetostatics and electromagnetism to real life problems, and especially to experiments employed in Forensic sciences.

MODULE-1 Atomic and Nuclear Physics Teaching Hours: 15 Hours

Atomic Physics: Structure of atom. Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Idea of discrete energy levels and electron spin: Franck-Hertz and Stern-Gerlach experiments, Significance of four quantum numbers, Pauli's exclusion principle, Orbital magnetic dipole moment, Orbital, spin and total angular momenta, and Vector model of atom.



Nuclear Physics and Radioactivity: Composition and size of nucleus, atomic masses, isotopes, isobars, isotones. Alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission and fusion with examples.

MODULE-2 Lasers and Its Applications

Teaching Hours: 15 Hours

Introduction to Lasers: Characteristics of laser light, Spontaneous emission, Stimulated emission, Stimulated absorption, Einstein coefficients and its significance, Characteristics of laser radiation, Population inversion, condition for light amplification, Essential components of the laser, Optical resonator, CW and pulsed laser, peak power and pulse energy.

Application of lasers: Holography: Formation of a hologram, Reconstruction of the hologram, Requirements, Application In forensic investigation.

MODULE-3 Electricity and Magnetism

Teaching Hours: 15 Hours

Electric field and potential: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. Electrostatic energy of a charged sphere.

Magnetic Field: Biot-Savart Law and its simple applications: straight wire and circular loop. Ampere's Circuital Law and its application solenoid and wire. Properties of magnetic field: curl and divergence. Magnetic Force on (a) point charge (b) current carrying Torque on a current loop in a uniform Magnetic Field.

Electromagnetic Induction: Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

Reference books:

1. Physics of atoms and molecules, B. H. Bransden and C. J. Joachain, 2003, Pearson.
2. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
3. Laser Fundamentals, William T. Silfvast, 2008, Cambridge University Press.
4. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw.
5. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education.
6. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edition, 1998, Benjamin Cummings.

BSC-AE-205: English Language Skills -II

Teaching and Examination Scheme

Teaching Scheme						Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams		University Exams (LPW)		
					TA-1 & TA-2		MSE		Mark s	Hrs	Mark s	Hrs	
					Mark s	Hrs	Mark s	Hrs	100	03:00	-	-	200
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	-	200

Course Objectives:

1. Strengthen students' understanding and application of English grammar usage specific to forensic science contexts.
2. Enhance students' writing skills to effectively produce forensic reports and essays.
3. Develop students' ability to identify and correct common errors in English usage, improving overall language proficiency.

Learning Outcomes: Upon successful completion of this course, students will be able to:

1. Apply English grammar rules specific to forensic science with accuracy and clarity
2. Produce well-structured and coherent forensic reports and essays
3. Identify and correct common English usage errors, enhancing overall language proficiency

MODULE-1 English Grammar and Usage

Teaching Hours: 15 Hours

Conditional Sentences, Degrees of Comparison, Passive Voice, Collocations, Common Errors in

MODULE-2 Different skills and its importance

Teaching Hours: 15 Hours

English Usage, Idioms & Phrases.

Essay Writing, Precise Writing, Email Writing, Report Writing (Related to Forensic Science)

Reference Books:

- Hewings, Martin. *Advanced Grammar in Use*. Cambridge University Press, 2015.
- Strunk, William Jr., and E.B. White. *The Elements of Style*. Pearson, 1999.
- Oshima, Alice, and Ann Hogue. *Writing Academic English*. Pearson, 2013.
- Bailey, Stephen. *Academic Writing: A Handbook for International Students*. Routledge, 2018.
- Gowers, Ernest. *The Complete Plain Words*. Penguin, 2014.



BSC-SE-206: Financial Literacy

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs	University Exams (LPW)	
Marks	Hrs	Marks	Hrs						Marks	Hrs	Hr s	
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	200

Course Objectives: The aim of this course is to:

1. Familiarize students with the financial systems, financial products and services.
2. Introduce the significance of fundamental financial concepts, which includes budgeting, savings, investments, credit, debt management, and the time value of money.

Learning Outcomes: At the end of this course, students will be able to describe and implement the concepts of:

1. Financial literacy
2. Financial system
3. Interpret the future and present value of money
4. Features of financial products
5. Various investment plans in terms of risk and return

MODULE 1 Concept of Financial System

Teaching Hours: 15 Hours

An overview of financial system, brief discussion on components of financial system—Financial Institutions, Financial Markets and Financial Instruments, Concept of Investment and characteristics, types of risks involved in financial investment, Capital Market—Primary Market and Secondary Market, procedure to make investment in equity in primary and secondary market.

MODULE 2 Financial Products

Teaching Hours: 15 Hours

Banking Resources and related products: Commercial Banks, Post Office and Insurance companies – functions and regulatory framework, Banking products and return and risk features, Savings Bank Account, Term Deposit, Current, Account, Recurring Deposit, PPF, etc., Formalities to open various types of bank accounts, PAN Card, Address proof, KYC norm; ATM, Debit and Credit Card, and APP based Payment system; Various types of loans- short term, medium term, long term, micro finance, agricultural etc. and related interest rates offered by various nationalized banks and post office; Banking complaints and Ombudsman; CIBIL Score.

MODULE 3 Financial Services

Teaching Hours: 15 Hours

Post office Savings Schemes: Savings Bank, Recurring Deposit, Term Deposit, Monthly Income Scheme, Kisan Vikas Patra, NSC, PPF, Senior Citizen Savings Scheme (SCSS), Sukanya Samridhi Yojana/ Account (SSY/SSA), India Post Payments Bank (IPPB), Money Transfer: Money Order, EMoney order, etc.

Insurance Services: Life Insurance, Term Life Insurance, Endowment Policies, Pension Policies, Health Insurance, Postal Life Insurance and Rural Postal Life Insurance.

Reference Books:

1. Prasanna Chandra, Investment Analysis and Portfolio Management, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Chandra, P. (2012). Investment Game: How to Win, Tata McGraw Hill Education, New Delhi
3. Milling, B. E. (2003). The Basics of Finance: Financial Tools for Non – Financial Managers. Indiana: Universe Company.
4. Mittra, S., Rai, S. K., Sahu, A. P., & Starn, H. J. (2015). Financial Planning, Sage Publications India Pvt. Ltd., New Delhi;
5. Zokaityte, A. (2017). Financial Literacy Education, Palgrave Macmillan, London



BSC-VA-207: Indian Knowledge System

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme								
L	T	P	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hr s	
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	-	200

Course Objective: The aim of this course is to:

1. Equip the students with the basic concepts of Ancient Wisdom, need and demand of Indian knowledge system
2. Teach about its application in modern era, contribution from Ancient Indian system & tradition to modern science & Technology.

Learning Outcomes: With successful completion of this course students will be able to:

1. Understand the need and nature of Indian tradition.
2. To sensitize the students about context in which they are embedded i.e. Indian culture and civilization including its Knowledge System and Tradition.
3. Understand how to use Indian wisdom in modern context.
4. To help student to understand the knowledge, art and creative practices, skills and values in ancient Indian system.

MODULE-1 Roti, Makkan Kappada अवश्यकितयम् & Life learning जीवितपाठ्यं

Teaching hours: 15 Hours

❖ **Roti, Makkan Kappada अवश्यकितयम्:**

- Concept aharakrama in ancient wisdom (Bhgavad geeta sradhatraya yoga)
- Importance of vastradarana sambradaya (Adharpveda pippalada shakha)
- Methodology of vaastu jnana understanding of ancient architecture (Stapatya Veda samhita, sukta 1-20)

❖ **Life learning जीवितपाठ्यं:**

- Explore Daily habits to improve the quality of life (Yoga sutra of patanjali ashtanga yoga specially yama, sadana pada)
- Concept mind and thoughts for achieve the goals (Yogavasishta 3pada)

❖ **Bio communication with nature विश्व दृष्टारं:**

- Concept of sthoola and sookshma world. (Vedanta saram 2 part)
- Methods of Inner and outer communication techniques with universe (Mundakopanishad Alathasanti prakaranam)
- *Mind analysis process (Chadhogyopanishad chapter)*

MODULE-2 Simple thoughts manifestations & Way of life with love and truth

Teaching hours: 15 Hours

❖ **Simple thoughts manifestations:**

- Concept of लक्ष्य पूर्तीकरण प्रक्रिया in vedas (लक्ष्य पूर्तीकरण प्रक्रिया yajurveda satapada brahma)
- Concept of Improving the critical thinking (Shvetasvataraopanishad)
- Ways of manifestations in upanishads (Koushitiki upanishad)

❖ **Way of life with love and truth:**

- Lifestyle techniques in vedas (muktikopanishad bhagam 4 चर्याक्रम विनयक्रम)
- Methods of life learning.
- Control over emotions (Titareeyopanishad)

Reference Books:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmaya mission trust, Bombay, 1995.
3. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
- 4 Chatterjee, S.C. The Nyaya Theory of Knowledge. Calcutta: University of Calcutta Press, 1950.
- 5 Dasgupta, Surendra. A History of Indian Philosophy. Delhi: Motilal Banarsidass, 1991.Vol1



BSC-PR-208: Practical-II

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme							
L	T	P	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
0	0	6	3	6	-	-	50	3:00	-	-	100	6:00
												150

Course Objectives:

1. This course is designed with the objective to provide practical training for the concepts studied by the students during the entire semester with the help of various course papers.

Learning Outcomes: By the end of this course students will be able to gain practical training for aspects related to:

1. Fingerprint Science
2. General Biology-I
3. General Physics-II

MODULE-1 Fingerprint Science

1. To record plane and rolled fingerprints.
2. To identify different fingerprint patterns.
3. To carry out digit classification of fingerprints.
4. To investigate physical method of fingerprint detection.
5. To use different light sources for enhancing to develop fingerprints.

MODULE-2 General Biology-I

1. Visualization of animal cells under microscope
2. Visualization of bacterial cells under microscope
3. Visualization of mitosis in plant cell
4. Isolation of bacteria from soil/water sample
5. Mendelian inheritance using seeds of different colour/sizes of any plant

MODULE-3 General Physics-II

1. Determine the divergence and beam spot of a laser beam.
2. To determine the Resolving Power of a Plane Diffraction Grating.
3. To determine the Resolving Power of a Prism
4. To determine the wavelength of Laser light using Diffraction grating.
5. To use a digital multi-meter for measuring AC & DC voltage, dc current, resistance and



capacitance.

6. B-H curve-Determination of the hysteresis energy loss.
 7. To determine the resistance per cm of a given wire by plotting a graph of potential difference versus current, and hence determining the resistivity.
 8. Measurement of field magnetic field strength and its variation in a solenoid.
 9. To study the Characteristics of a Series RC Circuit.

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Semester III

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BSC-MJ-301: Forensic Psychology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								Total		
Th	Tu	Pr	C	TCH	Theory				Practical		Marks	Hrs	Marks	Hr s	
					Internal Exams				University Exams						
					TA-1 & TA-2	MSE		Marks	Hrs	Marks	Hrs	Marks	Hr s		
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	-	200		

Course Objectives:

This course aims to equip students with comprehensive knowledge and understanding of forensic psychology and its principles that focus on detection of deception. It will focus on the principles that form the basis of internal and unconscious changes that are indicative of deception in psychological analysis during criminal investigations. Emphasizing on the ways to use Forensic Psychological tools and techniques along with their legal limitations, students will learn the intricate ways in which this allied field of forensic science directly deals with the suspects in question unlike other branches. The course prepares students for effective understanding, knowledge and practical aspects of this branch in forensic investigations through case studies and exposure to its aspects.

MODULE-1 Basics of Psychology Teaching Hours: 15 Hours

Psychology Introduction Scope and importance, Principles of development, Attention and perception, Process of learning, Memory and forgetting, Motivation, Attitudes, Values of emotions, Behavioural problems, Conflict and use of defence mechanisms, Psychology of criminal behaviour.

MODULE-2 Techniques of Forensic Psychology Teaching Hours: 15 Hours

Forensic Psychology: Truth and Deception, Psychology of lying, Various methods of lie detection, Principles of Polygraph, Legal aspects, Narco analysis, Brain Fingerprinting, BEOS: History, Importance as an investigative tool, methods as use of drugs, Hypnosis etc., Limitations and legal aspects. Biological basis of behavior - Nervous System, CNS, PNS, Fight and Flight.

MODULE-3 Forensic psychology of crime Teaching Hours: 15 Hours

Forensic Psychology and the Law, Ethical Issues in Forensic Psychology, Civil and criminal case assessment, Assessing mental competency, Mental disorders and Forensic Psychology, Eye witness testimony, Criminal profiling- need and types, Forensic Scientific evidence, Crime and Psychopathology, Genetics and Crime, Serial murders, Modus Operandi. NHRC guidelines.

Learning Outcomes: Upon successful completion of this course, students will be able to:



1. Understanding various psychological principles underlying changes in behaviour and personality that govern truth and deception.
2. Understand and implement various checks and procedural limitations of using forensic psychological tools and techniques.
3. Gain expertise in the forensic analysis of various types of tools and techniques used for forensic psychological analysis.
4. Understanding various legal limitations of the use of the techniques and tools used.
5. Understanding the use of forensic psychological principles in use for prisoners and in prison structure to address recidivism and rehabilitation.

References and Suggested Readings:

1. Bruce A. Arrigo, Stacey L. Shipley: Introduction to Forensic Psychology, Second Edition.
2. Jadunath Sinha: Elementary Psychology.
3. Bruce, A. A: Introduction to Forensic Psychology, Academic Press, 2000.
4. Shapiro, D. L.: Forensic Psychology Assessment – An Investigative Approach, Allen & Bacon, 1991.
5. Kleiner, M.: Handbook of Polygraph Testing, Academic Press, 2002.
6. Turrey, B.: Criminal profiling – An Introduction to Behavioral Evidence Analysis, Academic Press, 1999.

BSC-MJ-302: Questioned Document

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	200

Course Objective: The primary objective of the course is to provide an understanding of the questioned documents, writing standard, collections and various tools used for its examination. The student will explore basics of handwriting, forgery, Alteration of documents and counterfeited documents.

MODULE-1 Basics of Questioned Document Teaching Hours: 15 Hours

Definition of Questioned Document, Types of Questioned Document, Preliminary Examination of Questioned Document. Procurement of writing standards, collection, preservation and handling of questioned documents

Basic Tools Needed for Forensic Document Examination- Ultraviolet, Visible, Infrared, and Fluorescence Spectroscopy, Photomicrography, Microphotography, Video Spectral Comparator, Electrostatic Detection Apparatus.

MODULE-2 Fundamentals of Questioned Document Teaching Hours: 15 Hours

Comparison of Handwriting, Determination of sequence of strokes, Development of Individuality in Handwriting, Natural Variations and Fundamental Divergences in Handwriting, Class & Individual Characteristics.

Requested and Non-requested Standards and their merits and demerits. Standards for Comparison of Handwriting, Comparison of Paper, Ink, Printed Documents, Typed Documents, Xeroxed Documents.

MODULE-3 Examination of Questioned Document Teaching Hours: 15 Hours

Forgery and its types, Alterations in Documents, Including Erasures, Additions, Over-Writing, and Obliterations. Indented and Invisible Writings. Charred Documents. Examination of Counterfeit Indian Currency Notes, Passports, Visa, stamp, credit card, seal and other mechanical impressions.

Learning Outcomes: The student will be able to;

1. To learn about questioned documents, various tools are used for its examination



2. To learn about fundamentals of handwriting, printed documents, and their comparison.
3. To learn about various alterations used in documents.
4. To learn about charred documents and its examination.
5. To learn about Examination of Counterfeit Indian Currency Notes, Passports, Visas, stamp, credit card, visa, seal and other mechanical impressions.

References and Suggested Readings:

1. "Questioned Documents: A Lawyer Handbook" by Albert S. Osborn
2. "Forensic Document Examination: Principles and Practice" by Katherine M. Koppenhaver
3. "Handwriting Identification: Facts and Fundamentals" by Roy A. Huber and A.M. Headrick
4. "Fundamentals of Document Examination" by David Ellen
5. "Forensic Handwriting Identification: Fundamental Concepts and Principles" by Ron N. Morris
6. Hardless H.R. (1988). Disputed Documents, Handwriting and Thumbs -Print Identification, Profusely Illustrated. India: Low Book Co.
7. Rev. ED.; Ordway Hilton; Scientific Examination. I of Questioned Documents, Elsevier, New York.
8. Wilson R. Harrison; Suspect Documents -Their Scientific Examination; Universal Law Publishing, Delhi.
9. Hard less, H.R: Disputed Documents, handwriting and thumbs -print identification: profusely illustrated, Low Book Co., Allahabad.
10. Kurtz Sheila: Graphotypes a new plant on handwriting, analysis, Crown Publishers Inc., USA.
11. Lerinson Jay; Questioned Documents, Acad Press, London.

BSC-MN-303: General Chemistry-II

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	200

Course Objectives:

This course aims to provide students with a deep understanding of analytical and physical chemistry concepts, including calibration, statistical evaluation, precipitation, analytical reagents, radio-analytical methods, electrolytic dissociation, and nuclear chemistry. It emphasizes practical applications and theoretical knowledge essential for precise chemical analysis and interpretation in the field of forensic sciences.

MODULE-1

Analytical Chemistry

Teaching Hours: 15 Hours

Concepts of Controls & Standards: Calibration, Positive and Negative control, False positive and false negative results, Reference Standards, Certified Reference Materials, Internal Standards and Internal Standardisation Method, Standard Addition Calibration Method.

Statistical Evaluation: Determinant and indeterminant errors, Normal error curve, Accuracy and Precision, Relative and standard deviation, Methods for minimizing errors, Criteria for rejection of observation, Significant figures and computation rules, Error propagation.

Precipitation: Desirable properties of gravimetric precipitates, Formation of gravimetric precipitates, Conditions for quantitative precipitations, Contamination in precipitates, Method for removal of impurities in precipitates, Steps involved in quantitative precipitation, Organic precipitants (oxine, dithizone, α -nitroso-(naphthol, cupferon, dimethyl glyoxime) in chemical analysis.

Analytical Reagents: Theoretical and practical aspects of the use of EDTA, cerate, iodate, bromate, chloramine-T, Karl Fischer and periodate reagents in chemical analysis.

MODULE-2

Electrochemistry

Teaching Hours: 15 Hours

Arrhenius theory of electrolytic dissociation, Hydrolysis of salts, hydrolysis constant, buffer solutions, indicators and theory of acid-base indicators. Migration of ions: transference number and its determination by Hittorf methods. Conductance of electrolyte solutions, molar conductance of electrolyte and its splitting into ionic molar conductance, Kohlrausch law of independent migration of ions, ionic mobility. Application of conductance measurements: determination of degree of dissociation and dissociation constant of weak electrolytes/ acids, solubility of sparingly soluble salts, and Conductometric titrations.



MODULE-3 Nuclear and Radiation Chemistry

Teaching Hours: 15 Hours

Nucleus and its classification, nuclear forces, nuclear binding energy, stability of nucleus. Radioactivity: Radioactive elements, general characteristics of radioactive decay, decay kinetics (decay constant, half-life, mean life period), units of radioactivity. Nuclear fission: the process, fragments, mass distribution, and fission energy. Nuclear reactor: Characteristics for reactor classification, classification of reactors, breeder reactor. Nuclear fusion and stellar energy. **Radio-Analytical Methods:** Elementary theory, Isotope dilution and Neutron activation methods and applications.

Radiation chemistry: Elementary ideas of radiation chemistry, radiolysis of water and aqueous solutions, unit of radiation chemical yield (G-value), radiation dosimetry (Fricke's dosimeter), units of radiation energy (Rad, Gray, Rontgen, RBE, Rcm, Sievert)

Course Learning Outcomes: Upon successful completion of this course, students will be able to:

1. Develop proficiency in using controls and standards, Calibration methods, ensuring accuracy and reliability in chemical analysis.
2. Understand and apply various methods for precipitation, the use of analytical reagents and radio-analytical techniques to conduct quantitative and qualitative chemical analyses.
3. Gain expertise in conducting titrations, electrolytic dissociation and their applications
4. Comprehend the fundamentals of nuclear chemistry, including radioactivity, nuclear reactions, and radiation chemistry.

Reference Books:

1. Modern Methods of Chemical Analysis', R.L. Peccock, L.D. Shields, T. Cairns, and I.C. Mc William, 2nd Edition (1976), John Wiley, New York.
2. 'Basic Concepts of Analytical Chemistry', S.M. Khopkar, 2nd edition (1998), New Age International Publications, New Delhi.
3. 'Analytical Chemistry', G.D. Christian, John Wiley & sons, New York (2001).
4. Instrumental Methods of Analysis', H.H. Willard, L.L. Merritt, and J.A. Dean, 6th edition (1986), CBS Publishers & Distributors, Shahdara, Delhi.
5. Principles of Instrumental Analysis, D.A. Skoog, F.J. Holler and T.A. Nieman, , 5th edition (1998), Horcourt Brace & Company, Florida.
6. Physical Chemistry, P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.
7. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
8. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
9. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).
10. Essentials of Nuclear Chemistry H. J. Arnikar, 4th Edition (1995), New Age International (p) Ltd., Wiley Eastern Ltd., New Delhi.

BSC-MN-304: General Biology-II

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	200

Course Objectives:

The primary objective of this course is to develop students' understanding about animal and plant anatomy to the anatomy as well as basics of physiology. It also aims at linking this gained knowledge with its forensic application. In addition to this this course also tries to elaborate on various aspects of evolution and ecology.

MODULE-1 Animal-Anatomy and Physiology Teaching Hours: 15 Hours

Animal cell and Animal tissues- Type, structure, location and function, Basics of Human physiology (Parts and their functions)-Digestive system, Respiratory system, Circulatory system, Excretory system, Skeletal system, Muscular system, Nervous system and Endocrine system, Entomology- General characteristics of Arthropoda, Characteristics features, classification of insects, Life cycle of insect (Flies, Beetles).

MODULE-2 Evolution and Ecology Teaching Hours: 15 Hours

Evolution:

Theories of Origin of life, biological evolution and evidences for biological evolution, Theories of evolution; Mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection, Gene flow and genetic drift, Hardy - Weinberg's principle, Adaptive radiation

Ecology:

Ecological hierarchy, Habitat and niche, Components of environment, Effect of abiotic factors of environment, Ecological adaptations, Population and population attributes; population interactions, Ecological services

MODULE-3 Plant-Anatomy and Physiology Teaching Hours: 15 Hours

Plant cell, Morphology of different parts of flowering plants- root, stem, leaf, flower, fruit and seed, Structure of pollen grain and its role in species identification, Diatoms- Characteristic and structure, Plant Anatomy-Location and functions of different tissues and tissue systems in flowering plants, Basics of plant physiology-Transport in Plants, Growth and Development.



Course Learning Outcome: By the end of this course the students will be able to:

1. Understand the structure of animal cells and the tissues and their importance in development of organs and functioning.
2. Elaborate various concepts of evolution and ecology.
3. Gain the knowledge of plant cell-tissue structure and functioning of various transport systems of plants.
4. Understand the forensic implication of animal and plant anatomy.

References and Suggested Readings:

1. Jennifer L. Regan, Andrew F. Russo, Cinnamon L. VanPutte (2021) Seeley's Essentials of Anatomy and Physiology, 11th Edition. McGraw Hill
2. Elaine N. Marieb, Suzanne Keller (2017) Essentials of Human Anatomy & Physiology Global Edition, 12th Edition, Pearson Education
3. Richard Crang, Sheila L. Sobaski (2018) Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants, 1st Edition, Springer
4. S N Pandey, B K Sinha (2005) Plant Physiology, 4th Edition, S Chand
5. William G. Hopkins, Norman P A Huner (2013) Introduction to Plant Physiology 4th Edition, Wiley India
6. T M Smith, R L Smith (2015) Elements of Ecology Global Edition, 9th Edition, Pearson Education India
7. Douglas J. Futuyma (2020), Mark Kirkpatrick Evolution, 4th Edition, Oxford University Press

BSC-AE-305: Communication Skills

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)	
					TA-1 & TA-2	MSE			Marks	Hrs		
Marks	Hrs	Marks	Hrs							Hrs		
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	200

Learning Objectives:

1. To understand the fundamental principles of communication skills and to enhance effectiveness in professional interactions.
2. To develop proficiency in non-verbal communication techniques essential for forensic interviews and presentations.
3. To cultivate effective speaking and active listening skills and comprehension in professional

MODULE-I Fundamentals of Communication

Teaching Hours: 15 Hours

Communication Process, Types, and Barriers, Importance of Effective Communication, Non-verbal Communication: Kinesics, Proxemics, Chronemics, Vocalic Listening.

Developing Reading Skills, Developing Conversational skills, Technical Writing skills.

MODULE-2 Effective Listening and Speaking Skills Teaching Hours: 15 Hours

Techniques for Effective Speaking: Clarity, Tone, and Body Language, Active Listening Skills, Introduction to Presentation Skills

Course Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Analyse and apply fundamental communication processes enhancing their overall communication effectiveness
2. Demonstrate a clear understanding of non-verbal communication techniques
3. Exhibit effective speaking and active listening skills for successful professional interactions and presentations

References and Suggested Readings:

- Adler, Ronald B., and Jeanne Marquardt Elmhorst. *Communicating at Work: Principles and Practices for Business and the Professions*. McGraw-Hill Education, 2012.
- Verderber, Rudolph F., Kathleen S. Verderber, and Deanna D. Sellnow. *Communicate!* Cengage Learning, 2017.
- Knapp, Mark L., Judith A. Hall, and Terrence G. Horgan. *Nonverbal Communication in Human Interaction*. Cengage Learning, 2013.
- Lucas, Stephen E. *The Art of Public Speaking*. McGraw-Hill Education, 2014.
- Brownell, Judi. *Listening: Attitudes, Principles, and Skills*. Pearson, 2012.



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SCHOOL OF FORENSIC SCIENCES

B.Sc.-M.Sc. Forensic Sciences

BSC-SE-306: Cyber Security

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01:30	100	03: 00	-	200

Course Objectives: This course is design for students to provide exposure of the real-world security challenges, basic internet security, to protect the remote access and local computing devices, to apply the tools and utilities for Network threats & Attacks.

MODULE-1 Introduction to cyber security & Network Defence Tools

Teaching Hours: 15 Hours

Introduction, Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control and Cryptography, Web attack: Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks, Network Vulnerabilities: Overview of vulnerability scanning, Open Port / Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning (Netcat, Socat), Network Sniffers and Injection tools.

Network Defence Tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding. VPN: the basic of Virtual Private Networks. Firewall: Introduction, Linux Firewall, Windows Firewall. Snort: Introduction Detection System.

MODULE-2 Cyber Crime, law and Investigation Teaching Hours: 15 Hours

Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world. Internet crime and Act: A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT Page 3 of 23 2000. Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.



Course Learning Outcomes: At the end of this course, students will be able to demonstrate the;

1. Basics of Cyber Security access and monitoring systems.
2. Concepts of intrusion detection and security challenges.
3. Implementing the protection tools for local and intrusion detection.
4. Appreciate the vulnerabilities, identifying and defending against threats.

References:

1. Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, B.B.Gupta, D.P.Agrawal, Haoxiang Wang, CRC Press, 2018
2. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

BSC-VA-307: Yoga and Its benefits

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	200

Course Objectives: The aim of this course is to provide opportunity to practice yoga leading to oneself with basic knowledge about one's personality, emotional stability, to learn to handle oneself well in all life situations, to learn techniques of gaining good health, to develop a discriminative mind capable of knowing the real from the unreal and to face the dualities of life with equanimity.

MODULE-1 Self-Identity & Development of Spiritual Self

Teaching Hours: 15 Hours

Self -Identity

- Concept of Self and Self-identity
- Indian Concept of Self with reference to Satva, Rajas and Tamas Guna
- Constituent of Panch Kosh
- Components of Self – Attitude, Beliefs, Values

Development of spiritual Self

- Concept of Spiritual Self, Spiritualism and Integral Humanity
- Process of Self-awareness, Self-observation, Introspection and Austerity
- Concept of Sthitpragya (Bhagwad Geeta Ch-2)
- Yoga as a tool for Integration of Individual and Universal Self (Ashtang Yog)

MODULE-2 Pranayama

Teaching Hours: 15 Hours

Foundations of Yoga: History, Evolution of Yoga and Schools of Yoga.

Perform any five;

1. Anulom vilom,
2. Bhrastika,
3. Kapalbhanti,
4. Shitali,
5. Sitkari,
6. Bhramari,
7. Surya bhedan
8. Chandra Bhedan



BSC-PR-308: Practical-III

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total	
					Practical					
L	T	P	C	TCH	Internal Exam		University Exams			
					Mid Sem					
					Marks	Hour	Marks	Hour		
0	0	8	4	8	50	3:00	100	6:00	150	

Course Objectives:

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-1

Forensic Psychology

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

MODULE-2

Question Documents

1. Authorship identification through handwriting.
2. Identification of forgery in signatures.
3. Detection of tampering in documents.
4. Variation in handwriting under natural conditions.

MODULE-3

General Chemistry-II

1. Preparation of molar solutions and molal solutions of NaOH & HCl.
2. Quantitative estimation of protein in any food sample by UV-Visible spectroscopy
3. Complexometric titration of Zinc using EDTA.
4. Determination of oxidation & reduction potential of Potassium ferrocyanide by Electrochemical workstation.
5. To perform test for alcohols using positive and negative controls.

MODULE-4

General Biology-II



-
1. Preparation of temporary slides of animal tissue
 2. Separation of plant pigments through paper chromatography
 3. Test for presence of urea, sugar, albumin and bile salt in urine.
 4. Study the plant population density and frequency by quadrat method.
 5. Study of different soil samples for texture, moisture content, pH and water holding capacity.



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SCHOOL OF FORENSIC SCIENCES

B.Sc.-M.Sc. Forensic Sciences

SEMESTER-IV

BSC-MJ-401: Fundamentals of Forensic Toxicology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
3	0	0	3	3	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives: To facilitate learning the concepts of basics of forensic toxicology including history and development, procedures followed at forensic laboratories, collection and preservation of biological specimens in poisoning cases, extraction and forensic examination of specimens.

Module-1 Basics of Forensic Toxicology

Teaching Hours: 15 Hours

History, Scope and Significance, Crime scene involving poisons, medico legal aspects of poisoning, Laws related to poisons, nodal agencies and stake holders in forensic toxicology, nature of forensic toxicological examinations, Roles and Responsibilities of forensic toxicologists, drug paraphernalia, poisoning management, Format of autopsy report and laboratory report, expert witness testimony.

Module-2 Collection and Preservation

Teaching Hours: 15 Hours

Biological and non-biological samples, classes of matrices, National and International guidelines of toxicological sample collection, post-mortem examination, types of viscera, viscera collection and preservation, types of preservatives, types of containers, self-life of samples, Safety measures of toxicological samples handling, Personal Protective Equipment (PPEs).

Module-3 Extraction and Examination

Teaching Hours: 15 Hours

Extraction of poisons from biological and non-biological samples, Methods of Extraction, Liquid-Liquid extraction, extraction methods for acidic, basic and neutral poisons, extraction of volatile and non-volatile poisons, extraction of plant poisons, common methods of poison detection, chemical tests, Instrumental methods for toxicological examination, Toxicological analysis of decomposed material and body remains, challenges in forensic toxicological examination.



Course Learning Outcomes: On completion of the module's students should be able to understand;

1. Basics of forensic toxicology.
2. Nodal agencies and working procedures at FSL.
3. Collection and preservation of biological specimens.
4. Analysis and examination of biological specimens in poisoning cases.

Reference Books:

1. Modi JS: Medical Jurisprudence and Toxicology
2. Taylor: Medical Jurisprudence
3. Parikh CK: Medical Jurisprudence and Toxicology
4. Keith Simpisen & Bernard Knight: Forensic Medicine
5. Poison, CJ, DJ Gee, B. Knight: Forensic Medicine
6. Reddy: Forensic Medicine
7. Laboratory Procedure Manual- Forensic Toxicology, DFS, MHA, New Delhi
8. Pharmacology and Therapeutics-Bhandarkar & Satoskar
9. Medical Pharmacology- Tripathy
10. Essentials of Toxicology- Ellenhorn

BSC-MJ-402: Forensic Physics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams				
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs	
					Marks	Hrs	Marks	Hrs					
3	0	0	3	3	50	00:45	50	01:30	100	03:00	-	-	200

Course Objectives: To impart basic knowledge of physical evidence such as Glass, Paints and Soil samples encountered on the crime scene.

MODULE-1

Glass

Teaching Hours: 15 Hours

Introduction to glass, Types of glass and their compositions, Forensic examination of glass fractures under different conditions, determination of direction of impact: hackle marks, backward fragmentation, Physical measurements of glass, color and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis, and interpretation of glass evidence, Case Studies.

MODULE-2

Paints & Soil

Teaching Hours: 15 Hours

Introduction, Composition, Manufacture of Paint, types of paint, Forensic Examination of Paints and Coatings: Collection and Preservation of paint samples, macroscopic and microscopic techniques for the characterization of Paint Fragments, Physical, Chemical & Instrumental analysis of paint, interpretation of Paint Evidence, Case Studies.

Soil and its composition, Classification of soil, Collection and preservation of soil as a evidence, analysis of soil samples: Physical, chemical and instrumental, interpretation of soil evidence, Soil as a geomarker, Case Studies.

**MODULE-3
Hours**

Forensic Prints & Impression Evidences

Teaching Hours: 15

Introduction to tool marks: Types of tool marks, Class characteristics and individual characteristics of tool marks, Collection and Preservation of tool marks, Forensic examination of tool marks, Case Studies.

Fibre evidence – artificial and man-made fibres. Collection of fibre evidence. Identification and comparison of fibres. Cloth evidence – importance, collection, analysis of adhering material. Matching of pieces.



Tyre Impressions:

Introduction to tire impressions, Collection and Preservation of the tire impression evidence, Forensic Significance of skid marks, Forensic Examination for identification and comparison, Case Studies.

Footprints & Shoe impression examination:

Introduction to footprints & Shoe impression, locating impressions at the scene of crime, Evidence collection: Collection, Lifting/Casting and Preservation of foot/footwear impressions, importance of Gait pattern, Forensic Identification and Methods of comparison, Case Studies.

Lip print:

Introduction to Cheiloscopy and history of lip prints, Classification of lip prints, Collection, Development, Identification and Comparison of lip prints.

Ear Prints:

Introduction to the history of ear prints, Morphology of the ear, Procedure of taking standards from the suspects, Identification and comparison of ear prints.

Course Learning Outcomes: The students will gain knowledge of:

1. Basic concepts of the Glass formation, formulation of different types of paints and Soil.
2. Forensic Examination of physical evidence involving their collection, packaging and physical & chemical examination.
3. Investigation of the cases related to such physical evidence.

References and Suggested Readings:

1. Forensic Science Evidence: Can the Law Keep Up With Science (Criminal Justice: Recent Scholarship by Donald E. Shelton.
2. M. Byrd, *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, CRC Press, Boca Raton (2001).
3. T.J. Gardener and T.M. Anderson, *Criminal Evidence*, 4th Ed., Wadsworth, Belmont (2001).
4. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
5. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, *Techniques of Crime Scene Investigation*, CRC Press, Boca Raton (2013).

BSC-MJ-403: Forensic Biology and Wildlife Forensics
Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	0	0	3	3	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

The objective of this course is to introduce students to various fields of forensic biology, Forensic Limnology, Forensic Entomology and importance of Forensic Science in Wildlife based investigations.

MODULE-1 Introduction to Forensic Biology Teaching Hours: 15 Hours

Brief History of Forensic Biology: Developments and Scope in the field of Forensic Biology, Branches of Forensic Biology Different types of biological Evidences and their significance in Forensic Science Collection, Preservation, Packing, Forwarding and Documentation of Biological Evidences.

Types and identification of microbial organisms of forensic significance, case studies.

Introduction to wood and its anatomy, Identification of endangered wood & its significances, case studies.

Forensic Palynology: Introduction and history of palynology, structure of pollen, identification and comparison of pollen, forensic significance, case studies.

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, case studies.

Introduction and classification of fibers, identification and comparisons of fibers and different microscopic, spectroscopic and chromatographic techniques, case studies.

MODULE-2 Forensic Limnology & Forensic Entomology Teaching Hours: 15 Hours

Forensic Limnology-diatoms:

Introduction to Forensic Limnology, Role of algae & fungi in Forensic Science, Introduction to Diatoms, Identification of diatoms from biological matrices from soil & water, Diatoms testing, Legal aspects of Diatoms, Case Studies.

Forensic Entomology:



Introduction and History of Forensic Entomology, Anatomy and Taxonomy of Forensically relevant Insects (Diptera), Insect Succession (in buried bodies, burnt bodies, decomposed bodies above the soil and in water) & Factors that affect Insect Succession, Estimating Post-mortem Interval/ Time since infestation from invertebrate development rates, Forensically important Aquatic Insects, Insects as weapons and Threats to National Security, Collection of entomological evidence during death investigations, Forensic Entomology and the Law, Case studies.

MODULE-3

Wildlife Forensics

Teaching Hours: 15 Hours

Definition and advances in wildlife forensics, Threats to the natural resources and wild species inhabiting globally, Importance of Wildlife Conservation, Classification of Species as per IUCN Red Data Book, Introduction to CITES and CBD, Wildlife (Protection) Act, 1972 of India and other related acts, Different Methods of Poaching, Conventional methods of species identification, Morphological identification and examination of wildlife parts and products, Application of DNA technologies used in Wildlife Forensics.

Course Learning Outcome: After studying this course, the students will be able to explain-

1. The significance of biological evidence.
2. The forensic importance of hair evidence.

References and Suggested Readings:

1. Forensic Biology. Richard Li, Sue Norman, Jane Schober. Edition Published :2015. ISBN 1439889724, 9781439889750. Published by CRC Press.
2. "Environmental Biology (Principles of Ecology)" by Verma P S and Agarwal V K
3. Wildlife Forensics: Methods and Applications. Editor(s):Jane E. Huffman, John R. Wallace. First Edition published :2012. Print ISBN:9780470665088 |Online ISBN:9781119953142 |DOI:10.1002/9781119953142. Published by John Wiley & Sons, Ltd.
4. Wildlife Forensic Investigation: Principles and Practice. John E. Cooper and Margaret E.Cooper. First Edition published: 2013. ISBN-10: : Published by CRC Press.
5. The Wildlife (Protection) Act, 1972 of India as published in Gazette of India.
6. Forensic science in wildlife investigations. Editor, Adrian Linacre. (International forensic science and investigation series) ISBN 978 0 8493 0410 1.
7. Species Identification from guard hairs of selected Indian Mammals: A reference guide. Bahuguna et al, 2010. Wildlife Institute of India.
8. Webiste : <https://moef.gov.in>
9. Webiste : <http://nbaindia.org>
10. Webiste : <https://www.iucn.org>



BSC-MN-404: Forensic Medicine

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs						
3	0	0	3	3	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives:

The objective of the course is to provide a comprehensive understanding of the intersection between medical science and the legal system. It aims to equip students with the theoretical knowledge and practical skills required to perform medico-legal investigations, including the determination of cause and manner of death, injury analysis, and the identification of deceased individuals through various forensic techniques.

MODULE-1

Death Investigations

Teaching Hours: 15 Hours

Fundamental aspects and scope and objectives of forensic medicine. Need of forensic medicine. Approaching the crime scene of death. Inquest, 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 logbook. 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-2

Thanatology

Teaching Hours: 15 Hours

Definition of death- types and causes of death. – Mode of death- - post-mortem changes- Estimation of time since death. Molecular and systemic death- Objectives of medico legal autopsy- Medico-legal aspects of death - asphyxia- various types- mechanical asphyxia- hanging strangulation. Death by drowning- medico legal aspects.

MODULE-3

Traumatology

Teaching Hours: 15 Hours

Injuries and violence against women and children. Mechanical Injuries. -Types and classification of injuries. Ante mortem and post-mortem injuries. Aging of injuries. Self-inflicted injuries. - Thermal deaths – electrocution-sexual offences- investigations of victim and accused. Child abuses -human trafficking investigative protocols.



Course Learning Outcomes:

At the end of this course, student will gain understanding about;

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

References and Suggested Readings:

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. J. Dix, Handbook for Death Scene Investigations, CRC Press, Boca Raton (1999).
4. H. B. Baldwin and C. P. Mayin, Encyclopaedia in Forensic Science, Volume 1, J. A. Siegel, P.J. Saukkoand G.C. Knupfer (Eds.), Academic Press, London (2000).
5. V. J. Geberth, Practical Homicide Investigation, CRC Press, Boca Raton (2006).
6. T. Beveland R. M. Gardner, Bloodstain Pattern Analysis, 3rdEdition, CRC Press, Boca Raton (2008).

BSC-EL1-405: Multimedia Forensics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	200

Course objectives:

This course covers the essentials of multimedia forensics, including tools, applications, and techniques for detecting and handling forgeries in media files. Students will learn about the legal aspects of digital evidence, recovery, and preservation of multimedia files, and laws on copyright and plagiarism. The course includes authentication and enhancement techniques for audio, video, and images, forensic voice analysis, and digital signal processing methods. It also addresses CCTV technology, footage analysis, handling and preservation, video management systems, and intelligent video analytics.

MODULE-1 Introduction to Multimedia & CCTV Forensics Teaching Hours: 15 Hours

Introduction: Need of multimedia forensics, multimedia tools, their applications, forgeries in media files, Handling and preservation of multimedia files, Legal Aspects of digital multimedia evidence, and recovery of audio and video files, copyright infringement, plagiarism and related laws.

CCTV Forensics: Role and functioning of CCTV cameras, Types of CCTVs, CCTV footage analysis, Handling, Preservation and transport of CCTV footages, Video Management system, CCTV surveillance, Intelligent Video analytics and related case studies

MODULE-2 Audio, Video and Image Examination Teaching Hours: 15 Hours

Authentication of audio, video and image file, enhancement techniques, forensic voice analysis, video/image analysis, Digital Signal Processing, Origin and integrity of multimedia files, digital watermarking, LPC, DFT and FFT, Multimedia file Formats, Tools for Analysis

Course Learning Outcomes:

1. Understand the need for multimedia forensics and the applications of multimedia tools.
2. Identify and analyze forgeries in media files, and handle and preserve multimedia evidence.



3. Comprehend legal aspects of digital multimedia evidence, including copyright infringement and plagiarism laws.
4. Perform authentication and enhancement of audio, video, and image files, and conduct forensic voice and video/image analysis.
5. Analyze CCTV footage, manage video surveillance systems, and apply intelligent video analytics in case studies.

Reference books:

1. Forensic Speaker Identification by Phil Rose & James R Robertson
2. Forensic Voice Identification by Harry Hollien
3. The Acoustic Analysis of Speech by Ray D Kent & Charles Read
4. Voice Recognition by Richard L Klevans & Robert D Rodman
5. Multimedia Forensics and Security: Foundations, Innovations, and Applications by Mohamed Mostafa Fouad et al
6. Multimedia Forensics and Security by Chang-Tsun Li
7. Intelligent Video Surveillance Systems by Jean-Yves Dufour
8. Digital Image Processing by Rafael Gonzalez & Richard Woods
9. Digital Image forensics by Roy, A. et al

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BSC-EL2-405: Immunology and Immunological Techniques

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course objectives:

This course aims to build the foundation of basic immunological concepts like components, structure as well as type of immune system and responses. It elaborates the mechanisms involved in immune responses. This course also apprises the students about the various immune-techniques and vaccine development.

MODULE-1 Introductory Immunology

Teaching Hours: 15 Hours

Innate and Acquired immunity, Clonal nature of immune response, Cells and Organs of the immune system: Hematopoiesis and differentiation, B-lymphocytes, T-lymphocytes, Macrophages, Dendritic cells, Natural killer cells, Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells, Organization and structure of lymphoid organs.

Antigen – Epitope, essential factors for antigenicity, haptens and adjuvant. Antibody: structure and function, antigenic determinants on immunoglobulins, isotypic, allotypic and ideotypic variants, antigen and antibody interactions, and their importance, Major histocompatibility complex and their importance in Forensics, Antigen Processing and presentation, Cytokines and their role in immune regulation.

MODULE-2 Immunotechniques

Teaching Hours: 15 Hours

Different techniques to study antigen-antibody interactions, immunodiffusion, Immunoelectrophoresis, radioimmunoassay, ELISA, immunohistochemistry, development of dot blot, Flow cytometry, production of monoclonal and polyclonal antibodies, hybridoma technology, Vaccine, Concepts of vaccines, whole-organism vaccines, recombinant vaccines, DNA vaccine, synthetic peptide and multivalent sub unit vaccines., different strategies of vaccine development.

Course Learning Outcomes:

By the end of this course, students will be able to:

1. Gain foundational knowledge of the Immune System including innate and adaptive immunity.



2. Learn about mechanisms of immune response and the molecular mechanisms underlying immune activation and regulation.
3. Learn the principles of vaccine development and the role of vaccines in preventing infectious diseases.
4. Gain proficiency in immunological techniques and to understand the principles and applications of these techniques in research and diagnostics.

Reference Books

1. J.J. Owen, J. Punt, S. Stranford, (2012) Kuby Immunology (8th Edition), WH Freeman and Company, USA.
2. J.M. Berg, J.L. Tymoczko, L. Stryer. (2012) Biochemistry (7th Edition), WH Freeman and Company, USA.
3. D.M. Male, J. Brostoff, D. Roth, I. Roitt, (2012) Immunology (8th Edition), Saunders, Elsevier, USA.
4. K. Murphy (2011) Janeway's Immunobiology (8th Edition), Garland Science, USA.
5. A. Abbas, A. Lichtman, S. Pillai, (2014) Cellular and Molecular Immunology (8th Edition), Saunders, Elsevier, USA

BSC-AE-406: Scientific Communication Skills

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

1. To develop clear, precise, and objective scientific communication skills
2. To enhance students' abilities to present scientific data ensuring accuracy and comprehensibility.
3. To build proficiency in public speaking and presentation skills in delivering scientific content.

MODULE-1 Scientific communications

Teaching Hours: 15 Hours

Fundamentals of Scientific Communication: Clarity, Precision, and Objectivity, Communicating Scientific Data: Graphs, Tables, and Figures, Writing Abstracts, Summaries, and Scientific Reports.

MODULE-2 Presentation and Public Speaking Teaching Hours: 15 Hours

Techniques for Effective Scientific Presentations, Use of Visual Aids in Presentations, Public Speaking Skills: Clarity, Engagement, and Confidence

Course Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Demonstrate the ability to write clear, precise, and objective scientific documents
2. Effectively communicate scientific data through well-constructed graphs, tables, and figures
3. Exhibit strong presentation and public speaking skills, utilizing visual aids in scientific presentations.

References and Suggested Readings:

- Alley, Michael. *The Craft of Scientific Writing*. Springer, 2018.
- Day, Robert A., and Barbara Gastel. *How to Write and Publish a Scientific Paper*. Cambridge University Press, 2016.
- Zinsser, William. *On Writing Well: The Classic Guide to Writing Nonfiction*. Harper Perennial, 2016.
- Doumont, Jean-Luc. *Trees, Maps, and Theorems: Effective Communication for Rational Minds*. Principiae, 2009.
- Gallo, Carmine. *Talk Like TED: The 9 Public-Speaking Secrets of the World's Top Minds*. St. Martin's Press, 2014.



BSC-SE-407: Entrepreneurship

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives: The aim of this course is to familiarize students with the concept of Startups and Entrepreneurship and to provide the knowledge of becoming an entrepreneur by identifying business opportunities and developing business plans.

MODULE-1 Introduction to Entrepreneurship

Teaching Hours: 15 Hours

Introduction: Meaning and importance of Entrepreneurship, Evolution of the term, entrepreneurship, Factors influencing entrepreneurship, characteristics, of entrepreneurship, types of entrepreneurship, objectives of entrepreneurship development, Startups- Definition, Types.

Entrepreneurship Development Skills: Types of entrepreneurial skills - team work and leadership skill, analytical and problem-solving skills, critical thinking skills, branding, marketing and networking skills. Role of entrepreneurship development programmes (EDP)

MODULE-2 Financial Support Agencies and Business Plans Teaching Hours: 15 Hours

Financial Support Agencies: Institutions supporting Entrepreneurs: Various Central and State, Level Organizations which help the Entrepreneurs, Banks and non-banking financial organisations, Fund Collection for Entrepreneurship.

Business Plans: Concept of Business plan, format, and components of business plan. Significance of Business Plan. Making of a Business plan.

Course Learning Outcomes: At the end of this course, the students will be able to start his/ her own business by understanding the opportunities that are lying in front of them. He / she will learn how to make a business plan and how to approach funding agencies for getting their loans sanctioned.

References:

1. Kathleen R Allen, Launching New Ventures, an Entrepreneurial Approach, Cengage Learning.



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- 2. Anjan Raichaudhuri, Managing New Ventures Concepts and Cases, Prentice Hall International.
 - 3. S. R. Bhowmik & M. Bhowmik, Entrepreneurship, New Age International.
 - 4. Steven Fisher, Ja-nae' Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd.
 - 5. Byrd Megginson, Small Business Management An Entrepreneur's Guidebook, 7th ed, McGrawHill
 - 6. A Fayolle Entrepreneurship and new value creation, Cambridge, Cambridge University Press.



BSC-PR-408: Practical-IV

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total	
					Practical					
L	T	P	C	TCH	Internal Exam		University Exams			
					Mid Sem		LPW			
					Marks	Hour	Marks	Hour		
					50	3:00	100	6:00		
0	0	8	4	8					150	

Course Objectives

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-1

Forensic Toxicology

1. Extraction of heavy metals using wet digestion and dry digestion.
 2. Extraction of volatile and non-volatile poisons
 3. Analysis of heavy metals using colour tests (reinsch test).
 4. Colour test and TLC of various plant poisons and pesticides
 5. Analysis of drug using UV-Vis spectroscopy.

MODULE-2

Forensic Physics

1. Density gradient analysis of soil samples.
 2. Determination of density of glass by specific gravity bottle method
 3. Restoration of erased identification marks.
 4. Determination of refractive index of glass and liquid.
 5. Comparison of broken glass bangles.
 6. Physical matching of broken pieces of different objects.
 7. Determination of tensile strength of rope/dupatta.
 8. Physical examination of paint samples by microscopic method

MODULE-3

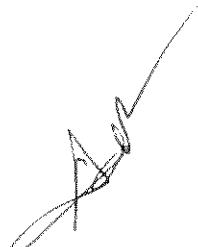
Forensic Biology and Wildlife Forensics

1. Microscopic examination of hairs – identification of species origin.
 2. Examination of natural fibre like cotton, jute, coir and silk by microscope.
 3. Examination of diatoms from different water bodies.
 4. Examination of pollen grains of forensic relevant plants.
 5. Examination of wood by microscopy method
 6. To study life cycle of housefly and interpret time since death

MODULE-4

Forensic Medicine

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





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B.Sc.-M.Sc. Forensic Sciences

SEMESTER-V

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BSC-MJ-501: Digital Forensics and Cyber Law

Teaching and Evaluation Scheme

Th	Tu	Pr	C	TCH	Evaluation Scheme								Total	
					Theory				University Exams		Practical			
					Internal Exams		MSE		Marks	Hrs	University Exams (LPW)	Hrs		
TA-1 & TA-2	Marks	Hrs	Marks	Hrs										
3	1	0	4	4	50	00:45	50	01:30	100	03:00	-	-	200	

Course Objectives:

The primary objective of this course is to teach students how to identify and classify various types of cybercrimes occurring in the digital realm. Comprehend the fundamental principles and methodologies of Digital Forensics, including data acquisition, analysis, and preservation techniques. To acquire knowledge of Incident Response procedures, emphasizing the handling and preservation of digital evidence in accordance with legal standards. Gain insight into the key sections of the Information Technology (IT) Act and related laws governing the admissibility of digital evidence in legal proceedings.

MODULE-1 Forms of Cyber-Crime and Introduction to Digital Forensics

Teaching Hours: 15 Hours

Cyber-crime – Overview, Internal and External Attacks, Online and Offline Attacks.

Cyber-crime against Individual and Organization – Email spoofing, Phishing; types and techniques, spamming, unauthorized access to computer, Denial-of-Service (DoS) attack and its types, DDoS attack, Computer sabotage, Malwares and its types, E-mail bombing, Salami Attack, Software Piracy, Industrial Espionage; Cyber-crime against women and children, Crimes on social media, Online and Banking frauds, Intellectual Property Frauds. Different stages of cyber-attack.

Digital Forensics – Introduction, Objective, Methodology, Rules and Services of Digital Forensics, various branches of digital forensics - Live Forensics, Disk Forensics, Network Forensics, Mobile Device Forensics etc.

MODULE-2 Incident Response and Digital Evidence Teaching Hours: 15 Hours

Incident Response and First Responder at crime scene – role, toolkit, stages of response, Do's and Don'ts. Types and source of Digital Evidences, Principles for collection of digital evidence, Best Evidence Rule, Forensic Readiness: Planning and Pre-search requirement, Qualities and Ethics of a good forensic investigator, Code of Ethics, benefits and challenges in digital forensics, Search, Seizure Collection and Preservation of Volatile and Non-volatile evidence; Introduction to Imaging, Hashing, Deleted data recovery.



MODULE-3 Introduction to IT Act and Cyber Laws Teaching Hours: 15 Hours

IT Act 2000 - Objectives, Applicability, Non-applicability, Definitions, Amendments and Limitations; Digital Signature and its legal recognition, Electronic records and their legal recognition, Electronic Evidence, Electronic governance, Controller and Certifying Authorities; Information Technology (Amendment) Act 2008 – Objective, Applicability and Jurisdiction; Various cyber-crimes under Sections 43 (a) to (j), 43A, 65, 66, 66A to 66F, 67, 67A, 67B, 70, 70A, 70B, 80 etc. along with respective penalties, punishment and fines. Penal Provisions for Phishing, Spam, Virus, Worms, Malware, Hacking, Trespass and Stalking; Relevant Sections of Indian Evidence Act.

Course Learning Outcomes: After studying this paper, the students would be able to:

1. Understand the different types of crimes in the cyberspace.
2. Get familiar with the principles of Digital Forensics.
3. Learn the basics of Incident Response and principles pertaining to digital evidence.
4. Get an overview of the different sections of IT Act and laws related to the admissibility of digital evidences.

References and Suggested Readings:

1. Nina Godbole and Sunit Belapure, "Cyber Security: Understanding Cyber-crimes, Computer Forensics and Legal Perspectives", Wiley Publications, 2011.
2. Bill Nelson, Amelia Phillips and Christopher Steuart, "Guide to Computer Forensics and Investigations, 5th Edition", Cengage, 2010 BBS.
3. William Stallings. "Cryptography and Network Security: Principles and Practices, 5th Edition", Prentice Hall Publication Inc., 2007.
4. Majid Yar, "Cybercrime and Society", Sage Publications, 2006.
5. Michael E. Whiteman and Herbert J. Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.
6. EC-Council, "Computer Hacking Forensic Investigator v.9".
7. Harish Chander; "Cyber Laws and IT Protection", PHI Learning Pvt. Ltd, 2012.
8. Karnika Seth; "Computers, Internet and New Technology Laws", Lexis Nexis Butterworth Wadhwa, 2012.



BSC-MJ-502: Forensic Chemistry
Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

To provide a comprehensive understanding of forensic chemistry principles, techniques, and quality management standards in forensic laboratories. To equip students with the knowledge and skills needed to analyse various types of forensic evidence, including drugs, explosives, fire residues, petroleum products, alcoholic beverages, and food adulterants.

MODULE-1 Introduction to Forensic Chemistry, Narcotic Drugs & Psychotropic Substances

Teaching Hours: 15 Hours

Introduction to forensic chemistry, Types of cases/exhibits received for analysis, Overview of forensic chemical analysis.

Introduction to NDPS drugs, Controlled Substances, Classification of controlled substances, Precursor chemicals, Narcotic raids and clandestine drug laboratories investigation, Mandatory provisions of NDPS Act, 1985.

Designer Drugs, Testing, Isolation, Presumptive and Screening tests for Narcotic Drugs & Psychotropic Substances by colour test and TLC.

MODULE-2 Quality Management and Introduction to Fires & Arson Investigation and Explosives

Teaching Hours: 15 Hours

Introduction to Quality, Quality Assurance, Quality control, Definition of Accreditation, History and development of ISO, Importance of accreditation in Forensic science laboratories, equipment maintenance and calibration, reference standards and validation of methods, Proficiency testing.

Introduction to thermodynamics and chemistry of Fire, Investigation of Fire and Arson, Forensic analysis of fire debris by instrumental methods.

Introduction and classification of explosives, Post blast investigation, Systematic examination of explosive and Explosion residues (organic and inorganic) by colour test and TLC.

MODULE-3 Forensic Analysis of Petroleum Products, Alcoholic Beverages, Bribe Trap and Food Adulteration

Teaching Hours: 15 Hours



Introduction to Petroleum Products and Analysis of Petrol, Kerosene and Diesel as per BIS Specifications.

Alcoholic Beverages: Forensic Analysis of alcoholic beverages, country made liquor, illicit liquor and medicinal preparations containing alcohol as constituents. Identification of alcoholic beverages by chromatographic methods

Bribe Trap: Examination of Chemicals (Phenolphthalein) used in Bribe trap cases.

Introduction to Food adulteration, Different methods of detection of common food adulterants like oil, ghee, chilli and turmeric.

Course Learning Outcomes: Upon successful completion of this course, students will be able to-

1. Analyse various substances of forensic interests using techniques such as colour tests, and chromatography.
2. Implement Quality Management, quality assurance and ensuring the validity and reliability of forensic results.
3. Interpret and apply regulations governing narcotics, psychotropic substances, and food adulteration.
4. Conduct investigations like fires, arson and post-blast scenes using systematic forensic methods.

Suggested Readings:

1. Bogusz, M. J.; Hand Book of Analytical Separations, Vol. 2: Forensic Science 1st ed., Elsevier Science, 2000.
2. NABL Guide for Internal audit and Management Review for Laboratories.
3. NABL-210, Assessor Guide Issue No.3, 1.5.2002.
4. DFSS: Manuals of Forensic Sciences.
5. Maudham Bassett et al.; Vogel Textbook of Quantitative Chemical Analysis, 6th Ed. Longman Essex.
6. Brean S. Furniss et al; A. I. Vogel Textbook of Practical Organic Chemistry, Addison Wesley Longman, Edinburg.
7. D. A. Skoog, D. M. West, F. J. Holler.; Analytical Chemistry – An Introduction, 7th Ed. Saunders College Pub, Philadelphia, USA.
8. C.A. Watson; Official and Standardized Methods of Analysis, Royal Society of Chemistry, UK.
9. Feigl; Spot Test in Inorganic Analysis, Elsevier Pub. New Delhi.



BSC-MN-503: Forensic Anthropology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
Marks	Hrs	Marks	Hrs											
3	0	0	3	3	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course objectives:

The objective of the forensic anthropology subject is to equip students with the specialized knowledge and skills required to analyse human skeletal remains in a legal context. This course aims to teach students the methods for determining age, sex, ancestry, and stature from bones, as well as identifying trauma and pathological conditions. Students will learn to apply osteological techniques to assist in the identification of individuals and the interpretation of life and death circumstances. Emphasizing both theoretical understanding and practical application, the course prepares students to contribute effectively to forensic investigations, work collaboratively with other forensic specialists, and provide crucial evidence in judicial proceedings.

MODULE-1 Basics of anthropology and application in forensics Teaching Hours: 15 Hours

Forensic Anthropology – History - Scope and development - Role of forensic anthropologist - Collection and preservation of evidences - Human osteology - Determination of age, sex, stature- Determination of personal identity by superimposition technique - Video image analysis - Facial reconstruction – Legal provisions and tools involved in it - Pathology of bones and its importance in identification.

MODULE-2 Basics of odontology and application in forensics Teaching Hours: 15 Hours

Forensic Odontology: Introduction - Structure and types of teeth - Dentition and dental formula - Dental diseases - Determination of age, sex and race from teeth - Role of teeth in mass disaster - Forensic significance in identification. Bite marks examination.

MODULE-3 Disaster Victim Identification (DVI)

Teaching Hours: 15 Hours

Identification of burnt bones, skeletal remains in accidents, crimes and mass disaster, Examination and identification of dead bodies in mass disasters, mutilated bodies, fragmentary skeletal remains and bones, Determination of age, sex, race and species origin from bones and assessment of stature.



Course Learning outcomes:

At the end of course, students will be able to:

1. Analyze Skeletal Remains: Identify and analyze human skeletal remains to determine age, sex, ancestry, and stature.
2. Identify Trauma and Pathology: Recognize and interpret signs of trauma and pathological conditions in bones.
3. Apply Osteological Techniques: Utilize osteological methods to assist in the identification of individuals.
4. Reconstruct Life Histories: Infer details about an individual's life, health, and circumstances of death from skeletal remains.
5. Preserve and Document Evidence: Properly document and preserve skeletal evidence for forensic analysis and legal proceedings.
6. Perform Field Recovery: Conduct field recovery of human remains, ensuring proper excavation techniques and evidence preservation.

Reference Books:

1. MariaTeresa,Tersigni-Tarrant, Natalie R. Shirley; "Forensic Anthropology: An Introduction", CRC Press, Taylor & Francis Group, 2012.
2. AngiChristensen, N.Passalacqua,& E. Bartelink; "Forensic Anthropology: Current Methods and Practices", Academic Press, Elsevier, 2014.
3. Anil Mahajan & Surinder Nath; "Application areas of Anthropology", Reliance Publishing House, 1992.
4. Megan Brickley&Roxanna Ferllini; "Forensic Anthropology: Case Studies from Europe", Charles C. Thomas Publisher, Springfield, Illinois, USA, 2007.
5. Whitaker, D.K. and MacDonald, D.U. (1989), Forensic Dentistry, Wolfe Medical Publications Ltd.



BSC-MN-504: Instrumental Techniques-I

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
Marks	Hrs	Marks	Hrs											
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course objectives:

This course aims to equip students with proficiency in instrumental techniques crucial for forensic analysis, covering microscopy, biochemical analytical methods, and electromagnetic spectrum analysis. Highlighting the pivotal role of instrumental techniques in forensic science, students will learn to apply various microscopy tools and analytical methods such as electrophoresis to accurately analyze and identify biological samples. Additionally, students will explore the electromagnetic spectrum and theoretical concepts of separation and extraction techniques, enabling them to effectively analyze and interpret forensic evidence with precision and reliability.

MODULE-1 Microscopic Techniques in Forensic Science Teaching Hours: 15 Hours

Mirrors & Lenses, Basic principles of microscopy, Simple and Compound microscope, Study of different types of microscopes: Types of Light Microscopes and their working principles, Electron Microscopes and their working principles: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM); Comparison microscope, Stereoscopic microscope, Polarizing microscope, Fluorescence microscopy, IR microscopy.

MODULE-2 Analytical Techniques Teaching Hours: 15 Hours

Biological / Biochemical Analytical Techniques: Introduction to pH, Buffer systems and pH meter, Physiological solution, Theories of Precipitation, Coagulation, Sedimentation & Centrifugation, Different centrifugation techniques: Density Gradient Centrifugation, Differential Centrifugation & Preparative Centrifugation.

Electrophoretic techniques: Zone electrophoresis (ZE), Paper electrophoresis (PE), Classical gel electrophoresis (CGE), Starch gel electrophoresis (SGE), Poly acrylamide gel electrophoresis (PAGE), SDS-PAGE, Isoelectric focusing (IEF) & Two dimensional SDS-PAGE.

MODULE-3

Teaching Hours: 15 Hours



Electromagnetic Spectrum: Electromagnetic radiations, Absorption & Emission Spectra; General properties of electromagnetic radiations: Wave and Quantum mechanical properties, Light-Matter Interaction: Introduction to atomic & molecular spectra, Fluorescence & Phosphorescence, Jablonski Diagram.

Theoretical Concepts of Separation and Extraction techniques: Adsorption, Absorption & Partition, Partition co-efficient, Solvent extraction and Multiple extraction, Supercritical Fluid Extraction, Accelerated Solvent Extraction, Solid Phase Extraction & Solid Phase Micro Extraction, Plate theory and concept of theoretical plates with respect to peak width and peak intensity, Rate theory and van Deemter equation, Concept of Retention factor and Retention time.

Course Learning Outcomes:

1. Master the use of microscopy tools and biochemical analytical methods, enabling precise analysis and identification of biological samples crucial for forensic investigations.
2. Develop proficiency in various electrophoretic techniques, allowing accurate separation and analysis of biomolecules for forensic applications.
3. Gain a deep understanding of the electromagnetic spectrum and its application in forensic analysis, facilitating the interpretation of absorption and emission spectra for identifying substances.
4. Acquire theoretical knowledge and practical skills in separation and extraction techniques, enabling efficient extraction and analysis of forensic evidence using methods such as solvent extraction and solid-phase microextraction.
5. Cultivate critical thinking and analytical reasoning skills, empowering students to evaluate complex forensic evidence accurately and make informed conclusions based on instrumental analysis results.

Reference Books:

1. D.A.Skoog, F.J.Holler and T.A.Neman, Harcourt Principles of Instrumental Analysis college publishers, Singapore
2. G.D.Christian and J.E.O'Reilly, Instrumental Analysis, Allyn and Bacon, Inc., Boston.
3. F.W.Fifield and D.Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London. SCHOOL OF FORENSIC SCIENCES M. Sc. Forensic Sciences
4. R.P.Bauman, Absorption Spectroscopy, John Wiely, New York.
5. M.Donhrow, Instrumental Methods in Analytical Chemistry; Their Principles and practice Vol.2, optical method, Pitaman, New York.
6. G.G.Guilbanlt, Practical Fluorescence: Theory, Methods and Practice, Marcel Dekker, New York.
7. S.Udenfriend, Fluorescence Assay in Biology and Medicine, Academic Press, New York.
8. W.J.Price, Spectrochemical Analysis by Atomic Absorption, Hyden, London.
9. R.S.Alger, Electron Paramagnetic Resonance: Techniques and Applications, Interscience, New York.
10. Analytical Chemistry by open Learning, John Wiley & Sons, New York.
11. J.C.Giddings, Dynamics of Chromatography, Marcel Dekker, New York.
12. R.C.Grob, Modern Techniques of Gas Chromatography, Marcel Dekker, New York.

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- 13. J.A.Dean, Chemical Separation Methods, Ban Nostrand Reinhold Co., New York.
 - 14. R.E.Smith, Ion Chromatography Applications, C.R.C. Press, Inc., Boca Raton.
 - 15. R.E.Smith, Supercritical Fluid Technology, C.R.C. Press, Inc., Boca Raton.
 - 16. G.Zweig and J.R.Whitaker, Paper Chromatography and Electrophoresis, Academic Press, New York.
 - 17. Safferstein: Forensic Science Handbook Vol. I, II, III.
 - 18. Lee Honry: An Introduction to Forensic Science
 - 19. Egon Stahl: Thin Layer Chromatography



BSC-EL3-505: Incident Response Management

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: The aim of this course is to equip students with the basic and important concepts of incident response, incident response management and important steps of incident responses and handling.

MODULE-1 Introduction to Incident Response

Teaching Hours: 15 Hours

Computer Security Incident, Key Concepts of Information Security, Incident Management, Purpose of Incident Management, Need and Goals of Incident Response, Incident Response Plan, Signs / Indicators of an Incident, Incident Categories, Incident Prioritization, Incident Response, Incident Handling, Estimating Cost of an Incident, Incident Reporting, Incident Response Team, Incident Response Team Members Roles and Responsibilities.

MODULE-2 Management of Incident Response

Teaching Hours: 15 Hours

Steps of Incident Response / Handling: 1: Identification, 2: Incident Recording, 3: Initial Response, 4: Communicating the Incident, 5: Containment, 6: Formulating a Response Strategy, 7: Classification, 8: Investigation, 9: Data Collection, 10: Forensic Analysis, 11: Evidence Protection, 12: Notifying External Agencies, 13: Eradication, 14: Systems Recovery, 15: Documentation, 16: Damage and Cost Assessment, 17: Lessons Learned, 18. Review and Update the Response Policies.

MODULE-3 Goals of Incident Response

Teaching Hours: 15 Hours

Goals of Incident Response, Incident Response Plan, Incident Identification, Incident Prioritization, Incident Handling, Estimating Cost of an Incident, Incident Reporting, Incident Reporting Organizations, Vulnerability Resources.

Course Learning Outcomes:

At the end of course, students will be able to explain;

1. Key concepts of information security
2. Incident response

3. Steps involved in Incident handling

References and Suggested Readings:

1. CERT IN Guidelines.
2. ENISA Manuals
3. Computer Incident Response and Forensics Team Management: Conducting a Successful Incident Response, Leighton Johnson, Syngresss
4. Incident Handling and Response: A Holistic Approach for an efficient Security Incident Management by Jithin Alex,
5. The Computer Incident Response Planning Handbook: Executable Plans for Protecting Information at Risk, N.K. McCarthy, Incident Response & Computer Forensics, Jason T. Lutgens, McGraw-Hill



BSC-EL4-505: Forensic Statistics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs						
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	-	200	

Course Objective:

The major objective of this course is to acquaint students with the basic concepts of statistics, and to offer a comprehensive knowledge of the statistical tools useful for evaluation and interpretation of forensic data. The statistical tests include the major areas of probability theory, probability distribution functions, probability mass functions, correlation and regression analysis, test of hypothesis & survey sampling. The practical applications of statistics will enable students to analyse and interpret data, and also to draw conclusions with valid reasoning and theory.

MODULE-1 Introduction to statistics & Probability distribution functions Teaching Hours: 15 Hours

Introduction to statistics, Frequency distribution, Concept of probability, Basic terms- Events, Trials, mutually exclusive events, Favourable events, Exhaustive events etc. Addition, multiplication and Bayes's theorem & applications, Probability in Forensic Evidence. Concept of measures of central tendencies, Mathematical and positional average, Normal distribution, mean, Median & Mode for continuous and discrete data, concept of measures of dispersion, significance of Variance & Standard Deviation. Concept of random variable, Discrete and continuous random variables, Concept of probability distribution functions, Normal distribution, Binomial and Poisson, Probability mass functions, Simple linear regression and correlation.

MODULE-2 Error Analysis and Test of Hypothesis

Teaching Hours: 15 Hours

Error analysis, systematic, instrumental and random error, absolute error, mean absolute error, relative error and percentage error. Propagation of errors in addition, subtraction, multiplication, and division of two quantities.

Testing of Hypothesis- Null hypothesis, alternative hypothesis- type I and type II errors, level of significance, critical region. Test of significant of attributes, Z- test significance and coefficient of correlation, small sample test, T-test, Chi- square test, F-Test for equality of variance, large sample test and Normal Test, ANOVA test.



Course Learning Outcomes: At the end of this course, students will be able to explain and implement the concepts of;

1. Basic statistical theories commonly used for the interpretation of data in Forensic Sciences.
2. Statistical knowledge to design and conduct research studies in real life problems.
3. Different types of data, Classification and tabulation of data, basics of random variables.
4. Applications of probability density functions for data interpretation.
5. Measures of central tendency, dispersion, skewness and kurtosis and moments.
6. Concepts of test of hypothesis for making statistical inferences about the population data.

Suggested Reading:

1. David Lucy: Introduction to Statistics for Forensic Scientists, Wiley, 2004
2. Colin Aitken & Franco Taroni: Statistics and Evaluation of Evidence for Forensic Scientists (Statistics in practice)
3. Wing kam Fung & Yue-Qing Hu: Statistical DNA Forensics, Theory Methods & Computation, Wiley, 2008.
4. I. W. Evett & B. S. Wier: Interpreting DNA Evidence – Statistical Genetics for Forensic Scientists, 1998
5. Miller, J. C. and Miller, J. N.: Statistics for Analytical Chemistry, Ellis Horwood, 1988
6. Fisher, R. A.: Statistical Methods for Research Workers, John Wiley, 1954
7. Sokal, R. R. and Rolf, F. J.: Biometry – Principles and Practices of Statistics in Biological Research, Freeman, 1981.



BSC-PR-507: Practical-V

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total	
					Practical					
L	T	P	C	TCH	Internal Exam		University Exams			
					Mid Sem		LPW			
					Marks	Hour	Marks	Hour		
0	0	6	3	6	50	3:00	100	6:00	150	

Course Objectives:

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-1

Digital Forensics & Cyber Law

1. Acquisition and Preservation of Volatile data from standalone computer.
2. Hash Calculation the files using different algorithms.
3. Recovery of Deleted Files and Folders
4. Imaging of data storage media using different file formats
5. Recovery Password from the protected word, pdf and rar files.

MODULE-2

Forensic Chemistry

1. To carry out qualitative test of ethyl alcohol.
2. To perform confirmatory test for ethyl alcohol and methyl alcohol
3. To identify drugs of abuse by spot tests.
4. To perform TLC of drugs of abuse
5. To carry out qualitative test for bribe trap by UV and TLC
6. To perform microcrystalline tests for drugs of abuse.
7. To study the case and prepare a report on clandestine drug investigation.
8. To study the case and prepare a report on narcotic drugs investigation.

MODULE-3

Forensic Anthropology

1. Determination of age from skull and teeth
2. To determine the 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.

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BSC-MJ-601: Forensic Ballistics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

This course aims to develop a comprehensive understanding of firearm characteristics, classifications, historical background, functional assemblies, and operating principles. This course will provide fundamental understanding of ballistics principles and methods for ballistic evidence analysis.

MODULE-1

Firearms and Ammunition

Teaching Hours: 15 Hours

Firearms characteristics & classification of firearms; History and background of firearms, Functional assembly & Operating principle of firearms, Characteristics & Working mechanism of Standard: Rifled firearms, Small arms, Shot guns & Non-standard: Improvised, Country made, Imitative firearms, identification of origin. Ammunition & its constructional parts, Classifications of Ammunition on basis of constructional features, Functional assembly of different types of ammunition & their types, Safety aspects for handling firearms and ammunition, cartridge-firing mechanism.

MODULE-2

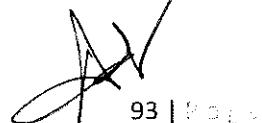
Basics of Ballistics

Teaching Hours: 15 Hours

Types of ballistics & their aspects, Internal, External, and Terminal Ballistics, General elementary & other principal problems: Heat problems, Pressure, Recoil, Vibration & Jump, Barrel Fouling, Trajectory formation & its computation, Vacuum Trajectories & its measurement, Influence of earth trajectory, Effect of air resistance on trajectories, Parameters involved in exterior ballistics. Effect of projectile on target based on: nature of target, bullet shape, striking velocity, striking angle and nature of target, intermediate targets, and range.

MODULE-3 Analysis of Firearm and Gunshot Residues (GSR) Teaching Hours: 15 Hours

Identification of firearms, ammunition and their components: Principles, Processing of Firearm Exhibits involved, Class characteristics & Individual characteristics (Identifiable marks) produced during firing process on cartridge cases & projectiles and their linkage with firearms. Analysis of GSR -Composition of GSR, Location & Collection, Mechanism of formation, Chemical &





Instrumental techniques involved in analysis, Shooter Identification technique. Case studies related to firearms cases.

Course Learning Outcomes: On the completion of the course the students will be;

1. Able to identify the firearms.
2. Familiarise with the characteristics of ammunition.
3. Know the importance and analysis methods of different firearm evidence.
4. Learn about the nature of firearm injuries.

References and Suggested Readings:

1. J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1, 2, & 3; Springfield, Illinois.
2. Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, P. A.
3. Vincent Di Maio, Gunshot Wounds; CRC Press, Washington, Dc.
4. Brain J. Heard., Hand Book Of Firearms And Ballistics; John Willey, England.
5. TA, Warlow., Firearms, The Law And Forensic Ballistics; Taylor And Francis, Landon.
6. Karl G. Sellier et al., Wound Ballistics And The Scientific Background; Elsevier, London.
7. M. Johari, Identification Of Firearms, Ammunition And Firearms Injuries; BPR&D, New Delhi.



BSC-MJ-602: Basics of Immunology and Forensic Serology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives:

The course aims at providing a comprehensive understanding of the immune system's, its components and functions, including innate and acquired immunity, antigen-antibody interactions, and the roles of cytokines, B cells, T cells, and the major histocompatibility complex. It also equips the students with knowledge about the forensic significance of blood groups, HLA typing, bloodstain pattern analysis, different blood grouping methods and analysis of different body fluids.

MODULE-1 Immunology

Teaching Hours: 15 Hours

Introduction and history of Immunology, Innate and Acquired immunity

Antigen – Epitope, essential factors for antigenicity, haptens and adjuvant.

Antibody: structure and function, antigenic determinants on immunoglobulins, isotypic, allotypic and ideotypic variants, antigen and antibody interactions, and their importance.

Major histocompatibility complex and their importance in Forensics, Antigen Processing and presentation. Generation of humoral and cell mediated immune responses, B-cell receptor, T-cell receptor, Cytokines and their role in immune regulation.

MODULE-2 Basics of Serology

Teaching Hours: 15 Hours

Blood and its composition, Haemoglobin and its variants, History and genetics of ABO and Rh blood grouping system and its significance in forensic investigation, Other forensically relevant blood group like MN, I, P, Kell, Duffy, Kidd, Lewis, Lutheran and Bombay blood group, Secretors and non- secretors.

MODULE-3 Forensic Identification of Biological Fluids

Teaching Hours: 15 Hours

Study of blood stain patterns, Composition, presumptive and confirmatory tests for blood, semen, saliva, urine, and other biological fluids, origin of species, Blood grouping of dried blood stains, semen, saliva stains (Absorption, Elution, Absorption Inhibition method, and mixed agglutination), Recent developments in detection of various body fluids by spectroscopic techniques (FTIR and Raman). Polymorphic enzymes and their forensic significance.

Course Learning outcomes: At the end of the course, students will be able to:

1. Appraise the history of immunology.
2. Explain the different fundamental concepts of immunology
3. Describe different blood groups and their relevance in forensics
4. Apply different blood grouping techniques for different body fluid stains.

Reference Books:

1. The examination and Typing of Blood Stains in the crime laboratory – B J Culliford, U. S. Dept. of Justice, Washington D. C.
2. Blood Group Serology – Boorman KE, Dodd BE and LOncin PJ, Churchill Livingstone Inc. New York.
3. Laboratory Procedure Manual - Forensic Serology (2005), Directorate of Forensic Science, MHA, New Delhi.
4. Laboratory Procedure Manual – DNA Profiling (2005), Directorate of Forensic Science, MHA, New Delhi.
5. Molecular Biology of the Cell, 6th Edition (2014) – Bruce Alberts, et al., Garland Science, ISBN: 978-0815341055.
6. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528.
7. Forensic Science: An Introduction to Scientific and Investigative Techniques – Stuart H. James, Jon J. Nordby, CRC Press, ISBN:0849327474.
8. An Introduction to Forensic Genetics 2nd Edition (2010) - William Goodwin, Adrian Linacre and Sibte Hadi, Wiley-Blackwell, ISBN: 978-0470710197.



BSC-MN-603: Instrumental Techniques - II

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total *	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs						
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives:

This course aims to provide a comprehensive understanding of instrumental techniques, including spectroscopy, chromatography, and elemental analysis, crucial for forensic investigations. Students will learn the theoretical principles, instrumentation, and practical applications of UV-Visible, infrared, Raman, and mass spectroscopy, as well as various chromatographic methods, enabling accurate analysis and interpretation of forensic evidence. Emphasizing the importance of instrumental techniques in forensics, the course will equip students with the skills necessary to utilize these tools effectively in forensic analysis and evidence interpretation.

MODULE-1

Spectroscopic Techniques

Teaching Hours: 15 Hours

UV-Visible spectroscopy: Theory, Instrumentation and Applications; Infrared Spectroscopy: Molecular vibration, Theory of IR absorption, IR Sources and Instrumentation, FT-IR Applications; Raman Spectroscopy: Theory of Raman spectroscopy, Instrumentation and Applications. Differences & Similarities between Raman & IR spectroscopy. FT-NIR spectroscopy: Theory, Instrumentation & Applications, Neutron Magnetic Resonance: Theory, Instrumentation & Application.

MODULE-2

Chromatographic Techniques

Teaching Hours: 15 Hours

Introduction to Chromatography: Partition, Adsorption, Ion exchange, Affinity Chromatography, Size Exclusion Chromatography, their principle and types of chromatography. Forensic applications of Chromatography.

Gas Chromatography: Principle, instrumentation and applications. Gas-liquid and gas-solid chromatography, GC – MS, GC – MS – MS (Tandem).

Gas Chromatography – Head Space: Principle, instrumentation and applications.

High Performance Liquid Chromatography: Principle, instrumentation and applications, LC - MS, LC - MS - MS (Tandem).

MODULE-3

Elemental Techniques

Teaching Hours: 15 Hours

Time-of-flight mass spectrometry: Theory, Instrumentation and Applications.
Quadrupole mass spectrometry: Theory, Instrumentation and Applications.
Atomic Absorption Spectroscopy: Theory, Instrumentation and Applications.
Atomic Emission Spectroscopy: Theory, Instrumentation and Applications.
ICP-OES: Theory, Instrumentation and Applications.
ICP-MS: Theory, Instrumentation and Applications.
X-Ray Spectroscopy: Theory, Types, Instrumentation and Applications.
EDXRF: Theory, Instrumentation and Applications.

Course Learning Outcomes: After completion of the course, students will:

1. Develop proficiency in a range of instrumental techniques, including spectroscopy, chromatography, and elemental analysis, essential for forensic analysis.
2. Master the theoretical principles, instrumentation, and practical applications of UV-Visible, infrared, Raman, and mass spectroscopy, as well as various chromatographic methods.
3. Acquire the skills to accurately analyze and interpret forensic evidence using instrumental techniques, enhancing investigative capabilities in forensic science.
4. Gain practical experience in utilizing techniques such as gas chromatography, high-performance liquid chromatography, atomic absorption spectroscopy, and X-ray spectroscopy for forensic sample analysis.
5. Cultivate critical thinking and problem-solving skills through hands-on experience and theoretical understanding, enabling students to effectively apply instrumental techniques in real-world forensic scenarios.

Reference Books:

1. D.A.Skoog, F.J.Holler and T.A.Neman, Harcourt Principles of Instrumental Analysis college publishers, Singapore
2. G.D.Christian and J.E.O'Reilly, Instrumental Analysis, Allyn and Bacon, Inc., Boston.
3. F.W.Fifield and D.Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London. SCHOOL OF FORENSIC SCIENCES M. Sc. Forensic Sciences
4. R.P.Bauman, Absorption Spectroscopy, John Wiely, New York.
5. M.Donhrow, Instrumental Methods in Analytical Chemistry; Their Principles and practice Vol.2, optical method, Pitman, New York.
6. G.G.Guilbanlt, Practical Fluorescence: Theory, Methods and Practice, Marcel Dekker, New York.
7. S.Udenfriend, Fluorescence Assay in Biology and Medicine, Academic Press, New York.
8. W.J.Price, Spectrochemical Analysis by Atomic Absorption, Hyden, London.
9. R.S.Alger, Electron Paramagnetic Resonance: Techniques and Applications, Interscience, New York.
10. Analytical Chemistry by open Learning, John Wiley & Sons, New York.
11. J.C.Giddings, Dynamics of Chromatography, Marcel Dekker, New York.
12. R.C.Grob, Modern Techniques of Gas Chromatography, Marcel Dekker, New York.
13. J.A.Dean, Chemical Separation Methods, Ban Nostrand Reinhold Co., New York.
14. R.E.Smith, Ion Chromatography Applications, C.R.C. Press, Inc., Boca Raton.
15. R.E.Smith, Supercritical Fluid Technology, C.R.C. Press, Inc., Boca Raton.
16. G.Zweig and J.R.Whitaker, Paper Chromatography and Electrophoresis, Academic Press, New York.



17. Safferstein: Forensic Science Handbook Vol. I, II, III.
18. Lee Honry: An Introduction to Forensic Science
19. Egon Stahl: Thin Layer Chromatography.



BSC-MD-604: Information Security Audit and Compliance

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
Marks	Hrs	Marks	Hrs											
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives:

The primary objective of this course is to teach students how they will be equipped to comprehend the multifaceted landscape of information security, including an understanding of the fundamental concepts such as risks, threats, and vulnerabilities. They will gain familiarity with policy standards, baselines, and the classification of information assets, enabling them to navigate the intricacies of safeguarding digital resources effectively. Additionally, students will develop a comprehensive understanding of risk management principles and various security technologies such as firewalls, VPNs, Honeypots, IPS, and IDS, thereby laying a foundation for implementing robust information security measures and effectively managing them in diverse organizational contexts.

MODULE-1 Introduction to Information Security

Teaching Hours: 15 Hours

Basics of Information Security – CIA Triad, Threats and vulnerabilities, Policy standards, Procedures, Guidelines and Baselines, Information Asset Classification: Classification of Information, Information Assets - Owner, Custodian, User Access Control, Authentication and Authorization; System Development Lifecycle and SSDLC -Investigation, Analysis, Logical and Physical Design, Implementation and security; CCNS Security Model; Attacks: Malicious code, Backdoors, Password crack.

MODULE-2 Risk Management and Security Technologies Teaching Hours: 15 Hours

Overview of Risk, Risk Identification- asset identification and recovery, Information Asset valuation, Vulnerability and Threat identification; Risk Assessment- likelihood, risk determination, Identification of controls, documentation; Risk Control Strategies- defend, transfer, mitigate, accept and terminate; Cost Benefit Analysis (CBA), Quantitative v/s Qualitative Risk Control Practices.

Access Controls- identification, authorization, authentication and accountability; Firewalls- processing modes, types, generations, configuration and content filters; Remote Access and VPNs; Intrusion Detection and Prevention System (IDPS)- types, Detection methods, Response behaviour, approaches, strengths and limitations, deployment and effectiveness measurement;



Honeypots and Honeynets, Scanning and Analysis Tools- ports scanners, firewall analysis tools, operating system detection tools, vulnerability scanners and packet sniffers; Biometric Access Controls.

MODULE-3 Security Planning, Implementation and Maintenance Teaching Hours: 15 Hours

Information Security Planning and Governance, IS Policies- EISP, ISSP, SysSP, policy management; NIST Security Models, IETF Security Architecture, Baseline and Best Business Practices, Security Education, Training and Awareness Program; Business Impact Analysis, Incident Response Planning, Disaster Recovery Planning, Crisis Management.

Information Security Project Management, Conversion Strategies and Bull's Eye Model, Consideration for Organizational Change, Information Systems Security Certification and Accreditation- certification vs accreditation, NIST SP 800-37, National Information Assurance Certification and Accreditation Process (NIACAP), ISO 27001/27002 system certification and accreditation; Security Management Maintenance Models- NIST SP 800-100, Security Maintenance Model, Monitoring Internal and External Environment, Vulnerability Assessment and Remediation; Digital Forensics- The team, methodology.

Course Learning Outcomes: After studying this paper, the students would be able to;

1. Understand the various concepts of information security, risks, threats & vulnerabilities.
2. Understand the various policy standards, baselines, and classification of information assets.
3. Get familiar with the concepts of risk management and other security technologies like firewalls, VPNs, Honeypots, IPS and IDS.
4. Comprehend the techniques for implementing information security and its subsequent management.

References and Suggested Readings:

1. Michael E. Whiteman and Herbert J. Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.
2. William Stallings. "Cryptography and Network Security: Principles and Practices, 5th Edition", Prentice Hall Publication Inc., 2007.
3. Majid Yar, "Cybercrime and Society", Sage Publications, 2006.
4. EC-Council, "Computer Hacking Forensic Investigator v.9".
5. Atul Kahate, "Cryptography and Network Security", 3rd Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2009.

BSC-EL5-605: Forensic DNA Analysis

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	200

Course objectives: The course aims to equip students with knowledge of DNA's role in forensic investigations, including its structure, function, and significance in individualization and identification. It also imparts knowledge on DNA extraction, quantification, PCR, RFLP, emphasizing practical forensic applications and familiarize students to apply genetic principles and statistical methods in forensic contexts, such as paternity testing and population genetics.

MODULE-1 Basics of DNA & Forensic DNA Typing

Teaching Hours: 15 Hours

Importance of DNA as evidence in forensic investigation, sequence polymorphisms, individualization of evidence. Structures and functions of nucleic acids, Mitochondrial DNA and its importance. Collection of different biological specimens for DNA analysis.

Principles of extraction and quantification of DNA, Fundamentals of Polymerase chain reaction and its application in forensic DNA analysis, Restriction fragment length polymorphism (RFLP) – genetic markers used in RFLP, typing procedure and interpretation of results, DNA markers, Role of fluorescent dyes, Introduction of Touch DNA in solving crimes.

MODULE-2 Parentage Testing

Teaching Hours: 15 Hours

Genetics of paternity in human, Mendelian laws and its relevance in paternity testing, mathematical basis of parentage identification, Report Writing: Role of DNA typing in identifying unrecognizable bodies.

Allele frequency determination, Hardy-Weinberg law, Probability determination in a population database

Course Learning Outcomes: By the end of the course, students will be able to;

1. Describe the structure of DNA and RNA and explain the eukaryotic nuclear genome organization
2. Comment on the importance of mitochondrial DNA in forensics
3. Apply the principles of DNA extraction



4. Illustrate the technique of RFLP and its importance in forensics
5. Integrate the principles of genetics in forensic cases

References and Suggested Readings:

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

BSC-EL6-605: Data Science and Artificial Intelligence

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives: The aim of this course is to equip students with the strong foundation for data science and application area related to it and understand the underlying core concepts and emerging technologies in data science. Students will learn the basics of artificial intelligence.

MODULE-1 Introduction to Python

Teaching Hours: 15 Hours

Python: Setting up Environment, Basic Python Commands, Creating Python Scripts, Conditions, Loops, List, Dictionary, User Defined Functions, Introduction to Anaconda, Working with NumPy, Pandas and Matplotlib.

Mathematics for Machine Learning: Vectors, Matrices, Linear Equations, Mean, Median, Mod, Standard Deviation and Variance, Probability, Correlation, Regression, Handling and Representing Data.

Introduction to Machine Learning: Definition and History of AI, Defining Machine Learning, Applications of ML, Issues and Challenges in ML, Types of ML. Basics of Supervised Learning, Prediction, Classification, Understanding Datasets, Feature Selection, Feature Normalization, Data Cleaning, Training, Testing & Validation Sets, Different Models of Supervised Learning, Hyper parameters, Measuring Performance, Accuracy and Loss Under-fitting & Over fitting, Basics of Unsupervised Learning, Different Models of Unsupervised Learning.

MODULE- 2 Neural Network:

Teaching Hours: 15 Hours

Understanding Biological Brain, Defining Artificial Neural Network (ANN), Applications of ANN & DL. Defining & Building a Perceptron, Feed Forward, Back propagation, Single-layer & multi-layer ANNs, building an ANN Model, Activation & Loss Functions, Compiling & Evaluating a Model. Convolutional Neural Networks (CNN): Understanding Convolutions, Pooling, Building & Fitting CNN Models, Evaluating Model Performance. Recurrent Neural Networks (RNN): Basic RNN Architecture, Applications of RNN, Building &

Fitting RNN Models, Evaluating Model Performance. Long Short-Term Memory Networks (LSTM): LSTM Network Architecture, Understanding LSTM, Building LSTMs.



Course Learning Outcomes: At the end of this course students will be able to explain and implement the;

1. Fundamental concepts of data science
2. Data analysis techniques for applications handling large data
3. Various machine learning algorithms used in data science process
4. Concept of Visualization and presenting the inference using various tools.

References books:

1. Mathematics for Machine Learning 1st Edition by Marc Peter Deisenroth
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition by Aurélien Géron
3. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition by Sebastian Raschka and Vahid Mirjalili
4. Hands-On Neural Networks with Keras: Design and create neural networks using deep learning and artificial intelligence principles 1st Edition by NiloyPurkait
5. Deep Learning with Keras: Implementing deep learning models and neural networks with the power of Python by Antonio Gulli, Sujit Pal6. Practical Machine Learning for Computer Vision 1st Edition by Valliappa Lakshmanan, Martin Görner and Ryan Gillard
6. Learning OpenCV 4 Computer Vision with Python 3: Get to grips with tools, techniques, and algorithms for computer vision and machine learning, 3rd Edition by Joseph Howseand Joe Minichino
7. Natural Language Processing in Action: Understanding, analyzing, and generating text with Python 1st Editionby Hobson Lane, Hannes Hapke and Cole Howard.
8. Machine Learning for Cybersecurity Cookbook: Over 80 recipes on how to implement machine learning algorithms for building security systems using Python by Emmanuel Tsukerman.

BSC-PR-606: Practical-VI

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total	
					Practical					
L	T	P	C	TCH	Internal Exam		University Exams			
					Mid Sem		LPW			
					Marks	Hour	Marks	Hour		
0	0	8	4	8	50	3:00	100	6:00	150	

Course Objectives:

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-1

Forensic Ballistics

1. To describe, with the aid of diagrams, the firing mechanisms of different types of firearms
2. To correlate the velocity of bullet with the impact it produces on the target
3. To correlate the striking angle of the bullet with the impact on the target.
4. To estimate the range of fired bullets and to carry out the comparison of fired bullets as well as cartridge cases.
5. To identify gunshot residue.
6. To correlate the nature of injuries with distance from which the bullet was fired.
7. To differentiate, with the aid of diagram, contact wounds, close range wounds and distant wounds.

MODULE-2

Basics of Immunology and Forensic Serology

1. Physical, biochemical and spectrophotometric examination of blood stains.
2. Examination of seminal stains by crystal tests, biochemical and microscopical analysis.
3. Examination of saliva and its stains.
4. Biochemical and microscopic examination of urine.
5. Determination of origin of species from biological fluids.
6. Blood group typing of biological fluid stains by absorption elution, absorption inhibition and mixed agglutination techniques.
7. Isolation of DNA from blood and its quantification.
8. Collection and extraction of DNA using FTA card.

MODULE-3

Instrumental Techniques-II

1. UV-Visible spectroscopic determination of chemical dyes of forensic importance
2. To understand and perform quantitation by calibration graph method, internal standard method and standard edition method with the help of any one pharmaceutical drugs.
3. Validation of a method (drugs, pesticide) by anyone instrumental technique



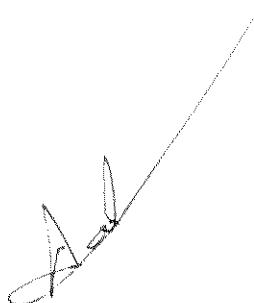
-
- 4. Elemental analysis using mass spectrometry/optical emission spectroscopy/X-ray spectroscopy

MODULE-4

Information Security Audit and Compliance

- 1. Secure configuration of ports and services of windows system
- 2. Encrypting and Decrypting the partition using Bit Locker
- 3. Creating sandbox and honeypots for analysis of malwares
- 4. Vulnerability scanning using different tools
- 5. Creating different rules and Configuring firewall

SEMESTER-VII





Specialization-1

“Forensic Physics & Ballistics”



BSHN-SP1-MJ-701: Lasers and Spectroscopy

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
Marks	Hrs	Marks	Hrs						Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

This course is designed for the students with the aim of delivering knowledge of light sources, optical spectroscopy, fundamentals of vacuum science and technology in context to experimental techniques employed in forensic science, practical application of optical fibers, and various spectroscopic techniques relevant in forensic applications.

MODULE-1 Basic components of optical spectroscopy Teaching Hours: 15 Hours

Light sources and spectrometer: CW & pulsed light sources (Lasers), Sodium lamp, a brief review of Lasers, Q-switching and Mode locking to generate short and ultra-short laser pulses, Laser output profile. Prisms and gratings, Czerny-Turner Spectrometer/ Monochromator, Resolution and dispersion of Prism and grating spectrometer, Charge Coupled Devices (CCD), Photodiodes and Photomultiplier tubes.

MODULE-2 Vacuum Science and Optical Fibre Teaching Hours: 15 Hours

Vacuum Science and Technology: Types of Vacuum and different flow regimes, Conductance, pumping speed and Throughput, Creation of vacuum: Vacuum pumps, Rotary vane pump and Turbo-molecular pump, measuring the vacuum: Pirani and Penning gauges, Vacuum chamber and their components, Requirement of vacuum for an experiment (e.g. CRT, Fragmentation studies of a molecule etc.).

Optical Fibers: Advantages of optical fiber communication over normal medium, Step index and graded-index fibers, Numerical aperture, single mode and multimode fiber. Relative refractive index, losses in optical fiber communication.

MODULE-3 Spectroscopic Techniques Teaching Hours: 15 Hours

Absorption and emission spectroscopy, Raman Spectroscopy and its application. Principle of Fourier Transform Infrared (FTIR) spectroscopy, Fluorescence spectroscopy, Laser Induced Breakdown Spectroscopy, Applications of laser spectroscopy.



Course Learning Objectives:

At the end of this course, students will be able to explain and implement the concept of;

1. Light sources and basic components of optical spectrometer
2. Light detectors and Gratings
3. Vacuum pumps and gauges
4. Optical fibers
5. Spectroscopic techniques and their application

Reference books:

1. Laser Fundamentals, William T. Silfvast, 2008, Cambridge University Press.
2. Laser Spectroscopy 1: Basic Principles, Wolfgang Demtröder, 2014, 5th edition, Springer.
3. Laser Spectroscopy 2: Experimental Techniques, Wolfgang Demtröder, 2016, 5th edition, Springer.
4. Vacuum Physics and Techniques, T. A. Delchar, Chapman and Hall.
5. Introduction to Fibre Optics, A. K. Ghatak & K. Thyagarajan, 1998, Cambridge University Press.

BSHN-SP1-MJ-702: Advancement in Forensic Ballistics and Armour Material

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

This course aims to offer the core concepts and advancements in forensic ballistics and forensic investigation of firearms. The students will be equipped with the knowledge of forensic investigation method of ballistics evidence and armour material.

MODULE-1 Ballistics & Armour Material

Teaching Hours: 15 Hours

Introduction to Forensic Ballistics: Arms Act, Classification of firearms, firing mechanism, measurement of strength of barrel, trigger pull, assembling and dismantling of firearms, Ammunition and its types, safety aspects for handling of firearm and ammunition. Concepts of Internal Ballistics, various factors affecting the internal ballistics, Theory of recoil and its measurement

Armour Structure: Basis concepts of armour structure, types of armour, materials: Stress and Strain, Elasticity, Strength, Hardness and dynamic, Penetration Mechanics, Reactive Armour Systems, Human Vulnerability.

Types of armour: Metallic Armour Materials and Structures, Ceramic Armour, Woven Fabrics and Composite Laminates for Armour Applications, Blast and Ballistic Testing Techniques.

Characterization of bullet proof jacket

Introduction to Ballistic Resistance of Body Armor NIJ Standard: NIJ Body Armor Classification, Sample Requirements and Laboratory Configuration, Flexible Armor Conditioning Protocol, Hard Armor Conditioning Protocol, Ballistic Test Methods.

MODULE-2 Core concepts of External & Terminal Ballistics

Teaching Hours: 15 Hours

Principles of external ballistics, Trajectory Formation & its computation, effect of air resistance on trajectory, Angle of Fall, Influence of Earth on Trajectory, base drag, yaw, shape of projectile and stability, ballistics coefficient and limiting velocity, Ballistics tables, measurements of trajectory parameters, Escape velocity & Ricochet.

Effect of projectile on hitting the target, Ricochet and its effects, stopping power of the bullet, Introduction to wound ballistics & its forensic significance, nature of wounds and injuries, Determination of nature, range and time of firing, GSR analysis.



**MODULE-3 Instrumental techniques used for ballistic evidence analysis Teaching Hours:
15 Hours**

Bore scope, Comparison Microscope, Stereo microscope, travelling microscope, Scanning Electron microscope, EDXRF, BDAS, IBIS, Management and reconstruction of cases involving firearm; Report writing and court findings

Principles and practice of identification of origin of ammunition and their components, purpose and procedure for test firing. Recovery methodology, Specifications of Firing gallery, working of automatic firing rest, Safety & Preventive measures.

Course learning outcomes:

At the end of this course, students will be able to explain;

1. The classification of firearms and their firing mechanisms.
2. The methods of identifying firearms.
3. The characteristics of ammunition.
4. The importance of firearm evidence.
5. The nature of firearm injuries.
6. The methods for characterization of gunshot residue.

Reference Books:

1. J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols 1,2,& 3; Springfield, Illinois;
2. Hatcher, Jury And Weller, Firearms Investigation, Identification And Evidence; Stackpole Books, Harrisburg, P A
3. Vincent Di Maio, Gunshot Wounds; Crc Press, Washington, Dc;
4. Brain J. Heard; Hand Book Of Firearms And Ballistics; John Willey, England;
5. TA, Warlow; Firearms, The Law And Forensic Ballistics; Taylor And Francis, Landon;
6. Karl G. Sellier et al ; Wound Ballistics And The Scientific Background; Elsevier, London
7. M. Johari, Identification Of Firearms, Ammunition And Firearms Injuries; BPR&D, New Delhi;
8. L V. Hogg; The Cartridges Guide - A Small Arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, P A
9. Gary J. Ordog, Management Of Gunshot Wounds, Elsevier, New York
10. Working Procedures Manual: Ballistics, BPR&D Pub.
11. S.K.Sharma, cyber laws and crime.
12. Fry & Nystron, security monitoring, O. reilly
13. Tipton Krause, Information security management, Aner Bach
14. Schneiner, hacking the code, Syngers.



BSHN-SP1-MJ-703: Audio and Video Analysis

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs						
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives:

This course provides a comprehensive understanding of voice identification and speaker recognition, focusing on forensic applications. Students will learn about voice analysis history, voice production uniqueness, and techniques for handling audio evidence. Key topics include feature extraction, pattern matching, speaker profiling, audio enhancement, and authentication. The course also covers phonetic and linguistic analysis, acoustic parameters, and the impact of alcohol on speech. Additionally, it extends to video/image analysis, including forensic techniques, biometric analysis, and related case studies with legal implications.

MODULE-1 Introduction to voice identification/speaker recognition. Teaching Hours: 15 Hours

Introduction to voice identification/speaker recognition and its forensic importance, History of voice analysis, Voice production and its uniqueness, collection of standards for comparison, handling of audio recording evidences & its physical examination, Components of speaker recognition- feature extraction, pattern matching and comparison, normalization techniques, speaker profiling, enhancement of speech signal/audio recordings, establishing the authenticity and integrity of audio recordings.

MODULE-2 Approaches to speaker recognition

Teaching Hours: 15 Hours

Approaches to speaker recognition, phonetic Transcription, linguistic & phonetic analysis, acoustic parameters for examining speech samples, Fourier analysis, frequency & time domain representation of speech signal, analogue to digital conversion

Alcohol speech relationships, Techniques used in forensic audio/voice examination and analysis

Report writing, Limitations, Precautions, Related Case Studies and its admissibility in court proceedings

MODULE-3 Video/Image analysis

Teaching Hours: 15 Hours

Concepts of Video/Image analysis, establishing the authenticity of video/image files, Processing of video/image evidences, Enhancement techniques, Specific frame analysis, technical parameters of video/image, Biometric Analysis for Identification of Individual, Scope & its forensic application in the field of security, CCTV analysis

Related Case Studies and its admissibility in court proceedings.

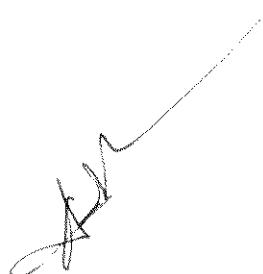
Course learning outcomes:

At the end of this course, students will be able to explain;

1. Voice identification, handling of audio recording evidences and speaker profiling
2. The authenticity of audio recordings
3. Video/image analysis and CCTV analysis
4. Biometric Analysis for Identification of Individual

Reference books:

1. Forensic Speaker Identification by Phil Rose & James R Robertson
2. Forensic Voice Identification by Harry Hollien
3. The Acoustic Analysis of Speech by Ray D Kent & Charles Read
4. Speech Language & Hearing Disorders by Franklin H Silverman
5. Voice Recognition by Richard L Klevans & Robert D Rodman
6. Multimedia Forensics and Security: Foundations, Innovations, and Applications by Mohamed Mostafa Fouad et al
7. Multimedia Forensics and Security by Chang-Tsun Li
8. Intelligent Video Surveillance Systems by Jean-Yves Dufour
9. Digital Image Processing by Rafael Gonzalez & Richard Woods
10. Digital Image forensics by Roy, A. et al





BSHN-SP1-MN-704: Research Methodology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01:30	100	03:00	-	200

Course Objectives: The major objective of this course is to acquaint students with the basic concepts of research, its type's data analysis methods and statistics. This course will also provide the useful insights over ethical intellectual property rights, ethical issues in research, and will impart the skills of scientific writing and communication.

MODULE-1 Basics of research

Teaching Hours: 15 Hours

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis. Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs.

MODULE-2 Data analysis methods

Teaching Hours: 15 Hours

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

MODULE-3 Scientific reports and thesis writing

Teaching Hours: 15 Hours

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

Course learning outcomes:

At the end of this course, students will be able to explain;

1. Literature review
2. The development of a research plan
3. Data collection, interpretation and errors
4. Important components for writing the research paper and thesis
5. Basics of Ethical issues, Intellectual property rights, Copy right

Reference books:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
8. Satarkar, S.V., 2000. Intellectual property rights and copy right. EssEss Publications.



BSHN-SP1-PR-706: Practical-VII

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total	
					Practical					
L	T	P	C	TCH	Internal Exam		University Exams			
					Mid Sem		LPW			
					Marks	Hour	Marks	Hour		
0	0	6	3	6	50	3:00	100	6:00	150	

Course Objectives:

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-I

Lasers and Spectroscopy

List of Practical:

1. Measurement of wavelength of laser using diffraction grating.
2. Measurement of the Prism angle, Angle of minimum deviation and Refractive index of a prism using spectrometer.
3. To determine the Resolving Power of a Prism.
4. Determination of Numerical Aperture of given optical fibre and find its acceptance cone.
5. Determine the wavelength of Sodium light using diffraction grating.

MODULE-2

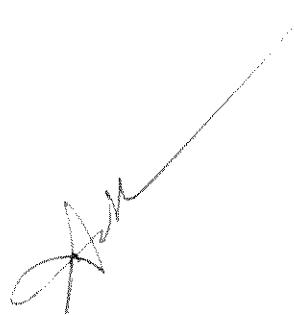
Advancement in Forensic Ballistics and Armour Material

1. Characteristics of Firearms-Caliber, Choke, Trigger pull, and Proof marks.
2. Examination and comparison of fired bullet with reference to caliber, rifling characteristics, and identification of firearm
3. Examination and comparison of fired cartridge case with reference to caliber, firing pin, breech face, chamber indentations, extraction, and ejector marks by comparison microscope
4. Determination of shot numbers from size and weight of shots
5. Identification of propellants
6. Chemical tests for powder residue and barrel wash
7. Instrumental examination of GSR

MODULE-3

Audio and Video Analysis

1. Recording, editing, processing, and conversion of audio files using Goldwave v 5.63 software.
2. Speech acquisition and analysis of speech samples using CSL-4500 and Multispeech software.
3. Detection of tampering in audio files, audio restoration and speech enhancement using CEDAR Cambridge™.
4. Working procedure of SIS.
5. Working procedure of Voice net software.
6. Video analysis and detection of tampered video files using Video focus.





Specialization-2

“Fingerprints and Questioned Documents”

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BSHN-SP2-MJ-701: Advanced Fingerprint Technologies

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course objectives: This course provides a foundation in fingerprint analysis and methods of development of fingerprints on various surfaces, molecular fingerprints and its role in individual identification. You will gain an understanding of the Automated Fingerprint Identification System (AFIS), ridgeology, poroscopy and the significance of fingerprints in personal identification.

MODULE-1 Advanced Fingerprint Development Techniques Teaching Hours: 15 Hours

Development of fingerprint from porous surfaces, Development of fingerprint from non-porous surfaces, Development of fingerprint from nanoparticles, Development of latent prints on Special surfaces and situations: bloody prints, tape and sticky surfaces and skin.

Post mortem fingerprinting techniques, Molecular fingerprinting, application of instruments in analyzing the fingerprint residues and significance in personal identification.

MODULE-2 Introduction & Importance of ridgeology and poroscopy Teaching Hours: 15 Hours

Definition, Basic Concepts of Ridgeology, Poroscopy For individual identification. Application of the pores dimensions and ridge dimensions in the identification- scope of establishing the identification – characteristics and traits.

Definition, Basic Concepts of Edgeoscopy, Application of edgeoscopy- personal identification using fingerprints.

MODULE-3 Automated Fingerprint Identification System Teaching Hours: 15 Hours

Automated fingerprint Identification and imaging systems: Introduction, emerging application System architecture, sensing, fingerprint representation Minutiae feature extraction, orientation, estimation, segmentation, Ridge detection, fingerprint matching, fingerprint enhancement. Latent print enhancement by Laser and other alternate light sources.

Course Learning Outcomes: At the end of this course, students will be able to explain;

1. Basics of fingerprint development techniques
2. Basics concepts of ridgeology, poroscopy and edgeoscopy.
3. Automated fingerprint Identification and different imaging systems.





4. Fingerprinting from the cadaver
5. Molecular fingerprinting and the application of instruments in analyzing the fingerprint residues

Reference Books:

1. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press (1999)
2. E. Roland Menzel; Fingerprint Detection with Lasers, 2nd Ed., Marcel Dekker, Inc. USA (1999)
3. James F. Cowger; Friction Ridge skin, CRC Press London, (1993)
4. Mehta, M.K; Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay (1980)
5. Moenssens; Finger Prints Techniques, Chitton Book Co. Philadelphia, NY (1975)
6. Chatterjee S.K.; Speculation in Finger Print Identification, Jantralekha Printing Works, Kolkata (1981)
7. Cowger, James F; Friction ridge skin- Comparison and Identification of fingerprints, CRC Press, NY (1993)
8. Cook Nancy; Classifying Finger Prints, Innovative learning pub. Mento Park (1995)
9. Cossidy M.J; Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada (1980)
10. J A Seigel, P.J Saukoo and G C Knupfer; Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press (2000)
11. Smith B.C, Holland MM, Sweel DL & Dizinno. A; DNA & Forensic Odontology- Manual of Forensic Odontology, Colorado Springs, USA (1995)
12. Hillison, S; Dental Anthropology, Cambridge Univ. Press, UK (1996)
13. Kasprzak J; Possibilities of Cheiloscopy in Forensic Science (1980)
14. Iannarelli, A V; Ear Identification, Forensic Identification series, Paramount (1989).
15. Henry C. Lee & R. E. Ganesslen; Advances in Finger Print Technology, CRC Press, London (1991).
16. Saxena, B.L; Law and techniques relating to identification of handwriting, disputed documents, finger prints, foots and detection of forgeries, Central Law Agency, Allahabad (1990)
17. Hardless, H.R; Disputed documents examination and fingerprints Identification (with Illustrations, Sketches, Diagrams, Photos etc), Law Book Co. Allahabad (1995)
18. Menzel, E Roland; Fingerprint detection with lasers, Marcel Dekker, NY (1999)
19. Jain L C; Intelligent Biometric Techniques in Fingerprint and face recognition, CRC Press Ohio (1999)
20. Bridges B C; Criminal Inverstigation, Practical fingerprinting, Thumb Impressions, Hand writing expert testimony opinion Evidence, University Book Agency, Allahabd (2000)
21. Maltoni, Davide; Handbook of fingerprint recognition, Springer Verlag, NY (2003)
22. Ratha Nalini; Automatic Fingerprint recognition system, Springer Pub., NY (2004)

BSHN-SP2-MJ-702: Advances in Forensic Document Examination

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs						
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course objectives: To make the prospective students understand the detailed insight about Forensic document examination. The students will understand the basics of forensic examination of a special class of writings and learn about the detection of disputed and counterfeit documents.

MODULE-1 Basics of Document and handwriting examination. Teaching Hours: 15 Hours

Roles of Forensic Document Examiner, Scope of document examination, basic tools needed for forensic documents examination and their significance, Types of documents for examination, Care and Handling of Document Exhibits, Individuality in handwriting, natural variations, tremors in handwriting, handwriting comparison, Basics of Forensic linguistics and stylistics, its importance in writer identification.

MODULE-2 Examination of special class of writings and impressions. Teaching Hours: 15 Hours

Disguised writing and anonymous letters, Examination of alterations in documents, Examination, preservation and decipherment of secret writing, Indented writings and charred writings, seal and other mechanical impressions, Forgeries & ; its types, related case studies, Determination of age of document and writings, reporting of the cases and related case studies.

MODULE-3 Forensic Examination of different types of Document Teaching Hours: 15 Hours

Examination of Photostat (Xerox) copies, carbon copies, fax message, type writings, printed matter, Examination of e-documents & ; digital signature, counterfeit currency notes, passports, visa, credit cards, debit cards, legal deeds, postal stamps, etc, Related Case Studies.

Types of computer printers and their working: dot-matrix, daisywheel, line printers, ink-jet, thermal jet and laser printers, Examination of Computer printouts.

Course Learning Outcomes: At the end of this course, students will be able to explain;



-
- 1. The basics of forensic document examination
 - 2. Techniques of detection and decipherment of special class of writings and impressions.
 - 3. Examination of forgeries and alterations in documents
 - 4. Forensic examination of different types of disputed and counterfeited documents

References:

- 1. Koppenhaver, K. (2010). Forensic Document Examination: Principles and Practice (1 st Ed.).
- 2. Osborn, A. (1929). Questioned documents. 2d. ed (1st ed.). Albany, N.Y.: Boyd printing Company.
- 3. Hilton, O. (1993). Scientific examination of questioned documents (1st ed.). Boca Raton:CRC Press.
- 4. Harrison, W. (1958). Suspect documents.
- 5. Kelly, J., & Lindblom, B. (2006). Scientific examination of questioned documents. Boca Raton, FL: CRC/Taylor & Francis.
- 6. Ellen, D. (2006). Scientific examination of documents. Boca Raton, FL: Taylor & Francis.
- 7. Huber, R., & Headrick, A. (1999). Handwriting identification (1st ed.). Boca Raton: CRC Press.

BSHN-SP2-MJ-703: Forensic Accounting and Auditing

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								
Th	Tu	Pr	C	TCH	Theory				Practical		Total		
					Internal Exams				University Exams				
					TA-1 & TA-2		MSE		Marks	Hrs			
					Marks	Hrs	Marks	Hrs					
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200

Course objectives: To make the prospective students understand the detailed insight about the basics of forensic accounting. The students will understand the basic concepts of money laundering and fraud deterrence and learn about the legal admissibility of forensic accounting.

MODULE-1 Forensic Accounting and frauds Teaching Hours: 15 Hours

Principles and concepts of Forensic Accounting, Forensic auditing, Fraud triangle, types of frauds, methods for fraud detection, types of Financial Statement Frauds, Responsibility of Management and Auditors, reporting financial frauds, theory of fraud perpetrator, Litigation support bankruptcy, product liability, business valuations

Occupational frauds and abuses, Asset misappropriation, cheque tampering, false refunds, credit/debit card fraud.

MODULE-2 Money Laundering and Fraud deterrence Teaching Hours: 15 Hours

Basic concepts of money laundering, history, methods & related laws, fraud deterrence, international money laundering council, banking operations- national/international, commercial & economic damages and their factors, Investigative protocols for fraud detection, Corruption and Bribery, fraudulent schemes, Currency transaction

Tracing Illicit Transactions, examination, analysis and interpretation of electronic data relating to fraud, cybercrime loss evaluations, investigation of e-data, capturing digital media-hard drives, emails, deleted overwritten files, data recovery and extraction.

MODULE-3 Investigation of frauds and Legal Framework for Forensic Accounting

Teaching Hours: 15 Hours

Fictitious revenues generation, Concealed liabilities and expenditures, Red flags, Whistle blowers and responses to fraud, Evidence collection and data analysis and interpretation, reporting methods, Prevention and detection of conflicts of interest, Law in relation to cyber-crimes, Ethics for Forensic Accountants, Code of Ethics, Code of Professional Standards, Laws Related to Fraud, Individual Rights during Examination, Criminal Prosecutions for Fraud, The Civil Justice System, expert testimony, Intellectual property rights



Course Learning Outcomes: At the end of this course, students will be able to explain;

1. Forensic Accounting and frauds
2. Money Laundering and Fraud deterrence
3. Investigation of frauds and Legal Framework for Forensic Accounting

Reference books:

1. Money Laundering: A guide for criminal Investigation by John Madinger, Sydney A. Zalopany CRC Press New York (1999)
2. Financial Investigation and Forensic Accounting by George Manning CRC Press, New York USA (1999)
3. Corporate Fraud Hand Book by Joseph T Wells, John Wiley Sons Canada (2004)
4. Principles of Fraud Examination by Joseph T. Wells, John Wiley Sons Canada (2005)

BSHN-SP2-MN-704: Research Methodology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs						
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: The major objective of this course is to acquaint students with the basic concepts of research, its type's data analysis methods and statistics. This course will also provide the useful insights over ethical intellectual property rights, ethical issues in research, and will impart the skills of scientific writing and communication.

MODULE-1 Basics of research

Teaching Hours: 15 Hours

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis. Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs.

MODULE-2 Data analysis methods

Teaching Hours: 15 Hours

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

MODULE-3 Scientific reports and thesis writing

Teaching Hours: 15 Hours

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.



Course Learning Outcomes: At the end of this course, students will be able to explain and implement the concepts of;

1. Basic statistical theories commonly used for the interpretation of data in Forensic Sciences.
2. Statistical knowledge to design and conduct research studies in real life problems.
3. Different types of data, Classification and tabulation of data, basics of random variables.
4. Applications of probability density functions for data interpretation.
5. Measures of central tendency, dispersion, skewness and kurtosis and moments.
6. Concepts of hypothesis testing for making statistical inferences about the population data.
7. Intellectual property rights, ethical issues in research, methods and importance of scientific

Reference books:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
8. Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.

BSHN-SP2-PR-706: Practical-VII

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total	
					Practical				Total	
L	T	P	C	TCH	Internal Exam		University Exams			
					Mid Sem					
					Marks	Hour	Marks	Hour		
0	0	6	3	6	50	3:00	100	6:00	150	

Course Objectives:

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-1

Modern Trends in Fingerprint Science

1. Analysis of fingerprints with microscopic techniques for the ridge dimensions with the complete identification profiling
2. Comparison of males' and females' fingerprints with the specific reference to the ridge dimensions
3. Development of latent finger prints using Ninhydrin.
4. Development of latent finger prints using iodine fuming
5. Development of latent finger prints using Nanoparticles
6. Understanding AFIS method of fingerprints analysis
7. Palatoprints
8. Cheiloscopy
9. Importance of molecular fingerprints with special reference to fingerprint residues using instrumental methods

MODULE-2

Advances in Forensic Document Examination

1. Examination and Identification of handwriting on the basis of class and individual characteristics.
2. Examination and identification of forged signatures.
3. Identification of disguised in handwriting
4. Examination and identification of natural variations in handwritings
5. Examination of additions, alterations, and obliterations in the documents.
6. Examination of security features of currency notes, passports, visa
7. Examination of rubber seal impressions
8. Determination of sequence of strokes

MODULE-3

Forensic Accounting and Auditing

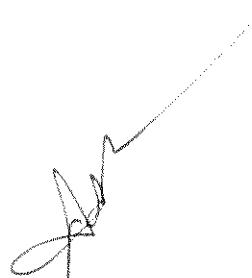


1. Examination of ink by TLC
2. Examination of ink by GCMS
3. Examination of ink by LCMS
4. Examination of ageing of paper
5. Examination of currency notes
6. Examination of Passport
7. Examination of Stamp
8. Examination of Rubber Stamp Impressions
9. Related case studies

Specialization-3

“Forensic Chemistry and Toxicology”

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BSHN-SP3-MJ-701: Forensic Pharmacy and Pharmacology of Controlled Drugs

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
Marks	Hrs	Marks	Hrs											
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: To impart the understanding of drugs and pharmacological preparations, types of drugs, effects of drugs on biological systems, drug-receptors concepts, pharmacokinetics and pharmacodynamics of drugs, pharmacology of different drugs.

MODULE-1 Basic Principles of Forensic Pharmacy

Teaching Hours: 15 Hours

Introduction to Pharmacology and Forensic Pharmacy, Branches of Pharmacology, Scope of Forensic Pharmacy, Pharmacopoeias IP, USP, EP, pharmacognosy, pharmacovigilance, Nature and Source of drug, forms of drugs, classification of drugs, Prodrug and soft drug concept, Drug synthesis, Route of administration of Drugs, Factor affecting the effects of Drug, Ferguson's principle, Adverse drug reactions and drug induced side effects.

MODULE -2 Concepts of Pharmacology

Teaching Hours: 15 Hours

Pharmacokinetics, Bioavailability, Bioequivalence and Bioaccumulation, Efficacy and potency, Dose response relationship, Pharmacodynamics, Phase-I and Phase-II mechanism, Drug Therapeutic Index, Drug Receptor concept, types of receptors and mechanism of action, Pharmacokinetic drug interactions, various biological barriers, Agonism, Antagonism, Addition, Synergism, Potentiation, drug addiction and drug dependence, drug tolerance, drug hypersensitivity.

MODULE-3 Pharmacology of Different classes of controlled drugs **Teaching Hours: 15 Hours**

Pharmacology of neurotransmitters like GABA, Glutamate, Glycine, Serotonin, Dopamine, General Anaesthetics, Neuroleptics, Sedatives, Hypnotics, Alcohol, antihypertensive drugs, Antidepressant, Anti-stimulants, anti-maniacs & hallucinogens, Anti-infective drugs Antipyretics, NSAIDs, and antipsychotics, Case Studies

Detection of prohibited drugs (anabolic steroids, peptide hormones, growth factors and mimetics, betagonist, metabolic modulators, diuretics and masking agents and beta blockers by different techniques)

Course Learning Outcomes: On the completion of the module's students should be able to:

1. Understands the concepts of drugs and drug formulations.
2. Effects of drugs and pharmaceuticals on biological systems.
3. Types of drugs and their pharmaceutical analysis.

Reference Books:

1. Klaassen, C. D.: Casarett and Doull's Toxicology: The Basic Science of Poisons, 5th ed, McGraw-Hill, 1995.
2. Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and post-mortem material, 3rd ed., PharmaceuticalPress2004.
3. Bogusz, M. J.: Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science ,2000.
4. Siegel, J.A., Saukko, P. J., Knupfer, G.: Encyclopaedia of Forensic Sciences (Vol3), Academic Press, 2000.
5. Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt/Churchill Livingstone, 2000.
6. Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed., Nirali Prakashan, 1990.
7. Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2nd ed.,1999.
8. Wiseman, H and Henry J.: Management Of Poisoning, A Handbook for Health care workers, 1st ed., A.I.T.B.S, 2002
9. Hardman, J. G. and Limbird, L. E.: Goodman and Gilman's The Pharmacological basis of Therapeutics, 9th ed., McGraw-Hill, 1996
10. Stolmen, A.; Progress in Chemical Toxicology: Academic Press, New York (1963)
11. Modi, Jaisingh, P.; Textbook of Medical Jurisprudence& Toxicology, M.M. Tripathi Publication (2001)
12. Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001
13. Curry, A. S: Poison Detection in Human Organ



BSHN-SP3-MJ-702: Advanced Forensic Toxicology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								Total	
Th	Tu	Pr	C	TCH	Theory						Practical			
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
Marks	Hrs	Marks	Hrs											
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: To impart the knowledge of fundamentals of toxicology, principles of toxicology, toxicokinetic and toxicodynamic of xenobiotics, concepts of toxicants, types of toxicants, toxic effects of different xenobiotics on biological systems.

Module-1 Concepts of Toxicology

Teaching Hours: 15 Hours

Branches of toxicology, Toxicants and Types of Toxicants, Dose and related terms used in toxicology, Sources of poisoning, duration and frequency of exposure, modalities of toxicity testing, Laws and Regulations in toxicological testing, Regulatory bodies national and International, Risk and Hazard characterization, Global Harmonization System (GHS), Good Laboratory Practice (GLP).

Module-2 Principles of Toxicology

Teaching Hours: 15 Hours

Dose-effects and dose-response relationship, types of toxicity, Factors affecting toxicity – species and strain, age, sex, nutritional status, hormones, environmental factors, circadian rhythms, Enzyme Induction and Inhibition, molecular mechanism of toxicity, role of electrophiles and nucleophiles in toxicity, translocation of toxicants, toxico-kinetics and toxico-dynamics processes, detoxification of xenobiotics, biotransformation of xenobiotics, bioaccumulation of xenobiotics, anti-dotal therapy.

Module-3 Toxic effects of Xenobiotics

Teaching Hours: 15 Hours

Toxic effects of drugs, mechanism of drug toxicity, Toxic effects of pesticides, mechanism of pesticide toxicity, toxicity, Toxic effects of heavy metals, mechanism of heavy metal toxicity, Toxic effects of Alcohol and solvents, mechanism of poisonous liquor, Toxic effects of plant poisons, Toxic effects of insects and animal poison, toxicity symptoms and treatment of xenobiotics.

Course Learning Outcomes: On the completion of modules students should be able to:

1. Concepts and fundamentals of principles of toxicology.
2. Concepts of xenobiotics, factors affecting toxicity, molecular mechanism of toxicity.
3. Toxic effects of various effects of xenobiotics on biological systems.

Reference books:

1. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
2. Gupta, P.K. Fundamentals of Toxicology: Essential Concepts and Applications. India, Elsevier Science, 2016.
3. Casarett & Doll Toxicology: The Basic Science of poisons.
4. Clark, E.G.C.: Isolation and identification of Drugs, 1966
5. Curry, A.S.: Poison Detection in Human Organs, 1976
6. Curry, A.S.: Advances in Forensic Chemical Toxicology, 1972
7. Hofmann, F.G.: Handbook of Drug and Alcohol Abuse.
8. Turner: Drugs & Poisons.
9. Samford: Poisons Their Isolation Identification
10. Stoleman: Progress in Chemical Toxicology.
11. Sunshine, I: Guidelines for Analytical Toxicology Programme, Vol-I, CRC press, 1950.
12. Sunshine, I: Handbook of Analytical Toxicology, press, 1969.
13. Mule, S. J. et al.: Immunoassays for Drugs subjects to ab, CRC Press, 1974
14. Connors, K.: A text book of pharmaceuticals analysis, Interscience, New York, 1975



BSHN-SP3-MJ-703: Modern and Applied Analytical Forensic Chemistry

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: This course aims to equip students with in-depth knowledge and analytical skills for the forensic examination of drugs, petroleum products, fire debris, explosives, and chemical warfare agents. It emphasizes the application of various presumptive, screening, and confirmatory methods to analyse controlled substances and hazardous materials. The course also prepares students to effectively present forensic findings in legal contexts.

MODULE-1 Advanced Forensic Drug Chemistry

Teaching Hours: 15 Hours

Drug Trafficking, Forensic examination of drugs/Narcotics - Cannabis, Phenethylamines (Amphetamine, Methamphetamine), Hydroxyl derivative (Ephedrine), Ketone Derivative (Cathinone), Methoxy Derivative (Mescaline), Tertiary Amines (Cocaine and Opiates), Tryptamines (Psilocin and Psilocybin), Anabolic Steroids, Miscellaneous Controlled Substances (Barbiturates, Benzodiazepines, GHB, Ketamine and LSD).

Presumptive/Screening and Confirmatory Methods: Colour/spot test, microscopic examination, Microcrystalline tests, Thin-Layer Chromatography, Sample Preparation before TLC Specimen, Extraction Evaluation of TLC for Drug Screening, Immunoassay Methods, Other instrumental techniques involved in analysis. Format of NDPS Report Writing & Court Room Testimony. Case studies.

MODULE-2

Teaching Hours: 15 Hours

Petro Forensics:

Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Physical Properties of Petroleum Products Analytical Techniques: Quantitative and Qualitative Steps in Analysis of Petroleum, Analysis of traces of petroleum products in forensic exhibits. Case studies.

Fire Chemistry:

Scientific Investigation of Fire, NFPA 921 and NFPA 1033, Separation and analytical techniques of ignitable liquid residues, Interpretation of Data Obtained from Fire Debris, Quality Assurance in Fire Debris Analysis, Report Writing and Court Testimony. Case studies.

MODULE-3

Teaching Hours: 15 Hours

Explosives Chemistry:

Introduction and assessment of explosives, Oxygen balance, Explosive Power Index, Heat and Temperature of Explosion, Pressure of explosion, Mechanism of Ignition and hot spot formation. Thermal decomposition, physical and chemical aspects of combustion, Deflagration and Detonation, Analysis of low and high explosives by different instrumental techniques, Quality control, Proficiency Testing, Interpretation and Significance of Results. Case studies.

Chemical Warfare Agents:

Classification, physical and biochemical properties, toxic effects detection by Biosensors and various instrumental techniques.

Course Learning Outcomes: Upon successful completion of this course, students will be able to:

1. Gain expertise in the forensic examination and identification of various drugs and narcotics.
2. Develop skills in performing presumptive, screening, and confirmatory tests for accurate and reliable forensic analysis.
3. Understand the forensic investigation processes for petroleum products, fire debris, and explosives.
4. Acquire knowledge of the detection methods for chemical warfare agents, and develop the ability to write detailed forensic reports.

Reference Books:

1. Clarke's Analysis of Drugs and Poisons, (Formerly Isolation & Identification of Drugs) 3rd Ed. 2 Vol. Set.
2. Clark, E.G.C.: Isolation and identification of Drugs, VI and Vol. II, 1966, 1975-1986.
3. Modi, Text Book of Medical Jurisprudence Forensic Medicines and Toxicology (1999) CBS Pub. New Delhi.
4. Saferstien (1982) Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
5. DFS -Working Procedure Manual- Narcotics.
6. E. Stahl (1969) Thin Layer Chromatography: A Laboratory Handbook.
7. Saferstein (1976) Criminalistics.
8. Klaassen, C. D.: Casarett and Doull's Toxicology: The Basic Science of Poisons, 5th ed., McGraw-Hill, 1995.
9. Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and post-mortem material, 3rd ed., Pharmaceutical Press2004.
10. Bogusz, M. J., Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science, 2000.
11. Siegel, J.A., Saukko, P. J., Knupfer, G.: Encyclopaedia of Forensic Sciences (Vol. 3), Academic Press, 2000.
12. Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt/Churchill Livingstone, 2000.
13. Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed., Nirali Prakashan, 1990.



BSHN-SP3-MN-704: Research Methodology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objective: The major objective of this course is to acquaint students with the basic concepts of research, its type's data analysis methods and statistics. This course will also provide the useful insights over ethical intellectual property rights, ethical issues in research, and will impart the skills of scientific writing and communication.

MODULE-1 Basics of research

Teaching Hours: 15 Hours

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis.

Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs

MODULE-2 Data analysis methods

Teaching Hours: 15 Hours

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

MODULE-3 Scientific reports and thesis writing

Teaching Hours: 15 Hours

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

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Course Learning Outcomes: At the end of this course, students will be able to explain and implement the concepts of;

1. Basic statistical theories commonly used for the interpretation of data in Forensic Sciences.
2. Statistical knowledge to design and conduct research studies in real life problems.
3. Different types of data, Classification and tabulation of data, basics of random variables.
4. Applications of probability density functions for data interpretation.
5. Measures of central tendency, dispersion, skewness and kurtosis and moments.
6. Concepts of hypothesis testing for making statistical inferences about the population data.
7. Intellectual property rights, ethical issues in research, methods and importance of scientific writing and communication.

Reference books:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
8. Satarkar, S.V., 2000. Intellectual property rights and copy right. EssEss Publications.



BSHN-SP3-PR-706: Practical-VII

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total	
					Practical					
L	T	P	C	TCH	Internal Exam		University Exams			
					Mid Sem					
					Marks	Hour	Marks	Hour		
0	0	6	3	6	50	3:00	100	6:00	150	

Course Objectives:

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-1 Forensic Pharmacy and Pharmacology of Controlled Drugs

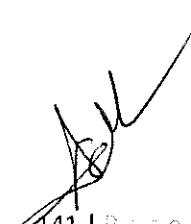
1. Qualitative and Quantitative analysis of paracetamol
2. Concepts and Parts identification of GC, GC-MS & HPLC.
3. LLE & DLLME based extraction of drugs.
4. Detection of drug classes by imaging system like Raman.
5. Detection of Sugars in Anti-diabetic drugs by IC.
6. Organic composition profiling of drug class by CHNS/O.
7. Detection of anabolic agents in supplements by GCMS.

MODULE-2 Advanced Forensic Toxicology

1. Preparation of standard and working solutions.
2. Plotting of calibration curve and quantification using UV-Vis Spectroscopy
3. Analysis of organochlorine, Organophosphorus, Carbamates and Pyrethroids by colour tests, TLC, GC-MS methods.
4. Identification of common plant poisons Oleander, Datura, Calotropis and Ricin.
5. Analysis of alcohol and derivatives by head-space gas chromatography (HS-GC).
6. Extraction and Analysis of heavy metals by microwave extraction and ICP-MS.
7. Analysis of non-volatile drugs by HPLC

MODULE-3 Modern and Applied Analytical Forensic Chemistry

1. Microcrystalline tests for Narcotic drugs.
2. Separation of Psychotropic substance by TLC.
3. Separation of Cannabis/Opium by TLC, UV, FTIR
4. Analysis of high explosives by TLC, UV, FTIR
5. Qualitative Analysis of fire residues by GC-HS and GC-MS.
6. Analysis of dye in petrol and kerosene by UV spectrophotometry and TLC.

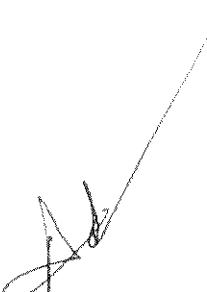


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7. Analysis of NDPS drugs and explosives by instrumental techniques.

Specialization-4

“Forensic Biology and Biotechnology”





BSHN-SP4-MJ-701: Fundamentals of Biological Chemistry

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme								Total	
Th	Tu	Pr	C	TCH	Theory						Practical			
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: This course aims to equip students with the fundamentals of biochemistry, principles and their importance in biomolecules. Along with that, students will also understand enzymes and their functioning in Biological Processes, and the importance of proteomics in Forensic investigation.

MODULE-1 Biomolecules

Teaching Hours: 15 Hours

Chemical foundations of Biology: pH, acids, bases pK, buffers, atomic bonds and Molecular interactions: Weak bonds (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction), Covalent bonds,

Bioenergetics: Basic principles, Laws of thermodynamics, Equilibria and concept of free energy, Standard free energy, free energy change.

MODULE-2 Chemistry of Carbohydrates, Lipids and Proteins Teaching Hours: 15 Hours

Chemistry of Carbohydrates: Definition, biological importance and classification. Monosaccharides Isomerism, anomerism. Sugar derivatives, Disaccharides, Polysaccharides. Structures of starch, glycogen and glycosaminoglycan.

Chemistry of Lipids: Definition, Biological importance and classification. Fats and fatty acids. Introduction to compound lipids. Hydrophobic and hydrophilic groups. Cholesterol. Bile salts. Micelle. Bimolecular leaflet, Lipoproteins – formation, function and turnover.

Chemistry of Proteins: Biological importance, classification of amino acids, amino acid racemization, and titration curve of amino acids, Proteins and peptides – Composition of proteins – Primary, Secondary and Tertiary structure of protein. Simple, conjugated, globular and fibrous proteins, denaturation and denaturation.

MODULE-3 Enzymology

Teaching Hours: 15 Hours

- Enzymes: Properties, Nomenclature, Classification,
- Enzyme kinetics, Mechanism of enzyme action,
- Enzyme inhibition
- Regulation of enzyme action.

Course Learning Outcome: At the end of course, students will be able to demonstrate understanding about;

1. Fundamental chemical concepts and their application to the biological sciences.
2. Various biomolecules and their importance in living organisms.
3. Nomenclature, Classification, Kinetics, and regulation of Enzyme in Biological Systems.

Reference Books:

1. Lehninger Principles of Biochemistry 6th Edition (2012) - Nelson and Cox, W.H. Freeman, ISBN: 978-1429234146
2. L. Stryer, Biochemistry, 5th Edition, (2002) Freeman & Co. New York
3. Wang, Xing, Kuruc, Matthew. 2019. Functional Proteomics, Springer.
4. E.D. Hoffmann, V. Stroobant. 2007. Mass Spectrometry: Principles and Applications, John Wiley & Sons Ltd. The Atrium, Southern Gate, Chichester, West Sussex PO198SQ, England.
5. D. Kambhampati. 2004. Protein Microarray Technology, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.



BSHN-SP4-MJ-702: Molecular Biology and rDNA technology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: The course aims at imparting a comprehensive understanding of genome organization in prokaryotes and eukaryotes, the chemical structures of DNA and RNA, different methods of DNA isolation, quantitation, PCR, DNA sequencing, and other molecular biology techniques essential for forensic investigations and accurate genetic analysis. The course also helps students to acquire detailed knowledge of the processes of transcription and translation, and helps them learn the principles and applications of recombinant DNA technology.

MODULE-1 Basics of Molecular Biology and advanced techniques Teaching Hours: 15 Hours

- Organization of genome in prokaryotes and eukaryotes
- Chemical structure of DNA and RNA
- DNA replication: Enzymes and accessory proteins, Mechanism of DNA replication in prokaryotes and eukaryotes.
- Procedure for collection and preservation of biological sample for DNA analysis.
- Techniques of DNA isolation and its quantitation.
- Polymerase Chain Reaction and its variants in PCR and primer designing
- DNA separation and detection techniques
- Methods of DNA sequencing
- Fluorescence in situ hybridization (FISH) for genome analysis and Chromosome micro-dissection

MODULE-2 Central Dogma of Genetic Engineering and rDNA technology Teaching Hours: 15 Hours

- Transcription: RNA polymerases, features of prokaryotic and eukaryotic promoters,
- Assembly of transcription initiation complex in prokaryotes and eukaryotes and its regulation;
- Synthesis and processing of prokaryotic and eukaryotic transcripts. Transport of RNA within eukaryotic cell.
- Translation: Structure and role of t-RNA in protein synthesis, ribosome structure, basic features of genetic code and its deciphering, translation (initiation, elongation and termination in detail in prokaryotes as well as eukaryotes).



MODULE-3 Fundamentals of rDNA technology

Teaching Hours: 15 Hours

- General introduction and concept of recombinant DNA technology.
- DNA modifying enzymes
- Cloning strategies: Genomic libraries, cDNA libraries, single gene cloning.
- Vectors: Types of vectors and choice of vectors- Plasmids, cosmids, lambda phage vectors, shuttle vectors, BACs and YACs
- Choice of hosts, Methods for transferring recombinant DNA to host cells (Transformation and Transfection)
- Expression systems in Eukaryotic cells, Yeast, Bacteria, Insect cell lines, Gene screening
- Biosafety guidelines and containment strategies.

Course Learning Outcomes: By the end of this course, students will be able to:

1. Explain the organization of genomes in prokaryotes and eukaryotes
2. Illustrate the mechanisms of DNA replication, transcription and translation in prokaryotes and eukaryotes.
3. Apply proper procedures for the collection and preservation of biological samples for DNA analysis.
4. Implement DNA separation and detection techniques
5. Develop and implement cloning strategies

Reference Books:

1. Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN:0121479528
2. Advanced Topics in Forensic DNA Typing: Methodology (2011), John M. Butler, Academic Press, ISBN: 978-0123745132
3. Advanced Topics in Forensic DNA Typing: Interpretation, (2014) - John Butler, Academic Press, ISBN:19780124052130
4. Forensic DNA Analysis Technological Development and Innovative Applications, 1st ed. (2021) - Elena Pilli and Andrea Berti, Apple Academic Press, Inc., ISBN 9781771889056
5. Forensic DNA Profiling - A Practical Guide to Assigning Likelihood Ratios, 1st ed. (2020) - Jo-Anne Bright and Michael D. Coble, CRC Press, ISBN: 9780367029029
6. Forensic Practitioner's Guide to The Interpretation of Complex DNA Profiles, 1st ed. (2020) - Peter Gill et. al., Academic Press, ISBN: 978-0-12-820562-4
7. Interpreting Complex Forensic DNA Evidence, 1st ed. (2020) - Jane Moira Taupin, CRC Press, ISBN:978-1-138-49567-8
8. An Introduction to Forensic Genetics, 2nd Edition (2010) - William Goodwin, Adrian Linacre and SibteHadi, Wiley-Blackwell, ISBN: 978-0470710197
9. Forensic Genetics in the Governance of Crime, 1st ed. (2019) - Helena Machado and Rafaela Granja, Palgrave Macmillan, ISBN 978-981-15-2429-5
10. High-Throughput Next Generation Sequencing – Methods and applications, 1st ed. (2011), Young Min Kwon and Steven C. Ricke, Humana Press, ISBN: 9781617790881
11. Next Generation DNA Led Technologies, 1st ed. (2016), SharadaAvadhanam et. al., Springer, ISBN: 978-981-287-669-0



12. Next Generation Sequencing – Methods and Protocols; 1st ed: (2018) - Steven R. Head et. al., Humana Press, ISBN: 978-1-4939-7514-3
13. A Primer of Conservation Genetics. 2004. Richard Frankham, Jonathan D. Ballou, David A. Briscoe. Cambridge University Press. <http://www.cambridge.org/9780521831109>
14. An Introduction to Population Genetics Theory and Applications. Rasmus Nielsen, Montgomery Slatkin. Publisher: Sinauer Associates, Year of Publication-2013.
15. Population Genomics: Concepts, Approaches and Applications. Edited by Om P. Rajora. Publisher: Springer International Publishing. DOI: 10.1007/978-3-030-04589-0. Year of Publication: 2019.
16. Conservation and the genetics of populations / Fred W. Allendorf, Gordon Luikart, Sally N. Aitken; with illustrations by AgostinhoAntunes. – 2nd ed. ISBN 978-0-470-67146-7. Year of Publication: 2013. Publisher: John Wiley & Sons, Ltd
17. Population genetics by Matthew B. Hamilton. 2009. ISBN 978-1-4051-3277-0. Publisher: John Wiley & Sons, Ltd

BSHN-SP4-MJ-703: Forensics Genomics and DNA Profiling

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
Marks	Hrs	Marks	Hrs											
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course objectives: This course aims to get the students acquainted with advanced principles used in DNA profiling, troubleshooting the different types of errors, and report writing in DNA Forensics, technological advancements like Next generation Sequencing, modern tools used in the field of genomics and the interpretation of the data. Course also aims to appraise the students with the importance of lineage markers in forensic science. This course will help students to get acquainted with fundamental aspects of Computational Biology and various tools and techniques used in Bioinformatics.

MODULE-1 Advanced topics in STR Profiling Teaching Hours: 15 Hours

- Modern techniques for DNA extraction and quantification
- STR Profiling, Types of errors, result interpretation and Report Writing
- DNA Mixtures – Current status of tools and guidelines
- Paternity/maternity indices, Sibship indices

MODULE-2 Application of lineage markers in DNA Forensics Teaching Hours: 15 Hours

- Mitochondrial DNA analysis for human and related databases
- Advanced Y-STR and X-STR analysis and its significance in establishing paternal relationships.
- Identity, Phenotypic and ancestry informative markers
- Genealogy and its applications in forensic genetics
- Quality assurance and quality control in DNA forensics
- Molecular autopsy and tissue identification by DNA and RNA
- Concepts in Next Generation Sequencing (NGS) and Genome analysis

MODULE-3 Fundamentals of bioinformatics and its application in Forensics Teaching Hours: 15 Hours

- Biological Data: The form of biological information



- Primer designing for forensically important markers
- Various databases for lineage and mtDNA markers
- Databases – Format and Annotation: Conventions for database indexing and specification of search terms, common sequence file formats, annotated sequence databases - primary sequence databases, organism specific databases
- Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, Submission of (new and revised) data, data submission tools
- Sequence Similarity Searches: Local v/s global, Distance metrics. Similarity and homology, Scoring matrices, Dynamic programming algorithms, Needleman-Wunsch and Smith-Waterman, FASTA, BLAST and other variants of BLAST
- Multiple Sequence Alignment and Whole genome analysis, existing software tools for MSA
- Database management tools in DNA Forensics: CODIS and DNAxs
- Other Databases and Online-Tools: NCBI, STRBase, STRidER, PhyloTreeMt, SNPforID Browser, popSTR browser, ALFRED, scientific literature

Course Learning Outcomes: At the end of this course, students will be able to;

1. Elaborate STR profiling.
2. Critically assess, and comprehend issues related to various markers and DNA analysis methods.
3. Recognize and understand challenges related to different types of lineage markers in DNA analysis.
4. Understand application of lineage markers in DNA Forensics
5. Learn the applications of various Bioinformatics databases used in Forensic Science.

References:

- Forensic DNA Typing, Second Edition: Biology, Technology, and Genetics of STR Markers 2nd Edition (2005) - John M. Butler, Academic Press, ISBN: 0121479528
- Advanced Topics in Forensic DNA Typing: Methodology (2011), John M. Butler, Academic Press, ISBN: 978-0123745132
- Advanced Topics in Forensic DNA Typing: Interpretation, (2014) - John Butler, Academic Press, ISBN: 19780124052130
- Forensic DNA Analysis Technological Development and Innovative Applications, 1st ed. (2021) - Elena Pilli and Andrea Berti, Apple Academic Press, Inc., ISBN 9781771889056
- Forensic DNA Profiling - A Practical Guide to Assigning Likelihood Ratios, 1st ed. (2020) - Jo-Anne Bright and Michael D. Coble, CRC Press, ISBN: 9780367029029
- Forensic Practitioner's Guide to The Interpretation of Complex DNA Profiles, 1st ed. (2020) - Peter Gill et. al., Academic Press, ISBN: 978-0-12-820562-4
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- Forensic Genetics in the Governance of Crime, 1st ed. (2019) - Helena Machado and Rafaela Granja, Palgrave Macmillan, ISBN 978-981-15-2429-5
- High-Throughput Next Generation Sequencing – Methods and applications, 1st ed. (2011), Young Min Kwon and Steven C. Ricke, Humana Press, ISBN: 9781617790881
- Next Generation DNA Led Technologies, 1st ed. (2016), Sharada Avadhanam et. al., Springer, ISBN: 978-981-287-669-0
- Next Generation Sequencing – Methods and Protocols, 1st ed. (2018) - Steven R. Head et. al., Humana Press, ISBN: 978-1-4939-7514-3
- A Primer of Conservation Genetics. 2004. Richard Frankham, Jonathan D. Ballou, David A. Briscoe. Cambridge University Press. <http://www.cambridge.org/9780521831109>
- An Introduction to Population Genetics Theory and Applications. Rasmus Nielsen, Montgomery Slatkin. Publisher: Sinauer Associates, Year of Publication-2013.
- Population Genomics: Concepts, Approaches and Applications. Edited by Om P. Rajora. Publisher: Springer International Publishing. DOI: 10.1007/978-3-030-04589-0. Year of Publication: 2019.
- Conservation and the genetics of populations / Fred W. Allendorf, Gordon Luikart, Sally N. Aitken; with illustrations by Agostinho Antunes. – 2nd ed. ISBN 978-0-470-67146-7. Year of Publication: 2013. Publisher: John Wiley & Sons, Ltd
- Population genetics by Matthew B. Hamilton. 2009. ISBN 978-1-4051-3277-0. Publisher: John Wiley & Sons, Ltd

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BSHN-SP4-MN-704: Research Methodology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives: The major objective of this course is to acquaint students with the basic concepts of research, its type's data analysis methods and statistics. This course will also provide the useful insights over ethical intellectual property rights, ethical issues in research, and will impart the skills of scientific writing and communication.

MODULE-1 Basics of research

Teaching Hours: 15 Hours

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis.

Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs.

MODULE-2 Data analysis methods

Teaching Hours: 15 Hours

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings.

MODULE-3 Scientific reports and thesis writing

Teaching Hours: 15 Hours

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

Course Learning Outcomes: At the end of this course, students will be able to explain and implement the concepts of;

1. Basic statistical theories commonly used for the interpretation of data in Forensic Sciences.
2. Statistical knowledge to design and conduct research studies in real life problems.
3. Different types of data, Classification and tabulation of data, basics of random variables.
4. Applications of probability density functions for data interpretation.
5. Measures of central tendency, dispersion, skewness and kurtosis and moments.
6. Concepts of hypothesis testing for making statistical inferences about the population data.
7. Intellectual property rights, ethical issues in research, methods and importance of scientific writing and communication.

Reference books:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
8. Satarkar, S.V., 2000. Intellectual property rights and copy right. EssEss Publications.



BSHN-SP4-PR-706: Practical-VII

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total						
					Practical										
Internal Exam			University Exams		Mid Sem	LPW	Marks	Hour							
Mid Sem			LPW												
Marks	Hour														
0	0	6	3	6	50	3:00	100	6:00	150						

Course Objectives:

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-II

Fundamentals of Biological Chemistry

1. Estimation of Protein, Sugar, Lipid and Cholesterol
 2. Protein Extraction and Separation by SDS PAGE
 3. Denaturation and renaturation of Protein
 4. Measuring time dependent activity of an enzyme
 5. Estimation of Km and Vmax for an enzyme.

MODULE-2

Molecular Biology and rDNA technology

1. DNA extraction from biological samples
 2. Polymerase Chain Reaction
 3. Sanger Sequencing

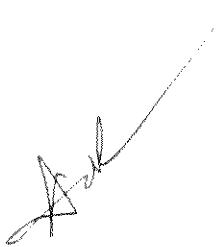
MODULE-3

Forensics Genomics and DNA Profiling

1. STR Profiling and report writing using simulated evidences
 2. Analysis of lineage markers (Y-STR and mtDNA) from simulated samples
 3. Primer designing and sequence alignment for forensic markers
 4. Data retrieval and analysis from various databases: NCBI, PubMed Central, STRidER
 5. Construction of phylogenetic tree and phylogeographic analysis using various tools
 6. Extraction of proteins from different body fluids
 7. Native PAGE, and Iso electric focusing
 8. Intrinsic fluorescence of body fluids
 9. Application of Swiss PDB viewer, Rasmol, NCBI database and FASTA sequence

Specialization-5

“Cyber Forensics”





BSHN-SP5-MJ-701: Advanced Digital Forensics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives:

The primary objective of this course is to teach steps of cybercrime investigation, advance digital forensic, forensic analysis of different operating and file systems.

MODULE-1 Cyber-crime Investigation and Digital Forensics Teaching Hours: 15 Hours

Introduction to cyber-crime investigation, Conducting an Investigation, preparing for search and seizure, securing crime scene, seizing digital evidence at SOC; Daubert Standards; ISO/IEC 27037: 2012; Forensics Investigation Process- Pre-search consideration, Collection of Evidences from crime scene, Acquisition, & Preservation, Examination and Analysis, Documentation and Reporting, Maintaining the Chain of Custody; Collection of Volatile and Persistent Data.

Hashing Algorithms; Cloning of Digital Exhibits, Different Imaging Formats- Raw Format, Proprietary Formats, Advanced Forensic Formats; Imaging vs Cloning/Copying; Data Acquisition from live systems, Shutdown Systems, Remote systems, RAID Servers and Encrypted systems; Validating Data Acquisitions techniques (Linux and Windows); Digital Forensics Standard Operating Procedures. Software and Hardware Tools used in Forensic Analysis – Open Source and Proprietary tools; Challenges and issues in Cyber-crime investigation and Digital forensics.

MODULE-2 Forensic Analysis of Windows System Artifacts Teaching Hours: 15 Hours

File Systems, Registry, Event logs, Shortcut files, Executables; Windows registry, startup tasks, Jumplists, Volume Shadow Backup, Shellbags; Forensic Analysis of the Registry – Use of registry viewers, Amcache.hve, Shimcache.hve, Regedit; Extracting USB related artifacts and examination of protected storages. Email investigations; Data recovery – Tools and techniques; Malware and Ransomware Analysis; Recycle Bin Forensics (INFO, \$I, \$R files); Anti-forensic techniques and their detection: Data Wiping, Partition Deletion, Bit-Shifting, Alternate Data Streams (ADS), Hidden files, Data in the Slack Space and Unallocated Space, Steganography and Steganalysis, File Extension Mismatch, Disk Encryption etc.

MODULE-3 Forensic Analysis of Linux and MAC System Artifacts Teaching Hours: 15 Hours

Linux File-system and Artifacts – Introduction and Architecture of Linux OS, Booting Process, Basics of Linux file-system, Use of built-in command line tools for forensic investigation – dd,

dcfldd, fdisk, mkfs, mount, umount, md5sum, sha1sum, dmseg, grep, find, pstree, ls, kill, history, xxd; Hash Computation and Verification; Checking File Extension Mismatch, Keyword Searching, Fragmentation of Forensic Images; Ownership and Permissions, Hidden files, User Accounts and Logs; Mounting of hard disk having forensic image; Timeline analysis.

MAC File-system and Artifacts – Introduction to MAC OS and File-system, Booting Process in MAC, System Services, Hidden directories, System Logs and user artifacts; Forensic Acquisition and Analysis of Plists; Function of File Vault, Keychain.

Course Learning Outcomes: After studying this paper, the students will be able to –

1. Understand the various stages of digital forensics investigation
2. Get familiar with the various artifacts and their sources, found in Windows Operating System.
3. Get a basic understanding of the various artifacts and evidences found in Linux and MAC forensics.
4. Identify the working of various tools and techniques used for digital forensics examination.
5. Get familiar with the various issues and challenges faced by digital forensic investigators.

Suggested Reading and Books:

1. Bill Nelson, Amelia Phillips and Christopher Steuart, "Guide to Computer Forensics and Investigations, 5th Edition", Cengage, 2010 BBS.
2. Dr. Darren Hayes, "A Practical Guide to Computer Forensics Investigation", Pearson Publishers, 2014.
3. EC-Council, "Computer Hacking Forensic Investigator v.9".
4. Eoghan Casey; "Handbook of Digital forensics and Investigation", Elsevier Academic Press, 2009.
5. Nina Godbole and Sunit Belapure; "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publications, 2011.
6. Harlan Carvey; "Windows Forensic Analysis Toolkit", Syngress, 2012.
7. Anthony Reyes, Jack Wiles; "The Best Damn Cybercrime and Digital Forensic Book", Syngress, USA, 2007.
8. Dr. Philip Polstra, "Linux Forensics with Python and shell scripting", Pentester Academy, 2015.
9. Jessie Varsalone and Rob Maxwell, "MAC OS X Forensic Field Guide: Digital Forensics Field Guides", Syngress, 2015.



BSHN-SP5-MJ-702: Mobile and Network Forensics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: The primary aim of this course is to teach concepts of mobile and network forensics concepts has become necessary in securing today's computing environment.

MODULE-1 Introduction to Mobile and Network Technologies Teaching Hours: 15 Hours

Mobile Technologies - Asynchronous Transfer Mode (ATM), Wireless Application Protocol (WAP); Cellular technologies including Advanced Mobile Phone System (AMPS), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA) and Global System for Mobile Communications (GSM); Functions of Subscriber Identity Module (SIM), International Mobile Equipment Identity (IMEI), Bluetooth and Mobile Payment Gateways; Understanding of the mobile phone operating systems – Android, iOS, Windows; Basics of Rooting \ Jailbreaking.

Basics of Networking - Server, client, routers, Shared Printers and other peripherals, Network Interface Card. Network Devices – hubs, Switches, routers, repeaters; Network Topologies; Introduction to OSI model and TCP/IP model; HTTP, World Wide Web, Web Browsers, Web Servers, Domain Names, URL and DNS; IP addressing – types and classes; Types of Networks – LAN, MAN, WAN and PAN; Routers and Routing Protocols; Basics of Wi-Fi; Basics of Cloud Computing.

MODULE-2 Mobile Device Forensics

Teaching Hours: 15 Hours

Introduction to Mobile Forensic, Types of Evidence present in mobile phones - SIM card, Internal, and evidences in SD card; SIM Card File-system and architecture; Different Stages of Forensic Investigation, Building Mobile Forensic Toolkit, Seizure and Preservation of mobile phones, Data Acquisition, Examination and Analysis, Tool Selection; Data Acquisition Methods – Manual, Physical, Logical, File System, Advanced Logical, Selective and Qualcomm Acquisition. Extraction of data from damaged phones: JTAG, Chip-off and Micro-Read; Good Forensic Practices; Tracking of mobile phone location. Analysis of mobile data like SMS, call logs, contacts, media files, recordings and important mobile application data (IM Chats like WhatsApp, telegram, iMessage, Email clients, Calendar, Reminder and Note apps); Challenges and Issues in Mobile forensics; CDR and IPDR analysis; Introduction to iOS Device Forensics.

MODULE-3 Network Forensics and Analysis

Teaching Hours: 15 Hours

Common Network Attacks; Post-mortem and Real-time analysis, Live Packet Capturing and Analysis; Searching and collection of evidences from the network; Monitoring of computer network and activities; Log files as Evidence: Legality of using Logs, Ensuring log file accuracy, Log Management System and its functions, Centralized Logging, Challenges and issues in log management and analysis; Event Correlation: Pre-requisites and approaches; Condensing Logs, Security Information and Event Management System (SIEM), tools for SIEM - Splunk, EDR Crowdstrike etc. Log capturing and analysis tools; Collection and Analysis of Router, Firewall and IDS logs; Evidence collection and analysis from CCTV DVRs; Network Packet Analyzer tools; Forensic analysis of online browsing activity and related artifacts; Introduction to Cloud Forensics.

Course Learning Outcomes: After studying this paper, the students will be able to –

1. Get familiar with the different mobile and network-based technologies.
2. Identify the various artefacts of evidentiary value found in mobile phone devices.
3. Appreciate the different data acquisition techniques used in mobile device forensics.
4. Understand the various evidences to be collected from different networking devices and to analyse the same.
5. Identify the different tools and techniques used for forensic analysis of mobile phones and computer networks.
6. Get to know about the challenges in forensic investigation of mobile phones and computer networks.
7. Get familiar with the basics of cloud computing and Forensics.

Suggested Reading and Reference Books:

1. Behrouz A Forouzan; "Data Communication and Networking", 4th Edition, TMH, 2000.
2. Anita Goel; "Computer Fundamentals", Pearson Publications, 2010.
3. Satish Bommisetty, Rohit Tamma and Heather Mahalik, "Practical Mobile Forensics – Dive into mobile Forensics on iOS, Android, Windows and Blackberry Devices with action-packed, practical guide", PACKT Publishing, 2015.
4. Iosif I. Androulidakis, "Mobile Phone Security and Forensics – A Practical Approach", Springer New York Heidelberg, 2012.
5. Sherri Davidoff and Jonathan Ham; "Network Forensics – Tracking Hackers through Cyberspace", Pearson Publications, 2012.
6. Samir Datt; "Learning Network Forensics – Identify and Safeguard your Networks against both Internal and External Threats, hackers and malware attacks", PACKT Publishing, 2016.
7. EC-Council, "Computer Hacking Forensic Investigation, v.9".
8. Jonathan Zdziarski, "iOS Forensic Investigative Methods", 2012.
9. Terrence V. Lillard; "Digital Forensics for Network, Internet and Cloud Computing: A Forensic Evidence Guide for moving Targets and Data", Syngress Publications, 2010.



BSHN-SP5-MJ-703: Vulnerability Assessment and Penetration Testing

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs						
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: This course aims to find the vulnerabilities and learn various vulnerability assessment techniques, to learn various aspects of web application security and exploitation of potential web vulnerability, and to learn industry standard techniques to exploit advanced vulnerability.

MODULE-1 Vulnerability Management Governance and Security Assessment
Teaching Hours: 15 Hours

Security Basics, Understanding the need for security assessment, penetration testing lifecycle, OWASP top 10 and testing guide, target scoping and planning, deciding upon the type of vulnerability, estimating resources and deliverables, preparing test plans, Information Gathering: Passive and Active Information Gathering.

MODULE-2 Penetration Testing Basics Tools and Techniques Teaching Hours: 15 Hours

Setting up the virtual lab, Using Kali Linux: Linux File-System, user privileges, file permissions, editing files, data manipulations, managing networking, Netcat; Bash and Python Scripting; Using the Metasploit Framework; Open-source Intelligence Gathering tools and Techniques, Finding Vulnerabilities and Capturing Traffic; Enumeration and Vulnerability Assessment; Gaining Remote Access, Cracking Passwords, Creating Backdoors using Backdoor Factory; Social Engineering; Client-side Exploitation.

MODULE-3 Vulnerability Assessment Techniques Teaching Hours: 15 Hours

Importance of web application security testing, Application Profiling, Common Web Application Security Testing tools, Privilege Escalation, Threat Modelling, Maintaining Access and Clearing Tracks, Vulnerability Scoring, Bypassing Anti-virus Applications; Vulnerability Reporting and Metrics- Importance of Reporting, type of reports, reporting tools, collaborative vulnerability management with Faraday v2.6 Metrics.

Course Learning Outcomes: After studying this paper, the students will be able to –

1. Understand the need for security assessments and vulnerability management governance.
2. Get familiar with the various tools and techniques used for penetration testing and vulnerability assessment.
3. Identify the modus operandi of different attacks and security assessment pre-requisites.
4. Study the importance of penetration testing and vulnerability assessment in the cyberspace.

Suggested Reading and Reference Books:

1. Sagar Rahalkar, "Network Vulnerability Assessment: Identify security loopholes in your network's infrastructure", Packt Publishing, Birmingham, 2018.
2. Georgia Weidman, "Penetration Testing: A Hands-on Introduction to Hacking", No Starch Press Inc., USA, 2014.
3. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, Taylor and Francis, USA, 2015.
4. Patrick Engebreston, "The Basics of Hacking and Penetration Testing", Syngress Press, Elsevier, 2011.



BSHN-SP5-MN-704: Research Methodology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
Marks	Hrs	Marks	Hrs											
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: The major objective of this course is to acquaint students with the basic concepts of research, its type's data analysis methods and statistics. This course will also provide the useful insights over ethical intellectual property rights, ethical issues in research, and will impart the skills of scientific writing and communication.

MODULE-1 Basics of research

Teaching Hours: 15 Hours

Objectives and types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical. Research Formulation, Literature review and Development of hypothesis

Research design and methods, developing a research plan - Exploration, Description, Diagnosis, and Experimentation. Determining experimental and sample designs

MODULE-2 Data analysis methods

Teaching Hours: 15 Hours

Data Collection and analysis: Methods of data collection – Sampling Methods and Data Processing. Data Analysis: Types of data, Basic concept of frequency distribution, measure of central values – Mean, median and mode, measure of dispersion, range, mean deviation and standard deviation, probability, theory and classical definition of probability, Bayes theorem of probability, conditional probability and coincidence probability, Chi-square test, ANOVA, SPSS. Types of Errors and Interpretation of Findings

MODULE-3 Scientific reports and thesis writing

Teaching Hours: 15 Hours

Reporting and thesis writing: Structure and components of scientific reports and thesis, Significance and Different steps in the preparation, Illustrations, Bibliography. Presentations: Oral and Poster, Importance of effective communication in scientific research.

Basics of Ethical issues, Intellectual property rights, Copy right, Reproduction of published material: Plagiarism in scientific research and communications.

Course Learning Outcomes: At the end of this course, students will be able to explain and implement the concepts of;

1. Basic statistical theories commonly used for the interpretation of data in Forensic Sciences.
2. Statistical knowledge to design and conduct research studies in real life problems.
3. Different types of data, Classification and tabulation of data, basics of random variables.
4. Applications of probability density functions for data interpretation.
5. Measures of central tendency, dispersion, skewness and kurtosis and moments.
6. Concepts of hypothesis testing for making statistical inferences about the population data.
7. Intellectual property rights, ethical issues in research, methods and importance of scientific writing and communication

Reference books:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
7. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall. 12.
8. Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.



BSHN-SP5-PR-706: Practical-VII

Teaching and Evaluation Scheme

Teaching Scheme					Examination Scheme				Total	
					Practical					
L	T	P	C	TCH	Internal Exam		University Exams			
					Mid Sem		LPW			
					Marks	Hour	Marks	Hour		
0	0	6	3	6	50	3:00	100	6:00	150	

Course Objectives:

At the end of course, students will be gaining the hands-on training in the following courses;

MODULE-I Advanced Digital Forensics

1. Windows Registry and Log Data Analysis
2. Hiding and Un-hiding information using steganography
3. Recovery and analysis of slack space data
4. Tracking and analysing of source of email
5. Static and Behavioural analysis of Malware

MODULE-2 Mobile and Network Forensics

1. Data Acquisition and Analysis of Android Phones
2. Analysis of Mobile Applications
3. Traffic Analysis of Network by Live packet capturing
4. Network scanning using different tools
5. Analysing Browser History and Browser Caches of windows system

MODULE-3 Vulnerability Assessment and Penetration Testing

1. Banner Grabbing and Enumeration of web server
2. Port Scanning and Google Dorking
3. Vulnerability Assessment of a website / web application
4. Social Engineering Exploit using Kali Linux
5. Erasing tracks using different tools



SEMESTER -VIII



BSHN-MD-801: DISASTER VICTIM MANAGEMENT

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
Marks	Hrs	Marks	Hrs									
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

1. To provide students basic conceptual understanding about disasters and Disaster management
2. To make students learn about the importance of the key aspect of Disaster victim identification
3. To Enhance the skill of the student's investigative procedure in mass fatality

UNIT-I

Teaching Hours: 15 Hours

Disaster and Disaster Management: Introduction, Types of disaster, Classification of Disasters, national and International Impact of Disasters; Causes, Effects and Practical examples for all disasters.

Disaster Management Techniques: Risk and Vulnerability Analysis, Its concept and Reduction, Early and Advance Warming Systems, Understanding climate risk, Mapping of risk assessment, Decision making for risk reduction, Problems in risk assessment, Geographical Information System (GIS).

Disaster preparedness and Response: Overview and Understanding of Disaster Preparedness, Early Warnings and Safety Measures of Disaster, Resource Management- Financial, Medical, equipment, communication, Human, transportation, Food and essential commodity, Directing and controlling functions, Role of Government, International and NGO Bodies.

UNIT-II

Teaching Hours: 15 Hours

Fundamentals of DVI: Principle and Guideline of DVI, Different expertise and equipment's, Composition of Investigation team (DVI team), Health and personnel safety.

Scene Processing and Recovery: Process of DVI operation on site and Mortuary, Handling and preservation of Human and non-human remains, Documentation, Body labelling, Disaster photography/videography and their kits, Different types of coordination centre.

Investigative Process: Establishing Identifiers, Biological Profiling of Primary and Secondary Identifiers (Fingerprint, Teeth and DNA), Advance Techniques (Radiology, Scanners, 3D printers), Different AM data collection and documentation, Different type of PM examination and Documentation, Digital data maintenance software, Reconciliation and Repatriation

UNIT-III

Teaching Hours: 15 Hours

Humanitarian Approach: Concept and Nature of ethics; Role and purpose of ethics; ethical norms and principles; International Humanitarian Law; Disaster Policy: The International Decade for Natural Disaster Reduction, Disaster Policy (National Policy on Disaster Management), Disaster Management Act 2005. National Disaster Management Plan, Role of Media and its importance, role

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of Fire Services, Para-military, Armed forces, presently challenging aspect of disaster management in India.

Course Learning Outcomes: At the end of this course, students will be equipped with the knowledge of;

1. Various aspects of disaster, it's management and preparedness.
2. Fundamentals and processes involved in disaster victim identification.
3. Humanitarian approaches towards disaster victims.

References:

1. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
2. Staggs, S. (2005). Crime scene and evidence photographer's guide. Staggs Pub.
3. Global perspective on disaster victim identification series, CRC Press (Latest Edition)



BSHN-MD-802: Ethics in Research and Publication

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

This course aims to provide exposure in philosophy of science and ethics, research integrity, publication ethics. Students will learn to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, impact factor, etc.) and plagiarism tools are also introduced in this course.

Module-1 Introduction to Ethics and Scientific Conduct Teaching Hours: 15 Hours

Philosophy and Ethics: Introduction to Philosophy: definition, nature and scope, concept, branches, Ethics: Definition, moral philosophy, nature of moral judgments and reactions.

Scientific Conduct: Ethics with respect to science and research, Intellectual honesty and research integrity, scientific misconducts: Falsification, Fabrication and Plagiarism (FFP), redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data

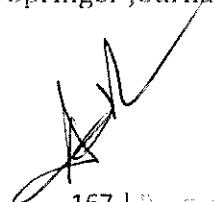
Module-2 Publication Ethics & Open Access Publishing Teaching Hours: 15 Hours

Publication Ethics: Publication ethics: definition, introduction and importance, best practices/standards setting initiatives and guidelines: COPE, WAME etc., Conflicts of interest

Publication misconduct: Definition, concept, problems that lead to unethical behavior and vice versa, types, Violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals

Open Access Publishing

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU: UGC-CARE list of journals
4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.



Module-3 Publication Misconduct & Database Teaching Hours: 15 Hours

Publication Misconduct: Group discussions, Subject specific ethical issues, FFP, authorship, Conflicts of interest, complaints and appeals: examples and fraud from India and abroad

Software tools: Use of reference management software like Mendeley, Zotero etc. and anti-plagiarism software like Turnitin, Urkund

Databases and research metrics: Databases, indexing databases, Citation databases: Web of Science, Scopus etc., Research Metrics, Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score, Metrics: h-index, g-index, i-10 index, altmetrics.

Course Learning Outcomes: At the end of this course, students will be equipped with the knowledge of;

4. Ethics in research
5. Scientific conduct
6. Publication ethics
7. Open access publishing
8. Publication misconduct
9. Database and research metrics

References:

1. Nicholas H. Steneck. Introduction to the Responsible Conduct of Research. Office of Research Integrity. 2007. Available at: <https://ori.hhs.gov/sites/default/files/rcriintro.pdf>
2. The Student's Guide to Research Ethics By Paul Oliver Open University Press, 2003
3. Responsible Conduct of Research By Adil E. Shamoo; David B. Resnik Oxford University Press, 2003
4. Ethics in Science Education, Research and Governance Edited by Kambadur Muralidhar, Amit Ghosh Ashok Kumar Singhvi. Indian National Science Academy, 2019. ISBN : 978-81-939482-1-7.
5. Anderson B.H., Dursaton, and Poole M.: Thesis and assignment writing, Wiley Eastern 1997.
6. Bijorn Gustavii: How to write and illustrate scientific papers? Cambridge University Press.
7. Bordens K.S. and Abbott, B.b.: Research Design and Methods, Mc Graw Hill, 2008.
8. Graziano, A., M., and Raulin, M.L: Research Methods – A Process of Inquiry, Sixth Edition, Pearson, 2007.



BSHN-MD-803: FORENSIC JOURNALISM

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objective: To provide students basic conceptual understanding about mass communication with fundamental theories and models of communication.

UNIT-I

Teaching Hours: 15 Hours

Introduction to Journalism: Scope and Definition of Journalism; Role and Responsibilities of Mass Media; Types of Communication Models; Types of Mass Communication Theories; Public Opinion and Democracy; The media scene: The characteristics of the Indian Press; The present state of Print Media, Electronic media, Cyber Media; A brief look into the Government media organizations.

UNIT-II

Teaching Hours: 15 Hours

Reporting and Editing: Defining news: news value, elements of news; Structure of news: five W's (Who, What, When, Why, Where) and one H (How); Selection of information, writing introduction/lead, body, different types of introduction/lead, organizing the news story; Understanding beats and their categories (Political, Health, Crime, Art and Culture); City reporting, Crime reporting: sources and related laws, Legal reporting; Investigative Reporting: Analysis of documents, Database of public records, Research into social and legal issues; Other Specialized reporting: Defence, Science & Technology etc.

UNIT-III

Teaching Hours: 15 Hours

New Media Studies: Revolutionary change in communication; rise of new media in contemporary era; New media as a tool for social change, freedom of expression vs. privacy, largest ungoverned space on earth; National Security and New Media, Guard the nation from Cyber Attack, Hacking, Fraud; Strengthen National Integration, Case Study : 'Digital Strike' etc.; Citizen Journalism: Concept, Case studies, Mobile Journalism; Types of Fake News: Parody, False connection, Misleading Content, False Content, Impostor Content, Manipulated Content, Fabricated Content; Detecting Fake News and Web portals: Targeted, Propaganda, Organized, Sensitization, Opinionated; Drone Journalism.

Learning Outcome: The student will be able to gain knowledge of

1. To provide students basic conceptual understanding about mass communication with fundamental theories and models of communication. It enhances the capacity to react to incidents and developments in the larger interests of the society.
2. To develop the skill to write for all kinds of media with emphasis laid on professional training in information gathering, processing and delivering including specialized reporting like Investigation.

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- 3. To understand the nature of new media journalism and how it can be put to good use for mutual benefit of the media house and the society; To develop an understanding to guard the nation from cyber-attack and strengthen national security by awaring the public at large.

Reference Books:

- 1. Fiske, John., Introduction to Communication Studies, Methew, London 1982.
- 2. Schramm, Wilbur, The process and Effects of Mass Communication, 1971.
- 3. Mitchell V Charnley (K Holt, Reinhart and Winston), Reporting
- 4. Lewis James, The Active Reporter, Vikas
- 5. The Active News room (International Press Institute) Noah Wardrip-Fruin and Nick Montfort (eds),
- 6. The New Media Reader, The MIT Press, Cambridge, 2003.
- 7. Christopher Callhan, A Journalist Guide to the Internet: The Net as a Reporting Tool, Pearson/Allyn and Bacon, 2007.
- 8. Jagdish Chakraborty, Cyber Media Journalism: Emerging Technologies, Authors Press, New Delhi, 2005.



BSHN-MJ-804: Research Proposal Writing

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

Module-1 Introduction of research writing Teaching Hours: 15 Hours

Role & purposes of Research Designs, Defining and differentiating research: Descriptive Research, Analytical Research, Applied Research, Fundamental Research, Quantitative Research, Qualitative Research, Conceptual Research, and Empirical Research.

Source of information: Finding/Gathering information for research, using information, Using research tools, Using Library and electronic databases.

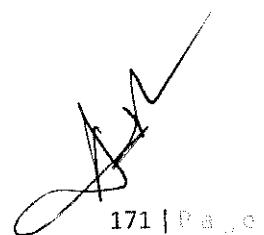
Module-2 Writing review article and academic honesty Teaching Hours: 15 Hours

Skill of writing research literature review article: Need for a literature review, Strategies for writing literature review, reviewing skills, Literature search and evaluation, Method of conducting a literature review, organizing the literature review

Citation procedures: Citing sources or references and maintaining Academic honesty -Referencing and in-text citations, Styles of referencing, Paraphrasing and summarizing, citing sources, Developing academic honesty

Module-3 Writing research paper and ethical issues in collection of data Teaching Hours: 15 Hours

Writing, refining and editing a research paper -Writing a Research Proposal. Developing objectives of the research topic, developing logical research statements and hypotheses, Editing the research paper, Proofreading techniques, Revision of the research paper.



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Ethical issues in collecting data -Ethics, stakeholders in research, ethical issues concerning participants, seeking consent, providing incentives, confidentiality, bias, incorrect reporting, issues with sponsoring organizations.

Course Learning Outcomes: At the end of this course;

1. Students will learn to develop and write a complete research paper (including an abstract, citations, references etc.).
2. Students will learn how to find, evaluate, and use data for research.
3. Students will improve the quality of research writing through the study of standard published research work in the respective majoring (specialized subject) areas.

References:

1. Kothari, C. R. (2004). Research Methodology: Methods and Techniques. New Delhi: New Age International.
2. Kumar, R. (2005). Research Methodology-A Step-by-Step Guide for. Singapore: Pearson Education.
3. Saravanavel, P. (2012). Research Methodology. Allahabad: Kitab Mahal Publishers. Page 3 of 3



BSHN-MN-805: IPR, Copyright and Patents

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives: The aim of this course is to introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries and to disseminate knowledge on patents, patent regime in India and abroad and registration aspects and copyrights and its related rights and registration aspects.

Module-1

Introduction to IPR

Teaching Hours: 15 Hours

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design - Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967, the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994.

Module-2

Copyright

Teaching Hours: 15 Hours

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights.

Module-3

Patents & Trademark

Teaching Hours: 15 Hours

Patents - Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of



Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non-Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

Course Learning Outcomes: At the end of this course, students will be able to demonstrate the;

1. Knowledge on patent and copyright for their innovative research works
2. Information in patent documents provide useful insight on novelty of their idea from state-of-the art search.
3. Pave the way for the students to catch up Intellectual Property (IP) as a career option

References:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
3. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.



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SCHOOL OF FORENSIC SCIENCES

B.Sc.-M.Sc. Forensic Sciences

SEMESTER -IX

BSMS-MJ-901: Ethics in Science Education and Research

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
3	1	0	4	4	50	00:45	50	01: 30	100	03: 00	-	200

Course objectives: This course aims to deliver the fundamentals of Ethics in Higher Education and Academic Research and ethics of research publication.

MODULE-1 Ethics in Higher Education and Academic Research Teaching Hours: 15 Hours

Ethics in Academic Research, Issues in Research Ethics, Postulates for Maintaining Ethical Standards in Higher Education like; Reliability and Integrity, Objectivity, Genuineness, Respect for Intellectual Property, Novelty in Publication, Confidentiality and Anonymity, Agreement for Consent, Concerns of Ethics in Academic Structure.

MODULE-2 Ethics of Research and Publication

Teaching Hours: 15 Hours

Ethics with respect to science and research, Collaborative Research and Sharing of Credits, Ethical Conventions of Publications, Research Supervisor-Student Relationship, General Responsibilities of Authors, Ethical Conventions of Publications, Peer-Reviewed Scholarly Journals, Predatory journals, Scientific misconducts: falsification, fabrication, and plagiarism, Impact factor of Journals, H-Index.

MODULE-3 Publication Ethics

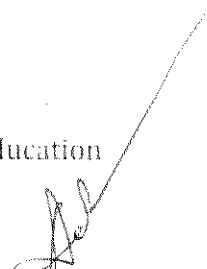
Teaching Hours: 15 Hours

Publication ethics: definition, introduction and importance, best practices/standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, Violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals.

Course learning outcomes:

At the end of course, students will be able to explain;

1. Ethics in Academic Research
2. Postulates for Maintaining Ethical Standards in Higher Education





3. Ethics with respect to science and research
4. Publication ethics

Suggested Readings:

1. Ethics in Science Education Research and Governance, Edited by K Muralidhar Amit Ghosh AK Singhvi, Indian National Science Academy 2019.
2. Charles E. Harris et al, Engineering Ethics, Cengage, 2009
3. N. N. Das, Ethical Considerations.
4. R. Subramaniam, Professional Ethics Oxford University Press
5. Ranjit Kumar, Research methodology- a step-by-step guide for beginners, Sage publications, 2011

BSMS-DS-902	Dissertation	L	T	P	C	TCH
		0	0	36	18	36



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SCHOOL OF FORENSIC SCIENCES

B.Sc.-M.Sc. Forensic Sciences

SEMESTER -X

943

178 | p



BSMS-IN-1001	Internship at Forensic Science Laboratory	L	T	P	C	TCH
		0	0	40	20	40



**Syllabus of Core Electives
For
Semester-VII**

A handwritten signature in black ink, appearing to read "Dr. S. K. Singh".



BSHN-EL7-705: CCTV Forensics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
Marks	Hrs	Marks	Hrs									
2	0	0	2	2	50	01:30	50	01:30	100	03:00	-	200

Course Objectives:

The course is designed to provide students with the technical conceptualization of surveillance cameras and to explicitly define its role in crime prevention & detection. The outline of the course module encompasses detailed explanation of the various types of CCTV Cameras that are used for surveillance along with its technical specifications and operational framework. Additionally, knowledge regarding the investigative procedure and techniques involved in collection, handling & preservation of footage evidence followed by its successful forensic examination is imparted to the students to equip them with the necessary scientific skills and aids to analyze the footage presented as evidence.

MODULE-1 Introduction to CCTV Forensics

Teaching Hours: 15 Hours

Introduction to CCTV camera: definition, its types: Dome shaped, Bullet Cameras, C-Mount Cameras, PTZ Pan Tilt & Zoom Cameras, Day/Night Cameras, Infrared/night vision Cameras, Network Cameras, Wireless Cameras, High Definition (HD) Cameras, Discreet cameras, Fish eye Cameras, varifocal Cameras, Drone cameras, components of CCTV camera: analog camera, IP based camera, monitoring station, cables, DVR, NVR, storage mechanism, Image sensors: CCD and CMOS sensors.

Introduction to Video Management System: Its components, working mechanism, Benefits of Utilizing a VMS, CCTV topology, design, network, integration, bandwidth. Acquisition of CCTV footages from the scene of crime, Handling and preservation of CCTV footages, hash value generation, extracting the data from DVR/NVR, maintaining chain of custody. Authentication and enhancement of CCTV footages, extraction of frames, Forensic tools for Enhancement and authentication of CCTV footages, legal admissibility of CCTV evidence, related cases studies.

MODULE-2 Introduction to Video Analytics

Teaching Hours: 15 Hours

Smart video content analysis, uses of video analytics, video synopsis, automatic license plate recognition, crowd detection, face recognition, indoor people tracking, object detection, motion detection, vertical motion detection, left and removed item detection, outdoor people and vehicle

tracking, ptz auto-tracking, behavior tracking, loitering detection, traffic monitoring, future of video analytics. Concept of active CCTV surveillance and monitoring techniques.

Course Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the components and working mechanisms of Video Management Systems.
2. Understand the concepts of video analytics and their applications such as smart video content analysis, automatic license plate recognition, crowd detection, face recognition, and object detection.
3. Acquire and handle CCTV footage from crime scenes, including preservation and hash value generation.
4. Learn about active CCTV surveillance and monitoring techniques.

Reference books:

1. Hill, T. (2020). *CCTV Handbook: Buying, Installing, Configuring, & Troubleshooting: A User's Guide to CCTV Security*. Independently published.
2. Damjanovski, V. (2005). *CCTV: Networking and Digital Technology* (2nd ed.). Butterworth-Heinemann.
3. Kroener, I. (2014). *CCTV: A Technology under the Radar?* (1st ed.). Routledge.
4. G. (2020, March 18). Types of CCTV Cameras – The Complete Guide. BusinessWatch. <https://www.businesswatchgroup.co.uk/types-of-cctv-cameras-the-complete-guide/>
5. Paul, D., & Puvvala, C. (2020). *Video Analytics Using Deep Learning*. Apress.
6. Ph.D., P. P. M. (2021). *The 2022 Report on Video Analytics, Intelligence, Surveillance, Reconnaissance and Object Recognition Technologies: World Market Segmentation by City*. ICON Group International, Inc.
7. Carle, B., & Jensen, R. C. (2018). *Understanding Video Management Systems*.
8. Wolper, V. E. (2020). *Photograph Restoration and Enhancement: Using Adobe Photoshop CC 2021 Version* (3rd ed.). Mercury Learning & Information.



BSHN-EL8-705: Accident Investigations

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives: This course aims develop a comprehensive understanding of accident scene investigation, including forensic information sources, eyewitness accounts, vehicle damage assessment, visibility conditions, and other evidences.

MODULE-1 Motor Vehicle Accidents

Teaching Hours: 15 Hours

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-2 Accident Analysis & Tachographs

Teaching Hours: 15 Hours

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.

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

Course learning outcomes: At the end of course, students will be able

1. To understand the nature of motor vehicle accident scene and its investigative principles.
2. to understand the analysis of Pre-crash and post-crash movement
3. to know working and interpretation of Tachograph data & Tachograph charts

References and Suggested Readings:

2. T.S. Ferry, Modern Accident Investigation and Analysis, Wiley, New York (1988).
3. D. Lowe, The Tachograph, 2nd Edition, Kogan Page, London (1989).

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4. T.L. Bohan and A.C. Damask, *Forensic Accident Investigation: Motor Vehicles*, Michie Butterworth, Charlottesville (1995).
 5. 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).





BSHN-EL9-705: Forensic Photography

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs				
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives: The aim of this course is to equip students with the fundamental knowledge of various photography & photographic Techniques useful in forensic sciences, and to provide them opportunity to learn the modern day photographic tools for analysis along with the case studies.

MODULE-1 Photography & Photographical Techniques Teaching Hours: 15 Hours

Photography History, Types of Cameras, lenses, filters, films, exposing, Reprofit unit, Specialized photography-UV, IR, close up, transmitted light, side light, trick photography, contact print photography, oblique light photography. Photography using scientific equipment and instruments, Development & printing process of photographs, different kinds of developers and fixers.

Photomicrography and macro photography, Digital photography, Scope of photography in various disciplines of forensic science-finger prints, foot prints, physics, chemistry, biology, ballistics, computer forensics etc. basic concepts of videography/high speed videography, application of videography in police work, Detection of manipulated digital image for identification, photography as secondary evidence. Crime scene and laboratory photography.

MODULE-2 Photographic tools in Forensics Teaching Hours: 15 Hours

Software for digital photography, file formats - jpg, gif, bmp, tiff, raw etc., digital watermarking, photogrammetry, radiography, image enhancement of mutilated/soiled/old documents., Faro technology for 3D documentation of crime scene CCTV image enhancement, processing of digital images and its manipulation. Case studies. Laws relating to digital evidence and its admissibility.

Course Learning Outcomes: At the end of this course, students will be able to explain and implement the concepts of;

1. Types of cameras and handling of modern day cameras in forensic sciences
2. Various photographic techniques and their working principles
3. Modern day photographic tools employed in forensic sciences

References and Suggested Readings:

1. Ang Tom; "The Complete Photographer", Dorling Kindersley Ltd., 2010.
2. Gernsheim Helmut; "A concise history of Photography", 3rdEd., Dover Publications, 1986.
3. Freeman Michael; "The Complete Guide to Digital Photography", 4thEd., Lark Books, 1945.
4. Farrell Ian; "Complete Guide to Digital Photography", Quercus Publications, 2017.
5. Edge Martin; "The Underwater Photographer", Focal Press, 2010.
6. Bergner Joachim, E. Gelbke, W. Mehliss; "Practical Photomicrography", Focal Press, 1966.
7. White Laurie; "Advance Infrared Photography", Amherst Media, 1995. Feininger Andreas; "The Complete Photographer", Prentice Hall, 1965.





BSHN-EL10-705: Forensic Linguistics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme							
Th	Tu	Pr	C	TCH	Theory				Practical		Total	
					Internal Exams				University Exams			
					TA-1 & TA-2		MSE		Marks	Hrs		
					Marks	Hrs	Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	200

Course Objectives:

This course offers the gateway to the intriguing world where language meets the law. This comprehensive online certificate program provides a solid introduction to the field of forensic linguistics, tailored to individuals with diverse backgrounds and interests. Students will explore the fundamental principles of linguistics and discover how they intertwine with the fascinating domain of forensic analysis.

MODULE-1 Introduction to forensic linguistics

Teaching Hours: 15 Hours

Introduction to Linguistics and Subfields, Concept, Origin and development of Forensic Linguistics, Significance of Forensic Linguistics, Crucial role played by Forensic Linguists in investigations.

Exploring the Interplay between Language and Law: Scrutinizing Linguistic Features within Legal Texts and Documents, the Dimensionality and Richness of Forensic Linguistics, Analyzing Language as Vital Evidence in Legal Contexts

MODULE-2 Linguistics Branches & Confronting Realities **Teaching Hours: 15 Hours**

Illuminating Authorship Analysis and Its Nuances, Navigating Through Forensic Phonetics, Traversing the Pathways of Forensic Stylistics, Discourse Analysis: A Journey through Linguistic Structures, Exploring the Depths of Threat and Deception Analysis, Unveiling the Secrets of Language Profiling.

Investigating Real-World Case Studies in Forensic Linguistics, Tackling the Challenges and Obstacles within Forensic Linguistics, Upholding Ethics and Professionalism in Forensic Linguistics, Envisioning the Future: Prospective Pathways in Forensic Linguistics.

Course Learning Outcomes: At the end of this course, students will be able to;

1. Identify core forensic linguistic principles of phonetics, the lexicon, discourse and pragmatics.
2. Analyse selected examples of the use of core forensic linguistic principles in the forensic analysis of language use.
3. Apply appropriate linguistic methodologies to the analysis of language use in selected legal and commercial contexts.
4. Identify some of the emerging trends in forensic linguistics and discuss some of the ethical issues surrounding them.

Books and References:

1. Johanson, Malcolm Coulthard and Alison. The Routledge Handbook of Forensic Linguistics. New York: Taylor and Francis, 2023.
2. Luchjenbriers, John Olsson and June. Forensic Linguistics. New Delhi: Bloomsbury Publishing India Limited, 2017.
3. Malcolm Coulthard, Alison Johnson and David Wright. An Introduction to Forensic Linguistics - Language in Evidence. New York: Taylor and Francis, 2017.
4. Olsson, John. Word Crimes - Solving Crime Through Forensic Linguistics. New York: Continuum International Publishing Group, 2012.
5. Robertson, Colin D. Multilingual Law - A Framework for Analysis and Understanding. Oxon: Routledge, 2017.
6. Stratman, James F. A Forensic Linguistic Approach to Legal Disclosures. New York: Routledge, 2016.
7. Turell, John Gibbons and M. Teresa. Dimensions of Forensic Linguistics. Amsterdam: John Benjamins Publishing Co., 2008.
8. Victoria Guillen-Nieta, Dieter Stein. Language as Evidence - Doing Forensic Linguistics. Switzerland: Springer Nature, 2021.



BSHN-EL11-705: Anti-dope Forensics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course objectives:

The course is aimed at introducing anti-dope forensics and role of Drugs of abuse. It also aims at develop understanding regarding pharmacovigilance and other legal aspects.

MODULE-1 Introduction to Anti-Dope Forensics & Drugs of Abuse in Sports **Teaching Hours: 15 Hours**

Doping & Sports Forensics; Problem of Doping in Sports; Types of Sports under anti-doping norms; Introduction to Dope Drugs; New medicines and medical technologies; Stimulants, Anabolic Steroids, Energy Boosters, Contraband Drugs, Growth Hormones, Diuretics, Synthetic Oxygen Carriers, Blood Doping, Insulin, Gene Doping; Therapeutic drug use exemptions.

MODULE-2 Pharmacovigilance and Legal aspects **Teaching Hours: 15 Hours**

Pharmacodynamics and Pharmacokinetics of Dope drugs; Protecting the health of the athlete and maintaining clean sport; Healthcare providers at major sporting events; National & International Laws governing doping in sports; Anti- Doping Agencies NADA & WADA; Need of Doping Education & Awareness among athletes.

MODULE-3 Testing & Analysis **Teaching Hours: 15 Hours**

Dope testing in Humans & Animals; Guidelines for dope testing; Role of Body Fluids in Analysis of Dope drugs (Blood, Urine, and Saliva & Sweat); International Standards for Dope testing Laboratories and Accreditation, Effective Testing Programs. Case Studies.

Course learning outcomes: At the end of course, students will be able to explain;

1. Anti-Dope Forensics & Drugs of Abuse in Sports
2. Pharmacodynamics and Pharmacokinetics of Dope drugs
3. Dope testing in Humans & Animals



Suggested readings:

1. W. Goodwin, A. Linacre, H. Sibte, An Introduction to Forensic Genetics, John Wiley & Sons, England, 2007, pp. 17-50.
2. World Anti-Doping Agency (WADA), The World Anti-Doping Code, Montreal, 2009 (accessed April 2011) <http://www.wada-ama.org>.
3. At-a-Glance - About Anti-Doping." World Anti-Doping Agency. N.p., 04 July 2014. Web. 18 Apr. 2016.
4. At-a-Glance - The Doping Control Process." World Anti-Doping Agency. N.p., 04 July 2014. Web. 18 Apr. 2016.
5. Reardon, Claudia L., and Creado, Shane. "Drug Abuse in Athletes." Substance Abuse and Rehabilitation (2014): 95-105. Web. 29 Feb. 2016.
6. 2016 Prohibited List." World Anti-Doping Agency. N.p., 29 Sept. 2015. Web. 18 Apr. 2016.
7. Moston, S., & Engelberg, T. (2016). Detecting Doping in Sport (1st ed.). Routledge. <https://doi.org/10.4324/9781315718514>.



BSHN-EL12-705: Clinical Toxicology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives:

The course is designed to provide overview of clinical toxicology including poisoning and drug toxicology. It also aims at imparting the knowledge related to various aspects of heavy metal and pesticide toxicology.

MODULE-1 Overview of Clinical Toxicology

Teaching Hours: 15 Hours

General principle of clinical toxicology, acute, sub-acute, sub-chronic and chronic toxicity, human healthcare, Estimation of LD50 and ED50, Symptoms of clinical toxicity, Assessment of clinical symptoms, complete blood count profile, kidney and liver function test, urine test etc., Erythrocyte sedimentation rate (ESR) determination and its importance in the diagnosis of certain diseases, Duties and responsibilities of registered medical practitioner, forensic investigator and police person, Green toxicology for the protection human and environment health.
Poisoning, risk assessment and characterization methods, exposure and hazard assessment, Drug safety and evaluation, drug toxicology, adverse reaction of drug,

MODULE-2

Teaching Hours: 15 Hours

Heavy metal induced toxicity: Signs and Symptoms of arsenic, lead, cadmium, mercury toxicity, oxidative stress, Analysis of heavy metal in tissue and body fluids, food items, extraction techniques of these heavy metal and their determination, Determination of trace metals present in cosmetic products and their toxic effects, method of clinical assessment, common antidotes.

Pesticide induced toxicity: Types of pesticides, classification, uses, harmful clinical effect and treatment, Pesticide poisoning in farmers, suicides, depression and neuropsychological effects, assessment of clinical symptoms, general health questionnaire (GHQ), Mechanism of action of pesticide toxicity, first aid in pesticide poisoning, method of clinical assessment, common antidotes.

Course learning outcomes: At the end of course, students will be able to explain;

1. General principle of clinical toxicology
2. Epidemiological toxicity & drug toxicology
3. Heavy metal & Pesticide induced toxicity

References and Suggested Readings:

1. Modi JS: Medical Jurisprudence and Toxicology
2. Brent, J., K. L. Wallace, K. K. Burkhardt, et al., eds. Critical Care Toxicology. Philadelphia: Elsevier Mosby, 2005.
3. Parikh CK: Medical Jurisprudence and Toxicology
4. Levine, B. Postmortem forensic toxicology. In Principles of Forensic Toxicology, ed. B. Levine, pp. 3 – 13 . Washington, DC : AACC Press , 2003 .
5. Mancuso, J. D., M. Ostafin , and M. Lovell , Postdeployment evaluton of health risk communication after exposure to a toxic industrial chemical . Mil. Med. 173: 369 – 374, 2008 .
6. Laboratory Procedure Manual- Forensic Toxicology, DFS, MHA, New Delhi
7. Pharmacology and Therapeutics-Bhandarkar & Satoskar 8. Essentials of Toxicology- Ellenhorn





BSHN-EL13-705: Nano-Biotechnology

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: The aim of the course is to demonstrate the importance of biological components in the field of nanotechnology. It is designed as to give the student an understanding of the characterization, properties and applications of nanostructures existing in nature at cellular and molecular level and to appreciate how the understanding of various self-assembling or multifunctional synthetic nano-systems at tiny scale finds application in the fields of biotechnology. The course seeks to provide the advance education and learning in bio-nanotechnology and explore sustainable solutions for agriculture, environment, medicine and forensic sciences.

MODULE-1 Introduction to Nanotechnology and Characterization tools

Teaching Hours: 15 Hours

Introduction, history and development in nanotechnology, Physical synthesis of nanoparticles, biological production of nanoparticles: fungi, bacteria, yeast and actinomycetes, Properties and characteristic of nanomaterials.

Tool for the characterization of nanomaterial: Optical microscopy, Electron microscopy (TEM and SEM), scanning probe microscopy, atomic force microscopy, fluorescence microscopy. DNA based nanostructure, DNA-protein nanostructure, Carbon nanotubes, Nano rods and fullerenes.

MODULE-2 Application of Nanotechnology

Teaching Hours: 15 Hours

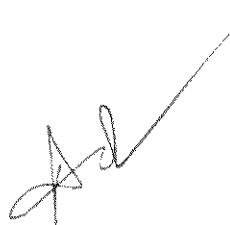
Application of nanoparticles as molecular imaging probes (Quantumdots), Application of nanoparticles as therapeutic drug carriers, gene delivery and diagnostics. Application of nanomaterials in forensic and life science., Nanoparticles as a tool for cleaning environment: Remediation of heavy metal, Nanoparticles as sensors.

Course Learning Outcomes: After completion of the course, students will be able;

1. To gain an insight on the history, development and multidisciplinary nature of nanotechnology and nanoscale paradigm in terms of properties at the nanoscale dimension.
2. To understand the various synthesis methodologies and characterization techniques of nanomaterials.
3. To distinguish different types of nanomaterials based on their dimensions and structure.
4. To understand the characterization, properties and applications of nano-bio materials which are existing in nature at cellular and molecular level as well as various synthetic nano-bio materials and their properties.
5. To get familiarized with applications of nanobiotechnology in the fields of life science, medicine, environment and forensic sciences.

Reference books:

1. Bionanotechnology - Lessons from nature - David S. Goodshell, Wiley-Liss, ISBN: 978-047141719-4
2. Nanobiotechnology: Concepts, Applications and Perspectives - Christof M. Niemeyer and Chad A. Mirkin, Wiley, ISBN:978-3527306589
3. Nanoscale Materials in chemistry, 2nd edition - Kenneth J. Klabunde and RyanM. Richards, John Wiley and Sons Inc., ISBN:978-0470222706





BSHN-EL14-705: Forensic Proteomics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
					Marks	Hrs	Marks	Hrs						
2	0	0	2	2	50	00:45	50	01:30	100	03:00	-	-	200	

Course objectives:

This course aims to provide students with a basic understanding of proteomics. It intends to provide knowledge of various techniques and application of proteomics. It also aims at providing the insight into proteomics-based investigations.

Module-1: Techniques in Proteomics Teaching Hours-15 Hours

Native PAGE, SDS-PAGE, Circular Dichroism, Iso electric focusing, Western Blotting, Mass Spectroscopy, Protein sequencing by mass spectrometry, FRET, Protein sequencing; Strategies for protein identification; Protein chips and functional proteomics; Protein-protein interaction; Protein-ligand interaction, Clinical and biomedical application of proteomics; Proteome database; Protein structure visualization and modelling software.

Module-2 Proteomics in Forensic Investigation

Extraction of protein from various body fluids, Biochemical changes in body fluids and proteins, Protein biomarkers and their application in forensic investigation. Applications of forensic proteomics using human samples like blood, hair, bone, saliva, fingerprint, and urine. Plant, animal and insect proteome of forensic importance, molecular basis and investigation. Case Studies in Forensic Proteomics.

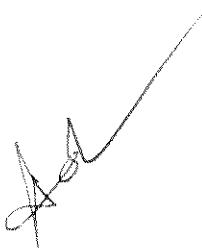
Course Learning Outcomes:

After completion of the course students will be able to:

- Gain a comprehensive understanding of various techniques for protein and proteomics analysis applicable to Forensic, clinical, and biomedical research.
 - Critically evaluate the significance and applications of proteomics in forensic investigations.

Reference Books

1. Lehninger Principles of Biochemistry 6th Edition (2012) – Nelson and Cox, W.H. Freeman, ISBN: 978-1429234146
2. L. Stryer, Biochemistry, 5th Edition, (2002) Freeman & Co. New York
3. Wang, Xing, Kuruc, Matthew. 2019. Functional Proteomics, Springer.
4. E.D. Hoffmann, V. Stroobant. 2007. Mass Spectrometry: Principles and Applications, John Wiley & Sons Ltd. The Atrium, Southern Gate, Chichester, West Sussex PO198SQ, England.
5. D. Kambhampati. 2004. Protein Microarray Technology, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.
6. Applications in Forensic proteomics: Protein Identification and Profiling (2019) - Eric D. Merkley, ACS Publication, ISBN13:9780841236493.





BSHN-EL15-705: Applied Cryptography

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30			100	03: 00	-	200

Course Objectives: This course aims to make students familiar with the advancement in cryptographic keys, algorithms, and to provide an understanding of the processes of cryptography, cryptanalysis and its information theory.

MODULE-1 Security, Cryptography Techniques & Internet Security Protocols

Teaching Hours: 15 Hours

Need for security, security approaches, basics of cryptography techniques, Substitution and Transposition ciphers, Symmetric and Asymmetric key cryptography, possible types of attacks, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC4, Advanced Encryption Standard (AES), Blowfish.

Overview of asymmetric key cryptography, RSA Algorithm, Digital Signatures, Attacks on digital signatures, problems with public-key exchange; Introduction to Public-Key Infrastructure, Digital Certificates, Private-key management, Public-key cryptography standards, XML, PKI and security; SSL-TLS, HTTPS v/s SHTTP, Secure Electronic Transaction (SET), SSL v/s SET, Email Security, Wireless Application Protocol (WAP), IEEE 802.11 Security, Security in GSM and 3G

MODULE-2 User Authentication Mechanisms and Network Security

Teaching Hours: 15 Hours

Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based authentication, Biometric Authentication, Kerberos, Key Distribution Center (KDC), Single Sign On (SSO) approaches, attacks on authentication schemes; Introduction to Network Security, Firewalls- types and techniques, IP Security, Virtual Private Networks (VPNs), Intrusion, IDS and IPS.

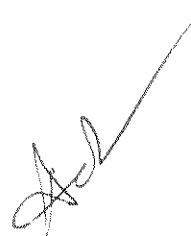
Course Learning Outcomes: After studying this paper, the students will know –

1. The basic concepts of security and cryptography
2. Computer-based symmetric and asymmetric cryptography algorithms
3. Public-Key Infrastructure and Internet Security Protocols.

4. User Authentication Mechanisms and Network Security.

Suggested Readings:

1. Atul Kahate, "Cryptography and Network Security", 3rd Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2009.
2. Nina Godbole and Sunit Belapure, "Cyber Security: Understanding Cyber-crimes, Computer Forensics and Legal Perspectives", Wiley Publications, 2011.
3. William Stallings. "Cryptography and Network Security: Principles and Practices, 5th Edition", Prentice Hall Publication Inc., 2007.





BSHN-EL16-705: Drone Forensics

Teaching and Evaluation Scheme

Teaching Scheme					Evaluation Scheme									
Th	Tu	Pr	C	TCH	Theory						Practical		Total	
					Internal Exams				University Exams		University Exams (LPW)			
					TA-1 & TA-2		MSE		Marks	Hrs	Marks	Hrs		
2	0	0	2	2	50	00:45	50	01: 30	100	03: 00	-	-	200	

Course Objectives: This course is design to with the specific aim of delivering knowledge in drone forensics. Students will be learning about basics of drones, analysis of Data stored/hidden in Drones, tools required in Drone forensics domain, laws with respect to drones in India.

Module 1 Introduction to Drone Forensics Teaching Hours: 15 Hours

Unmanned Aerial Vehicle (UAV): Introduction, History, Technology, Criminal Use; Drones: Description, History, Classification, Parts of Drones & Storage Devices, Data Retrieval, Methodology for acquisition-Analysis, Detection methods of unidentified Drones. Drones - National Security, Threats, Smuggling, Usage of Drones- mapping and surveying of topographies, agriculture, security and surveillance, aerial photography and videography, navigation, infrastructure solutions for roads and highways including transportation management in high density urban zones, construction support, telecom services, LiDAR in mining, watershed management and monitoring emergency/ disaster situations, Kisan Drones.

Module 2 Data analysis, Techniques & Legal Aspects Teaching Hours: 15 Hours

Analysis of Flight history, Geo-location mapping, Unique-Id extraction, Image Data Analysis, Date & Time stamp Analysis, EXIF metadata Analysis, SSID Authentication, Registry Entries, File System Data Analysis, Analysis of footage recorded.

File System Data Carving Tools, EXIF Optimal sensor metadata Analysis Tools, VideoFootage Analysis Tools, Imaging Tools, FTK, VIP 2.0, XRY Drone, XAMN, MDDRONE, DJI Assistant-2, DatCon, DJI GO 4 App, CsvView, Cellebrite (UFED4PC), AvsPmod, AviSynth, VirtualDub, open- source tools.

Registration & Licensing of Drones in India, Restrictions in usage of Drones, Green, Yellow & Red Zones, Introduction of Laws related to UAVs in India- Drone Rules, 2021 and the Drone (Amendment) Rules, 2021. Laws for Nano, Micro, Small, Medium, Large Drones. Drone Registration & Operation Guidelines. Remote Pilot Licensing guidelines, Drone traffic management.



Course Learning Outcomes:

After completing this course, students will be able to explain;

1. UAVs in Forensic Examination
2. Classification of Drones
3. Analysis of Data stored/hidden in Drones
4. Tools required in Drone forensics domain
5. Application, Threats & Anti-Forensic Techniques
6. Laws with respect to Drones in India

Reference books:

1. The Big Book of Drones – Ralph DeFrangesco, Stephanie DeFrangesco (2022)
2. Drone Forensics: The Impact and Challenges - Atkinson, Carr, Shaw and Zargari (2020)
3. The Drone Rules, Gazette of India, Ministry of Civil Aviation (2021)