

Rayat Shikshan Sanstha's
YASHAVANTRAO CHAVAN INSTITUTE OF
SCIENCE, SATARA
(AN AUTONOMOUS COLLEGE)

Reaccredited by NAAC with 'A+' Grade

Bachelor of Science

Part - II

Forensic Science

Syllabus

to be implemented w. e. f. June, 2022

Structure of the course:

Semester III

Sr. No.	Subject Code	Theory			Practical			
		No. of lectures	Hours	Credits	Subject	No. of lectures	Hours	Credits
1	BFST: 301	3	2.4	2	BFSP: 307	8	6.4	4
2	BFST: 302	3	2.4	2				
3	BFST: 303	3	2.4	2	BFSP: 308	8	6.4	4
4	BFST: 304	3	2.4	2				
5	BFST: 305	3	2.4	2	BFSP: 309	8	6.4	4
6	BFST: 306	3	2.4	2				
7	AECC	3	2.4	2				
	Total of SEM III	21	16.8	14		24	19.2	12
TOTAL NO OF CREDITS FOR SEMESTER III: 26								

Semester IV

Sr. No.	Subject Code	Theory			Practical			
		No. of lectures	Hours	Credits	Subject	No. of lectures	Hours	Credits
1	BFST: 401	3	2.4	2	BFSP: 407	8	6.4	4
2	BFST: 402	3	2.4	2				
3	BFST: 403	3	2.4	2	BFSP: 408	8	6.4	4
4	BFST: 404	3	2.4	2				
5	BFST: 405	3	2.4	2	BFSP: 409	8	6.4	4
6	BFST: 406	3	2.4	2				
7	AECC	3	2.4	2				
	Total of SEM III	21	16.8	14		24	19.2	12
TOTAL NO OF CREDITS FOR SEMESTER III: 26								

Structure and Titles of the course B.Sc. II

Semester III

Code	Name of Course	Units
BFST 301	Advanced Forensic Science I (Credits:02; TOTAL HOURS:45)	Unit - I: Crime Scene Management Unit - II: Crime Scene Documentation Unit - III: Crime Scene Evidence Unit - IV: Report writing
BFST 302	Advanced Forensic Chemistry I (Credits:02; TOTAL HOURS:45)	Unit - I: Spectroscopy Unit - II: Polymers Unit - III: Chemical Toxicology - I Unit - IV: Chemical Toxicology - II
BFST 303	Advanced Forensic Biology I (Credits:02; TOTAL HOURS:45)	Unit - I: Advanced Genetics: Unit - II: Methods of DNA extraction Unit - III: Metabolism Unit - IV: Bioinstrumentation and Biochemical techniques
BFST 304	Advanced Forensic Physics I (Credits:02; TOTAL HOURS:45)	Unit - I: Diffraction Unit - II: Polarization Unit - III: Resolving Power Unit - IV: Interaction of Radiation with Matter and Newton's Law of Motion
BFST 305	Advanced forensic psychology I (Credits:02; TOTAL HOURS:45)	Unit - I: The Content of Forensic Psychology Unit - II: Aggression and Violence Proceedings Unit - III: Perspective of Criminal Behaviour and Legal Proceedings Unit - IV: Application of Forensic Psychology in Civil and Criminal Legal Proceedings-
BFST 306	Advanced Computer & Cyber Forensic I (Credits:02; TOTAL HOURS:45)	Unit - I: Introduction to Cyber Forensic Unit - II: Identification of Computer Peripherals Unit - III: Basics of Mobile Phone Investigation Unit - IV: Incident Response

Semester IV

Code	Name of Course	Units
BFST 401	Advanced Forensic Science II (Credits:02; TOTAL HOURS:45)	Unit - I: Physical Evidences - I Unit - II: Physical Evidences - II Unit - III: Impression evidences - I Unit - IV: Impression evidences - II
BFST 402	Advanced Forensic Chemistry II (Credits:02; TOTAL HOURS:45)	Unit - I: Petroleum Products - I Unit - II: Petroleum Products - II Unit - III: Cases Involving Arson Unit - IV: Explosive
BFST 403	Advanced Forensic Biology II (Credits:02; TOTAL HOURS:45)	Unit - I: Enzymology, Protein purification and Metabolism Unit - II: Analysis of Biological Fluid and Other evidences Unit - III: Human Skeleton and Locomotion Unit - IV : Blotting techniques
BFST 404	Advanced Forensic Physics II (Credits:02; TOTAL HOURS:45)	Unit - I: Forensic Trace Analysis Unit - II: Ballistics Unit - III: Fiber Optics Unit - IV: Magnetic, Electric Measurements and Radiation Detection
BFST 405	Advanced forensic psychology II (Credits:02; TOTAL HOURS:45)	Unit - I: Social Psychology Unit - II: Social Cognition: - Unit - III: Applying Social Psychology in The Interpersonal Aspects of Legal System Unit - IV: Behavioural Abnormalities and Personality Disorders in Crime
BFST 406	Advanced Computer & Cyber Forensic II (Credits:02; TOTAL HOURS:45)	Unit - I: Computer Networks Unit - II: Mobile Crime Investigations Unit - III: Cyber Forensic Tools and Utilities Unit - IV: Legal Provisions For Digital Evidences

Semester III

Course- BFST 301: Advanced Forensic Science I

Course Objectives: - Students will be able to...

- 1] Study basics of crime scene management and its types and methods to access the crime scene.
- 2] Know How to record the crime scene and the duties of different agencies involved in the investigation.
- 3] Understand the types of evidence, labelling, packaging and chain of custody.
- 4] Understand the procedure of investigative report writing and its legal considerations.

Credits (Total Credits 2)	SEMESTER III BFST 301 Advanced Forensic Science I	No. of hours per unit/Credit
Unit - I	Crime Scene Management	(12)
	Types of crime scenes- Macroscopic, Microscopic, Indoor and Outdoor. Securing and isolating the crime scene, surveying the crime scene, searching the crime scene, Safety measures at crime scenes, Duties of first responders at crime scenes.	
Unit - II	Crime Scene Documentation	(11)
	Note taking, Crime scene photography and videography, Sketching and crime scene measurement techniques, Crime scene logs. Legal considerations at crime scenes- Coordination between police personnel and forensic Scientists at crime scenes. The evaluation of 5Ws -who? what?, when?, where?, why? And 1H - how?.	
Unit - III	Crime Scene Evidence	(11)
	Classification of crime scene evidence – physical and trace evidence. Locard's principle. Collection of evidences. Labelling and sealing of evidence. Hazardous evidence. Preservation and packaging of evidence. Chain of custody	
Unit - IV	Report writing	(11)
	Preparation of report, Purpose of writing an investigative report, Legal considerations of report: sec 45 IEA, sec 293 of CrPC	

Course Outcomes: Students should be able to...

1. Introduce several aspects of crime scene management.
2. Study safety measures at crime scenes
3. Prepare investigative reports with legal considerations.
4. Understand Classification of crime scene evidence
5. Understand Preparation of report

References:

1. *Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence*, M. Byrd, CRC Press, Boca Raton (2001). (Unit-I)
2. *Forensic science from the crime scene to the crime lab*, Richard Saferstein, Pearson (3rd edition) 2014
3. *Forensic Science: An Introduction to Scientific and Investigative Techniques*, S.H. James and J.J. Nordby, CRC Press, Boca Raton, 2nd Edition, (2005). (Unit-II, III)
4. *Fisher's, Techniques of Crime Scene Investigation*, W.J. Tilstone, M.L. Hastrup and Camilla Hald, CRC Press, Boca Raton (2012). (Unit-I, II).

Course- BFST 302 Advanced Forensic Chemistry I

Course Objective: Students will be able to ...

- 1] Understand the basics of the spectroscopic method. The student will understand UV - visible spectroscopy and working of UV-visible spectroscopy and its application.
- 2] Understand the health risk associated with exposure to lead, cadmium, and mercury and approaches health effects.
- 3] Understand chemical nature as well as detection, extraction methods of lead cadmium.
- 4] Understand the major classes of pesticides and their environment and humans.

Credits (Total Credits 2)	SEMESTER III BFST 302 Advanced Forensic Chemistry I	No. of hours per unit/Credit
Unit - I	Spectroscopy	(11)
	Introduction electromagnetic radiations, full range, absorbance, transmittance, Beer-Lambert's laws, - Applications, U.V. Visible IR-molecular spectroscopy, electronics, vibrational, rotational spectra, Principle, diagram, working and construction, applications.	
Unit - II	Polymers	(12)
	Introduction-General idea of structures, types, tacticity, polymerization processes with examples, radical and ionic mechanism of polymerization, characteristic properties of polymers, Structure, preparation and applications of Polyethylene (types and Ziegler-Natta process), Teflon, PVC, Polystyrene.	
Unit - III	Chemical Toxicology - I	(11)
	Toxic chemicals in the environment – physical and chemical properties of lead, mercury, arsenic, cadmium and chlorine, bromine – Metallic and non-metallic toxic chemicals and its toxic effect– Extraction and detection methods, Forensic significance.	
Unit - IV	Chemical Toxicology - II	(11)
	Introduction of pesticides, classification of pesticides, properties, and its biochemical effects – Extraction and detection methods of pesticides, forensic significance.	

Course outcomes: Students should be able to...

1. Understand the basics of spectroscopy
2. State applications of spectroscopy
3. Understand characteristic properties of polymer
4. Explain basics of chemical toxicology
5. Understand the classification of pesticides

References:

1. DFS manual of chemistry (Forensic Toxicology).(Unit-III,IV)
2. A. Poklis, Forensic toxicology in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).(Unit-III,IV)
3. Instrumental methods of chemical analysis by GurdeepR.Chatwal& Sham K.Anand.Himalaya Publication (1 August 2016)(Unit-I)
4. Introduction to spectroscopy by Pavia(2015)(Unit-I)
5. Instrumental analysis by Skoog Holler Crouch. (2007)(Unit-I)
6. Principles of forensic medicine by ApurbaNandy, M.DNew Central Book Agency (2012)(Unit-III,IV).
7. Fundamentals of polymer (Raw material to finishing product) by Niranjankarak. Kindle Edition, PHI (1 December 2009) (Unit-II)

Course- BFST 303 Advanced Forensic Biology I

Course Objective: Students will be able to...

1. Understand the advanced knowledge of genetics.
2. Study of various Extraction methods for DNA analysis.
3. Learn the metabolic pathway of the human body.
4. Understand the knowledge about Bioinstrumentation.

Credits (Total Credits 2)	SEMESTER III BFST 303 Advanced Forensic Biology I	No. of hours per unit/Credit
Unit - I	Advanced Genetics:	(11)
	Cell division: Cell cycle, mitosis and meiosis, Structural and definitive properties of chromosomes, nomenclature of chromosomes, types of chromosomes, packaging of heredity material, concept of euchromatin and heterochromatin, chromatin modification, Human genome: genes and related sequences, non-coding sequences (interspersed and tandem repeats), human DNA polymorphism	
Unit - II	Methods of DNA extraction	(12)
	Enzymatic DNA extraction method Phenol-Chloroform method- Cell lysis and Protein digestion. Silica – Column based method- Cell lysis and Protein digestion, DNA adsorption onto silica, washing, elution of DNA. Magnetic bead method, Differential Extraction.	
Unit - III	Metabolism	(11)
	Tricarboxylic acid cycle-Introduction, Pathway, Function. Electron Transport Chain- Introduction, Pathway, Function. Glycolysis/EMP pathway- Introduction, Pathway, Function.	
Unit - IV	Bioinstrumentation and Biochemical techniques	(11)
	Electrophoresis: Basic principle, types of electrophoresis – moving boundary, zonal, paper, gel. 1]Agarose 2]PAGE 3]SDS-PAGE 4]Pulse Field Gel Centrifugation: Principle, types and applications of centrifuge. Ultra-centrifuge: differential and density gradient centrifugation. Care and maintenance of centrifuge.	

Course Outcomes: Students should be able to...

1. Know the advanced knowledge about the chromosome and its packaging.
2. Understand the modern concept of gene and human DNA polymorphism.
3. Understand the different types of DNA extraction methods.
4. Learn the TCA, Glycolysis, Electron transport chain and EMP pathways.
5. Understand the Electrophoresis techniques and their types, Forensic application.

References

- 1] *Cell biology, genetics, molecular biology, evolution and ecology*: V.S Verma, V.K Agrawal, S.Chand and company,2005 (Unit I)
- 2] *Principles of Genetics*,Snustad and Simmons,12 December, 2006 (Unit I)
- 3] *Genetics a conceptual approach* 4thedtn. : Benjamin A Pierce., W. H Freeman and company, NewYork 19 December, 2016 (Unit I)
- 4] *Bioinstrumentation* by L.Veerakumari 1 January 2011 (Unit IV)
- 5] *Bioinstrumentation* by Bhawana Pandey M.H.Fulekar 1 January 2019 (Unit IV)
- 6] *Forensic DNA analysis : A Laboratory Manual* McClintock, J.Thomas 19 February 2008 (Unit II)
- 7] *Principles of Biochemistry* Lehninger 16 March 2021 (Unit III)

Course- BFST 304 Advanced Forensic Physics I

Course Objective: Students will be able to...

1. Learn Diffraction and its types.
2. Get knowledge of Polarization of light, production of polarized light.
3. Understand Resolving power of optical instruments.
4. Get the Basic knowledge of Newton's law and its Forensic applications.

Credits (Total Credits 2)	SEMESTER III BFST 304 Advanced Forensic Physics I	No. of hours per unit/Credit
Unit - I	Diffraction	(12)
	Introduction, Huygens- Fresnel's theory, Fresnel's assumptions, Distinction between interference and diffraction, Fresnel and Fraunhofer types of diffraction, Diffraction due to single edge, Diffraction due to a narrow slit.	
Unit - II	Polarization	(11)
	Introduction, Types of Polarization, Production of Plane polarized light, Polarizer and Analyzer, Malus law, Anisotropic crystal: Calcite crystal, Nicol prism, Production and detection of linearly, elliptically and circularly polarized light.	
Unit - III	Resolving Power	(11)
	Raleigh's criterion, resolving power of optical instruments, Criterion for resolution according to Lord Rayleigh's, resolving power of telescope, resolving power of a prism, Resolving power of a plane transmission grating.	
Unit - IV	Interaction of Radiation with Matter and Newton's Law of Motion	(11)
	Interaction of radiation with matter: Reflection, Absorption, Transmission, Fluorescence, and Phosphorescence. Newton's all law, its forensic application; Elasticity, elastic properties of matter, elastic constants and their interrelation	

Course Outcomes: Students should be able to...

1. Understand difference between Interference and Diffraction.
2. Learn Polarization and its types
3. Understand production and detection of various types of polarization
4. Understand Raleigh's criterion.
5. Learn Newton's laws and its forensic application.

References:

1. C. V. Raman, Molecular diffraction of light (Forgotten Books, 2012)
2. Avijit Lahiri, Basic Optics: Principle and concepts, (Elsevier; 1 edition 2016)
3. David S. Kliger, James W. Lewis, Cora E. Randall, Polarized light in optics and spectroscopy. (Elsevier, 2012)
4. Frank L. Pedrotti, S.J., Leno S. Pedrotti, Leno S. Pedrotti, Introduction to optics, (Cambridge University Press; 3rd edition, 2017),
5. Nicholas Croce, Newton and three law motions (The Rosen Publishing Group, 2005)
6. Joshi Dattu R, Engineering Physics (Tata McGraw Hill Education Private Limited, 2010)

Course- BFST 305 Advanced Forensic Psychology I

Course Objective: Students will be able to...

1. Learn the Basic knowledge of Forensic Psychology and its forensic applications.
2. Study the knowledge of different types of Aggression and Violence
3. Study the knowledge of Perspective of Criminal Behaviour and Legal Proceedings.
4. Study will understand the Application of Forensic Psychology in Civil and Criminal Legal Proceedings.

Credits (Total Credits 2)	SEMESTER III BFST 305 Advanced Forensic Psychology I	No. of hours per unit/Credit
Unit - I	The Content of Forensic Psychology	(12)
	History of Forensic Psychology, Defining Forensic Psychology, Importance of Forensic Psychology, Ethical Standards of Forensic Psychology, Services provided by Forensic Psychologists, Tests that are used in Forensic Psychology for Assessment-Intelligence Tests, Achievement Tests, Personality Tests.	
Unit - II	Aggression and Violence	(11)
	Aggression-Definition, Nature, Types of aggression- Instrumental versus Hostile, Proactive versus Reactive, Spontaneous versus Competitive, Positive versus Negative, Thoughtful versus Thoughtless, Childhood onset and Adolescent onset. Violence- Definition, Nature of Violence-Self-directed, Interpersonal, family and community interpersonal, and Collective. Types of Violence-Physical, Sexual, Emotional, Psychological, Spiritual and Cultural.	
Unit - III	Perspective of Criminal Behaviour and Legal Proceedings	(11)
	Psychobiological Approaches, Psychological Approaches-Emotional Deprivation, Psychological Motives of Crime, Frustration, Attitudes, Peer Influence. Psychological Disorder - Psychosis, Neurosis. Social Perceptive – Differential Association theory, Labelling theory, Critical theory, Control theory.	
Unit - IV	Application of Forensic Psychology in Civil and Criminal Legal Proceedings-	(11)
	Civil Proceedings -Domestic law and Rights of Adults, Domestic Issues in Childhood and Adolescent, Assessment of Childhood and Adolescent, Assessment of Civil Competency, Personal Injury Evaluation, Evaluation of Trauma Caused by Sexual Harassment or Rape.	

	Criminal Proceedings -Competency to stand trial, Criminal responsibility and insanity defence, Risk assessment, Evaluation of Eyewitness testimony, Psychotherapeutic and Counselling services	
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Course Outcomes: Students should be able to

1. Understand the Basic of Forensic Psychology and its Forensic application.
2. Learn the Ethical Standards of Forensic Psychology.
3. Understand the Thoughtful versus Thoughtless and Forensic application.
4. Study the Domestic Violence.
5. Apply the Social Perceptive and Forensic application Civil and Criminal Legal Proceedings

References –

1. 'Introduction to Forensic Psychology-Research and Application', Curt R. Bartol, Anne M. Bartol, Editon 5nd, 2018,Sage Publication. (Unit I)
2. 'Criminology', Digumarti Bhaskara Rao, Edition 1st, 2012, Discovery Publication House PVT. LTD., New Delhi.
3. 'Human Aggression-theory, research and intervention', Sunil Saini, Nilam Goyal, Edition 1st Global Vision Publication House, New Delhi.2011.(Unit II)
4. Applied Criminology Concepts, Theories and Application', Joseph Ronald, 2013, Cyber Tech Publication, New Delhi. (Unit III)
5. 'Psychological Testing', Anne Anastasi, Susana Urbina, Edition 7th, 2010, PHI Learning PRI. LTD, New Delhi (Unit I)
6. 'Applied Criminology-Concept, Theories and Applications', Joseph Ronald, Edition 1st, 2013, Cyber Tech publications, New Delhi. (Unit IV)
7. 'Forensic Criminology', Petherick W. A., Turvey B. E., Ferguson C. E., [2010], Elsevier Inc. (Unit IV)

Course- BFST 306 Advanced Computer & Cyber Forensic I

Course Objective: Students will be able to...

1. Know the Basic Investigation techniques related to computer forensic.
2. Understand the methods to investigate Cyber Crime.
3. Learn How to collect & handle the evidence in mobile phone investigation.
4. Know the preventive measures should be taken before occurring Incident, minimize the risk factor.

Credits (Total Credits 2)	SEMESTER III BFST 306 Advanced Computer & Cyber Forensic I	No. of hours per unit/Credit
Unit - I	Introduction to Cyber Forensic	(12)
	Introduction to Cyber Forensic, Cyber Forensic Steps (Identification, Seizure, Acquisition, Authentication, Presentation, Preservation), Computer Forensic Expert, Cyber Forensic Investigation Process. The Goal of the Forensic Investigation, Why Investigate (Internet usage exceeds norm, Using e-mail inappropriately, Use of Internet, e-mail, or PC in a non-work related manner, Theft of information, Violation of security policies or procedures, Intellectual property infractions, Electronic tampering) Establishing a Basis or Justification to Investigate, Determine the Impact of Incident, Auditing V/s Cyber Forensic Investigations.	
Unit - II	Identification of Computer Peripherals	(11)
	Components of Computer, composition of computer, CMOS, BIOS. Input Devices, Storage Devices, Secondary storage Devices, Other Components of Computer-Processor, Motherboard, Input/output Ports-USB, Infra-Red, and Bluetooth. Network Connections- RAID, SMPS, How computer memory measured.	
Unit - III	Basics of Mobile Phone Investigation	(11)
	Cell Phone work, mobile system network, mobile technologies, mobile number tracing. Modes of Data Transfer, latest cell phone crimes, types of mobile crimes, mobile crime investigation. Investigating- mobile handset theft, Flash SMS, SMS tampering, back/post dated SMS, SMS spoofing, and MMS Scandals.	
Unit - IV	Incident Response	(11)
	Introduction to Incident Response Process (What is Computer Security Incident, Goals of Incident Response Involved in Incident Response Process, Incident Response Methodology, Formulate a Response Strategy, Investigate the Incident.) Preparing For Incident Response, Overview of Pre- incident Preparation, Identifying Risk, After Detection of an Incident.	

Course Outcomes: Students should be able to...

1. Understand the Computer Forensic Investigation Process.
2. Study the Role of Cyber Expert in Investigation of Cyber Crimes.
3. Understand the Difference between the Auditing & Cyber Forensic Investigation.
4. Understand Mobile Technology.
5. Learn the types of Mobile Crimes.

References:

1. *Incident Response & Computer Forensics* by Kevin Mandia, Chrisporis, Mattpepe, Third Edition, 16 March 2014, (Unit-IV).
2. *Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation*, by Lee Reiber, Second Edition,, Published by McGraw Hill, December 2018 (Unit-III)
3. *Cybercrime and Digital Forensics: An Introduction* by Thomas J. Holt, Adam M. ,Bossler , Kathryn C. Seigfried-Spellar, publisher Roulledge, 19 Oct 2017 (Unit-I,II).
4. *Digital Forensics: Digital Evidence in Criminal Investigations* by Angus Mc Kenzie Marshall, Wiley-Blackwell; 1st edition, 21 Nov 2008, (Unit-I,II,III,IV).

Course- BFSP 307 Advanced Forensic Science I and Advanced Forensic Chemistry I

Course Objective: Students will be able to...

1. Know the Evaluation report of Crime Scene, Crime Scene Reconstruction.
2. Demonstrate the Sketching methods for Different types of Crime Scene.
3. Understand the Collection & Packaging of Different Types of Evidence on Crime Scene.
4. Know the Preliminary and confirmatory detection methods for Pesticides.
5. Know the detection of Poison by Preliminary test and Learn the Detection of metal poison by Preliminary test.

Credits (Total Credits 4)	SEMESTER III BFSP 307 Advanced Forensic Science I and Advanced Forensic Chemistry I	No. of hours per unit/Credit
	Part I Advanced Forensic Science I	
1	To prepare a report on evaluation of crime scenes.	
2	To reconstruct a crime scene (outdoor and indoor)	
3	To study the Triangulation method of various types of crime scene.	
4	To study the rectangular polar coordinate method of sketching.	
5	Collection, packaging and preservation of evidence at crime scenes.	
6	To prepare a report on crime scene investigation.	
7	To prepare a crime scene sketch by using a baseline method.	
8	To prepare a crime scene sketch by using a triangulation method.	
9	To prepare a crime scene sketch by using a cross projection method.	
	Part II Advanced Forensic Chemistry I	
1	Preliminary and confirmatory test for detection of pesticides(2) i] Organophosphate ii] Organochlorine	
2	To detect the metal & Non metal poison by Preliminary test(2) i] zinc(Zn) ii] Lead (Pb) iii] Mercury(Hg) iv] Chlorine (Cl) v] Iodine(I)	
3	To detect the metal poison by chemical method(2) i] zinc(Zn) ii] Lead (Pb) iii] Mercury(Hg) iv] Chlorine (Cl) V] Iodine(I)	

4	Introduction UV-visible spectrophotometer	
5	pH-Metry i] To determine the dissociation constant of monobasic acid (acetic acid) ii] To determine dissociation of dibasic acid (malonic acid)	
6	Commercial analysis (double titration). i] Determination of percentage of magnesium in the given sample of talcum powder. iii] Determination of titrable acidity in the given sample of milk or lassi using sodium hydroxide.	

Course outcome: Students should be able to...

1. Acquire the strength to investigate the crime scene thoroughly
2. Acquire skills to cover each and every detail of a crime scene through sketching methods.
3. Write a report on crime scene investigation which helps to solve the crime.
4. Detect the pesticide in poisoning cases by using preliminary and confirmatory test.
5. Detect the metallic poison easily Acquire skills regarding instrumentation.

References:

1. *Forensic science from the crime scene to the crime lab*, Richard Saferstein, Pearson (3rd edition) 2014 (Unit-I,II,III,IV)
2. *Forensic Science: An Introduction to Scientific and Investigative Techniques*, S. H. James and J.J. Nordby, CRC Press, Boca Raton, (2nd Edition), (2005).(Unit-II,III)
3. Textbook of qualitative and quantitative analysis by A.I Vogel.
4. DFS manual.
5. A course in practical chemistry for B.Sc. I (Shivaji University)
6. A course in practical chemistry for B.Sc. II (Shivaji University)
7. Laboratory Procedure Manual: Petroleum Products, Directorate of Forensic Science, MHA, Govt. of India, 2005.
8. Working Procedure Manual on Chemistry; Directorate of Forensic Science MHA Govt. of India.

Course- BFSP 308 Advanced Forensic Biology I and Advanced Forensic Physics I

Course Objective: Students will be able to...

1. Study the analysis & handling of Centrifugation Instrumentation.
2. Study the Isolation technique of DNA.
3. Study the handling of HPLC & analysis of body fluids by using various methods.
4. Understands the how to determine the resolving power of telescope
5. Understands the how to determine the resolving power of prism
6. Understands how to determine the resolving power of plane diffraction grating.

Credits (Total Credits 4)	SEMESTER III BFSP 308 Advanced Forensic Biology I and Advanced Forensic Physics I	No. of hours per unit/Credit
	Part I :- Advanced Forensic Biology I	
1	To study the centrifugation of milk.	
2	To demonstrate the gel electrophoresis.	
3	Study and working of Ion exchange chromatography.	
4	To Study the Isolation of chromosomal DNA.	
5	Study of DNA Extraction and Quantification.	
6	To study HPLC.	
7	To perform electrophoresis for separation of various polymorphic enzymes.	
8	DNA extraction by Phenol-Chloroform method.	
9	DNA extraction by Silica –column-based method.	
	Part I :- Advanced Forensic Physics I	
1	To determine the Resolving power of a telescope.	
2	To determine the Resolving power of a given prism.	
3	To determine the Resolving power of plane diffraction grating.	
4	To determination of wavelength of sodium light using Fresnel's biprism	
5	To determine the specific rotation of sugar solution (Polarimeter)	
6	To determination of refractive index of material of prism using Spectrometer	

7	To determine the radius of capillary using Travelling microscope.	
8	Spectrometer: Schuster's Method Adjustment of Collimator and Telescope for Parallel rays.	
9	Measurement of divergence of laser	
10	Interference with single slit	
11	Diffraction due to Plane grating.	
12	Fraunhofer diffraction at a circular aperture	
13	Verification of Malus Law	
14	Determination of wavelength of light using Plane grating.	
15	Determination of Refractive Index of given liquid using Laser	
16	Determination of wavelength of spectral lines using Plane diffraction grating	

Course Outcomes: Students should be able to...

1. Understand the Various techniques for DNA extraction
2. Know the separation of sample by using centrifugation method
3. Know the electrophoresis technique for the detection of macromolecules
4. Handle optical instruments and understand measuring skills in optical instruments
5. Understand basic working of the optical bench and develop awareness of minimizing errors.

References:

1. Forensic Biology by Richard Li.
2. Forensic Analysis pre laboratory and laboratory student manual Dr. E. Hywel Evans
3. Practical handbook of B.Sc. I (Shivaji university)
4. Practical handbook of B.Sc. II (Shivaji university)
5. B. L. Worsnop, H. T. Flint, Advanced Practical Physics for Students, Asia Publ. House
6. S. L. Gupta and V. Kumar, Practical Physics, Pragati Prakashan., 27th Edition, 2010)

Course- BFSP 308 Advanced Forensic Psychology I and Advanced computer and cyber forensics I

Course Objective: Students will be able to...

1. Learn the about the psychological test and their interpretation.
2. Study the different types of psychological test.
3. Study the intelligence and medico psychological questionnaire.
4. Learn the Process of Recovery of Data and Understand the Analysis of Data.
5. Learn the Analysis Process for Data and Use of Software's & tools for Analysis Purpose.

Credits (Total Credits 4)	SEMESTER III BFSP 309 Advanced Forensic Psychology I and Advanced computer and cyber forensics I	No. of hours per unit/Credit
	Part I: - Advanced Forensic Psychology I	
1	Standard progressive matrices- J. Raven, J.C. Raven and J. H. Court	
2	Locus of Control	
3	Indian adaptation of Bell's Adjustment inventory- Sharma L.	
4	Social Adjustment Inventory- R. C. Deva	
5	Life satisfaction scale- Q.G. Alam, Ramji Shrivastava	
6	Observation and Testimony	
7	Koh's block design test	
8	Bhatia's Battery of Intelligence	
9	Medico Psychological Questionnaire-J. Bharatraj	
	Part II: - Advanced Computer and Cyber Forensics I	
1	To identify, seize and preserve digital evidence computers from crime scenes.	
2	To detect deletions, obliterations and modifications of files using encase software.	
3	To trace routes followed by e-mails and chats.	
4	To identify the IP address of the sender of e-mails.	
5	To identify Encrypted files.	
6	To identify Hidden files.	

Course Outcomes: Students should be able to:

1. Understand about the psychological test, and their interpretation
2. Understand the intelligence test and their forensic application.
3. Practically retrieves the deleted data from various pen drives, flash drives etc.
4. Practically collect the digital evidences and preserve the evidences by doing demo practical.
5. Acquire thorough knowledge regarding collection of digital evidences their analysis.

References:

1. Standard progressive matrices- J. Raven, J.C. Raven and J. H. Court
2. Indian adaptation of Bell's Adjustment inventory- Sharma L.
3. Social Adjustment Inventory- R. C. Deva
4. Life satisfaction scale- Q.G. Alam, Ramji Shrivastava
5. Medico Psychological Questionnaire-J. Bharatraj
6. Bhatia's Battery of Intelligence
7. *Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation* by Lee Reiber, publisher McGraw Hill, Second Edition, December 2018
8. *Practical Mobile Forensics: Forensically investigate and analyze iOS, Android, and Windows 10 devices*, by Rohi Tamma, Oleg Skulkin et.al., 4th Edition, April 9, 2020
9. *Handbook of Digital Forensics and Investigation* by Eoghan Casey, Elsevier Academic Press, 27th November 2010.

SEMESTER – IV

Course- BFST 401 Advanced Forensic Science II

Course Objective: Students will be able to...

1. Know the art of collecting, packaging and preserving Glass, Paint and Fibre evidence at crime scenes.

2. Understand the art of collecting, packaging and preserving Soil, Tool Mark evidence and Forensics Gemology at crime scenes.
3. Know the art of collecting, packaging and preserving Lip Print, Gait Pattern, Ear Print and Palm Print evidence at crime scenes.
4. Know the art of collecting, packaging and preserving Tire Marks, Fingerprint, Footprints and Shoeprints evidence at crime scenes.

Credits (Total Credits 2)	SEMESTER IV BFST 401 Advanced Forensic Science II	No. of hours per unit/Credit
Unit - I	Physical Evidences - I	(12)
	<p>Glass evidence- collection, packaging, analysis. Matching of glass samples by mechanical fit and refractive index measurements. Analysis by spectroscopic methods. Fracture analysis and direction of impact. Paint evidence – collection, packaging and preservation. Analysis by destructive and non- destructive methods. Importance of paint evidence in hit and run cases.</p> <p>Fiber evidence- artificial and man-made fibres. Collection of fibre evidence. Identification and comparison of fibres.</p>	
Unit - II	Physical Evidences - II	(11)
	<p>Soil evidence – importance, location, collection and comparison of soil samples. Cloth evidence- importance, collection, analysis of adhering material. Matching of pieces.</p> <p>Tool mark evidence. Classification of tool marks. Forensic importance of tool marks. Collection, preservation and matching of tool marks. Restoration of erased serial numbers and engraved marks, Forensic gemology.</p>	
Unit - III	Impression evidences - I	(11)
	<p>Lip print analysis (Development, collection, packaging, preservation, analysis) Gate pattern analysis (Development, collection, packaging, preservation, analysis) Ear print (Development, collection, packaging, preservation, analysis)</p> <p>Palm print (Development, collection, packaging, preservation, analysis)</p>	
Unit - IV	Impression evidences - II	(11)
	<p>Tire marks (Development, collection, packaging, preservation, analysis) Fingerprint (Development, collection, packaging, preservation, analysis)</p> <p>Footprints and Shoe prints (Development, collection, packaging, preservation, analysis)</p>	

Course Outcomes: Students should be able to...

1. Explain the difference between the identification and comparison of physical evidence.
2. Understand Collection of fibre evidence.
3. Appreciate the value of class evidence as it relates to a criminal investigation.

4. Understand Matching of pieces
5. Explain the types of trace evidence.
6. Study Palm print.
7. Students should be able to list and explain the functions of analysis of evidence.
8. Understand Tire marks collection and packaging.

References:

1. DFS Manual.
2. *Forensic science from the crime scene to the crime lab*, Richard Saferstein, Pearson (3rd edition) 2014 (Unit-II)
3. *Forensic Science: An Introduction to Scientific and Investigative Techniques*, S.H. James and J.J. Nordby, CRC Press, Boca Raton, 2nd Edition, (2005). (Unit-I, II, III, IV)
4. *Fisher's, Techniques of Crime Scene Investigation*, W.J. Tilstone, M.L. Hastrup and Camilla Hald, CRC Press, Boca Raton, (2013). (Unit-I, II, III, IV)

Course- BFST 402 Advanced Forensic Chemistry II

Course Objective: Students will be able to...

1. Understand the quality control criteria for petroleum products and motor fuels
2. Learn to analyse the Petroleum product adulteration

3. Study the collection and analysis of fire scene data.
4. Determine the origin and cause of a fire

Credits (Total Credits 2)	SEMESTER IV BFST 402 Advanced Forensic Chemistry II	No. of hours per unit/Credit
Unit - I	Petroleum Products - I	(12)
	Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Analysis of petrol and diesel, Analysis of traces of petrol and diesel in forensic exhibits. Comparison of petrol and diesel. Adulteration of petrol and diesel.	
Unit - II	Petroleum Products - II	(11)
	Analysis of kerosene and ATF, Analysis of traces of kerosene and ATF, in forensic exhibits. Comparison of kerosene and ATF, Adulteration of kerosene and ATF.	
Unit - III	Cases Involving Arson	(11)
	Chemistry of fire. Conditions for fire. Fire scene patterns. Location of point of ignition. Recognition of type of fire. Searching the fire scene. Collection and preservation of arson evidence. Analysis of fire debris. Analysis of ignitable liquid residue. Post-flashover burning. Scientific investigation and evaluation of clue materials. Information from smoke staining.	
Unit - IV	Explosive	(11)
	Classification of explosives – low explosives and high explosives. Homemade explosives. Military explosives. Blasting agents. Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Blast waves. Bomb scene management. Searching the scene of the explosion. Mechanism of explosion. Post blast residue collection and analysis. Blast injuries. Detection of hidden explosives.	

Course outcomes: Students should be able to...

1. Understand the quality control criteria for products and motor fuels
2. Demonstrate comparison of petrol and diesel.
3. Understand analyzing the petrol and diesel adulteration.
4. Understand comparison of kerosene and ATF.
5. Explain chemistry of fire,

6. Understand analysis of fire debris.
7. Understand the classification of explosives
8. Explain mechanism of explosion.

References:

1. J.D. DeHaan, Kirk's Fire Investigation, 3rd Edition, Prentice Hall, New Jersey . (Unit III)
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York(1995).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004). (Unit-III,IV)
4. S. Ballou, M. Houck, J.A. Siegel, C.A. Crouse, J.J. Lentini and S. Palenik in Forensic Science,
5. D.H. Ubelaker (Ed.), Wiley - Blackwell, Chichester (2013).(Unit - III, IV)
6. Instrumental Method of Chemical Analysis. Chatwal &Anand, Himalya Publication.(Unit - I, II, III)
7. SeropeKalpakjian, Steven R Schmid. "Manufacturing Engineering and Technology". International edition. 4th Ed. Prentice Hall, Inc. 2001. ISBN 0-13-017440-8. (Unit-I,II)
8. Hans-J. Koslowski. "Dictionary of Man - made fibers". Second edition. Deutscher Fachverlag. (Unit - III)

Course- BFST 403 Advanced Forensic Biology II

Course Objective: Students will be able to...

1. Study the protein extraction and purification method.
2. Understand the analysis of biological fluid.

3. Demonstrate the analysis of macromolecules by using blotting techniques.
4. Study the human skeleton systems.

Credits (Total Credits 2)	SEMESTER IV BFST 403 Advanced Forensic Biology II	No. of hours per unit/Credit
Unit - I	Enzymology, Protein purification and Metabolism	(12)
	Enzymes: Introduction, IUB classification, active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Allosteric enzymes, enzyme inhibition (reversible and irreversible, MM equation). Protein Extraction and Purification: Methods of cell disruption (blenders, grinding with abrasives, presses, enzymatic method, sonication) ; salt participation – salting in, salting out, organic solvent precipitation.	
Unit - II	Analysis of Biological Fluid and Other evidences	(11)
	Saliva, Semen, Vaginal Fluid, Urine, Sweat, Blood, Vomit, Other Evidence-Hair, Nails and tissue samples.	
Unit - III	Human Skeleton and Locomotion	(11)
	Human Skeleton –Axial Skeleton, Appendicular Skeleton Locomotion -Types of joints.	
Unit - IV	Blotting techniques	(11)
	Southern Blotting (Principle, Procedure and Application), Northern Blotting (Principle, Procedure and Application), Western Blotting (Principle, Procedure and Application) Quantitative Method PCR (Polymerase Chain Reaction)	

Course Outcomes: Students should be able to...

1. Know the basic of enzymes.
2. Understand the protein extraction and purification.
3. Know the various biological fluids.
4. Understand the analysis of the fluid sample.
5. Know the Human Skeleton and their types

References

1. Principles and Techniques and molecular biology, Wilson and Walkers 8etd 1
January 2018. (Unit I)

2. Cell biology, genetics, molecular biology, evolution and ecology: V.S Verma, V.K Agrawal, S.Chand and company,2005 (Unit I)
3. Fundamentals of Enzymology, by Nicholas C.Price 3rd edition,1 January 2009 (Unit 1)
4. Forensic DNA analysis : A Laboratory Manual McClintock, J.Thomas 19 February 2008 (Unit II)
5. Protein Purification, Philip L.R.Booner 2nd edition,2019 (Unit I)
6. Principles of Biochemistry Lehninger 16 March 2021 (Unit I, IV)
7. Biological Anthropology of the Human Skeleton, M.Anne katzenberg and Anne L.Grauer October 2018 (Unit III)

Course- BFST 404 Advanced Forensic Physics II

Course Objective: Students will be able to...

1. Understand trace analysis of glass.
2. Get knowledge of Ballistics and types of Ballistics.
3. Understand knowledge of fiber optics.

4. Study magnetic, electric measurements and G.M. Counter.

Credits (Total Credits 2)	SEMESTER IV BFST 404 Advanced Forensic Physics II	No. of hours per unit/Credit
Unit - I	Forensic Trace Analysis	(12)
	Review of physical properties of materials: temperature, weight and mass, density, refractive index; methods of comparing refractive indices, Composition of glass, Comparison of glass fragments, Measuring and comparing density and refractive index of glass, Classification of glass samples, Glass fractures.	
Unit - II	Ballistics	(11)
	Introduction of Ballistics, Types of ballistics: internal, external and terminal ballistics, Theory of recoil, Ballistics coefficient, Trajectory formation, Vacuum trajectories, Range, Classification of range (Maximum horizontal / vertical, effective, dangerous, safe and legal sense).	
Unit - III	Fiber Optics	(11)
	Fiber Geometry Total internal reflection, Light propagation through Fibers, Numerical Aperture, Modes of propagation, Classification of Optical Fibers, Step-Index and Graded- Index Fibers, Applications of Fibers.	
Unit - IV	Magnetic, Electric Measurements and Radiation Detection	(11)
	Magnetic Measurement; (magnetic susceptibility), Electric Measurements; (Hall Voltage, Resistivity Measurement & FET Characteristics), Radiation Detection; Geiger Muller counter, Optical fiber communication system, Piezoelectricity	

Course Outcomes: Students should be able to...

1. Understand the Classification of glass samples, Glass fractures.
2. Understand classification of physical properties of material
3. Understand Range of a firearm and classification of range.
4. Understand the Basic concept of optical fiber.

5. Learn optical fiber communication systems.
6. Understand various types of magnetic and electric measurement.

References:

1. Brain J Heard, Handbook of Firearms and Ballistics Examination and Interpreting Forensic Evidence, (Wiley-Blackwell, 2nd Ed, 2017)
2. B.R. Sharma, Firearms in criminal investigation and trials (Universal Law Publishing, 2017) Page No - 127,134, 143,-145,152,319,
3. Jay A Siegel, Pekka J Saukko, Geoffery Knupfer, Encyclopedia of Forensic Science, Volume one: (Elsevier Science, Academic Press, 2000)
4. Kaushalendra Kumar, Forensic Ballistics in Criminal Justice (Eastern Book Company, 2015)
5. B. R. Sharma, Firearms in Criminal Investigation and Trials, 4th Edition, Universal Law Publishing Company. New Delhi. (2004)
6. P. Chakrabarti, Optical Fiber Communication, (McGraw-Hill Education, 3rd edition, 2002)

Course- BFST 405 Advanced Forensic Psychology II

Course Objective: Students will be able to...

1. Understand the overall knowledge of social psychology and its application.
2. Understand the Social cognition, prejudice and discrimination and its application.

3. Understand the memory and eyewitness and its application in legal system
4. Understand Behavioural Abnormalities and Personality Disorders in Crime

Credits (Total Credits 2)	SEMESTER III BFST 405 Advanced Forensic Psychology II	No. of hours per unit/Credit
Unit - I	Social Psychology	(12)
	Social Cognition, Attitude - Meaning and Nature of Attitudes-Explicit Attitudes, Implicit Attitudes. Attitude Formation – Based on Classical Conditioning, Instrumental Conditioning and Observational Learning. Persuasion- The Cognition Process-Systematic processing, Central route, Heuristic processing, peripheral route, Elaboration-Likelihood Model, Heuristic-Systematic Model.	
Unit - II	Social Cognition: -	(11)
	Prejudice and Discrimination: The Origins of Prejudice – Direct Intergroup Conflict, Social Categorization, The Role of Social Learning, Cognitive Sources of Prejudice. Techniques to Change Prejudices- Breaking Cycle of Prejudice, Direct Intergroup Contact, Re-categorization.	
Unit - III	Applying Social Psychology in The Interpersonal Aspects of Legal System	(11)
	Memory and Eyewitness, Social Influence and Legal System- Police Interrogations, Lineups and Effect of Media Coverage on Perception of Defendants. Social Cognition and Legal System: Eyewitness Testimony, Errors /Problems in Eyewitness Testimony, Solutions for Increasing Eyewitness Accuracy. The Influence of Prejudice and Stereotypes On The Legal System.	
Unit - IV	Behavioral Abnormalities and Personality Disorders in Crime	(11)
	Behavioral abnormalities – Harassment and types of harassment, Bullying and types of bullying, Stalking and types of stalking. Defining and Diagnosing Personality Disorders. Odd-Eccentric Personality Disorders. Dramatic-Emotional Personality Disorders. Anxious-Fearful Personality Disorders.	

Course Outcomes: Students should be able to...

1. Understand the social psychology and Forensic application

2. Study the attitude and cognitive process.
3. Demonstrate the prejudice and discrimination, Forensic application.
4. Understand the legal system and Forensic application
5. Learn the memory and eyewitness and social influence.

References:

1. 'Criminology, Penology and Victimology, [2016] S. M. A. Qadri, Seventh edition, EBC Publication, Lucknow. (Unit I)
2. 'Crime Psychology', Dr. R. G. Parmar, Jignesh H. Tapariya, Edition 1st, 2010, Paradise Publishers, Jaipur. (Unit III)
3. 'Criminology', DigumartiBhaskara Rao, Edition 1st, 2012, Discovery Pulication House PVT. LTD., New Delhi. (Unit V)
4. 'Criminal Profiling-An Introduction to Behavioural Evidence analysis', Brent Turvey, Edition 4th, 2011, Elsevier Academic press. (Unit IV)
5. 'Abnormal Psychology-The Problem of Maladaptive Behaviour', Irwin G. Sarson, Barbara R. Sarson, Editon 11th, 2012, PHI Publication, New Delhi. (Unit III, IV)
6. 'Abnormal Psychology', James N. Butcher, Susan M. Mineka, Jill M. Hooley, Edition 15th, 2014, Pearson. (Unit III, IV)
7. 'Forensic Criminology', Petherick W. A., Turvey B. E., Ferguson C. E., [2010], Elsevier Inc.(Unit IV)
8. 'Social Psychology', Robert A. Baron, Nyla R. Branscombe, Donn Byrne, Gopa Bhardwaj, Edition 12th, 2010 Pearson Publication. (Unit I)
9. Social theory and social structure' Robert K. Merton., (1981), Amerind Publications & Co., New Delhi. (Unit I)

Course- BFST 406 Advanced Computer and Cyber Forensic II

Course Objective: Students will be able to...

1. Know the Basic Computer networking information.
2. Study the tools used in Mobile Crime Investigation.
3. Know the Extraction of data from mobile device, analysis tools.
4. Understand the Registration of FIR of Cyber Crimes.

Credits (Total Credits 2)	SEMESTER IV BFST 406 Advanced Computer and Cyber Forensic II	No. of hours per unit/Credit
Unit - I	Computer Networks	(12)
	Computer Networks, Client Server architecture, Network technologies, Network Topologies, Network Devices, Network Commands.	
Unit - II	Mobile Crime Investigations	(11)
	Seizure note for Mobile Handset, care taken for while confiscating Mobile Handset. Toolkit for Investigation of mobile Handset, Software Required for Investigation. Mobile Number Portability, Mobile Number Tracing, Tracing Stolen/Lost Handset.	
Unit - III	Cyber Forensic Tools and Utilities	(11)
	Introduction, Examining a Breadth of Products Cyber Forensic, Tools Good, Better, Best: What's the Right Incident Response, Tool for Your Organization, Tool Review Forensic Toolkit, Encase, Mobil edit, F-RAT, FTK, Cyber check suites, etc. Specifications for Forensic tool Tested.	
Unit - IV	Legal Provisions For Digital Evidences	(11)
	Registration of FIR(ITAA 2008), Panchnama (Seizure Memo),Seizure Proceedings, Legal Procedure after Seizure of Evidence. Expert Opinion from Forensic Examiner, Gathering information from ISP/MSP/other service Providers, Analyzing and Handling external data. Guideline to Prepare Chargesheet, Guideline for IO on what to include in Charge sheet, Tips to preserve seized digital media, Deposition of Evidence in court.	

Course Outcomes: Students should be able to...

1. Understand & Study the Computer Network & its applications.
2. Study the use of Networking Commands.

3. Understand the Role of Networking Devices and learn mobile technology
4. Learn to use types of tools for analysis of data.
5. Understand Information Technology Act (ITAA 2008).

References:

1. *Computer Network : A top to down Approach* by James kurose, Keith Rose, Publisher Pearson, 26 April 2016 (Unit I)
2. *Computer Network* by Tanenbaum, Publisher Pearson Education India, 1 January 2013 (Unit I).
3. *Practical Mobile Forensics: Forensically investigate and analyze iOS, Android, and Windows 10 devices, 4th Edition* by Rohit Tamma, Oleg Skulkin et.al, Packt Publishing (April 9, 2020).
4. *Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes* by Albert Marcella Jr, Doug Menendez, Second Edition (Information Security), Auerbach Publications, 19 December 2007 (Unit III).
5. *Cyber Forensics : Examining emerging and Hybrid technology* by Albert .J. Marcella, 1st Edition, Published September 13, 2021 by CRC Press.
6. *Digital Forensics with Open Source Tools* by Cory Altheide, Harlan Carvey, Syngress; 1st edition , April 28, 2011. (Unit III)
7. *Computer Forensics: Computer Crime Scene Investigation* by John Vacca, Laxmi Publications, First edition (2015) (Unit III)
8. *Electronic Evidence* by Nayan Joshi, Kamal Publishers, Kamal Publisher, January 2020.
9. *Cyber Laws & Information Technology* by Dr. Jyoti Rattan, publisher BHARAT LAW HOUSE PVT LTD, 1 January 2020.

Course- BFSP 407 Advanced Forensic Science II and Advanced Forensic Chemistry II

Course Objective: Students will be able to...

1. Know the Evidences in details such as fiber, soil, paint, glass etc.
2. Analyze the various physical evidence found on the crime scene.
3. Understand how to carry out analysis of gasolines, diesels, and kerosene.
4. Prepare a case report on a case involving arson.
5. Carry out analysis of explosives substances.

Credits (Total Credits 4)	SEMESTER IV BFSP 407 Advanced Forensic Science II and Advanced Forensic Chemistry II	No. of hours per unit/Credit
	Part I Advanced Forensic Science II	
1	To identify and compare toolmarks.	
2	Examination fiber by using a microscope.	
3	To compare soil samples by density gradient method.	
4	To compare paint samples by physical matching method.	
5	To compare paint samples by thin layer chromatography method.	
6	To compare glass samples by refractive index method.	
	Part II Advanced Forensic Chemistry II	
1	To carry out analysis of gasoline.	
2	To carry out analysis of diesel.	
3	To carry out analysis of kerosene oil.	
4	To analyze arson accelerators. (no.2)	
5	To prepare a case report on a case involving arson.	
6	To carry out analysis of explosive substances.(no.2)	
7	To separate explosive substances using thin layer chromatography.(no.2)	
8	To prepare a case report on bomb scene management.	
9	Polymer Testing(no.2)	
10	Chemical analysis of explosive materials.(Gun powder)- Color test, Microscopic examination.(no.2)	
11	Examination of fire arson cases by GC, TLC.(no.2)	

Course outcome: Students should be able to...

1. Acquired the skill regarding soil analysis, paint analysis etc.
2. Operate the microscope effectively and perform TLC
3. Prepare a case report on bomb scene management.
4. Understand how to carry out chemical analysis of explosives materials.
5. Understand how to carry out examination of fire arson cases by GC,TLC

References:

1. *Forensic science from the crime scene to the crime lab*, Richard Saferstein, Pearson (3rd edition) 2014.(Unit-IV)
2. *Forensic examination of glass, paint- Analysis and Interpretation*, Brain caddy, Tayler and Fransis, CRC Press,(1st Edition)2001.
3. DFSL manual
4. Forensic Analysis pre laboratory and laboratory student manual Dr. E. Hywel Evan

Course- BFSP 408 Advanced Forensic Biology II and Advanced Forensic Physics II

Course Objective: Students will be able to...

1. Demonstrate detection amylase activity of starch by using Starch –Iodine Assay.
2. Understand the estimation of Vitamins C from biological source and separation of

- compounds by using TLC methods
3. Know microscopic comparison of human hair and animal hair.
 4. Understand the Presumptive and Confirmatory test for Blood
 5. Know how to investigate fake documents and examination of the soil sample
 6. Understand classification of bullets and know different types of glass fractures.

Credits (Total Credits 4)	SEMESTER IV BFSP 408 Advanced Forensic Biology II and Advanced Forensic Physics II	No. of hours per unit/Credit
	Part I: - Advanced Forensic Biology II	
1	Detection of Amylase activity- a) Starch-Iodine Assay.	
2	Estimation of vitamin C from a biological source.	
3	Separation of compounds using TLC, calculation of R _f values.	
4	Microscopic Comparison of Hair- i] Human Hair ii] Animal Hair	
5	Presumptive test for Blood a] Phenolphthalein Assay b] Benzidine c] Leucomalachite Green d] Luminol test	
6	Confirmatory Tests for Blood –Crystallization Assays.	
	Part I :- Advanced Forensic Physics I	
1	Investigation of fake documents using UV light	
2	Classification and measurement of bullets	
3	Measurement of Hall voltage.	
4	Working with the Geiger Muller counter.	
5	Comparison of glass fragments and Study of fractures in forensic material.	
6	Examination of soil sample.	
7	Determination of density of a given sample.	
8	Determination of refractive index of a transparent material.	
9	Examination of tire / other marks.	
10	Measurement of recoil (Sample calculations) and Determination of remaining velocity (Sample Calculations).	
11	Twist versus muzzle velocity (Sample Calculations) and Muzzle velocity (Sample Calculations).	

12	Determination of remaining velocity (Sample Calculations).	
13	To study the comparison of glass fragment	
14	To Study the different types of glass fractures	
15	Piezoelectric measurements.	
16	Fiber strength measurements.	

Course Outcomes: Students should be able to...

1. Understand presumptive test for blood by using Phenol phthalein Assay, Benzedrine, Leucomalachite Green, Luminol test.
2. Understand Confirmatory Tests for Blood - Crystallization Assays.
3. Understand the amylase activity in Saliva sample.
4. To investigate the fake document.
5. Measure fiber strength and hall voltage
6. Understand comparison of the glass fragments.

References:

1. *Forensic Serology and Blood examination*, by A.K.Dwivedi, Dr.Archana Tripathi,2012
2. *Forensic Biology* by Richard Li.
3. Forensic Analysis pre laboratory and laboratory student manual Dr. E. Hywel Evans
4. DFS manual
5. Harold Franck and Darren Frank, Forensic Engineering Fundamentals, (5th edition 2007)

Course- BFSP 409 Advanced Forensic Psychology II and Advanced Computer and Cyber Forensics II

Course Objective: Students will be able to...

1. Understand instrumentation and working of UV-visible spectrophotometer.
2. Know analysis of plant poisons by using UV- visible spectrophotometer.
3. Understand how to collect the digital evidence.

4. Understand work on networking commands.
5. Understand how to authenticate the online transaction.

Credits (Total Credits 4)	SEMESTER IV BFSP 309 Advanced Forensic Psychology II and Advanced Computer and Cyber Forensics II	No. of hours per unit/Credit
	Part I :- Advanced Forensic Psychology II	
1	Emotional Maturity Scale. Dr. Yashvir Singh and Dr. Manesh Bhargav.	
2	Introvert and Extrovert test – Neiman Kostalt	
3	Achievement motivation- Deo Mohan	
4	Children’s Apperception Test – Leopold Bellak	
5	Level of Aspiration – Dr. Chandra BhalDwivedi.	
6	Aggression test – C.G. Pati	
7	Culture fair intelligence test	
8	State trait anxiety inventory for children- Charles D., Spielberger	
9	Religiosity Scale – Dr. L I Bhushan	
10	Self-Confidence Inventory –Dr. Rekha Agnihotri	
	Part II :- Advanced Computer and Cyber Forensics I	
1	To identify, seize and preserve mobile evidence from crime scenes.	
2	To study the working of networking commands by using cmd.	
3	To study the working of networking tools N-map.	
4	To use digital signatures for securing e-mail and online transactions.	
5	To acquire data from PCs/laptops/HDDs/USBs, pen drives, memory cards and SIM cards.	
6	To use symmetric and asymmetric keys for protection of digital record.	
7	To carry out imaging of hard disks.	

Course Outcomes: Students should be able to

1. Know how to conduct psychological test like emotional test.
2. Understand the introvert and extrovert personality.
3. Understand the self-confidence inventory.
4. Retrieve the data effectively.
5. They will do online transaction safely and protect digital record

References:

1. Emotional Maturity Scale. Dr. Yashvir Singh and Dr. Manesh Bhargav.
2. Introvert and Extrovert test – Neiman Kostalt
3. Achievement motivation- Deo Mohan
4. Children’s Apperception Test – Leopold Bellak
5. Level of Aspiration – Dr. Chandra BhalDwivedi.
6. Aggression test – C.G. Pati
7. Culture fair intelligence test
8. State trait anxiety inventory for children- Charles D., Spielberger
9. Religiosity Scale – Dr. L I Bhushan
10. Self-Confidence Inventory –Dr. RekhaAgnihotri
11. *Mobile Forensics Cookbook: Data acquisition, extraction, recovery techniques, and investigations using modern forensic tools*, by Igor Mikhaylov,December 15, 2017.
12. *Hands-on Incident Response and Digital Forensics* ,by Mike Sheward,July 12, 2018..
13. *A Practical Guide to Digital Forensics Investigations* by Darren R. Hayes,2nd Edition (Pearson IT Cyber security Curriculum (ITCC)).