

Syllabus for B.Sc. - II
Forensic Science introduced from June 2019
Structure of syllabus
B.Sc. - II : SEM - 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	BFST : 307	3	2.4	2				
	Total of SEM III	21	16.8	14		24	19.2	12
TOTAL NO OF CREDITS FOR SEMESTER III: 26								

B.Sc. II SEM 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	BFST-AECC 4	3	2.4	2				
	Total of SEM IV	21	16.8	14		24	19.2	12
TOTAL NO OF CREDITS FOR SEMESTER IV: 26								
TOTAL NO OF CREDITS FOR SEMESTER III + IV: 52								

1. Titles of papers**B.Sc. - II : SEM - III****Theory: 45 lectures, 36 hours (for each paper)**

BFST : 301	Criminalistics I
BFST : 302	Forensic Chemistry III
BFST : 303	Forensic Biology III
BFST : 304	Forensic Physics III
BFST : 305	Microscopy
BFST : 306	Computer Forensic and Incident Response
BFST : 307	Environmental Science

Practical: 80 lectures, 64 hours

BFSP : 307	Criminalistics I and Forensic Chemistry III
BFSP : 308	Forensic Biology III and Forensic Physics III
BFSP : 309	Microscopy and Computer Forensic and Incident Response

B.Sc. - II SEM - IV**Theory : 45 lectures, 36 hours (for each paper)**

BFST : 401	Criminalistics II
BFST : 402	Forensic Chemistry IV
BFST : 403	Forensic Biology IV
BFST : 404	Forensic Physics IV
BFST : 405	Spectroscopy
BFST : 406	Computer Forensic Investigation
BFST : 407	Environmental Science

Practical : 80 lectures, 64 hours

BFSP : 407	Criminalistics II and Forensic Chemistry IV
BFSP : 408	Forensic Biology IV and Forensic Physics IV
BFSP : 409	Spectroscopy and Computer Forensic Investigation

B.Sc. - II - Forensic Science

Year	Semester	Paper No.	Title of Paper
Second	III	BFST : 301	Criminalistics I
		BFST : 302	Forensic Chemistry III
		BFST : 303	Forensic Biology III
		BFST : 304	Forensic Physics III
		BFST : 305	Microscopy
		BFST : 306	Computer Forensic and Incident Response
		BFST : 307	Environmental Science
	IV	BFST : 401	Criminalistics II
		BFST : 402	Forensic Chemistry IV
		BFST : 403	Forensic Biology IV
		BFST : 404	Forensic Physics IV
		BFST : 405	Spectroscopy
		BFST : 406	Computer Forensic Investigation
		BFST:407	Environmental Science

**YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA COURSE
STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)
B. Sc. FORENSIC SCIENCE(ENTIRE)
B. Sc. - II - SEMESTER – III (Duration – 6 Months)**

Subject	Paper	ESE	Internal Exam		Subject	Practical-I		Submission	
			CCE-I	CCE-II (Online Test)		Exam	Journal	Case study/ Edu. Tour/ Seminar	Day to day Performance
BFST : 301	Criminalistics I	30	5	5	BFSP : 307	50	10	5	5
BFST : 302	Forensic Chemistry III	30	5	5					
BFST : 303	Forensic Biology III	30	5	5	BFSP : 308	50	10	5	5
BFST : 304	Forensic Physics III	30	5	5					
BFST : 305	Microscopy	30	5	5	BFSP : 309	50	10	5	5
BFST : 306	Computer Forensic and Incident Response	30	5	5					
AECC 3	Environmental Science	30	10	10					
Total of SEM III	TOTAL	210	40	40		150	30	15	15
	GRAND TOTAL	500							

**YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA COURSE
STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)**

B. Sc. FORENSIC SCIENCE (ENTIRE)

B. Sc. II SEMESTER– IV (Duration – 6 Months)

Subject code	Paper	ESE	Internal Exam		Subject	Practical-I		Submission	
			CCE-I	CCE-II (Online Test)		Exam	Journal	Case study/ Educational Tour/ Seminar	Day to day Performance
BFST : 401	Criminalistics II	30	5	5	BFSP : 407	50	10	5	5
BFST : 402	Forensic Chemistry IV	30	5	5					
BFST : 403	Forensic Biology IV	30	5	5	BFSP : 408	50	10	5	5
BFST : 404	Forensic Physics IV	30	5	5					
BFST : 405	Spectroscopy	30	5	5	BFSP : 409	50	10	5	5
BFST : 406	Computer Forensic Investigation	30	5	5					
AECC 3	Environmental Science	30	10	10					
Total of SEM IV	TOTAL	210	40	40		150	30	15	15
	GRAND TOTAL	500							
TOTAL OF MARKS FOR SEMESTER III+ IV: 1000									

B.Sc. II - (Semester III)**BFST: 301****Criminalistics I****Credit: 2(45)****Course Objectives : Student Should**

- 1] Know the 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, labeling, packaging and chain of custody.
- 4] Understand the procedure of investigative report writing and its legal considerations.

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. Labeling 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

Reference Books :

1. M. Byrd, Crime Scene Evidence: A Guide to the Recovery and Collection of Physical Evidence, CRC Press, Boca Raton (2001). (Unit-I)
2. Richard Saferstein: Forensic science from the crime scene to the crime lab (3rd edition)
3. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005). (Unit-II, III)
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013). (Unit-I, II).

Course Outcomes :**Unit - I : After completion of the unit, Students are able to:**

- * Students should be able to introduce several aspects of crime scene management.
- * Study safety measures at crime scenes

Unit - II : After completion of the unit, Students are able to :

- * Students should be able to explain procedures of crime scene recording.
- * Understand coordination between police personnel and forensic scientists at crime scenes.

Unit III: After completion of the unit, Students are able to:

- * Students should be able to prepare investigative reports with legal considerations.
- * Understand Classification of crime scene evidence

Unit - IV : After completion of the unit, Students are able to :

- * Students should be able to evaluate the 5Ws and 1H in investigation process.
- * Understand Preparation of report

BFST: 302 Forensic Chemistry III
Credit: 2(45)

Course Objectives : Students should :

- 1] Understand basic of 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 environmental and human.

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 chemical 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.

Reference Books:

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(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. Fundamental of polymer (Raw material to finishing product) by Niranjankarak. (Unit-II)

Course outcomes :**Unit – I : After completion of the unit, Students are able to :**

1. Understand the basics of spectroscopy
2. Understand applications of spectroscopy

Unit – II : After completion of the unit, Students are able to :

1. Understand types of polymers
2. Understand characteristic properties of polymer

Unit – III : After completion of the unit, Students are able to :

1. Explain basics of chemical toxicology
2. Understand forensic significance of toxicology

Unit – IV : After completion of the unit, Students are able to :

1. Understand the classification of pesticides
2. Explain forensic significance of pesticides

BFST : 303 Forensic Biology - III**Credit : 2(45)****Course Objectives : Students should :**

1. Study the Basic structure of DNA.
2. Study the basic knowledge of genetics.
3. Study of various Extraction methods for DNA analysis.
4. Study the metabolic pathway of humanbody.

Unit - I : History of Genetics and Nucleic Acids [11]

Introduction, DNA: as a genetic material, Modern concept of gene, DNA: Structure of eukaryotic DNA, RNA: General structure, types and function. DNA Replication-Initiation, Elongation, Termination Transcription- Initiation, Elongation, Termination protein synthesis-Initiation, Elongation, Termination

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.

Reference Books

- 1] Protein Purification – Harris and Angel. (Unit-III)
- 2] Principle of Biochemistry by Lehninger. (Unit-I)
- 3] Practical Biochemistry – Keith Wilson and Walker 4) Forensic Biology by Richard Li. (Unit-II,IV)
- 5] i-genetics-Russel. (Unit - I)
- 6] U-Satynarayan. (Unit - I)
- 7] Biochemistry by Stryer (Unit - I)
- 8] Biochemistry by Voet. (Unit - I)
- 9] Biochemistry by Chatwal. (Unit - I)

Course Outcomes :

Unit I: After completion of the unit, Students are able to:

1. Know the process of replication, transcription, translation.
2. Understand the modern concept of gene, Eukaryotic, Prokaryotic DNA, RNA

Unit II: After completion of the unit, Students are able to:

1. Know the methods of DNA extraction.
2. Understand the different types of DNA extraction methods.

Unit - III : After completion of the unit, Students are able to :

1. Know the Metabolic pathway.
2. Understand the TCA, Glycolysis, Electron transport chain and EMP pathways.

Unit - IV : After completion of the unit, Students are able to:

1. Understand the Electrophoresis techniques and their types, Forensic application.
2. Understand the Centrifuge techniques and their types, Forensic application.

BFST : 304 Forensic Physics - III
Credit: 2(45)

Course Objectives : Student should :

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 different applications.

Unit - I : Diffraction

[12]

Introduction, Huygen's-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.

Reference Books :

1. Molecular diffraction of light By- C. V. Raman. Forgotten Books (2016) (Unit-I,II)
2. Basic Optics: Principle and concepts by – Avijit Lahiri. Elsevier; 1 edition (2016) (Unit-II,III)
3. Polarized light in optics and spectroscopy-David S. Kliger, James W. Lewis, Cora E. Randall. Elsevier, (2012)(Unit- II)
4. System for ophthalmic Dispensing – Clifford W. Brooks and Irvin M. Borish 3rd edition, (2007) (Unit-I)
5. Introduction to optics – Frank L. Pedrotti, S.J. , Leno S. Pedrotti, Leno S. Pedrotti. 3rd edition (2005)(Unit-II,III)
6. Newton and three law motion – Nicholas Croce, Chapter 5(Law Explained). (Unit-IV)
7. Engineering Physics- Dattu R. Joshi McGrawhill HED (2009)
 - * Diffraction –(Unit-I)
 - * Resolving Power of Optical Instruments.(Unit-III)
 - * Polarization.(Unit-II)

Course Outcomes :**Unit - I : After completion of the unit, Students are able to :**

1. Understand difference between Interference and Diffraction.
2. Study types of diffraction

Unit - II : After completion of the unit, Students are able to:

1. Learn Polarization and its types
2. Understand production and detection of various types of polarization

Unit - III : After completion of the unit, Students are able to:

1. Know about resolving power
2. Understand Raleigh's criterion.

Unit - IV : After completion of the unit, Students are able to :

1. Students will learn Newton's all law and its forensic application.
2. Students will be able to know the elastic constants and their inter relation.

BFST : 305 Microscopy**Credits: 2 (45)****Course Objectives: Students should :**

1. Learn the Basic knowledge of compound microscope and its forensic applications.
2. Study the knowledge of different types of microscope and their principle, construction and Working.
3. Study the knowledge of difference between compound microscope and light microscope.
4. Study the Students will know the difference between SEM and TEM.

Unit - I : Microscopy - I**[11]**

Compound microscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Binocular microscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Light microscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Unit - II : Microscopy - II**[12]**

Comparison Microscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Dark field microscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Fluorescence microscope - Principle, construction, working, well labeled diagram, Application in Forensic science

Unit - III : Microscopy - III**[11]**

Polarizing microscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Phase contrast microscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Stereomicroscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Unit - IV : Microscopy IV**[11]**

Electron microscope - Principle, construction, working, well labeled diagram, Application in Forensic science.

Types of Electron Microscopy: 1) Scanning electron microscopy 2) Transmission electron microscopy.

Reference Books –

1. Bioinstrumentation : L. Veerakumari
2. Bradbury, S. (1968) The Microscope, past and present. Pergamon Press.
3. Exploring With the Microscope 1995. Werner Nachtigall. Sterling Publishing.

Course Outcomes :

Unit – I : After completion of the unit, Students are able to :

1. Understand the Compound Microscope's construction, working, principle and Forensic application.
2. Understand the Binocular Microscope's construction, working, principle and Forensic application.
3. Understand the Light Microscope's construction, working, principle and Forensic application.

Unit – II : After completion of the unit, Students are able to:

1. Understand the Comparison Microscope's construction, working, principle and Forensic application.
2. Understand the Dark Field Microscope's construction, working, principle and Forensic application.

Unit – III : After completion of the unit, Students are able to :

1. Understand the Polarizing Microscope's construction, working, principle and Forensic application.
2. Understand the Phase Contrast Microscope's construction, working, principle and Forensic application.
3. Understand the Stereo Microscope's construction, working, principle and Forensic application.

Unit – IV : After completion of the unit, Students are able to :

1. Understand the Electron Microscope's construction, working, principle and Forensic application.
2. Understand the SEM & TEM Microscope's construction, working, principle and Forensic application.
3. Understand the difference between SEM & TEM.

BFST : 306 Cyber Forensic & Incident Response**Credit: 2 [45]****Course Objectives : Students should :**

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

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.

Reference Books:

1. Incident Response & Computer Forensics by KavinMandia, Chrisporis, Mattpepe (Second Edition)(Unit-IV).
2. Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation 1stEdition.(Unit-III)
3. Cybercrime and Digital Forensics: An Introduction 2ndEdition.(Unit-I,II).
4. Digital Forensics: Digital Evidence in Criminal Investigations by Angus Mc Kenzie Marshall.(Unit-I,II,III,IV).

Course Outcomes :**Unit I: After completion of the unit, Students are 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.

Unit - II : After completion of the unit, Students are able to :

1. Learn the Use of Computer Peripherals in detail.
2. Understand the Function of Computer Devices.

Unit - III : After completion of the unit, Students are able to:

1. Learn & understand the Process of Mobile Phone Investigation.
2. Understand Mobile Technology.
3. Learn the types of Mobile Crimes.

Unit - IV : After completion of the unit, Students are able to:

1. Understand the Incident Response Process.
2. Learn the Preparation for incident Response.

**BFSP: 307 Criminalistics I and
Forensic Chemistry III Part I (Criminalistics I)**

Course Objectives : Students should :

Credit : 2

1. Know the Evaluation report of Crime Scene, Crime Scene Reconstruction.
2. Know the Sketching methods for Different types of Crime Scene.
3. Know the Collection & Packaging of Different types of evidences on Crime Scene.

Practical :

1. To prepare a report on evaluation of crime scene.
2. To reconstruct a crime scene (outdoor and indoor)
3. To study the Triangulation method of various types of crime scene.
4. To study rectangular polar coordinate method of sketching.
5. Collection, packaging and preservation of evidences at crime scene.
6. To prepare a report on crime scene investigation.
7. To prepare a crime scene sketch by using baseline method.
8. To prepare a crime scene sketch by using triangulation method.
9. To prepare a crime scene sketch by using cross projection method..

Reference Books :

1. Richard Saferstein : Forensic science from the crime scene to the crime lab. (Unit-I,II,III,IV)
2. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).(Unit-II,III)

Course outcome:

1. The student will acquire the strength to investigate the crime scene thoroughly.
2. The students will acquire skills to cover each and every details of crime scene through sketching method. Students will able to write a report on crime scene investigation which helps to solve the crime

Part - II : (Forensic Chemistry)**Course Objectives : Students should :**

1. Know the Preliminary and confirmatory detection methods for Pesticides.
2. Know the detection of Poison by Preliminary test.
3. Know the Detection of metal poison by Preliminary test.
4. Know the Instrumentation analysis.

Practical :

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).
 - ii] 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.

Reference Books:

1. Textbook of qualitative and quantitative analysis by A.I Vogel.
2. DFS manual.
3. A course in practical chemistry for B.Sc. I (Shivaji University)
4. A course in practical chemistry for B.Sc. II (Shivaji University)
5. Laboratory Procedure Manual: Petroleum Products, Directorate of Forensic Science, MHA, Govt. of India, 2005.
6. Working Procedure Manual on Chemistry; Directorate of Forensic Science MHA Govt. of India.

Course outcome:

1. The students will be able to detect the pesticide in poisoning cases by using preliminary and confirmatory test.
2. They will detect the metallic poison easily.
3. They will acquire skills regarding instrumentation.

**BFSP : 308 - Forensic Biology III and
Forensic Physics III
Practical's: Part I (Forensic Biology III)**

Course Objectives : Students should

1. Study the analysis & handling of Centrifugation Instrumentation.
2. Study the Isolation technique of DNA.
3. Study the handling & analysis of body fluids by using the HPLC instrumentation.

Practicals :

- 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.

Reference Books :

1. Forensic Biology by Richard Li.
2. Forensic Analysis pre laboratory and laboratory student manual Dr. E. Hywel Evans

Course Outcomes :

After completion of the unit, Students will 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

Part - II (Forensic Physics - III)**Credit: 2****Course Objectives: Student should :**

1. Understands the how to determine the resolving power of telescope
2. Understands the how to determine the resolving power of prism
3. Understands the how to determine the resolving power of plane diffraction grating.
4. Study the working of polarimeter

Practicals :

1. To determination the Resolving power of telescope.
2. To determination the Resolving power of given prism.
3. To determination 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 determination of 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

Reference Books :

1. Practical handbook of B.Sc. I (Shivaji university)
2. Practical handbook of B.Sc. II (Shivaji university)
3. Advanced Practical Physics for Students, B. L. Worsnop, H. T. Flint, Asia Publ. House
4. Practical Physics, S. L. Gupta and V. Kumar, PragatiPrakashan., (27th Ed.), 2010.

Course Outcomes:**After completion of the practical, Students are able to:**

1. Handle optical instruments
2. Understand measuring skills in optical instruments.
3. Understand basic working of the optical bench.
4. Develop awareness of minimizing errors.

BFSP : 309 - Microscopy and Cyber Forensic & Incident Response
Part - I : [Microscopy]
Credit : 2

Course Objectives : Students should

1. Learn the types of Microscope and used for analysis of evidence.
2. Study the Comparison Microscope and used for ballistic evidence analysis.
3. Study the Polarizing and Fluorescence effect of Microscope..

Practical's :

1. To study the compound microscope.
2. To study the light microscope.
3. To study the comparison microscope.
4. To study the stereomicroscope.
5. To study the dark field microscope.
6. To study the polarizing microscope.
7. To study the Fluorescence microscope.

Reference Books :

1. Practical handbook of B.Sc. II year (Shivajiuniversity)
2. Practical handbook of B.Sc. III year (Shivaji university)
3. Bioinstrumentation L Veerakumari.

Course Outcomes :

After completion of the unit, Students will be able to:

1. Operate the microscope effectively to solve the various crime cases such as sexual assault and rape cases.
2. Analysis various physical evidences such as glass fragments, soil sample and cloth sample to determine the origin.

Part - II : (Cyber Forensic & Incident Response Part II)**Course Objectives : Students should**

1. Learn the Process of Recovery of Data.
2. Study & Understand the Analysis of Data.
3. Learn the Analysis Process for Data.
4. Learn the Use of Software's & tools for Analysis Purpose.

Practicals :

1. To identify, seize and preserve digital evidence computer 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.

Reference Books :

1. Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation, Second Edition 2nd Edition by Lee Reiber.
2. Practical Mobile Forensics: Forensically investigate and analyze iOS, Android, and Windows 10 devices, 4th Edition Paperback -April 9, 2020 by Rohi Tamma (Author), Oleg Skulkin (Author), Heather Mahalik (Author), Satish Bommisetty (Author).
3. Handbook of Digital Forensics and Investigation 1st Edition by Eoghan Casey, Elsevier Academic Press 2010.

Course outcomes :

1. Students practically retrieves the deleted data from various pen drives, flash drives etc.
2. Students will practically collect the digital evidences and preserve the evidences by doing demo practical.
3. Students will acquire thorough knowledge regarding collection of digital evidences their analysis.

SEMESTER - IV

SEMESTER - IV
BFST : 401 Criminalistics - II
Credit : 2 [45]

Course Objectives : Students should :

1. Know the art of collecting, packaging and preserving Glass, Paint and Fibre evidence at crime scenes.
2. Know the art of collecting, packaging and preserving Soil, Tool Mark evidence and Forensic 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.

Unit - I : Physical Evidences - I

[11]

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.

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

Unit - II : Physical Evidences - II

[11]

Soil evidence – importance, location, collection and comparison of soil samples. Cloth evidence- importance, collection, analysis of adhering material. Matching of pieces.

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.

Unit - III : Impression evidences - I

[12]

Lip print analysis (Development, collection, packaging , preservation, analysis)

Gate pattern analysis (Development, collection, packaging , preservation, analysis)

Ear print (Development, collection, packaging , preservation, analysis)

Palm print(Development, collection, packaging , preservation, analysis)

Unit - IV : Impression evidences - II**[11]****Tire marks** (Development, collection, packaging, preservation, analysis)**Fingerprint** (Development, collection, packaging, preservation, analysis)**Footprints and Shoe prints** (Development, collection, packaging, preservation, analysis)**Reference Books :**

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

Course Outcomes**Unit - I : After completion of the unit, Students are able to:**

- * Explain the difference between the identification and comparison of physicalevidence.
- * Understand Collection of fibre evidence.

Unit - II : After completion of the unit, Students are able to:

- * Appreciate the value of class evidence as it relates to a criminalinvestigation.
- * Understand Matching of pieces

Unit - III : After completion of the unit, Students are able to:

- * Students should be able to explain the types of traceevidence.
- * Study Palm print.

Unit - IV : After completion of the unit, Students are able to:

- * Students should be able to list and explain the functions of analysis ofevidence.
- * Understand Tire marks collection and packaging.

BFST : 402 Forensic Chemistry - IV
Credits:2(45)

Course objective :

Students should

1. Understand the quality control criteria for petroleum products and motor fuels
2. Learn to analyze the Petroleum product adulteration
3. Perform the collection and analysis of fire scene data.
4. Determining the origin and cause of a fire.

Unit - I : Petroleum Products - I

[11]

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

[12]

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 explosion. Mechanism of explosion. Post blast residue collection and analysis. Blast injuries. Detection of hidden explosives.

Reference Books :

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 outcomes :**Unit – I : After completion of the unit, Students are able to :**

1. Understand the quality control criteria for products and motor fuels
2. Understand comparison of petrol and diesel.

Unit – II : After completion of the unit, Students are able to:

1. Understand analyzing the petrol and diesel adulteration.
2. Understand comparison of kerosene and ATF.

Unit – III : After completion of the unit, Students are able to:

1. Explain chemistry of fire,
2. Understand analysis of fire debris.

Unit –IV : After completion of the unit, Students are able to :

1. Understand the classification of explosives
2. Explain mechanism of explosion.

BFST: 403 Biology IV
Credits: 2 (45)

Course Objectives : Students should:

1. Study the protein extraction and purification method.
2. Study the analysis of biological fluid.
3. Study the analysis of macro molecules by using blotting techniques.
4. Study the human skeleton systems.

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 solventprecipitation.

Unit - II : Analysis of Biological Fluid and Otherevidences [11]

Saliva, Semen, Vaginal Fluid, Urine, S weat, 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)

Reference Books

- 1] Principle of Biochemistry by Lehninger.
- 2] Harper's Biochemistry by Murray.
- 3] Biological spectroscopy by LaKowicz.
- 4] Analytical Biochemistry by Holme.
- 5] Enzyme Kinetics by Plowman.
- 6] Biophysical chemistry by Upadhyay.
- 7] Protein Purification – Harris and Angel.
- 8] Practical Biochemistry – Keith Wilson and Walker.

Course Outcomes :**Unit - I : After completion of the unit, Students are able to :**

1. Know the basic of enzymes.
2. Understand the protein extraction and purification.

Unit - II : After completion of the unit, Students are able to:

1. Know the various biological fluids.
2. Understand the analysis of the fluid sample.

Unit - III : After completion of the unit, Students are able to:

1. Know the Human Skeleton and their types
2. Understand the Locomotion and types of joints

Unit - IV : After completion of the unit, Students are able to :

1. Understand the Southern, Western and Northern blotting techniques
2. Understand the PCR

BFST : 404 Forensic Physics - IV**Credits : 2 (45)****Course Objectives : Students should**

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.

Unit - I : Forensic Trace Analysis [11]

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 [12]

Magnetic Measurement; (magnetic susceptibility), Electric Measurements; (Hall voltage, Resistivity measurement & FET Characteristics), Radiation Detection; Geiger Muller counter, Optical fiber communication system, Piezoelectricity

Reference Books :

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

Course Outcomes:**Unit - I : After completion of the unit, Students are able to:**

1. Understand the Classification of glass samples, Glass fractures.
2. Understand classification of physical properties of material

Unit - II: After completion of the unit, Students are able to :

1. Understand the Basic concept theory of recoil and trajectory formation.
2. Understand Range of a firearm and classification of range.

Unit - III : After completion of the unit, Students are able to:

1. Understand the Basic concept of optical fiber.
2. Learn types of optical fiber.

Unit - IV : After completion of the unit, Students are able to :

1. Learn optical fiber communication system.
2. Understand various types of magnetic and electric measurement.

BFST : 405 Spectroscopy**Credit: 2 (45)**

1. Understand the overall knowledge of the NMR spectroscopy and working of NMR spectroscopy and its application.
2. Understand the Mass spectroscopy and working of Mass spectroscopy and its application.
3. Understand AAS and AES spectroscopy and working of AAS and AES and its application
4. Understand Nephelometry and Turbidometry

Unit - I : Introduction to spectroscopy**[12]**

Introduction to spectroscopy, Types of spectroscopy, Introduction to UV -visible spectroscopy, Principle, instrumentation, working, of UV-visible spectroscopy and forensic application of UV- visible spectroscopy. Introduction to IR spectroscopy, Molecular vibration and types of molecular vibration, Principle, instrumentation, working, of IR spectroscopy and forensic application IR spectroscopy.

Unit - II : Mass spectroscopy and NMR**[11]**

Introduction to Mass spectroscopy, Principle, instrumentation, working of Mass spectroscopy and forensic application of Mass spectroscopy. Introduction to NMR, Principle, instrumentation, working of NMR and forensic application NMR.

Unit - III : Atomic absorption and Atomic Emission spectroscopy [11]

AAS (Atomic absorption spectroscopy) Introduction to Atomic absorption spectroscopy, Principle, instrumentation, working of Atomic absorption spectroscopy and forensic application.

AES (Atomic Emission spectroscopy) Introduction to Atomic Emission spectroscopy ,Principle, instrumentation, working of Atomic Emission spectroscopy and forensic application.

Unit - IV : Nephelometry and turbidometry**[11]**

Nephelometry and turbidometry, Introduction to Nephelometry, principle, working, construction of Nephelometry and forensic application. Introduction to turbidometry, principle, working, construction of turbidometry and forensic application.

Reference Books :

1. Instrumental methods of chemical analysis by GurdeepR. Chatwal& Sham K. Anand. Himalaya Publication (Unit - I, II, III, IV)
2. Introduction to spectroscopy by Pavia (Unit - I, II, III, IV)
3. Instrumental analysis by Skoog Holler Crouch.(Unit - I, II, III, IV)
4. Instrumental methods of chemical analysis by Y.R Sharma. (Unit - I, II, III, IV)

Course Outcomes :**Unit – I : After completion of the unit, Students are able to :**

1. Understand the Basics and Types of Spectroscopy.
2. Understand the UV and IR Spectroscopic techniques construction, working, principle and Forensic application.

Unit – II : After completion of the unit, Students are able to :

1. Understand the Mass spectroscopy technique construction, working, principle and Forensic application
2. Understand the NMR spectroscopy technique construction, working, principle and Forensic application.

Unit – III : After completion of the unit, Students are able to :

1. Understand the Atomic Absorption Spectroscopy construction, working, principle and Forensic application.
2. Understand the Atomic Emission Spectroscopy technique construction, working, principle and Forensic application.

Unit – IV : After completion of the unit, Students are able to :

1. Understand the Nephelometry construction, working, principle and Forensic application
2. Understand the Turbidometry technique construction, working, principle and Forensic application.

BFST : 406 Computer Forensic Investigation IV
Credit : 2(45)

Course Objectives : Students should :

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

Unit - I : Computer Networks

[11]

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

[12]

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.

Reference Books :

1. Incident Response and Computer Forensic by Kelvin Mandia, TMH publication. (Unit-I,II,III,IV)
2. Digital Forensics : Digital Evidence in Criminal Investigation by Angus McKenzie Marshall.(Unit-II)
3. Cyber Forensic A field Manual for Collecting Examining and Preserving Evidence of Computer. Crimes by Albert J Menedez.Auerba .(Unit-III)
4. Richard Saferstein: Forensic science from the crime scene to the crimelab.(Unit-IV)

Course Outcomes:**Unit - I : After completion of the unit, Students are able to:**

1. Understand & Study the Computer Network & its Applications.
2. Study the use of Networking Commands.
3. Understand the Role of Networking Devices.

Unit - II : After completion of the unit, Students are able to :

1. Learn the Mobile Technology.
2. Learn & understand the detail Process of Mobile phone investigation.
3. Study the tools & technique used for Mobile Crime investigation.
4. Understand the types of mobile Crimes.

Unit - III : After completion of the unit, Students are able to :

1. Understand the Detail Examination Process of Cyber Forensic.
2. Study the Toolkit & Software use.
3. Learn to use types of tools for analysis of data..

Unit - IV : After completion of the unit, Students are able to :

1. Understand Information Technology Act (ITAA 2008).
2. Learn the Legal Procedures related Digital evidences.
3. Study the Formation of expert Opinion.
4. Study & Understand the Preservation Process of Digital evidence.

**BFSP: 407 Criminalistics II and Forensic
Chemistry IV
Part I (Criminalistics II)
Credit 2**

Course objective : Students should

1. Know the Evidences in details such as fiber, soil, paint, glass etc.
2. Analyze the various physical evidences found on crime scene.

Practical :

1. To identify and compare toolmarks.
2. Examination fiber by using 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.

Reference Books:

1. Richard Saferstein: Forensic science from the crime scene to the crime lab.(Unit-IV)
2. Forensic examination of glass, paint by brain caddy.

Course outcome :

1. Students had acquired the skill regarding soil analysis, paint analysis etc.
2. Students will able to operate the microscope effectively
3. Students will able perform TLC

Part - II : (Forensic Chemistry - IV)**Credits :2****Course objective : Students should**

1. Understand how to carry out analysis of gasolines, diesels, and kerosene.
2. Prepare a case report on case involving arson.
3. Carry out analysis of explosives substance.

Practicals :

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)

Reference Books:

1. DFSL manual
2. Forensic Analysis pre laboratory and laboratory student manual Dr. E. Hywel Evan

Course outcome :

The student will be able to prepare a case report on bomb scene management.

1. The student will be able to understand how to carry out chemical analysis of explosive materials.
2. The student will be able to understand how to carry out examination of fire arson cases by GC, TLC

**BFSP : 408 - Forensic Biology - IV and Forensic Physics - IV
Part - I (Forensic Biology - IV)**

Course Objectives : Students should

1. Know how to detect 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

Practicals:

1. Detection of Amylase activity- a) Starch-Iodine Assay.
2. Estimation of vitamin C from 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.

Reference Books

1. Forensic Biology by Richard Li.
2. Forensic Analysis pre laboratory and laboratory student manual Dr. E. Hywel Evans

Course Outcomes :**After completion of the unit, Students will be able to :**

1. Understand presumptive test for blood by using Phenol phthalein Assay, Benzidine, Leucomalachite Green, Luminol test.
2. Understand Confirmatory Tests for Blood - Crystallization Assays.
3. Understand the amylase activity in Saliva sample.

Part - II : (Forensic Physics IV)**Credit : 2****Course Objectives : Students should :**

1. Know how to investigation of fake documents.
2. Understand classification of bullets.
3. Know different types of glass fractures.
4. Understand examination of the soil sample

Practicals :

1. Investigation of fake documents using UV light
2. Classification and measurement of bullets
3. Measurement of Hall voltage.
4. Working with 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.

Reference Books:-

1. DFS manual
2. Forensic Engineering Fundamentals By Harold Franck and Darren Frank, (5th edition 2007)

Course outcomes:**After completion, Students are able to:**

1. To investigate the fake document.
2. Measure fiber strength
3. Understand comparison of the glass fragments.
4. Measure hall voltage.

**BFSP: 409- Spectroscopy and Computer Forensic Investigation
Part I (Spectroscopy)**

Course Objectives : Students should

1. Understand instrumentation and working of UV–visible spectrophotometer.
2. Know analysis of plant poisons by using UV- visible spectrophotometer.

Practicals :

1. To study UV-Visible spectro photo meter.(Instrumentation)
2. Analysis of plant poisons by UV-Visible spectrometer.(2)
3. Measurement of turbidity in unknown solution(2)
4. Measurement of absorbance in different concentration of solution (2)
5. Introduction to FTIR spectroscopy.(Instrumentation)
6. Introduction to Mass spectrophotometer.(Instrumentation)

Reference Books –

1. DFS L manual
2. Introduction to spectroscopy by Pavia(Unit-I,II,III,IV)
3. Instrumental analysis by Skoog Holler Crouch.(Unit-I,II,III,IV)
4. Instrumental methods of chemical analysis by Y.R Sharma.(Unit-I,II,III,IV)

Course Outcomes:

After completion of the unit, Students are able to:

1. Know how to measure turbidity and absorbance in different Concentration of solution
2. Understand instrumentation and working of FTIR spectroscopy
3. Understand instrumentation and working of Mass Spectrophotometer.

Part - II : (Computer Forensic Investigation)**Course objective: Students should**

1. Understand to collect the digital evidences.
2. Understand work on networking commands.
3. Understand the authenticate the online transaction.

Practicals:

1. To identify, seize and preserve mobile evidence from crimescenes.
2. To study the working of networking commands by usingcmd.
3. To study the working of networking toolsN-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.

Reference Books :

1. Mobile Forensics Cookbook: Data acquisition, extraction, recovery techniques, and investigations using modern forensic tools Paperback – December 15, 2017by Igor Mikhaylov (Author).
2. Hands-on Incident Response and Digital Forensics Paperback – July 12, 2018by Mike Sheward (Author).
3. A Practical Guide to Digital Forensics Investigations (2nd Edition) (Pearson IT Cyber security Curriculum (ITCC)) 2nd Edition by Darren R. Hayes (Author).

Course outcomes :

1. Students retrieve the data effectively.
2. They will do online transaction ssafely.
3. They will do protect the digital record