

# University of Mumbai



No. AAMS(UG)/ 58 of 2022-23

## CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office circular No.UG/314 of 2017-18 dated 8<sup>th</sup> December, 2017 relating to the revised syllabus as per the CBCS for T.Y.B.Sc. (Forensic Science) (Sem V & VI).

They are hereby informed that the recommendations made by the Ad-hoc Board of Studies in **Forensic Science** at its meeting held on 07<sup>th</sup> May, 2022 and subsequently passed by the Board of Deans at its meeting held on 17<sup>th</sup> May, 2022 **vide** item No. 6.4 (R) have been accepted by the Academic Council at its meeting held on 17<sup>th</sup> May, 2022 **vide** item No. 6.12 (R) and that in accordance therewith, the revised syllabus of **T.Y.B.Sc. (Forensic Science) (Sem V & VI) (CBCS)** has been brought into force with effect from the academic year 2024-25. (The same is available on the University's website [www.mu.ac.in](http://www.mu.ac.in)).

MUMBAI - 400 032

28<sup>th</sup> June, 2022

To

The Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology.

A.C/6.12(R)/17/05/2022

\*\*\*\*\*

No. AAMS(UG)/ 58 -A of 2022-23

28<sup>th</sup> June, 2022

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Ad-hoc Board of Studies Forensic Science,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology,
- 6) The Co-ordinator, MKCL.

(Dr. Vinod Patil)  
I/c Registrar

**Copy to :-**

- 1. The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
- 2. The Deputy Registrar, College Affiliations & Development Department (CAD),**
- 3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
- 4. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
- 5. The Deputy Registrar, Executive Authorities Section (EA),**
- 6. The Deputy Registrar, PRO, Fort, (Publication Section),**
- 7. The Deputy Registrar, (Special Cell),**
- 8. The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
- 9. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

**They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.**

- 1. P.A to Hon'ble Vice-Chancellor,**
- 2. P.A Pro-Vice-Chancellor,**
- 3. P.A to Registrar,**
- 4. All Deans of all Faculties,**
- 5. P.A to Finance & Account Officers, (F.& A.O),**
- 6. P.A to Director, Board of Examinations and Evaluation,**
- 7. P.A to Director, Innovation, Incubation and Linkages,**
- 8. P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
- 9. The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
- 10. The Director of Board of Student Development,**
- 11. The Director, Department of Students Welfare (DSD),**
- 12. All Deputy Registrar, Examination House,**
- 13. The Deputy Registrars, Finance & Accounts Section,**
- 14. The Assistant Registrar, Administrative sub-Campus Thane,**
- 15. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
- 16. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
- 17. The Assistant Registrar, Constituent Colleges Unit,**
- 18. BUCTU,**
- 19. The Receptionist,**
- 20. The Telephone Operator,**
- 21. The Secretary MUASA**

**for information.**

# UNIVERSITY OF MUMBAI



**Revised Syllabus for T.Y.B. Sc.  
(Forensic Science)  
Sem – V & VI  
(Choice Based Credit System)**

(With effect from the academic year 2024-25)

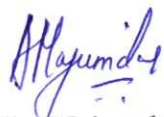
# UNIVERSITY OF MUMBAI



## Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course O. _____	<b>T.Y.B. Sc. (Forensic Science)</b>
2	Eligibility for Admission O. _____	Ordinance no. O.5719 Circular no. UG/284 of 2007 dated 16th June 2007
3	Passing Marks R. _____	40%
4	Ordinances / Regulations (if any)	As applicable for all B.Sc. Courses
5	No. of Years / Semesters R. _____	Three years – Six Semesters
6	Level	<b>P.G./ U.G. / <del>Diploma / Certificate</del></b> <b>(Strike out which is not applicable)</b>
7	Pattern	<del>Yearly / Semester</del> <b>(Strike out which is not applicable)</b>
8	Status	<del>New / Revised</del> <b>(Strike out which is not applicable)</b>
9	To be implemented from Academic Year	From the Academic Year <b><u>2024-25</u></b>

Dr. Pratima Jadhav  
BOS Chairperson in Forensic Science

  
Dr. Anuradha Majumdar  
Dean, Science and Technology

## **Preamble**

In a world where crime is incessantly improvising and rapidly evolving; it calls for equally competent minds and tools to solve it. Aiming towards the dream of a crime free society not only promises safety to the people but also fosters the progress of the nation. To achieve this, there are Central, State and Regional Laboratories by the Public sector; with many private laboratories and agencies recently operational in the country. There are also various public organizations such as Intelligence Bureau (IB), Central Bureau of Investigation (CBI) and the crime branch-Central Investigation Department (CID) in the country. To provide them with experts who are efficient, able and competent is the goal of the Institute. Department of Higher and Technical Education, Government of Maharashtra has started three Institutes of Forensic Science at Aurangabad, Mumbai and Nagpur to cater the need of quality human resources in the field of forensic sciences in the year 2009 and 2011. A study committee was appointed in 2021 to revise and update the syllabus of B.Sc. of all three Institutes and implement content similarity in all the three Institutes in the state. The study committee was comprised of experts from various subjects from Directorate of Forensic Science Laboratory, academic subject experts from the three Institutes and from other sectors. Accordingly, the curriculum of the B.Sc. course was revised and designed with the advice of the experts in the field and ensures the students are equipped with adequate skills and knowledge to provide expertise in the respective fields after successful completion of the course. It also encourages them to develop critical thinking and analytical skills, new ideas and strategies for effective crime solving.

The third-year syllabus are designed to get the students acquainted with the application of the knowledge, laws and principles of basic sciences like biology, physics, chemistry and psychology learnt in first and second year in order to analyze, investigate and interpret in the field of Forensic Science.

**Dr. Anuradha Majumdar (Dean, Science and Technology)**

**Dr. Shivram Garje (Associate Dean, Science)**

**Dr. Pratima Jadhav (Chairperson, Ad Hoc BOS in Forensic Science)**

**Dr. Sanjay Jagtap (Member)**

**Dr. Yuvaraj Malghe (Member)**

**Dr. Krishna Kulkarni (Member)**

**Dr. Rupendra Jadhav (Member)**

**T. Y. B.Sc. (Forensic Science) (Semester V) Credits**

**To be implemented from Academic Year 2024-2025**

Class	Title	Per Week		15 Weeks (Per Sem)		Per Sem (Hours)		Marks		Credits		Total Credits
		L (50 Min)	P (50 Min)	L	P	L	P	TH	PR	L	P	
USFS 501	Forensic Science–V	4		60		50		100		2		2
USFS 502	Chemical Science – V	4		60		50		100		2		2
USFS 503	Physical Science – V	4		60		50		100		2		2
USFS 504	Biological Science – V	4		60		50		100		2		2
USFS 505	Psychology – V	4		60		50		100		2		2
USFS 506	Computer Science – V	4		60		50		100		2		2
USFS 507	Law – V	4		60		50		100		2		2
USFS 5P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2
USFS 5P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 5P3	Psychology and Computer Science Practical		6		90		72		100		2	2
<b>Total</b>	<b>--</b>	<b>28</b>	<b>18</b>	<b>420</b>	<b>270</b>	<b>350</b>	<b>216</b>	<b>700</b>	<b>300</b>	<b>14</b>	<b>6</b>	<b>20</b>

**T. Y. B.Sc. (Forensic Science) (Semester VI) Credits**

**To be implemented from Academic Year 2024-2025**

Class	Title	Per Week		15 Weeks (Per Sem)		Per Sem (Hours)		Marks		Credits		Total Credits
		L (50 Min)	P (50 Min)	L	P	L	P	TH	PR	L	P	
USFS 601	Forensic Science–VI	4		60		50		100		2		2
USFS 602	Chemical Science – VI	4		60		50		100		2		2
USFS 603	Physical Science – VI	4		60		50		100		2		2
USFS 604	Biological Science – VI	4		60		50		100		2		2
USFS 605	Psychology – VI	4		60		50		100		2		2
USFS 606	Computer Science – VI	4		60		50		100		2		2
USFS 607	Law – VI	4		60		50		100		2		2
USFS 6P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2
USFS 6P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 6P3	Psychology and Computer Science Practical		6		90		72		100		2	2
<b>Total</b>	<b>--</b>	<b>28</b>	<b>18</b>	<b>420</b>	<b>270</b>	<b>350</b>	<b>216</b>	<b>700</b>	<b>300</b>	<b>14</b>	<b>6</b>	<b>20</b>

## B. Sc. (FORENSIC SCIENCE)

### Semester V - Theory

Course Code	Title	Credits
<b>USFS 501</b>	<b>Forensic Science – V</b>	<b>2</b>
<b>Course Overview:</b> The course covers core topic of forensic science viz Blood pattern analysis; various means of personal identification (biometrics) and related databases and instrumentation used in forensic analysis		
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>• To learn importance, scope, classification, documentation, reconstruction of blood stain pattern analysis.</li><li>• To understand various biometrics as a means of personal identification, their significance, collection and comparison</li><li>• To learn various databases used in forensic science and their scope and significance.</li><li>• To understand the working, principle and application of various instruments used in forensic science</li></ul>		
<b>Course Outcome:</b> <ul style="list-style-type: none"><li>• Classify and interpret different blood stain patterns. To reconstruct a crime scene using blood pattern.</li><li>• Perform acquisition and analysis of various biometrics</li><li>• Understand the working and scope of various databases in forensic science</li><li>• Operate, evaluate and interpret results of various instruments used in forensic science</li></ul>		
Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	<b>Blood pattern analysis</b> <ol style="list-style-type: none"><li>1. Introduction to Blood Pattern Analysis</li><li>2. Bloodstain patterns and its forensic significance.</li><li>3. Biological properties of human blood: functions and composition of human blood.</li><li>4. Physical properties of human blood: viscosity, surface tension and specific gravity.</li><li>5. Classification of blood stains</li><li>6. Directionality and motion of blood stains. Convergence and area of origin of blood stains. Altered blood stain pattern.</li><li>7. Digital Aids in Reconstruction (3- D Photography/Videography, Computer aided Reconstruction)</li></ol>	<b>15</b>
<b>Unit II</b>	<b>Means of person Identification-I</b> <ol style="list-style-type: none"><li>1. Historical perspective of person identification, Anthropometry</li><li>2. Fingerprint recognition: ACE-V method of fingerprint matching, Automated Fingerprint Identification System</li></ol>	<b>15</b>



	<p>(AFIS): components and working</p> <ol style="list-style-type: none"> <li>3. Facial identification: Portrait parle, anthropometric landmarks/fiducial points on face, computer-based facial identification: acquisition of facial data (2D/3D faces), facial features, matching of facial features, decision making</li> <li>4. Iris identification: anatomy of eye, iris and its characteristics, computer-based iris identification: acquisition of iris data, segmentation of iris, features of iris, matching of various features of iris, decision making</li> </ol>	
<b>Unit III</b>	<p><b>Means of person Identification-II and Forensic Databases</b></p> <ol style="list-style-type: none"> <li>1. Voice Recognition: Anatomy of vocal organs, neurological basis of speech production, forensic phonetics, approaches of voice recognition: acoustic-phonetic and automated methods, acoustic analysis of vowel and consonants. Legal aspects of voice identification, decision making</li> <li>2. Palm print Recognition: Anatomy of hand and hand geometry, features of palm, matching of palm prints, decision making</li> <li>3. Forensic Databases: Importance of forensic databases in personal identification and its role in prosecution and defence hypothesis</li> <li>4. Various Forensic databases</li> </ol>	
<b>Unit IV</b>	<p><b>Instrumentation in Forensic Science:</b></p> <ol style="list-style-type: none"> <li>1. Instrumentation in crime scene investigation: Various light sources and its importance</li> <li>2. Instrumentation in Document examinations: Spectral comparator, Electrostatic apparatus, VSC and other microscopic methods</li> <li>3. Spectrophotometers: UV-VIS, IR/FTIR, Raman, AAS, AES, Mass Spectrometers, ICP</li> <li>4. Chromatographic techniques: TLC, HPTLC, HPLC/UPLC, GC</li> </ol>	<b>15</b>

**Text books and Additional References:**

1. Kish, P. E., James, S. H., Sutton, T. P. (2005). Principles of Bloodstain Pattern Analysis: Theory and Practice. Singapore: Taylor & Francis.
2. Bevel, T., Gardner, R. M. (2008). Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction. United States: Taylor & Francis.
3. Wonder, A. (2011). Bloodstain Pattern Evidence: Objective Approaches and Case Applications. Netherlands: Elsevier Science.
4. Komarinski, P. (2005). Automated Fingerprint Identification Systems (AFIS). Netherlands: Elsevier Science.
5. Handbook of Biometrics for Forensic Science. (2017). Germany: Springer International Publishing.

6. Jain, A. K., Nandakumar, K., Ross, A. A. (2011). Introduction to Biometrics. United States: Springer US.
7. Hollien, H. F. (2002). Forensic Voice Identification. United Kingdom: Academic Press.
8. Patil, H. A. (2011). Forensic Speaker Recognition: Law Enforcement and Counter- Terrorism. Netherlands: Springer New York.
9. Voice Identification: Theory and Legal Applications, Oscar Tosi, University Park Press, Baltimore, USA, 1979
10. Fant, G. (2007). Speech Acoustics and Phonetics. Netherlands: Kluwer Academic.
11. Jain, A. K., Li, S. Z. (2011). Handbook of Face Recognition. Germany: Springer London.
12. Datta, A. K., Banerjee, P. K., Datta, M. (2015). Face Detection and Recognition: Theory and Practice. United Kingdom: CRC Press.
13. Forensic Face Matching: Research and Practice. (2021). United Kingdom: OUP Oxford.
14. Valentine, T., Davis, J. P. (2015). Forensic Facial Identification: Theory and Practice of Identification from Eyewitnesses, Composites and CCTV. Germany: Wiley.
15. Smith, M., Urbas, G., Mann, M. (2018). Biometrics, Crime and Security. United Kingdom: Taylor & Francis.
16. McCartney, C. (2013). Forensic Identification and Criminal Justice. United Kingdom: Taylor & Francis.
17. Elink-Schuurman-Laura, K. (2018). The Efficacy of Forensic Databases. United States: University of New Haven.
18. Forensic Science: An Introduction to Scientific and Investigative Techniques, Second Edition. (2005). Singapore: Taylor & Francis.
19. Rawtani, D., Pandey, G., Tharmavaram, M., Hussain, C. M. (2020). Handbook of Analytical Techniques for Forensic Samples: Current and Emerging Developments. Netherlands: Elsevier
- Science. Analytical Techniques in Forensic Science. (2021). United Kingdom: Wiley. Stuart, B. H. (2012). Forensic Analytical Techniques. Germany: Wiley.
20. Infrared and Raman Spectroscopy in Forensic Science. (2012). United Kingdom: Wiley.
21. Saferstein, R. (2018). Criminalistics: An Introduction to Forensic Science, 12th Edition.
22. Fisher, B. A., Tilstone, W. J., Woytowicz, C. (2009). Introduction to Criminalistics: The Foundation of Forensic Science. United Kingdom: Elsevier Science.

Course Code	Title	Credits
USFS 502	Chemical Science –V	2
<p><b>Prerequisites for the course:</b> Students should have preliminary knowledge about these topics from their previous classes.</p> <p><b>Course Objectives:</b> Introduction to new concept like stereochemistry and nuclear chemistry. Introduction to other applied concepts of the forensic chemistry and toxicology.</p> <p><b>Course Outcome:</b> To understand the Stereochemistry, Methods of extraction/ separation/ purification, Trap cases, Biomolecules, Nuclear chemistry, Polymers..</p>		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p><b>Stereochemistry</b> Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 dichlorobutane) and their interconversions; Geometrical isomerism in alkene and cycloalkanes: cis– trans and syn-anti isomerism E/Z notations with C.I.P rules; Optical Isomerism: Optical Activity, Specific Rotation, Chirality/ Asymmetry, Enantiomers, Diastereomers, meso structures, racemic mixture and resolution (methods of resolution not expected); Relative and absolute configuration: D/L and R/S designations; Conformation analysis of alkanes (ethane, propane and n-butane); Relative stability with energy diagrams.</p>	15
Unit II	<p><b>Methods of extraction/ separation/ purification</b> Theory and techniques of distillation, Distillation and its types, crystallization and recrystallization, solvent extraction, Soxhlet extraction, solid phase extraction, solid phase microextraction, microwave-assisted extraction, supercritical fluid extraction, dialysis, etc.</p> <p><b>Trap cases</b> Introduction, trap chemicals: phenolphthalein and anthracene; mechanism of color reaction; factor affecting the color; detection of phenolphthalein and alkali; method of detection of degraded product of phenolphthalein by TLC and UV visible spectrophotometer; forensic significance.</p>	15
Unit III	<p><b>Nuclear chemistry</b> Introduction, radio activity, types of radiation, properties of radiation, types of radioactive decay, units of radioactivity, Half-life, average life, radioactive dating, and nuclear chain reaction.</p>	15

	Forensic applications.  <b>Biomolecules</b> Characteristics, classifications, structures, and role of biomolecules such as carbohydrates, proteins, nucleic acids, lipids, natural products, etc. in biological systems.	
<b>Unit IV</b>	<b>Polymers</b> Introduction, General idea of structures, types of polymerization processes, radical and ionic mechanism of polymerization, properties of polymers, Structure, preparation and applications of Polyethylene, Teflon, PVC, Polystyrene, etc. <b>Rubbers, Fibers &amp; Plastics</b> General idea of plasticizers, stabilizers, fillers, Epoxy Resins. <i>Rubber</i> : Types of rubber, vulcanization of rubber, synthetic rubbers <i>Fibers (synthetic fibers)</i> : Classification, properties, polyamides - Nylon, Polyesters - Dacron <i>Fiber reinforced plastics</i> : Types, properties, applications. <b>Dyes and paints</b> Nature, classification, composition, uses and significance in forensic science.	<b>15</b>

**Text books and Additional References:**

1. Stereochemistry of Organic Compounds by E.L. Eliel
2. Stereochemistry of Organic Compounds: Principles and Applications by D. Nasipuri
3. Stereochemistry: Conformation and Mechanism by P.S. Kalsi
4. Bamford F.; Poisons : Their Isolation and Identification, (3rd Edition); McGraw-Hill Press, 1955
5. Rukmani Krishnamurthy; Introduction to Forensic Science in Criminal Investigation; Selective & Scientific Books, ISBN 9788189128272, 2011
6. Chemistry of Biomolecules: An Introduction by Richard Simmonds, RSC publishing, 1992
7. Chemistry of Biomolecules by S.P. Bhuta
8. JaVed I. Khan, Thomas J. Kennedy, Donnell R. Christian Jr.; Basic Principles of Forensic Chemistry; Springer Science, Humana Press, ISBN 978-1-59745-437-7; 2012
9. Jay Siegel, Geoffrey Knupfer, Pekka Saukko; Encyclopedia of Forensic Sciences, Three Volume Set; Elsevier Publications; ISBN 0122272153

Course Code	Title	Credits
<b>USFS 503</b>	<b>Physical Science –V</b>	<b>2</b>
	<p><b>Course Outcomes: -</b> At the completion of this course the candidate can: Know and understand</p> <ul style="list-style-type: none"> <li>• Various aspects of magnetic and electrical measurements</li> <li>• About radiation detection and using GM counter</li> <li>• Various aspects of road as well as rail accidents</li> <li>• Various marks that are left behind on site which are helpful as evidence as well as</li> <li>• Helpful in creating the picture of accident Relevant Provisions of Railway Act, 1989 and Relevant Provisions of Motor Vehicle Act, 1939 (Offenses and Penalties).</li> <li>• The history and basics of firearms ammunition and its ballistics</li> <li>• The working of firearms and ammunitions</li> <li>• the Internal ballistic studies and its importance in forensic science</li> <li>• Various aspects of tools and tool mark.</li> </ul>	
<b>Unit No.</b>	<b>Contents of Unit</b>	<b>No. of Lectures</b>
<b>Unit I</b>	<p><b>Experimental Techniques :</b> <b>Magnetic Measurements:</b> Magnetic susceptibility and its measurement by Quinck's and Gouy's method, Hall Effect and related measurements. <b>Electrical Measurements:</b> Resistivity measurement of thin samples by Four probe method, bulk samples by Van-der Pauw method, Resistivity measurement of electrical wires and cables and forensic examination for their source identification, Forensic examination of tampered electric energy meters and various tampering mechanisms adopted by criminals. <b>Radiation Detection and measurements:</b> Working principle of Ionization chamber, Proportional counter, Geiger Muller counter, Scintillation counter, Solid State Transducer. Radiation dose and its unit, Exposure, absorbed and dose equivalent rate and calculation of exposure and dose, Dose rates from natural and man-made sources, Radiation permissible limits, Shielding of radioactive sources.</p>	<b>15</b>
<b>Unit II</b>	<p><b>Road and Rail Accident Investigation:</b> <b>Road Terminologies:</b> Cut, Final Grade, Surface, Existing Grade, Fill, Sub grade, Base, Traffic lane, Travelled way, Shoulders, Roadbed, Roadway, Roadway ditch, Ditch slope, Back slope, Fill</p>	<b>15</b>

	<p>slope, Interceptor ditch, Slope ratio, Central line, Crown, Super elevation, Road dividers. Road signs, symbols and traffic control mechanisms.</p> <p><b>Road accidents:</b> Primary causes of road accident, Types of road accident, sources of information, eye witnesses, Tire and other marks, Pedestrian impacts and vehicle speed, vehicle condition, vehicle speed and damage, types of skid marks, curved scuffmarks, speed estimation from skid/scuffmarks. Time and distance, reaction time and peripheral vision of a driver, Photography and plans, Brake system and Steering failure, Motor vehicle examination.</p> <p><b>Rail Accidents:</b> Investigation of Rail Crash: Criminal and Safety Investigation, Investigation Principles, Best Practices: Tests, Inspection of Driving Cab, Examination of Electrical/Electronic/Technological System and their Failure. Necessary Equipments Required for Forensic Examination.</p>	
<b>Unit III</b>	<p><b>Elementary Ballistics-</b></p> <p><b>Fire Arms:</b> Early Fire Arms, Hand Cannons, Matchlock, Wheel Lock, Snaphaunce, Flintlock, Percussion System, Cartridge System, Centre Fire System, Dreyse Needle, Smooth Bore Firearms, Rifling, Revolver, Pistols, Actions of Firearms, Shotgun, Sub Machine Gun, Machine Gun, Improvised Firearms.</p> <p><b>Ammunitions:</b> Propellants- Black Powder, Smokeless Powders, Primers- Berdan Primer, Boxer Primer, Primer Cap Types- Rim Fire, Centre Fire, Pin Fire. Caseless, Blank Ammunition, Tear Gas, Grenade Launcher, Dummy, Cartridge Cases - Rimless, Semi Rimmed, Rimmed, Belted. Bullets and Its Types, Components of Shotgun Ammunition.</p> <p><b>Internal Ballistics-</b> Energy considerations, Propellants, Initiation, Combustion of propellants, Density of loading, Atmospheric temperature, Shape of the cartridge case. Heat problems, Barrel pressure and its determination, Recoil, facts and measurement, Vibration and jump, Barrel fouling.</p>	<b>15</b>
<b>Unit IV</b>	<p><b>Tools &amp; Tool Marks</b></p> <p>Common Hand Tools: Levers (Screw Drivers, Crow Bars, Pry Bars, Nail Pullers, Pinch Bars, Moulding Bar, Wrecking Bar), Hand Saw (Rip Saw, Cross Cutting Saw, Bow Saw, Teeth Saw, Compass Saw, Dip Cut, Coping Saw, Wall Board Saw, Bow Saw, Hacksaw, Chisel Teeth Saw, Coarse Cut Carpenter Saw), Striking Tools (Hammers, Hatches and Axes), Grasping Tools (Wrenches, Vise Grips, Pliers), Cutting Tools (Metal Snips, Wire Cutters, Bolt and Cable Cutters), Crimping Tools, Knives, Scissors and Shears, Chisels and Punches, Drill Bits. Tool Marks: Marks Made by Hand Tools (Impression / Compression Marks, Dent, Saw Marks, Drill Marks and Holes, Punctures, Point to Point Blade Cut Marks, Scratch and Scour Marks), Collection, Documentation and Forensic Examination of Tool Marks.</p>	<b>15</b>

**Text books and Additional References:**

1. Criminalistics- An Introduction to Forensic Science By Richard Saferstein.
2. Advanced Practical Physics, Vol.II: Dr. S.P.Singh, Pragati Prakashan, Meerut.
3. Practical Physics: Worsnoff and Flint.
4. Measurement, Instrumentation and Experiment Design in Physics and Engineering  
By Michael Sayer and Abhaaiman Singh.
5. Instrumental Analysis By Skoog, Holler and Crouch.
6. Laboratory Procedural manual, Physics Section, DFSL, Mumbai.
7. Laboratory Procedural Manual, Forensic Ballistics, DFS, New Delhi.
8. Elements of Civil Engineering By Mimi Das Saikia.
9. Encyclopedia of Forensic Science, Volume one: Jay A Siegel, Pekka J  
Saukko, Geoffery Knupfer. Academic Press.
10. Forensic Medical Investigation of Motor Vehicle Incidence By Michel P. Burke.
11. Forensic Engineering Fundamentals By Harold Franck.
12. Fire arms in criminal investigation and trials By B R Sharma
13. Handbook of Fire arm and ballistics By Brian J Heard.
14. Fire Arms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence By S  
N Gaur et.

Course Code	Title	Credits
<b>USFS 504</b>	<b>Biological Science– V</b>	<b>2</b>
	<p><b>Course Overview:</b> The course covers Forensic Serology, Anthropology and Odontology, and Instrumentation.</p> <p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>• To understand and interpret various forensic serological techniques through theoretical concepts and practical demonstration.</li> <li>• To understand, identify and distinguish between anthropological features for the determination of age, sex, race, stature and species.</li> <li>• To understand the concepts of odontology with reference to crime scene investigations.</li> <li>• To understand the instrumentation required in basic techniques of Forensic Biology</li> </ul> <p><b>Course Outcomes:</b></p> <ul style="list-style-type: none"> <li>• Examination, evaluation and designing of various forensic serological techniques.</li> <li>• Identification of individual and population characteristics from bone remains.</li> <li>• Application of their knowledge of teeth/oral structure to explain death associated with crime and mass disasters.</li> <li>• Familiarization of analytical techniques such as chromatography, centrifugation, spectrophotometry</li> </ul>	
<b>Unit No.</b>	<b>Contents of Unit</b>	<b>No. of Lectures</b>
<b>Unit I</b>	<p><b>Forensic Serology:</b> Body fluids- Presumptive and confirmatory detection and forensic significance of following body fluids: Blood, semen, saliva, sweat, and Urine Analysis of Amniotic fluid, synovial fluid, aqueous humor, menstrual blood, Faecal matter, tear, pus, vomit, bone marrow. Enzymatic markers</p>	<b>15</b>
<b>Unit II</b>	<p><b>Serological Techniques</b> Antigen-antibody reactions (primary, secondary) Serological techniques: primary binding assays, ELISA, Western Blotting, Hemagglutination, complement fixation Immunochromatography, Immunodiffusion assays (Ouchterlony, Single radial immune diffusion); Immunoelectrophoretic assays (Rocket and counter-current assay) and Radio immune assay.</p>	<b>15</b>
<b>Unit III</b>	<b>Instrumentation</b>	<b>15</b>



	<p>Separation techniques based on molecular size (dialysis, ultrafiltration, density gradient centrifugation, molecular exclusion chromatography).</p> <p>Solubility differences (isoelectric precipitation, solvent fractionation, salting-in and salting out). Electric charge (electrophoresis, ion-exchange chromatography), ligand specificity (affinity chromatography). Spectrophotometry: Principle and application of spectrophotometer.</p>	
<b>Unit IV</b>	<p><b>Anthropological &amp; Odontological evidences</b></p> <p>Sample collection: Biological evidence at crime scenes, evidence collection and preservation, collection of reference DNA samples, storage and sample characterization, sample storage and transport, contamination concerns</p> <p>Identification of skeletal remains from other evidence, Identification of fragmented remains, Identification of human and non-human remains. Determination of sex &amp; age from skeletal remains.</p> <p>History of forensic Dentistry, Morphology and identification of the teeth type, Chronology of dentition, Dental charting systems, Age estimation in adults</p>	<b>15</b>

**Text books and Additional References:**

1. Practical Crime Scene Analysis & Reconstruction – Roos M. Gardner & Tom Bevel
2. Death Scene Investigation – Scott A. Wagner
3. Forensic Science in criminal investigation and trials – B.R. Sharma
4. Forensic Science in Crime Investigation – Dr. Mrs. Rukmani Krishnamurthy
5. Forensic Science – An introduction to scientific and investigative techniques – Stuart H. James Jon J. Nordby
6. Forensic Medicine – P.V. Guharaj & M. R. Chandran
7. Bryant, V.M. Jr, Mildenhall, D.C. and Jones, J.G., Forensic Polynology in the United States of America Polynology. 1990, 14.PP.193-208
8. Faegri, K. Iverson, J. and Krzywinski, K. Textbook of Pollen Analysis 4th Edition. John Wiley & Sons, New York 1989.
9. Microbial forensics By Roger Breeze, Bruce Budowle, Steven E. Schutzer. Elsevier Academic Press
10. The Forensic Laboratory Handbook Procedures and Practice By Ashraf Mozayani, Carla Noziglia. 2nd edition. 2011. Human Press.
11. Forensic Science in Wildlife Investigations. Adrian Linacre Taylor and Francis, 2009
12. The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature By Donna M. Jackson, Wendy Shattil, Bob Rozinski Universal Athenaeum (Denver, CO, U.S.A.)
13. Forensic Entomology: The Utility of Arthropods in Legal Investigations Jason H. Byrd, James L. Castner Taylor and Francis, 2009
14. Forensic entomology: an introduction By Dorothy E. Gennard Wiley.

<p>15. Forensic palynology Dallas Mildenhall, Patricia Wiltshire, Vaughn Bryant Elsevier, 2006</p> <p>16. Forensic palynology: an in-depth look at its indispensable value National University, San Diego, 2002</p>		
Course Code	Title	Credits
<b>USFS 505</b>	<b>Psychology – V</b>	<b>2</b>
	<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>• A learner is oriented to all the applied aspect of forensic psychology, using various techniques of detection of criminal behavior</li> <li>• Learner studies about the different causes related to the offending behaviors</li> <li>• It also describes about the police psychology as they are involved in negative environment which affects their psychological wellbeing.</li> <li>• It explains the different aspect of delinquent behavior.</li> </ul> <p><b>Course Outcomes:</b></p> <ul style="list-style-type: none"> <li>• <b>Identify-</b> The learner learns the various techniques of detection of criminal behavior like use of polygraph, narco analysis, psychological profiling.</li> <li>• <b>Describe-</b> The learner can describe the criminal motives, behavior through different methodologies used in forensic psychology.</li> <li>• <b>Differentiate-</b> The learner can differentiate the causes relating to offending behavior for the purpose psychological profiling of an offender.</li> <li>• <b>Analyze-</b> The learner can analysis the criminal behavior and its purpose or motives through criminal behavior analysis.</li> <li>• <b>Review-</b> Over all the learner is able to understand criminal behavior and its analysis in professional manner.</li> <li>•</li> </ul>	
Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	<p><b>Psychology Of Investigations</b></p> <ol style="list-style-type: none"> <li><b>1. Introduction to Various Psychological Investigative Tools:</b></li> <li><b>2. Criminal Profiling:</b></li> <li><b>3. Polygraph:</b> Introduction, Objectives, Scientific Basis, Procedure, Question Formulation, Analysis, Admissibility, Case Study</li> <li><b>4. Narco Analysis :</b>History, Clinical Use, Forensic Use of Narcoanalysis, Legal Scrutiny, Constitutional Imperatives, Theoretical Viewpoints, Admissibility</li> <li><b>5. Psychological-Autopsy:</b> Definition, Aim &amp; Objectives,</li> </ol>	<b>15</b>

	<p>Cause And Manner of Death, Types, Methodology, Applications, Written Report, Ethical Issues, Case Study, Limitation, Admissibility</p> <p>6. <b>Forensic Hypnosis:</b> Definition, Procedure, Forensic Hypnosis and Cognitive Interviewing, Case Study</p> <p>7. <b>BEOS:</b> Scientific Basis, Concepts of Knowing And Remembering, Types, Designing Probes, Case Study</p> <p>8. Introduction To <b>Layered Voice Analysis ( LVA), Suspect Detection System ( SDS)</b></p>	
<b>Unit II</b>	<p><b>Psychology And Causes of Offending Behavior</b></p> <p>1. Psychological <b>Theories of Offending Behavior:</b> Psycho-Biological Theories, Psychodynamic Theories, Learning Theories, Cognitive- Behavioral Theories</p> <p>2. <b>Major Disorders and It's Symptoms And Features-</b> ADHD, Conduct Disorder, Antisocial Personality Disorder, Sexual Disorder, Substance-Use Disorder-Substance Dependence, Substance Abuse</p>	<b>15</b>
<b>Unit III</b>	<p><b>Police Psychology</b></p> <p>1. Introduction to Police Psychology</p> <p>2. Fitness for Duty Evaluation</p> <p>3. Police Selection- Selection Strategy, Psychological Tests.</p> <p>4. Police Stress- Sources, Resolving, Stress Effects, Police Suicide</p> <p><b>Correctional Psychology</b></p> <p>5. Correctional Facilities</p> <p>6. Psychological Assessment in Corrections</p> <p>7. Psychological Treatment- Behavioral &amp; Cognitive Model</p>	<b>15</b>
<b>Unit IV</b>	<p><b>Theories Of Crime And Delinquency</b></p> <p>1. <b>Social Theories Of Crime:</b> Economic, Geographical, Classical Theory, Rational Choice Theory, Eysenck's Theory of Personality and Crime, Social, Control Theory, Social Disorganization Theory, Theory of Differential Association, Labeling Theory, Structural Strain Theory.</p> <p><b>Psychology of Violence &amp; Sexual Assault</b></p> <p>1. Criminal Homicide</p> <p>2. Stalking- Definition, Characteristics, Types of Stalkers, Psychological And Social Consequences Of Stalking, Treatment of Stalkers</p>	<b>15</b>

**Text books and Additional References:**

1. Bull, R.(2011).Forensic Psychology(Four volume set).LA: Sage publications.
2. Davies, G. & Beech,A. (2012).Forensic Psychology : Crime, Justice, Law, Interventions (2nd ed.). BPS Blackwell: BPS text books & John Wiley and Sons Ltd.
3. Scott, A.(2010).Forensic Psychology. NY: Palgrave MacMillan.
4. Donohue,W.T.& Levensky,T.R.(2004).Handbook of Forensic Psychology. NY: Elsevier.
5. Goldstein,A.M.Volumeed.Weiner,I.B.Seriesed.(2003).Handbook of Psychology:

- Forensic Psychology (Vol. 11).NJ: J. Wiley and Sons.
6. Heilbrun,K,Marczyk,G.R.and DeMatteo,D.(2002)Forensic Mental Health Assessment: A Casebook. UK:OUP.
  7. McCaffrey,R.J., Williams,A.D.,Fisher,J.M.,and Laing,L.C.(1997).The practice of Forensic neuropsychology.NY: Plenum press.
  8. Weiner,I.B.& Hess,A.K.(2006).Handbook of Forensic Psychology. N J:J.Wiley andSons.
  9. Forensic and Criminal Psychology, Dennis Howitt,2002Pearson Education LTD, England.
  10. 'Introduction to Forensic Psychology-Court, Law Enforcement and Correctional Practices',Stacy L.Shipley,BruceA.Arrigo,3rd edition,2012,Elsevier Academic press.
  11. 'Forensic Psychology and Neuropsychology for Criminal and Civil Cases', Harold V.Hall,1st edition ,2008,CRC Press.
  12. 'Criminology'[2005] S.M.A.Qadri,fifth edition,EBC Publication, Lucknow 'StressManagement', WaltSchafer,4th edition Cengage Learning India Private Ltd.,New Delhi.
  13. Diagnostic and Statistical Manual of Mental Disorders(DSM)(5thEdition)by American Psychiatric Association (2013).
  14. 'Criminal Profiling-AnIntroductiontoBehaviouralEvidencanalysis',BrentTurvey, Edition2nd,2006, Elsevier Academic press.
  15. 'Handbook of Forensic Psychology',Prof Dr. Vimala Veeraraghwan, Edition 1st, 2009, Selective and Scientific Books Publications, New Delhi.
  16. 'HandbookofForensicPsychology',IrvingB.Weiner,AllenK.Hiss,Edition3rd, 2006,Wiley Publication.
  17. 'TheoreticalPsychology',Moazziz Ali Beg,SangeetaGuptaBeg,Vol[03],Edition 2nd,2013, Global Vision Publishing House, New Delhi.
  18. 'Theoretical Psychology',Moazziz Ali Beg,Sangeeta Gupta Beg,Vol[04],Edition 2nd,2013, Global Vision Publishing House, New Delhi.
  19. 'Abnormal Psychology-The Problem of Maladaptive Behaviour', Irwin G.Sarson, Barbara R. Sarson, Editon 11th,2012, PHI Publication, New Delhi.
  20. 'Abnormal Psychology',James N.Butcher,Susan M.Mineka, Jill M.Hooley,Edition 15th, 2014, Pearson.
  21. 'Stress Management', Ruth Baer, Edition 1st2010,Global Vision Publication House, New Delhi.
  22. 'Handbook of Stress,CopingandHealth',VirginiaHillRice,Edition1st,2000, Sage Publications, Inc.
  23. 'Juvenile and Crime In Indian', Dr.Rajesh S.Vyas, Dr.Ashok M.Shroff, Edition 1st,2013, Shri Niwas Publications, Jaipur.
  24. Parental development-Social & Emotional development-'A Text book of Child
  25. Psychology',D.N.Prabhakar, Editon1st,2014,Astha Publication, New Delhi.

Course Code	Title	Credits
<b>USFS 506</b>	<b>Computer Science – V</b>	<b>2</b>
	<p><b>Course Objectives:</b> To introduce the principle and concepts of digital forensic To detail about the various investigation procedures like data acquisition and evidence gathering.</p> <p><b>Course Outcomes:</b></p> <ul style="list-style-type: none"> <li>• Explain the principles of cyber forensic, network, mobile forensic.</li> <li>• Illustrate the cyber-crime investigation procedures</li> <li>• Apply the cyber-crime techniques to data acquisition and evidence collection</li> <li>• Analysing the digital evidences and arriving at conclusions</li> <li>• Examine the Volatile and Non-volatile Digital Evidence</li> </ul>	
Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	<p><b>Digital investigation foundation:</b> Digital investigation and evidence, digital crime scene investigation process, data analysis,  <b>Computer Forensics Evidence and capture:</b> Data Recovery Defined-Data Back-up and Recovery-The Role of Back -up in Data Recovery-The Data - Recovery Solution  <b>Cybercrimes and types, Crime Specific investigation</b></p>	<b>15</b>
<b>Unit II</b>	<p><b>Evidence Collection and Data Seizure:</b> Why Collect Evidence? Collection Options Obstacles-Types of Evidence-The Rules of Evidence-Volatile Evidence-General Procedure-Collection and Archiving-Methods of Collections- Art Facts-Collection Steps - Controlling Contamination: The chain of custody.  <b>Duplication and Preservation of Digital Evidence:</b> Preserving the Digital Crime Scene-Computer Evidence processing steps-Legal Aspects of collecting and Preserving Computer forensic Evidence.  <b>Live Forensic:</b> Collection of Live Evidence from Computer using FRAT,OS Forensic.  <b>Computer image Verification and Authentication:</b> Special needs of Evidential Authentication - Practical Consideration-Practical Implementation.</p>	<b>15</b>
<b>Unit III</b>	<p><b>Computer forensic analysis and validation:</b> Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions.  <b>Network Forensics:</b> Network forensic overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honey net and botnet</p>	<b>15</b>

	<p>project.</p> <p><b>Processing crime at incident scenes:</b> Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.</p>	
<b>Unit IV</b>	<p><b>Computer Forensic Tools:</b> evaluating computer forensic tool needs, computer forensic software tools, computer forensic hardware tools, validating and testing forensic software.</p> <p>Introduction, Examining a breadth of products, Cyber forensic tools, good, better, best: Right incident response tool for organization, Tool review forensic tool kit, EnCase, Cyber check suites, Disk imaging. Specifications for forensic tools tested. Evidence collection and analysis tools, Volatile and nonvolatile evidences collection (FTK, TSK, Autopsy, DD, EnCase etc.), Disk imaging/ cloning, File system (Details of file system, Data structure of file system, Data recovery in different file system</p>	<b>15</b>

**Text books and Additional References:**

1. Computer Forensics, Computer Crime Investigation by John R, Vacca, Firewall Media, New Delhi.
2. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Stuart, CENGAGE Learning.
3. Real Digital Forensics by Keith j. Jones, Richard Bejitlich, Curtis W. Rose, Addison Wesley Pearson Education
4. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brain Jenkinson, Springer International edition.
5. Computer Evidence Collection & Presentation by Chrostopher L.T. Brown, Firewall Media.
6. Homeland Security, Techniques & Technologies by Jesus Mena, Firewall Media.
7. Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M. Slade, TMH 2005
8. Windows Forensics by chad Steel, Wiley India Edition

Course Code	Title	Credits
<b>USFS 507</b>	<b>Law – V</b>	<b>2</b>

**Course Objectives:**

The Code of Criminal Procedure provides the machinery for the detection of crime, apprehension of suspected criminals, collection of evidence, determination of the guilt or innocence of the suspected person, and the imposition of suitable punishment on the guilty. It is further aimed at trying to provide a balance between the needs of the investigating and adjudicatory bodies to detect crime, maintain law and order and the rights of the accused

The primary objectives of this course are to:-

- To familiarize the students with the crucial aspects relating to investigation and trial of offences (like initiation of criminal cases, powers and duties of police during investigation of offences, stages of criminal trial, functions, duties, and powers of criminal courts).
- To sensitize the students about critical issues in administration of criminal justice (like protection of human rights of accused, victims, principles of fair trial)

**Course Outcomes:**

- To familiarize the students with the concept of ‘fair trial’ and constitutional perspective
- To develop the understanding of Warrant trials, summons cases and summary trial and Pardoning provisions as per statute
- To expose the students with latest amendments to the statute and its impact to Criminal Justice System
- To develop the understanding of the students with inquiry proceedings and bail provisions under Cr.P.C.

Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	<b>Introduction to crime, causes and kinds :</b>  Nature and Concept of crime, Essential elements of crime, Types of crime, Causes of crime: Social Causes of Crime, Economic Causes of Crime, Physical and Psychological causes of crime, Geographical Causes of Crime. Organized Crimes ,Environmental Crimes, Crime and Politics Economic Crimes ,White Collar Crimes Juvenile Delinquency and Female Delinquency Terrorism Cyber Crimes	<b>15</b>
<b>Unit II</b>	<b>Pre-Trial Proceedings</b> <b>Information to Police &amp; their Powers to investigate Jurisdiction of</b>	<b>15</b>

	Criminal Courts in Inquiries & Trials Conditions requisite for Initiation of proceedings Complaints to Magistrates Commencement of proceedings before Magistrates Provisions as to Bail & Bonds	
<b>Unit III</b>	<b>Trial Proceedings</b> Framing of Charge & Joinder of Charges Trial before a Court of Session Trial of Warrant cases by Magistrates Trial of Summons cases by Magistrates Summary Trials Evidence in Inquiries & Trials & General provisions	<b>15</b>
<b>Unit IV</b>	<b>Evidence In Inquiries And Trials</b> Mode of taking and recording evidence Commissions for the examination of witnesses General Provisions As To Inquiries And Trials Provisions As To Accused Persons Of Unsound Mind Provisions As To Offences Affecting The Administration Of Justice	<b>15</b>

**Text books and Additional References:**

1. Criminology and Penology, Second Edition, Paranjape N.V., Central Law Publication, Allahabad, U.P, 2001
2. Crime and Criminology, Rohinton Mehta
3. Crime and Science: The New Frontier in Criminology, Jurgen Thorwald
4. The Oxford Handbook of Criminology, Maguire Mike, Morgan Rod and Reiner Robert, Oxford University Press, 2007
5. Principle of Criminology, E.H. Sutherland, Times of India Press, (6th Edition), Bombay, 1968
6. Criminology, Siegal Larry J, Wordsworth Thomson Learning, New Delhi, 2007



## B.Sc. (FORENSIC SCIENCE)

### Semester V – Practical

Course Code	Title	Credits
<b>USFS 5P1</b>	<b>Forensic Science and Chemical Science Practical</b>	<b>2</b>
Practical No.	Title of the Practical	No. of Practical
<b>Forensic Science Practical</b>		
<b>1</b>	To identify blood stains patterns	1
<b>2</b>	To determine angle of impact and directionality of blood stains.	1
<b>3</b>	To study types of blood stain pattern on various surface	1
<b>4</b>	To study the working and operation of VSC	1
<b>5</b>	To study the working and operation of ESDA	1
<b>6</b>	To study the working and operation of Comparison and Stereomicroscope	1
<b>7</b>	To study the working and operation of various Spectrophotometric methods: UV-VIS, IR/FTIR, Raman, AAS, AES, Mass Spectrometers, ICP	4
<b>8</b>	To study the working and operation of various Chromatographic techniques: TLC, HPTLC, HPLC/UPLC, GC	4
<b>Chemical Science Practical</b>		
<b>1</b>	Introduction to Forensic Chemistry lab apparatus and instruments, Laboratory safety rules, MSDS.	1
<b>2</b>	Identification of commonly used organic solvents/ acids/ bases by physicochemical properties (smell, density, pH, refractive index, viscosity, boiling point, etc.)	1
<b>3</b>	To determine the relative viscosity of given liquid by using Ostwald's Viscometer.	1
<b>4</b>	To determine surface tension of the given liquid by using stalagmeter.	1
<b>5</b>	Analysis of single organic compound	04
<b>6</b>	To determine the strength of the given acid conductometrically using standard alkali solution.	1
<b>7</b>	To determine strength of given acid/base.	1
<b>8</b>	To determine the density of given alcoholic liquid.	1
<b>9</b>	To standardize KMnO <sub>4</sub> solution and find strength of the given oxalic acid solution.	1
<b>10</b>	Industry/Laboratory Visit	1
<b>Text books and Additional References:</b>		
1. Jerry Mohrig's Laboratory Techniques In Organic Chemistry 4th Ed by W.H.		

Freeman, ISBN 1464134227

- Vogel's textbook of macro and semi-micro qualitative inorganic analysis, 5<sup>th</sup> Ed, Longman Group Ltd, 1979
- Vogel's textbook of quantitative chemical analysis, 5<sup>th</sup> Ed, Longman Scientific and Technical, 1989

Course Code	Title	Credits
<b>USFS 5P2</b>	<b>Physical Science and Biological Science Practical</b>	<b>2</b>
Practical No.	Title of the Practical	No. of Practicals
<b>Physical Science Practical</b>		
1	Standard operation procedure for Vernier caliper, micrometer screw and travelling microscope.	1
2	Determine the combined focal length of given lens system.	1
3	Determine the angle of prism using spectrometer.	1
4	Determine the refractive index of material of prism using spectrometer.	1
5	Determine the magnification of given microscopes.	1
6	Determine the resolving power of microscope.	1
7	Determine the radius of capillary using travelling microscope.	1
8	Determine the radius of curvature of plano convex lens by Newton's Rings.	1
9	Determine the thickness of thin foil using air wedge	1
10	Measure the divergence of given laser.	1
11	Determine the wavelength of light using plane transmission gratings.	1
12	Determine the numerical aperture of optical fibre	1
13	Determine the numerical aperture of optical fibre.	1
<b>Biological Science Practical</b>		
1	Introduction to instrument and Glassware of the laboratory	1
2	To Study the calibration of laboratory equipment	1
3	To study laboratory safety practices	1
4	Beer-Lamberts Law (Validation)	1
5	Qualitative analysis of sugar, proteins, lipids	1
6	Qualitative analysis of Proteins	1
7	Qualitative analysis of Lipids	1
8	Qualitative analysis of nucleic acids	1
9	Determination of pH of any fluid and iso-electric point of protein	1

10	Determination of saponification value and rancidity of fats	1
11	Determination of GOD /POD activity in serum/plasma	1
12	Separation of amino acids and Protein or sugar using paper Chromatography techniques (Radial/Ascending)	1
Course Code	Title	Credits
<b>USFS 5P3</b>	<b>Psychology and Computer Science Practical</b>	<b>2</b>
<b>Practical No.</b>	<b>Title of the Practical</b>	<b>No. of Practical</b>
<b>Psychology Practical</b>		
<b>1</b>	Introduction To Psychology Practical's	<b>2</b>
<b>2</b>	Objective Personality Test: Locus Of Control Test	<b>3</b>
<b>3</b>	Projective Personality Test: House, Tree, Person Test	<b>3</b>
<b>4</b>	Anxiety Test	<b>1</b>
<b>5</b>	Muller- Lyer ( Perception) Experiment	<b>1</b>
<b>6</b>	Emotional Intelligence Test	<b>1</b>
<b>7</b>	Type A/B Behavior Pattern	<b>1</b>
<b>8</b>	Frustration Test	<b>1</b>
<b>9</b>	Depth Perception	<b>1</b>
<b>10</b>	Projective Personality Test: Sentence Completion Test	<b>1</b>
<b>Computer Science Practical</b>		
<b>1</b>	Hands-on on Computer hardware	<b>1</b>
<b>2</b>	Study of various commands in windows and Linux	<b>1</b>
<b>3</b>	Installation of Virtual Box	<b>1</b>
<b>4</b>	Installation of OS/ Windows	<b>1</b>
<b>5</b>	Installation of OS/ Linux	<b>1</b>
<b>6</b>	To create and run Live operating system	<b>1</b>
<b>7</b>	Disk partitioning	<b>1</b>
<b>8</b>	To configure network devices -1 (computer)	<b>1</b>
<b>9</b>	To configure network devices -2 (Wi-Fi router)	<b>1</b>
<b>10</b>	To configure network devices -3 (virtual OS)	<b>1</b>
<b>11</b>	Advanced Google search	<b>1</b>

**T. Y. B.Sc. (Forensic Science) (Semester VI) Credits**

**To be implemented from Academic Year 2024-2025**

Class	Title	Per Week		15 Weeks (Per Sem)		Per Sem (Hours)		Marks		Credits		Total Credits
		L (50 Min)	P (50 Min)	L	P	L	P	TH	PR	L	P	
USFS 601	Forensic Science–VI	4		60		50		100		2		2
USFS 602	Chemical Science – VI	4		60		50		100		2		2
USFS 603	Physical Science – VI	4		60		50		100		2		2
USFS 604	Biological Science – VI	4		60		50		100		2		2
USFS 605	Psychology – VI	4		60		50		100		2		2
USFS 606	Computer Science – VI	4		60		50		100		2		2
USFS 607	Law – VI	4		60		50		100		2		2
USFS 6P1	Forensic Science and Chemical Science Practical		6		90		72		100		2	2
USFS 6P2	Physical Science and Biological Science Practical		6		90		72		100		2	2
USFS 6P3	Psychology and Computer Science Practical		6		90		72		100		2	2
<b>Total</b>	<b>--</b>	<b>28</b>	<b>18</b>	<b>420</b>	<b>270</b>	<b>350</b>	<b>216</b>	<b>700</b>	<b>300</b>	<b>14</b>	<b>6</b>	<b>20</b>

## B.Sc. (FORENSIC SCIENCE)

### Semester VI– Theory

Course Code	Title	Credits
<b>USFS 601</b>	<b>Forensic Science – VI</b>	<b>2</b>
<p><b>Course Overview:</b> The course covers Crime scene reconstruction, basic statistical method, Death scene investigation and Ethics in Forensic Science</p> <p><b>Course Objectives:</b></p> <ul style="list-style-type: none"><li>• To understand the process of Crime Scene Reconstruction</li><li>• To understand the investigation process involving death</li><li>• To learn the basic statistical methods employed in analysis of data in forensic science</li><li>• To understand the ethical issues in the profession of forensic science.</li></ul> <p><b>Course Outcome:</b></p> <ul style="list-style-type: none"><li>• Formulate hypothesis and test it using crime scene reconstruction</li><li>• Carry out investigation in cases involving death.</li><li>• Employ statistical methods to evaluate and interpret data in forensic science</li><li>• Execute ethical behaviour in the profession of forensic science</li></ul>		
Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	<b>Crime Scene Reconstruction</b> <ol style="list-style-type: none"><li>1. Crime Scene Reconstruction (CSR): A history of crime reconstruction</li><li>2. Ethics of crime scene reconstruction</li><li>3. Principles of crime scene reconstruction</li><li>4. Methods and Steps involved in crime reconstruction</li><li>5. Evidence dynamics</li><li>6. Role of physical evidence in reconstruction</li><li>7. Role of trace evidence in reconstruction</li><li>8. Crime Scene Reconstruction of various crimes (Hit &amp; Run, homicide, arson, shooting)</li><li>9. CSR Report</li></ol>	<b>15</b>
<b>Unit II</b>	<b>Death Scene Investigation:</b> <ol style="list-style-type: none"><li>1. Introduction to Death Scene Investigation</li><li>2. Death Scene Response</li><li>3. Tools for death investigation</li><li>4. Role of various experts in death investigation</li><li>5. Investigation in Natural, Homicide, Suicidal and Accidental deaths</li></ol>	<b>15</b>

	6. Scientific and Research ethics	
<b>Unit III</b>	<b>Statistics in Forensic Science</b> <ol style="list-style-type: none"> <li>1. Introduction and importance of statistics in forensics</li> <li>2. Data: types, frequency distribution and presentation</li> <li>3. Measure of central tendency</li> <li>4. Measure of dispersion</li> <li>5. Skewness, kurtosis and moments</li> <li>6. Normal distribution and standard normal distribution</li> <li>7. Test of hypothesis: parametric and non-parametric test</li> <li>8. Test statistics</li> <li>9. Analysis of variance</li> <li>3.10. Introduction to probability theory</li> </ol>	<b>15</b>
<b>Unit IV</b>	<b>Ethics in Forensic Science</b> <ol style="list-style-type: none"> <li>1. A brief history of ethics</li> <li>2. Code of ethics in Forensic Science</li> <li>3. Ethics in Criminal Justice System</li> <li>4. Bias and Errors</li> <li>5. Criminal and Investigation ethics</li> <li>6. Ethics in Courtroom and Testimony</li> </ol>	<b>15</b>

**Text books and Additional References:**

1. Crime Scene Management: Scene Specific Methods. (2016). Germany: Wiley.
2. Gardner, R. M., Bevel, T. (2009). Practical Crime Scene Analysis and Reconstruction. Ukraine: CRC Press.
3. Nordby, J. J. (2012). Scientific Foundations of Crime Scene Reconstruction: Introducing Method to Mayhem. United Kingdom: Taylor & Francis.
4. Plotkin, S., Ogle, R. R. (2017). Crime Scene Investigation and Reconstruction. (n.p.): Pearson Education.
5. Chisum, W. J., Turvey, B. E. (2011). CrimeReconstruction. Netherlands: Elsevier Science.
6. Gardner, R. M., Krouskup, D. (2018). Practical Crime Scene Processing and Investigation, Third Edition. United States: Taylor & Francis.
7. Miller, M. T., Lee, H. C., Palmbach, T. (2001). Henry Lee's Crime Scene Handbook. Netherlands: Elsevier Science.
8. Maloney, M. S. (2017). Death Scene Investigation: Procedural Guide, Second Edition. United States: Taylor & Francis.
9. Wagner, S. A. (2017). Death Scene Investigation: A Field Guide. Ukraine: Taylor & Francis.
10. Lunn, M. M. (2016). Essentials of Medicolegal Death Investigation. United Kingdom: Elsevier Science.
11. Adam, C. (2010). Essential Mathematics and Statistics for Forensic Science. United Kingdom: Wiley.
12. Lucy, D. (2013). Introduction to Statistics for Forensic Scientists. Germany: Wiley.

13. Mahajan, B., Khanal, A. B. (2008). *Methods in Biostatistics: For Medical Students and Research Workers*. India: Jaypee Brothers Medical Publishers Pvt. Limited.
14. Willard, C. A. (2020). *Statistical Methods: An Introduction to Basic Statistical Concepts and Analysis*. United Kingdom: Taylor & Francis.
15. *Ethics in Forensic Science*. (2012). Netherlands: Elsevier Science.
16. Barnett, P. D. (2001). *Ethics in Forensic Science: Professional Standards for the Practice of Criminalistics*. United Kingdom: Taylor & Francis.
17. Bowen, R. T. (2017). *Ethics and the Practice of Forensic Science*. United Kingdom: Taylor & Francis.
18. Franck, H., Franck, D. (2020). *Ethical Standards in Forensic Science*. United Kingdom: Taylor & Francis.
19. *Professional Issues in Forensic Science*. (2015). Netherlands: Elsevier Science.
20. Siegel, J. A., Houck, M. M. (2015). *Fundamentals of Forensic Science*. Netherlands: Elsevier Science.
21. *Crime Scene to Court: The Essentials of Forensic Science*. (2020). United Kingdom: Royal Society of Chemistry.

Course Code	Title	Credits
USFS 602	Chemical Science – VI	2
<p><b>Prerequisites for the course:</b> Basic concepts about toxicology and spectroscopy that are discussed in previous classes..</p> <p><b>Course Objectives:</b> Introduction to applied forensic chemistry and toxicology. Introduction to molecular spectroscopic methods in the forensic chemistry and toxicology.</p> <p><b>Course Outcome:</b> To understand the applied chemistry of the Licit and illicit liquors, Narcotic Drug and Psychotropic Substances, Nuclear Magnetic Resonance (NMR) Spectroscopy, and Mass Spectrometry.</p>		
Unit No.	Contents of Unit	No. of Lectures
Unit I	<p><b>Licit and illicit liquors</b> Alcoholic and non-alcoholic beverages and their composition, Proof spirit, absorption, de-toxification and excretions of alcohol; Analysis of alcoholic beverages as per BIS and PFA Act.; Detection and determination of ethanol, furfural, organic acids, aldehydes, chloral hydrate, methanol and ethylene glycol in liquors by colour test, TLC, GC and GC-MS; methods of distinction between licit and illicit liquors; Estimation of ethanol, methanol, furfural, etc. from alcoholic beverages by titrimetric methods. Breath analysis, Different types of breath analyser and their working; Blood alcohol analysis by GC and colour tests.</p>	15
Unit II	<p><b>Forensic Toxicology</b> Introduction and concept of forensic toxicological examination and its significance. Collection and preservation of toxicological exhibits, signs and symptoms of poisoning, mode of action and its effect on vital functions, medico-legal and post mortem examination reports.</p> <p><b>Narcotic Drug and Psychotropic Substances</b> Introduction, History, Classification of Narcotics and other drugs, Drug effects, drug Hazards, Tolerance and dependence of drugs,</p>	15



	Problems of drug addiction. Identification of a drug addict, drug addicts and crimes, Analytical techniques for identification of drugs. Introduction to NDPS act	
<b>Unit III</b>	<b>Nuclear Magnetic Resonance (NMR) Spectroscopy</b> Introduction, theory of <sup>1</sup> H NMR spectroscopy, Nuclear shielding and deshielding, Chemical shift, Spin-spin splitting and Coupling constant. Integration and Areas of NMR signals. Brief overview of <sup>13</sup> C NMR spectroscopy, Interpretation of NMR spectra of simple organic molecules, Applications and Problem related to the structure elucidation by NMR technique.	<b>15</b>
<b>Unit IV</b>	<b>Mass Spectrometry</b> Introduction, Theory of Mass spectrometry, instrumentation, ionization methods with special emphasis on electron ionization, mass analyzers with special emphasis on magnetic sector, fragmentation pathways for organic functional groups, common mass fragments, information obtained from mass spectrum, interpretation of mass spectra of simple organic compounds, Applications and Numerical problems based on mass spectrometry.	<b>15</b>

**Text books and Additional References:**

1. Bamford F.; Poisons : Their Isolation and Identification, (3rd Edition); McGraw-Hill Press, 1955
2. Modi, Jaisingh, P.; Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Publication (2001)
3. Clarke E.G.C. and Moffat A.C.; Clark's Isolation and Identification of Drugs (Edition 2 revised); Publisher Pharmaceutical Press. 1986
4. "Working Procedure Manual on Chemistry", Directorate of Forensic Science MHA Govt. of India, 2005.
5. Anthony C. Moffat, M. David Osselton, Brian Widdop, Jo Watts. Clarke's Analysis of Drugs and Poisons: In Pharmaceuticals, Body Fluids and Postmortem Material, Pharmaceutical Press, 2011
6. F.W. Fifield and D. Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London.
7. M. Donhrow, Instrumental Methods in Analytical Chemistry; Their Principles and practice; Vol.2, optical method, Pitaman, New York.
8. Donald L. Pavia, Gary M. Lampman, George A. Kriz and James R. Vyvyan; Introduction to Spectroscopy, 5th Ed.; Cengage Learning India Private Limited, ISBN 978-9381466476, 2015
9. C.N. Banwell, E.M. McCash; Fundamentals of Molecular Spectroscopy, 5<sup>th</sup> Ed., Tata Mcgraw Hill Publishing, ISBN 9781259062599, 2016

Course Code	Title	Credits
<b>USFS 603</b>	<b>Physical Science – VI</b>	<b>2</b>
<b>Course Outcomes:</b>		
At the completion of this course the candidate can: Know and understand		
<ul style="list-style-type: none"> <li>• Exterior ballistics which deals with the various aspects of trajectory of bullet in ambient conditions, Maximum horizontal and vertical range of shot pellets, Ricochet etc</li> <li>• Various aspects of wounds caused by bullets</li> <li>• Various Forensic Applications in Trace Analysis which includes analysis of glass soil and fiber samples</li> <li>• Various microscopy techniques used in forensic science</li> </ul>		
Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	<p><b>Ballistics</b>  <b>Exterior Ballistics:</b>  Trajectory formation, Vacuum trajectories, Range, Experimental determination and shape of trajectory, Spin, Drift, Angle of fire, Structure of the projectile, Sectional density, Influence of earth and escape velocity, Air resistance, Retardation, Wind deflection, Firing guns in the air, Ricochet.</p> <p><b>Terminal Ballistics:</b> Introduction, Stopping Power of Bullet, Injuries and the Quantity of Energy of Projectiles, Shockwave and Cavitation Effect, Wounding Mechanism, Elements of Wound Ballistics; Nature of Target, Velocity of Projectile, Constructional Features of Projectile. Range; Classification of Range(Maximum Horizontal/ Vertical, Effective, Dangerous, Safe and Legal Sense), Contact Range, Point blank Range, Near Range, Chips Range, Distant Range. Penetration of Shots in Different Regions of the Body.</p>	<b>15</b>
<b>Unit II</b>	<p><b>Footwear Impressions:</b>  <b>Casting 3-D Footwear Impressions:</b> Introduction to casting, Importance of casting, Benefits of casts over photographs, Casting materials, Methods of casting with dental stone, Casting footwear impressions in snow.</p> <p><b>Treatment of 2-D Footwear Impressions:</b> Lifting 2-D footwear impressions, Lifting impressions electro statically and electrostatic lifting devices, Gelatin and adhesive lifting, Other lifting materials and choices, Powdering impressions, Deformable impressions, Impressions on carpets, cushions, grass and skin.</p>	<b>15</b>

	<b>Enhancement of Footwear Impressions:</b> Specialized lighting and photographic methods, Chemical enhancement, Other enhancement techniques.	
<b>Unit III</b>	<p><b>Trace Evidences and Its Analysis:</b> Physical properties of materials: temperature, weight and mass, density, refractive index and their forensic importance.</p> <p><b>Glass:</b> Composition of glass, Comparison of glass fragments, Measuring and comparing density and refractive index of glass, classification of glass samples, Glass fractures, Collection and preservation of glass evidence.</p> <p><b>Soil:</b> Significance of soil evidence, Variations in soil, Collection and preservation of soil evidence, Forensic examination of soil.</p> <p><b>Fibre:</b> Types, Identification and comparison of manufactured fibres (Microscopic examination, Dye composition, Chemical composition, Other properties for examination), Significance of match, Collection and preservation of fibre evidence. Forensic examination of cloth and cloth fibres</p> <p><b>Paint:</b> Composition of paint, Classification of common paints, Pigment Volume concentration number, Microscopic examination of paint, Analytical tools used in paint comparison, significance of paint evidence, collection and preservation of paint evidence. Forensic examination of paint.</p> <p><b>Plastic:</b> Classification of plastics according to thermal and mechanical property, Plastics in common use.</p>	
<b>Unit IV</b>	<p><b>Microscopes and Imaging devices:</b> Basics of microscope, common terms used in microscopy, Construction, working, applications and limitations of -Compound microscope, Comparison microscope, Stereomicroscope, Polarizing microscope, Phase contrast Microscope and Digital Microscope. Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), X- Ray Fluorescence (XRF), Atomic Force and Tunneling Scanning Microscope (AF &amp; TS).</p>	<b>15</b>

**Text books and Additional References:**

1. Footwear Impressions Evidence Detection, Recovery, and Examination Second Edition by William J. Bodziak, CRC Press.
2. Criminalistics- An Introduction to Forensic Science By Richard Saferstein.
3. Measurement, Instrumentation and Experiment Design in Physics and Engineering By Michael Sayer and Abhaaiman Singh.
4. Laboratory Procedural manual, Physics Section, DFSL, Mumbai.
5. Laboratory Procedural Manual, Forensic Ballistics, DFS, New Delhi.
6. Trace Evidence By Max M. Houck.
7. Hand book of Firearms and Ballistics By Brain J. Heard.
8. Forensic Science in Criminal Investigation and Trials By B. R. Sharma.

9. Firearms and Forensic Ballistics By S. N. Gaur and B. C. Jauhari.  
 10. Handbook of Microscopy; Marcel Locquin, Maurice Langeron.

Course code	Title	Credits
<b>USFS 604</b>	<b>Biological Science –VI</b>	<b>2</b>
<p><b>Course Overview:</b> The covers Forensic Entomology, Microbial Forensics, Forensic Botany and Wildlife Forensics.</p> <p><b>Course Objectives:</b>            To identify, classify forensically significant insects and understand their role in forensic investigations.            To understand bioterrorism and to identify an act of bioterrorism            To identify and examine botanical evidences of forensic significance            To familiarize the students with the various aspects of wildlife forensics.</p> <p><b>Course Outcomes:</b>            Development of collection procedures for entomological evidence, and calculation of PMI from entomological evidence.            Understanding of the response to bioterrorism and identification of the agents of such act            Examination and analysis of plants and plant derivatives involved in forensics, and understanding of their significance for crime investigation            Performing investigation in wildlife crimes and developing better strategies for wildlife conservation.</p>		
Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	<p><b>Forensic Entomology</b>            Introduction &amp; History of forensic entomology and development.            Identification of insects, insect growth and life cycle, Dipterans Larval Development, Successional Colonization of Body.            Introduction of forensically important insects: Necrophagous Species (Calliphoridae, Sarcophagidae).            Determination of displacement and disturbance of the body, Presence and Position of wounds, Determination of Time elapsed since death: role of entomology in the determination of PMI.            Drugs consumption a, Human &amp; Animal neglect or abuse, Collection and preservation of insects, Challenges encountered in Entomology.</p>	<b>15</b>
<b>Unit II</b>	<p><b>Microbial Forensics:</b>            History and development of forensic microbiology.            Understanding Bioterrorism: Types of biological agents – Category A, B, C epidemiology (one example of each type).</p>	<b>15</b>

	CDC Planning and response to bioterrorism: Preparedness, Bio- surveillance, Bio-defence. Prevention of Terrorism Act, 2002: Obligations and Punishments	
<b>Unit III</b>	<b>Forensic Botany</b> Botanical evidence in the legal investigation, stomach content of the plant, storage, analysis, and documentation of botanical evidence. Identification, classification and examination of plant derivative (leaves, flower, branches, stem, root, wood, grasses, fruits, and seeds) Forensic analysis of pollen grains, algae.  Investigation of ornamental, imported, stolen, endangered plants. Limnology (collection of diatoms from the drowned body, collection of the control sample, extraction, digestion, examination, comparison, and identification) Poisonous plants and drugs of abuse ( <i>Abrus precatorious</i> , <i>Ricinus communis</i> , <i>Opium</i> , <i>Cannabis</i> )	<b>15</b>
<b>Unit IV</b>	<b>Wildlife Forensics</b> Introduction and importance of wildlife, Protected and endangered spe (Red Data List). Identification of wildlife materials by conventional modern methods (Example: skin, antlers, fur, bones, nails, horn, te flowers, and plants). Identification by Pugmarks, wildlife census.  Feather structure and topography Birds flight and means of locomot Strikes, and collisions, Applications of Forensic Ornithology Poisonous animals: venomous snakes, scorpions. Collection, preservation, and transportation of wildlife specimens: Collection and preservation of carcasses (Taxidermy), Specimen Shipment.	<b>15</b>

**Text books and Additional References:**

1. Practical Crime Scene Analysis & Reconstruction – Roos M. Gardner & Tom Bevel
2. Death Scene Investigation – Scott A. Wagner
3. Forensic Science in criminal investigation and trials – B.R. Sharma
4. Forensic Science in Crime Investigation – Dr. Mrs. Rukmani Krishnamurthy
5. Forensic Science – An introduction to scientific and investigative techniques – Stuart H. James Jon J. Nordby
6. Forensic Medicine – P.V. Guharaj & M. R. Chandran
7. Bryant, V.M. Jr, Mildenhall, D.C. and Jones, J.G., Forensic Polynology in the United States of America Polynology. 1990, 14.PP.193-208
8. Faegri, K. Iverson, J. and Krzywinski, K. Textbook of Pollen Analysis 4th Edition. John Wiley & Sons, New York 1989.
9. Microbial forensics By Roger Breeze, Bruce Budowle, Steven E.

Schutzer. Elsevier Academic Press

10. The Forensic Laboratory Handbook Procedures and Practice By Ashraf Mozayani, Carla Noziglia. 2nd edition. 2011. Human Press.
11. Forensic Science in Wildlife Investigations. Adrian Linacre Taylor and Francis, 2009
12. The Wildlife Detectives: How Forensic Scientists Fight Crimes Against Nature By Donna M. Jackson, Wendy Shattil, Bob Rozinski UniversalAthenaeum (Denver, CO, U.S.A.)
13. Forensic Entomology: The Utility of Arthropods in Legal Investigations Jason H. Byrd, James L. Castner Taylor and Francis, 2009
14. Forensic entomology: an introduction By Dorothy E. Gennard Wiley.
15. Forensic palynology Dallas Mildenhall, Patricia Wiltshire, Vaughn Bryant Elsevier, 2006
16. Forensic palynology: an in-depth look at its indispensable value National University, San Diego, 2002

Course Code	Title	Credits
<b>USFS 605</b>	<b>Psychology – VI</b>	<b>2</b>
<p><b>Course objectives-</b></p> <ul style="list-style-type: none"> <li>• A learner understands different psychological theories related to criminal behavior</li> <li>• Also it explains about how to control different abnormal issues with the help of psychological assistance that is rehabilitation and counseling.</li> <li>• It explains the nature of juvenile delinquent behavior and its aspects.</li> <li>• It further explains the role of media in human life</li> </ul> <p><b>Course outcome</b></p> <ul style="list-style-type: none"> <li>• <b>Identify-</b> The learner learns the abnormal psychology and its influence on criminal behaviour also he can deal with different psychological issues and use of psychotherapies for different psychological issues.</li> <li>• <b>Describe-</b> The learner can describe the factors leading to delinquent behaviour, cause and preventive measures.</li> <li>• <b>Differentiate-</b> The learner differentiates different psychological, mental or personality disorders.</li> <li>• <b>Analyze-</b> The learner learns the usages of projective techniques, can formulate questions regarding polygraph, can form probe, that helps him to make criminal psychological profiling.</li> <li>• <b>Review-</b> Over all these techniques helps the learner orient with instruments, use in detection of deception. It helps learner to understand the role of psychology in forensic area, as human behaviour is affected by different motives, learning, emotions and cognition. As far as the crime is concern, the crime itself is a behavior and behind it there is always a reason. Thus learner must know why crimes take place. Along with the forensic assessment, behavioural assessment is equally important for crime investigation. Understand and estimate from various theories the association between intelligence, personality and offending behavior. Perform various psychological tests and evaluate the predictors of criminal behavior as well as predict the possible perpetrator.</li> </ul>		
Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	<p><b>Psychological Therapies</b></p> <p>1. <b>Psychoanalytical therapy:</b> Free Association, Dream analysis, Therapeutic transference, Interpretation.</p>	<b>15</b>

	2. <b>Behavior therapy:</b> Cognitive behavior therapy(REBT, Albert Ellis, Aaron Beck), Flooding, System desensitization, Aversion therapy.	
<b>Unit II</b>	<b>Rehabilitation, Recidivism and Counseling Psychology</b> 1. <b>Rehabilitation:</b> Types of rehabilitation, process, techniques and skills in rehabilitation, rehabilitation of offenders, rehabilitation of victims of crime. 2. <b>Recidivism:</b> Introduction, Criminal recidivism, Recidivism measures and models. <b>Counseling:</b> Definition, aims and fields of counseling, skills of a counselor, nature and goal of correctional counseling	<b>15</b>
<b>Unit III</b>	<b>Juvenile Delinquency</b> 1. Delinquency: Definition, Nature 2. Causes of Juvenile Delinquency 3. Bio-Psychological Theories of Juvenile Delinquency- Biological and Psychological Approach, 4. Prevention and Control of Juvenile Delinquency	<b>15</b>
<b>Unit IV</b>	<b>Media, Mental Health And Ethics</b> 1. Suggestions for Improving Media Coverage of Mental Health Issues 2. Addiction to The Internet & Online Gaming 3. Public Attitude, Media and Mental Illness 4. Movies and Mental Illness 5. Importance of Media on Human Sexual Behavior <b>Ethical And Legal Aspects of Suicide</b> 1. Suicide- Abetment and Attempt 1. Attempt to Suicide 1. Suicide- Epidemiology, Self Immolation 2. Public Health Concerns in The Field of Suicide	<b>15</b>

**Text books and Additional References:**

1. Bull, R.(2011).Forensic Psychology(Four volume set).LA: Sage publications.
2. Davies, G. & Beech,A. (2012).Forensic Psychology : Crime, Justice, Law, Interventions (2nd ed.). BPS Blackwell: BPS text books & John Wiley and Sons Ltd.
3. Scott, A.(2010).Forensic Psychology. NY: Palgrave MacMillan.
4. Donohue,W.T.& Levensky,T.R.(2004).Handbook of Forensic Psychology. NY: Elsevier.
5. Goldstein,A.M. Volumeed. Weiner,I.B.Seriesed.(2003).Handbook of Psychology: Forensic Psychology (Vol. 11).NJ: J. Wiley and Sons.
6. Heilbrun,K,Marczyk,G.R.and DeMatteo,D.(2002)Forensic Mental Health Assessment: A Casebook. UK:OUP.
7. McCaffrey,R.J., Williams,A.D.,Fisher,J.M.,and Laing,L.C.(1997).The practice of Forensic neuropsychology.NY: Plenum press.
8. Weiner,I.B.& Hess,A.K.(2006).Handbook of Forensic Psychology. N J:J.Wiley andSons.



9. Forensic and Criminal Psychology, Dennis Howitt, 2002 Pearson Education LTD, England.
10. 'Introduction to Forensic Psychology-Court, Law Enforcement and Correctional Practices', Stacy L. Shipley, Bruce A. Arrigo, 3rd edition, 2012, Elsevier Academic press.
11. 'Forensic Psychology and Neuropsychology for Criminal and Civil Cases', Harold V. Hall, 1st edition, 2008, CRC Press.
12. 'Criminology' [2005] S.M.A. Qadri, fifth edition, EBC Publication, Lucknow  
'Stress Management', Walt Schafer, 4th edition Cengage Learning India Private Ltd., New Delhi.
13. Diagnostic and Statistical Manual of Mental Disorders (DSM) (5th Edition) by American Psychiatric Association (2013).
14. 'Criminal Profiling-An Introduction to Behavioural Evidence Analysis', Brent Turvey, Edition 2nd, 2006, Elsevier Academic press.
15. 'Handbook of Forensic Psychology', Prof Dr. Vimala Veeraraghwan, Edition 1st, 2009, Selective and Scientific Books Publications, New Delhi.
16. 'Handbook of Forensic Psychology', Irving B. Weiner, Allen K. Hiss, Edition 3rd, 2006, Wiley Publication.
17. 'Theoretical Psychology', Moazziz Ali Beg, Sangeeta Gupta Beg, Vol [03], Edition 2nd, 2013, Global Vision Publishing House, New Delhi.
18. 'Theoretical Psychology', Moazziz Ali Beg, Sangeeta Gupta Beg, Vol [04], Edition 2nd, 2013, Global Vision Publishing House, New Delhi.
19. 'Abnormal Psychology-The Problem of Maladaptive Behaviour', Irwin G. Sarson, Barbara R. Sarson, Edition 11th, 2012, PHI Publication, New Delhi.
20. 'Abnormal Psychology', James N. Butcher, Susan M. Mineka, Jill M. Hooley, Edition 15th, 2014, Pearson.
21. 'Stress Management', Ruth Baer, Edition 1st 2010, Global Vision Publication House, New Delhi.
22. 'Handbook of Stress, Coping and Health', Virginia Hill Rice, Edition 1st, 2000, Sage Publications, Inc.
23. 'Juvenile and Crime In Indian', Dr. Rajesh S. Vyas, Dr. Ashok M. Shroff, Edition 1st, 2013, Shri Niwas Publications, Jaipur.
24. Parental development-Social & Emotional development-'A Text book of Child Psychology', D.N. Prabhakar, Edition 1st, 2014, Astha Publication, New Delhi.
- 25.

Course Code	Title	Credits
<b>USFS 606</b>	<b>Computer Science – VI</b>	<b>2</b>
<p><b>Course objectives-</b> This course introduce <b>Cyber security and Emerging Trend in Digital Technologies and Forensics</b></p> <p><b>Course outcome</b></p> <ul style="list-style-type: none"> <li>• Define key knowledge areas of cyber security</li> <li>• Implement various security policies.</li> <li>• Emerging Trend in Digital Technologies and Forensics:</li> </ul>		
Unit No.	Contents of Unit	No. of Lectures
<b>Unit I</b>	Speaker Identification: Forensic speaker identification Forensic phonetics Readership The take-home messages Use of Auditory analysis, Acoustic analysis, Computer technique to recognize, identify and discriminate between human voices, Voice characteristic for future verifications and identification, computer Recognition of Voice and Speech. Principles of Forensic speaker identification Characterizing forensic speaker identification: Principles of Generation of speech and its uniqueness Speaker recognition Speaker identification and verification Forensic significance: Phonemic structure.	<b>15</b>
<b>Unit II</b>	<b>E-mail investigations:</b> Exploring the role of email in investigations, exploring the role of client and server in email, investigating email crimes and violations, understanding email servers, using specialized email forensic tools. <b>Introduction to Cell phone and mobile device forensics:</b> Understanding mobile device forensic, understanding acquisition procedures for cell phones and mobile devices. <b>File system analysis:</b> What is file system? Different categories of data in file system, FAT ,NTFS and Ext file system and analysis	<b>15</b>
<b>Unit III</b>	<b>Introduction to Cyber Security:</b> Confidentiality, Integrity and Availability – Triad. Attacks: Threats, Vulnerabilities and Risk. Risk Management, Risk Assessment and Analysis. Information Classification, Policies, Standards, Procedure and Guidelines. Controls: Physical, Logical and Administrative; Security Frameworks, Defence in-depth: Layers of Security. Identification and Authentication – Factors.Authorization and Access Controls- Models, Methods and Types of Access Control. Future scope of cyber security <b>Web Security:</b> SSL Encryption, TLS, SET. Intrusion detection.	<b>15</b>

	Securing online payments (OTP).	
<b>Unit IV</b>	<b>Introduction to Emerging Trend in Digital Technologies and Forensics:</b> Data Science, Big Data, IoT, AI, Machine Learning, Deep Learning, Deep Fake, Dark Web, Cloud Technologies and other technologies.	<b>15</b>

**Text books and Additional References:**

1. Philip Rose, Forensic Speaker Identification, CRC Press, 2002 Brian Carrier, File System Forensic Analysis, Addison Wesley Professional.
2. Cory Altheide and Harlan Carvey, Digital Forensics with open source tools, Syngress.
3. Computer Forensics – Computer Crime Scene Investigation, Second Edition, John R. Vacca, Charles River Media Inc., ISBN 1-58450-389-0.
4. Practical Mobile Forensics, Satish Bommisetty, Rohit Tamma, Heather Mahalik, Packt Publishing Ltd., 2014, ISBN 978-1-78328-831-1
5. Learning iOS Forensics, Mattia Epifani, Pasquale Stirparo, Packt Publishing Ltd, 2015 ISBN 978-1-78355-351-8
6. Guide to Computer Forensics and Investigations, Fourth Edition, Bill Nelson, Amelia Phillips, Christopher Steuart, Cengage Learning, 2010, ISBN-13: 978-1-435-49883-9, ISBN-10: 1-435-49883-6
8. Wireless Crime and Forensic Investigation, Gregory Kipper, Auerbach Publications
9. Digital Evidence and Computer Crime, Third Edition Eoghan Casey. Published by Elsevier Inc
10. Mobile phone security and forensics: A practical approach by Iosif I. Androulidakis, Springer publications, 2012
11. The basics of digital forensics : the primer for getting started in digital forensics, John Sammons., Syngress publisher ,2012
12. Certified Information (Security Expert, Main Book, Innobuss Knowledge Solutions (P) Ltd.
13. Certified Ethical Hacker Manual
14. [www.hackthissite.org](http://www.hackthissite.org)
15. Security in Computing, C. P. Pfleeger, and S. L. Pfleeger, Pearson Education
16. Network and System Security by John R. Vacca, Syngrees Publication
17. Cryptography And Network Security: Principles and practice by Stallings,
18. Computer Security: Art and Science by Matt Bishop, Pearson Education.
19. Artificial Intelligence: A Modern Approach (4th Edition) (Pearson Series in Artificial Intelligence) BY Stuart Russell, Peter Norvig
1. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015
2. Kai Hwang, Min Chen, "Big-Data Analytics for Cloud, IoT and Cognitive Computing", Wiley publication
3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
20. Vijay Madiseti, Arshdeep Bahga, —Internet of Things: A Hands-On Approach
- 21.

Course Code	Title	Credits
<b>USFS 607</b>	<b>Law – VI</b>	<b>2</b>
<b>Course Objective:</b>		
The main objective of this course is to familiarize important aspects of Information Technology Law in the context of cyber forensics. Also to familiarize the students about cybercrime and analyse the digital evidences under Information Technology Law.		
<b>Course Outcome:</b>		
After completing the course, students will be familiar with:		
<ul style="list-style-type: none"> <li>• Understanding concepts of cyber space and cyber world.</li> <li>• Understand the various facets of cyber crimes</li> <li>• Understand the concepts of digital and electronic signature.</li> <li>• Understand the cyber offences and penalties under IT Law</li> <li>• Understand the Intellectual Property Rights in digital medium.</li> </ul>		
<b>Unit No.</b>	<b>Contents of Unit</b>	<b>No. of Lectures</b>
<b>Unit I</b>	Introduction to Cyber Crime Meaning & definitions of Cyber Crimes Conventional crime V/s Cyber Crimes Classification of Cyber Crimes Concept of e-Commerce, e-governance and e-Banking	<b>15</b>
<b>Unit II</b>	Introduction to Information Technology Act, 2000 Background of enactment of Information Technology Act, 2000 Objectives behind enactment of IT Act 2000 Definitions under IT Act 2000 Salient features of IT Act 2000 Relevant provisions from Indian Penal Code, Indian Evidence Act, Bankers Book Evidence Act, Reserve Bank of India Act, etc. IT Act 2000 vs. IT Amendment Act 2008	<b>15</b>
<b>Unit III</b>	Concept Of Electronic Signature And Digital Signature Relevance of Signature Handwritten signature vs Digital Signature Technological Advancement and development of signature Digital Signature under IT Act, 2000 Cryptography, Public Key and Private Key, Public Key Infrastructure	<b>15</b>

	Electronic Signature Electronic Signature vs. Digital Signature UNCITRAL Model Law on Electronic Signature Regulation Of Certifying Authorities	
<b>Unit IV</b>	Offences and penalties under IT Act 2000 Penalty and compensation for damage to computer, computer system, etc. Compensation for failure to protect data. Penalty for failure to furnish information, return, etc. Offences under IT Act 2000 (Section 65-75) Intellectual Property rights in digital medium.	<b>15</b>

**Text books and Additional References:**

1. Cyber Law in India by Farooq Ahmad- Pioneer Books
2. The Indian Cyber Law by Suresh T. Vishwanathan- Bharat Law House New Delhi
3. Guide to Cyber and E- Commerce Laws by P.M. Bukshi and R.K. Suri- Bharat Law House, New Delhi
4. Guide to Cyber Laws by Rodney D. Ryder- Wadhwa and Company, Nagpur
5. The Regulation of Cyberspace by Andrew Murray, 2006- Routledge –Cavendish
6. Cyber Law & Crimes (IT Act 2000 & Computer Crime Analysis) by Barkha & Ram Mohan, Publisher: Asian Law House, Hyderabad
7. Cyber Crime – Dr. R C Mishra, Publisher: Authorspress
8. Cyber Law and E .Commerce, David Baumer, J C Poindexter, TMG Cyberlaw Simplified Vivek Sood, TMG
9. The Law of Evidence, Dr. Sr. Myneni, New Edition, Asian Law House, 2010.
10. E-Commerce – The Cutting Edge of Business, Second Edition, Bajaj Nagar, Tata McGraw Hill, 2011.
11. Information Technology Law and Practice by Vakul Sharma- Universal Law Publishing Co. Pvt. Ltd.
12. The Code of Criminal Procedure, 21st Edition, Ratanlal and Dirajlal, Lexus Nexis, 2009.
13. Law Relating to Intellectual Property, Dr. B.L. Wadehra, Fifth Edition, Universal Law Publication, 2011

## B.Sc. (FORENSIC SCIENCE)

### Semester VI– Practical

Course Code	Title	Credits
<b>USFS 6P1</b>	<b>Forensic Science and Chemical Science Practical</b>	<b>2</b>
Practical No.	Title of the Practical	No. of Practicals
Forensic Science Practical		
<b>1</b>	Reconstruction of crime scene based on blood spatter pattern	1
<b>2</b>	Reconstruction of crime scene in arson cases	1
<b>3</b>	Scientific Report writing	1
<b>4</b>	Mock death scene crime investigation	1
<b>5</b>	To calculate mean, frequency distribution from the given data	1
<b>6</b>	To perform various parametric tests from the given data	1
<b>7</b>	To perform various non parametric tests from the given data	1
<b>8</b>	To perform Analysis of variance (ANOVA) on the given data	1
<b>9</b>	To measure skewness, kurtosis and moments from the given data	2
Chemical Science Practical		
<b>1</b>	Preparation of urea formaldehyde resin.	1
<b>2</b>	Determination of alkali content in commercially available washing soda sample.	1
<b>3</b>	Synthesis of tetra amine copper (II) sulfate monohydrate complex and its analysis.	1
<b>4</b>	Estimate the amount of copper in given solution by colorimetrically.	1
<b>5</b>	Titrimetric estimation of toxic metal (Pb/Hg/As).	1
<b>6</b>	Analysis of NDPS drugs/Pharma Drugs by color test.	1
<b>7</b>	Interpretation of given NMR spectrum of organic compound. – 04	4
<b>8</b>	Gravimetric estimation of toxic metal (Pb/Hg).	1
<b>9</b>	To determine moisture, ash content in coal by Muffle Furnace.	1
<b>10</b>	Extraction of solvent from given sample by using vacuum evaporator.	1
<b>11</b>	Analysis of fertilizer by FTIR and chemical test.	1
<b>12</b>	Color test analysis of pesticide residue – 02	2

<b>13</b>	Qualitative analysis of gun powder.	1
<b>14</b>	Analysis of Ink Sample by TLC, FT-IR.	1
<b>15</b>	Industry/Laboratory Visit	1

**Text books and Additional References:**

1. Jerry Mohrig's Laboratory Techniques In Organic Chemistry 4th Ed by W.H. Freeman, ISBN 1464134227
2. Vogel's textbook of macro and semi-micro qualitative inorganic analysis, 5<sup>th</sup> Ed, Longman Group Ltd, 1979
3. Vogel's textbook of quantitative chemical analysis, 5<sup>th</sup> Ed, Longman Scientific and Technical, 1989
4. Practical Aspects of Forensic Chemistry by Anil Kumar Theotia, Rishi Pal, 1<sup>st</sup> Ed, Selective and Scientific Books, Delhi, 2013

Course Code	Title	Credits
USFS 6P2	<b>Physical Science and Biological Science Practical</b>	2
Practical No.	Title of the Practical	No. of Practical's
<b>Physical Science Practical</b>		
1	Photography of 3-D /2- D shoe/bare foot prints.	1
2	Casting of 3-D Shoeprint using plaster of Paris/dental stone in mud or clay.	1
3	Casting of 3-D print in snow using Sulphur and other methods	1
4	Identification of foot prints by crime lights and lifting by gelatin and adhesive lifting.	1
5	Enhancement of shoe/bear print by specialized lighting source along with photography.	1
6	Development of latent shoe/bare foot print using physical developer (powder method )	1
7	Development and lifting of 2-D print by electrostatic methods.	1
8	Dismantling and assembling of compound microscope.	1
9	Study of forensic sample under stereomicroscope along with photography.	1
10	Examination of coins/metal pieces/wires/tools/bullets/palettes/ cartridges/under ballistic comparison microscope along with photography.	1
11	Examination of fibers under biological microscope along with photography.	1
12	Examination of soil sample using soil testing kit.	1
13	Comparison of soil/glass using density gradient column method.	1
14	Study of glass fractures due to impacts / heat.	1
15	Study the refractive index of glass samples.	
16	Determination of density of solid material by volume displacement method.	
17	To perform Thermal Decomposition test (TDT) test on soil sample.	
18	Examination of paint sample.	
19	Examination of plastic evidences under comparison microscope.	
20	Refractive Index of transparent liquid by using laser.	
21	Refractive Index of liquids by using Abbey Refractometer.	
<b>Biological Science Practical</b>		
1	Preparation of permanent slides by using maceration technique of various forensic material of Plant origin.	1
2	Study of life cycle of Blow fly/flesh fly	1



3	Study of forensically important insects	1
4	Rearing of forensically important insects	1
5	Study of pollens and spores of forensic significance.	1
6	Identification of birds from feathers	1
7	Microscopic Comparison of a. Animal Hair b. Human Hair	1
8	Preparation and identification of pugmarks	1
9	Isolation and microscopic examination of diatoms.	1
10	Visit to autopsy center at mortuary, Forensic Science Laboratory, Pathology Laboratory, Veterinary Center, Biodiversity and wildlife Center.	1

Course Code	Title	Credits
<b>USFS 6P3</b>	<b>Psychology and Computer Science Practical</b>	<b>2</b>
<b>Practical No.</b>	<b>Title of the Practical</b>	<b>No. of Practicals</b>
<b>Psychology Practical</b>		
<b>1</b>	Mass v/s Distributed Experiment	<b>3</b>
<b>2</b>	Neuroticism Scale Questionnaire (NSQ)- Ivan H. Scheier & R.B. Cattell	<b>3</b>
<b>3</b>	Differential Aptitude Test	<b>3</b>
<b>4</b>	Self Concept Questionnaire	<b>1</b>
<b>5</b>	Eight State Questioner (8SQ)	<b>1</b>
<b>6</b>	State Trait Anxiety Anger Expression Inventory- Charles D., Spielberger	<b>1</b>
<b>7</b>	Draw – a- Man Test	<b>1</b>
<b>8</b>	HCR -20 Verson-3 Assessing Risk For Violence	<b>1</b>
<b>9</b>	Introversion - Extroversion Scale	<b>1</b>
<b>10</b>	Word Association Test	<b>1</b>
<b>Computer Science Practical</b>		
<b>1</b>	File type analysis (extraction and analysis of metadata)	
<b>2</b>	Email investigation	
<b>3</b>	Study of voice samples	
<b>4</b>	Auditing network infrastructure	
<b>5</b>	Operating system hardening methods (windows and Linux)	
<b>6</b>	Deep fake detection	
<b>7</b>	Mobile Forensic	