Academic Council :
Item No. :

UNIVERSITY OF MUMBAI

Syllabus for Semester V and VI

Program : B.Sc.

Course : Forensic Science

(Credit Based Semester and Grading System with effect from the Academic Year 2017-2018)

T.Y.B.Sc. (Forensic Science) (Semester V) Credits
With effect from Academic Year 2017-2018

Class	Title	Class Room Instruction Face to Face						50 Hours = 1 Credit				
T.Y.B.Sc. Sem. V		Per Week		15 Weeks (Per Sem)		Per Sem (Hours)		Notional (Hours)		Credits		Total Credits
		L (50 Min)	P (50 Min)	L	P	L	P	L	P	L	P	
USFS 501	Forensic Science–V	3		45		36		100		2		2
USFS 502	Chemical Science - V	3		45		36		100		2		2
USFS 503	Physical Science –V	3		45		36		100		2		2
USFS 504	Biological Science – V	3		45		36		100		2		2
USFS 505	Psychology – V	3		45		36		100		2		2
USFS 506	Computer Science – V	3		45		36		100		2		2
USFS 507	Law – V	3		45		36		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
Total	**--**	**21**	**18**	**305**	**270**	**252**	**316**	**700**	**300**	**14**	**6**	**20**

B.Sc. (FORENSIC SCIENCE)

Semester V – Theory

<table>
<tr><td>USFS 501</td><td>Forensic Science – V</td><td>2 Credits (45 Lect.)</td></tr>
<tr><td colspan="3">Course Overview : The course covers core modules in the field of forensic science namely, forensic medicine, blood spatter analysis and questioned documents.

Course Objectives :

• To understand basic concepts of forensic medicine and its legal aspects.
• To learn importance, scope, classification, documentation and legal status of blood stain pattern analysis.
• To introduce need, qualification, scope and legal status of forensic document examiner.

Course Outcomes :

• Understand various stages of death.
• Classify and interpret different blood stain patterns.
• Examine and interpret the source of document under dispute and construct reports related to questioned document.</td></tr>
<tr><td>Unit I</td><td>Forensic Medicine – I
Introduction and scope of Forensic Medicine-definition, duties and responsibilities of medicolegal examiner. Legal aspects in view of Forensic Medicine: inquest, exhumation, dying declaration, dying deposition, medical certificates, post-mortem reports and MLR.

Forensic Thanatology- Definition and stages of death: somatic and molecular death. Modes of death: Syncope, asphyxia and coma. Cause, mechanism and manner of death. Signs of death, changes after death: Early changes- Algor mortis, rigor mortis, cadaveric spasm, heat and cold stiffening, changes in blood, cerebrospinal fluid and vitreous humor, post mortem lividity. Late changes- putrefaction, adipocere, mummification, destruction of body tissues by maggots and insects.

Asphyxia: Hanging, strangulation, smothering, suffocation and drowning with case studies.</td><td>15 L</td></tr>
<tr><td>Unit II</td><td>Bloodstain Pattern Analysis

Bloodstain patterns and its forensic significance. Biological properties of human blood: functions and composition of human blood. Physical properties of human blood: viscosity, surface tension and specific gravity.

Classification of bloodstains: Spatter blood stains- linear and non-linear</td><td>15 L</td></tr>
</table>

	spatter stains; non-spatter blood stains- irregular and regular margin stains. Directionality and motion of blood stains. Convergence and area of origin of blood stains. Altered blood stain pattern. Documenting blood stains and presenting blood stain evidence in the court of law.	
Unit III	**Forensic Document Examination-I** Functions of a Forensic Document Examiner: Training and qualifications. Identification of writer from specimen/admitted writings/signatures. Examination of anonymous writings. Determining the age of documents from ink and paper. Types of typewriting devices and identification of typewriter by comparison of typescripts. Examination of alterations, erasures, obliterations, overwriting, additions. Determination of sequence of strokes. Expert Testimony: Definition of expert-IEA 45, presentation of evidence in court, examination-in-chief, cross examination and re-examination. Case studies related to questioned documents including report writing.	**15 L**

USFS 502	Chemical Science –V	2 Credits (45 Lect.)
Course Overview : The course covers three main domains in the field of Forensic Chemistry namely separation and detection techniques, Forensic Toxicology, and Fuel (Petroleum) analysis. **Course Objectives :** • To introduce various separation and detection techniques with detailed principles and methodology. • To understand the classification of poisons based on their composition dealt in Forensic Toxicology. • To understand the importance and classification of different fuels (Petroleum products) and their analysis. **Course Outcome :** • Operate instruments and perform various separation techniques. • Classify and identify the source of various poisons dealt in Forensic Toxicology. • Examine different Fuels (Petroleum products) using various analytical tools and devise new methods to identify their composition and adulteration.		
Unit I	**Separation and Detection Techniques** **Introduction to Chromatographic techniques:** Paper Chromatography, Thin Layer Chromatography, Column Chromatography (Experimental methodology- Solvent selection, Forensic Applications). **Gas Chromatography:** Introduction, Principle, Instrumentation and Technique, Columns, Stationary Phases, Detectors, Forensic Applications, GC-MS. **HPLC:** Introduction, principle, Instrumentation, Technique, Column, Detectors, Forensic Applications, HP-TLC, LC-MS.	**15 L**
Unit-II	**Forensic Toxicology** Introduction and concept of Forensic Toxicological Examination and its significance. **Poisons:** Classification of Poisons : Volatile, Metallic poison and Non-metallic Poison, Organic and Inorganic poisons, Plant Poison and Animal Poison. **Agricultural Poison**: Pesticides, types of Pesticides based on Chemical composition. **Drugs of abuse**: Classification of Drugs of abuse, Chemical analysis of Benzodiazepines, Barbiturates, Amphetamines and Cannabis and their hazardous effects on human.	**15 L**

Unit III	**Fuels** Introduction of Fuels, Properties, Calorific values, Classification. **Solid Fuels**: Different types, formation, classification of coal, manufacture of coal gas, distillation of coal tar, advantages and disadvantages of solid fuels. sampling and analysis of solid fuel. **Liquid Fuels:** Petroleum-characteristics, origin and source, composition and classification, fractional distillation, fractions of distillation, sampling, analysis : chemical and instrumental. **Gaseous Fuel**: Classification, type, water gas, producer gas oil gas, LPG, Biogas, advantages and disadvantages, sampling and analysis of fuel gases.	**15 L**

USFS 503	Physical Science – V	2 Credits (45 Lect.)
Course Overview : The course covers core modules of Experimental Physics, Vehicular Accidents Investigation and Forensic Ballistics. **Course Objectives :** • To understand different techniques in modern physics viz. magnetic, electrical and radiation measurements. • To understand basic concepts of vehicular and rail accidents and their investigation. • To understand and learn the concepts of forensic ballistics. **Course Outcomes :** • Apply different experimental techniques to identify magnetic materials and to carry out examination of magnetic and electrical evidences. To examine tampered electric energy meters. • Understand, apply and analyze the various investigation steps in vehicular and rail accidents viz. Physical examination, crime scene photography, road accident reconstruction. • Evaluate the knowledge about the working of fire arms and to simulate bullet trajectory to estimate range, time of flight, velocity etc.		
Unit I	**Experimental Techniques-** **Magnetic Measurements:** Magnetic susceptibility and it's measurement by Quinck's and Gouy's method, Hall Effect and related measurements. **Electrical Measurements:** 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, Optical fiber communication system. **Radiation Detection and measurements:** Working principle of Geiger Muller counter, Radiation dose and it's 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.	**15 L**
Unit II	**Causes and Investigation of Vehicular Accidents-** **Road Terminologies:** Cut, Final Grade, Surface, Existing Grade, Fill, Sub grade, Base, Traffic lane, Travelled way, Shoulders, Roadbed, Roadway, Roadway ditch, Ditch slope, Back slope, Fill slope, Interceptor ditch, Slope ratio, Central line, Crown, Super elevation, Road dividers. Road signs, symbols and traffic control mechanisms. **Vehicular accidents:** 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.	**15 L**

	Rail Accidents: Investigation of rail crash: Criminal and safety investigation, Investigation principles, Best Practices: rail company tests, inspection of driving cab, examination of electrical/electronic/technological system and their failure. Necessary equipments required for forensic examination.	
Unit III	**Elementary Ballistics-** **General-** 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. **Exterior Ballistics-** 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. **Shotgun Ballistics-** Shotguns, Strength of the firearm, Jump and vibration, Recoil, Patterns, Stringing, Wounding power.	**15 L**

USFS 504	Biological Science – V	2 Credits (45 Lect.)

Course Overview : The course in the field of Forensic Biology covers Forensic Serology, Wildlife Forensics and Forensic DNA profiling.

Course Objectives :

- To understand and interpret various forensic serological techniques through theoretical concepts and practical demonstration.
- To familiarize the students with the various aspects of wildlife forensics.
- To understand the concepts underlying DNA profiling and its interpretation.

Course Outcomes :

- Examination, evaluation and designing of various forensic serological techniques.
- Performing investigation in wildlife crimes and developing better strategies for wildlife conservation.
- Examination, analysis, evaluation of DNA samples, followed by interpretation of DNA profiling results to aid in legal investigation.

Unit I	**Forensic Serology :** **Determination of origin of species:** Determination of human and animal origin from blood, semen, saliva, bones, hairs, nails, skin, body tissue and other fluids, Immuno assays and immunochromatographic techniques. **Serogenetic markers**: - Blood groups – biochemistry and genetics of ABO, Rh, MN systems, determination of secretor / non secretor Lewis antigen, Bombay Blood group **Polymorphic enzymes typing** – PGM, GLO, ESD, EAP, AK, ADA, etc., and their forensic significance, HLA typing, **Case studies** involving body fluids and body tissues	**15 L**
Unit II	**Wildlife Forensics :** **Role of Forensic Investigation in wildlife crimes**: Definition of wildlife crime, Illegal trade, Wildlife Protection Act, 1972. **Identification of species of wildlife animals from various parts and products** : methods of poaching, weapons of crime, collection and packaging of samples, identification of physical evidence. **DNA analysis of wildlife products** : Sample types for identification, species identification, individual identification, familial identification, identification of geographical location **Forensic ornithology:** species identification from feathers and eggs, analysis of artifacts, case studies. **Collection, preservation and transportation of wildlife specimen** : Collection and preservation of carcasses (Taxidermy), Specimen Shipment. **Forensic palynology and botany:** Role of palynomorphs in forensic investigation, analysis of pollen and spores, diatoms, identification of wood,	**15 L**

	dendrochronology.	
Unit III	**Forensic DNA Profiling :** **VNTR profiling**: Introduction, history, technique (RFLP), application. **STR Profiling**: Introduction, STR markers, commercially available kits, techniques (RT-PCR, Capillary electrophoresis, genetic analyser etc)**,** Y-Chromosome Profiling and Gender Typing **SNP Profiling**: Introduction, Methods, Significance. **Mitochondrial DNA Profiling**: Introduction, Markers, Methods, Significance. **Interpretation of DNA profiles**: DNA databases, Frequency Estimate Calculations, Likelihood Ratios, Admissibility of DNA evidence by Frye, Daubert, Federal Rules of Evidence, and The State of Debate.	**15 L**

USFS 505	Psychology – V	2 Credits (45 Lect.)
Course Overview : The course comprises the foundation of Forensic Psychology covering various theories of crime and deviant behavior, to different psychological tools and tests used to identify the causes of such behavior. **Course Objectives :** • To introduce the core elements in forensic psychology namely various psychological theories related to offending behavior. • To introduce various psychological tools and tests used in the field of Forensic Psychology. • To identify the causes of Juvenile Delinquency and its prevention. **Course Outcomes :** • Understand and estimate from various theories the association between learning, intelligence, personality and offending behavior. • Perform various psychological tests and evaluate the predictors of criminal behavior as well as predict the possible perpetrator. • Devise new theories, methods and strategies to identify the causes of Juvenile delinquency.		
Unit I	**Psychology and causes of offending behavior** **Theories of offending behavior:** Psychobiological theories, psychodynamic theories**,** learning theories**,** cognitive-behavioral theories, Control theories. **Introduction to various disorders:** Major mental disorders (MMD), Antisocial personality disorder (APD), Substance use disorders (SUD), Sexual Disorders.	**15 L**
Unit II	**Psychology of Investigations and Police Psychology** Introduction to Investigative psychology. **Introduction to various psychological investigative tools:** Psychological autopsy: Cause and manner of death, methodology, applications. **Forensic Hypnosis:** Definition, Procedure, Forensic hypnosis and cognitive interviewing. **Polygraph:** Introduction, procedure (Question formulation and result Analysis), Narco Analysis, Brain Electrical Oscillation. Nature, psychological testing and selection of police officers. **Stress and police:** Types of police stress, fitness for duty evaluation, police suicide.	**15 L**
Unit III	**Theories of crime and delinquency** **Theories of crime:** Economic, geographical, biological and sociological, Classical theory, Rational Choice Theory, Eysenck's theory of personality and crime, Social learning theory, social control theory, social disorganization theory, theory of differential association, labeling theory, structural strain theory. **Delinquency:** Definition, Biological and psychological approach, Prevention and control of Juvenile delinquency.	**15 L**

USFS 506	Computer Science – V	2 Credits (45 Lect.)
Course Overview : The course covers core modules in the field of digital and cyber forensics namely, structure of storage devices, file system analysis, and operating system specific investigation processes. **Course Objectives :** • To define and explain computer foundation, digital investigation foundation, hard disk data acquisition, and volume analysis. • To apply and examine analysis of file system, FAT concepts, NTFS concepts, and disk system. • To assess and elaborate artifacts of windows and Linux system as well as to explain speaker identification. **Course Outcomes :-** • Relate and interpret storage devices based on their structure. • Solve and distinguish volume and system analysis. • Choose and develop operating system specific investigation.		
Unit I	**Computer Foundation:** Data Organization, Booting Process, Hard Disk technology **Digital Investigation Foundation:** Digital investigation and evidence, digital crime scene investigation process, data analysis, overview of toolkits. **Hard Disk Data Acquisition:** Introduction, reading source data, writing output data, case study using DD command. **Volume Analysis:** Introduction, Background, analysis basics.	**15 L**
Unit II	**File System analysis:** What is file system, File system category, metadata category , File name category, application category , application level search techniques **Fat Concept and analysis :** File system category, metadata category , File name category, application category , application level search techniques **NTFS Concepts and analysis :** Introduction , MFT Concepts, MFT entry attribute concepts, Other attribute concepts, indexes, analysis tools **Disk and File System Analysis:** Media analysis concept, The sleuth kit, partitioning and disk layouts, special containers, Hashing, carving, forensic imaging.	**15 L**
Unit III	**Windows System and artifacts:** Introduction, Windows File system, Registry, events logs, prefect files, shortcut files, windows executables. **Linux System and artifacts:** Introduction, Linux file system, Linux boot process, Linux system organization and artifacts, user accounts, home directories, logs, schedule tasks. **Introduction to speaker identification:** Human vocal system, collecting samples, linguistic analysis, acoustic analysis.	**15 L**

USFS 507	Law – V	2 Credits (45 Lect.)
Course Overview : The course covers core modules from Indian Evidence Act, 1872 viz. relevancy of facts and expert opinion, oral and documentary evidence, production of evidence and examination of witness. **Course Objectives :** • To introduce various Sections of IEA for relevancy of facts and expert opinion. • To learn various Sections of IEA related to oral and documentary evidence. • To understand various Sections of IEA for production of evidence, witness and examination of witness. **Course Outcomes :** • Understand and relate to relevancy of facts and role of experts. • Process, present and evaluate oral and documentary evidence in the court of law. • Evaluate and propose production of evidence, witnesses and examination of witness.		
Unit I	**Preliminary The Relevancy of Facts and Expert Opinion (Sec 5 - 55)** Motive, preparation and previous or subsequent conduct, identification parade, facts not otherwise relevant become relevant, facts showing existence of state of mind, or of body or bodily feeling, facts bearing on question whether act was accidental or intentional, admissions, entries in books of account when relevant, dying declaration, Opinions of experts, facts bearing upon opinions of experts, Opinion as to handwriting, when relevant.	**15 L**
Unit II	**Oral and Documentary Evidence (Sec 56-90-A)** Facts which need not be proved, Oral Evidence, Documentary Evidence, Primary and Secondary evidence, evidence and admissibility of electronic records, proof of signature and handwriting, proof of electronic signature, comparison of signature, writing or seal with others admitted or proved, proof as to verification of electronic signature, public and private documents, presumption of documents and electronic records.	**15 L**
Unit III	**Production of Evidence and Examination of Witness (Sec 91-117)** exclusion of oral evidence by the documentary evidence, Burden of proof, presumptions as to legitimacy, abetment of suicide and absence of consent in rape cases, presumption as to certain offences, birth during marriage, conclusive proof of legitimacy, presumption as to abetment of suicide by a married women, presumption as to dowry death, Court may presume existence of certain facts, Presumption to absence of consent in certain prosecution for rape. **Witnesses and Examination of Witness (Sec 118-167)** witness and examination of witness, protected communications, production of documents, self incriminating statement, accomplice, provisions of examination of witnesses, examination-in-chief, cross-examination, re-examination, character of witnesses, leading questions and other questions, contradiction and omissions, refreshing memory of witness, production of	**15 L**

	translation of documents, provisions about improper admission and rejection of evidence.	

B.Sc. (FORENSIC SCIENCE)

Semester V – Practical

Note: Every Department is advised to arrange maximum number of experiments from list provided or experiments based on theory syllabus having forensic relevance. However, minimum seven experiments should be reported in journal for the purpose of certification.

USFS 5P1	Forensic Science and Chemical Science Practical	Credits: 02 Practical/Week : 06

USFS 5P1	Forensic Science Practical
1	To identify the given blood stains patterns.
2	To determine angle of impact from blood stains.
3	To study types of blood stain pattern on various surface.
4	To detect addition of strokes from various writing instruments in a given document.
5	To decipher obliterated writing.
6	To detect and decipher chemically erased writings/signatures.
7	To detect and decipher mechanically erased writings.
8	To examine various typescripts for their identification.
9	To examine style of a writer from the given document.
10	To identify the writer from the given document (i.e. from specimen/admitted writings/signatures).

USFS 5P1	Chemical Science Practical
1	Preparation of TLC plate using Silica gel.
2	Identification of poisons by TLC.
3	Separation of pigments using TLC.
4	Separation of given mixture by Column Chromatography.
5	Extraction of Nicotine from given plant leaves.
6	Qualitative and quantitative analysis of poisonous metals by ICP/AAS.
7	Gravimetric estimation of toxic metal (Pb/Hg).
8	Titrimetric estimation of toxic metal (Pb/Hg/As).
9	Quantitative and qualitative analysis of Opiates.
10	Colour tests for identification of given drug (CNS drug/ Analgesic /Anti-pyretic drug).
11	Synthesis of Paracetamol.
12	Estimation of Aspirin from drug sample.
13	Calculation of Calorific value by Bomb Calorimeter.
14	Identification and separation of petrol and kerosene mixture by distillation.
15	Identification and estimation of Dye from Kerosene/Diesel/Petrol.
16	Analysis of adulterants in Petrol.
17	Identification of Petroleum product by Densitometer.

USFS 5P2	Physical Science and Biological Science Practical	Credits: 02 Practical/Week: 06

USFS 5P2	Physical Science Practical
1	Magnetic susceptibility measurement by Quinck's / Gouy's method.
2	Hall effect and Hall measurements.
3	Resistivity measurement by Four Probe / Van der Pauw method.
4	Examination and Identification of electrical wires / cables.
5	Forensic examination of tampered electric energy meters.
6	Study of optical fiber communication system.
7	Working with Geiger Mueller counter.
8	Study of road design and road measurements.
9	Examination of tire/other marks
10	Physical examination accidental vehicle.
11	Peripheral vision measurement.
12	Side wall information of tire
13	Analysis of accident/crime scene photography
14	Physical examination of accidental vehicle.
15	Trajectory simulation (sample calculations).
16	Remaining velocity (sample calculations).

USFS 5P2	Biological Science Practical
1	Scale patterns of human and animal hairs and medullary index.
2	Barr body examination from human hair, blood and saliva.
3	Blood grouping from liquid blood and stains - Abs.-elution.
4	Preparation of Anti-H from Eulex europeus seeds.
5	Electrophoresis techniques for separation of polymorphic Enzymes & serum proteins (SDS-PAGE electrophoresis).
6	Determination of secretor/non-secretor status.
7	Preparation of gel plates for electrophoresis.
8	Extraction of Mitochondrial DNA & its profiling.
9	Identification of birds from feathers.
10	Isolation and identification of palynomorphs.
11	Preparation of antisera of different animal.
12	Identification of mammals from skull and dentition.
13	Identification and comparison of birds from mounted/cabinet specimen
14	Demonstration of Taxidermy techniques.

USFS 5P3	Psychology and Computer Science Practical	Credits: 02 Practical/Week: 06

USFS 5P3	Psychology Practical
1	Forming Relevant/Irrelevant/Control Questions with Polygraph.
2	Rosenzweig Picture Frustration (adult).
3	Neuroticism Scale Questionnaire (NSQ)- Ivan H. Scheier & R.B. Cattell.
4	Eight state questionnaire (8SQ)– M. Kapoor, M. Bhargava.
5	Dimensional Personality Inventory.
6	Maudsley Personality Inventory (MPI) - H.J. Eysenck.
7	NEO-PI Personality Inventory.
8	MMPI-2.
9	Rorschach Test.
10	Thematic Apperception Test (TAT).
11	16PF – R.B. Cattell.
12	Test of variables of Attention (T.O.V.A).
13	Vanderbilt Assessment Scale.

USFS 5P3	Computer Science Practical
1	Creating investigation environment
2	Incident response
3	Identification and seizure of evidence from the crime scene.
4	Acquiring the image
5	Basic analysis of image
6	Windows investigation
7	Linux investigation
8	FAT analysis
9	NTFS analysis
10	Study of toolkits.

B.Sc. (FORENSIC SCIENCE)

Semester V – References

USFS 501 : Forensic Science - V

Sr. No.	Suggested Readings
1	Rai Bahadur Jaising P. Modi, Modi's Medical Jurisprudence and Toxicology, Elsevier, 2013
2	C. K. Parikh, Forensic Medicine and Toxicology, CBS Publishers & Distributors Pvt. Ltd., India.
3	Anil Aggrawal, APC Insight into Textbook of Forensic Medicine and Toxicology, Avichal Publishing Company.
4	R.K. Sharma, Concise Textbook of Forensic Medicine & Toxicology, Elsevier, India, 2007.
5	Stuart H. James, Paul E. Kish, T. Paulette Sutton, Principles of Bloodstain Pattern Analysis: Theory and Practice, CRC Press, 2005.
6	Tom Bevel, Ross M. Gardner, Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction, Third Edition, CRC Press, 2008.
7	Stuart H. James, Scientific and Legal Applications of Bloodstain Pattern Interpretation, CRC Press, 1998.
8	Anita Y. Wonder, Bloodstain Pattern Evidence: Objective Approaches and Case Applications, Academic Press, 2011.
9	Jan Seaman Kelly and Brian S. Lindblom, Scientific Examination of Questioned Documents, Second Edition, Taylor and Francis, 2006.
10	Jan A.Lewis, Forensic Document Examination: Fundamentals and Current Trendsm, Elsevier, 2014.
11	Ordway Hilton, Scientific Examination of Questioned Documents, Revised Edition, CRC Press, South Carolina, 1992.
12	Wilson R. Harrison, Suspect Documents: Their Scientific Examination, Burnham Inc Pub, 1981.

USFS 502 : Chemical Science – V

Sr. No.	Suggested Reading
1	Organic Chemistry by Morrison and Boyd.
2	Organic Chemistry by John McMurry 5^{th} Edn. 1999.
3	Organic Chemistry by I. L.Finar, Vol.II 5^{th} Edn.
4	Qualitative organic analysis by Vogel.
5	Biochemistry by Lehninger.
6	Enzyme Biochemistry, Biotechnology, Clinical Chemistry , Trevor Palmer, first edition.
7	Toxicology :The Basic science of poison, Casarett and Doll.
8	Analysis of Plant poisons, Dr. M. P. Goutam.
9	Analytical methods in Human Toxicology, Curry, 1986.
10	Analytical Chemistry, 4^{th} edition, Gary G. Christian.
11	Principles of Instrumental Analysis, 5^{th} edition, Skoog, Holler and Nieman.
12	Basic concepts of Analytical Chemistry by S. M. Khopkar.
13	Instrumental methods of Chemical Analysis, Chatwal and Anand, Himalaya Publications.
14	Advances in Chromatography, Brown P. R.
15	Applied Chemistry by S. S. Dara.
16	Applied Chemistry by P. Jain.
17	Applied Chemistry Theory and Practice, O. P. Vermani and A. K. Narula.
18	A Text book of Environmental Science, V. Subramanian, Narosa Publication.
19	Chemistry of the Environment, 2^{nd} edition, Thomas G. Spiro, William M. Stigliani.
20	College Practical Chemistry by Ahluwalia and Dhingra.
21	Introductory Practical Biochemistry, S. K. Sawhney, R Singh, Narosa Publication House.
22	Lab Manual in Biochemistry, J. Jayaraman, New Age International Publishers, 2^{nd} edition.

USFS 503 : Physical Science – V

Sr. No.	Suggested Reading
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	Electronic Principles By Albert Malvino and D. J. Bates.
5	Measurement, Instrumentation and Experiment Design in Physics and Engineering By Michael Sayer and Abhaaiman Singh.
6	Instrumental Analysis By Skoog, Holler and Crouch.
7	Nuclear Forensic Analysis By Kenton J. Moody.
8	Nuclear Physics- An Introduction By S. B. Patel.
9	Transducers and Instrumentation By D V S Murty.
10	Laboratory Procedural manual, Physics Section, DFSL, Mumbai.
11	Laboratory Procedural Manual, Forensic Ballistics, DFS, New Delhi.
12	Electronics Communication Systems By Kennedy and Davis.
13	Elements of Civil Engineering By Mimi Das Saikia.
14	Encyclopedia of Forensic Science, Volume one: Jay A Siegel, Pekka J Saukko, Geoffery Knupfer. Academic Press.
15	Forensic Medical Investigation of Motor Vehicle Incidence By Michel P. Burke.
16	Forensic Engineering Fundamentals By Harold Franck.
17	Fire arms in criminal investigation and trials By B R Sharma
18	Handbook of Fire arm and ballistics By Brian J Heard.
19	Fire Arms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence By S N Gaur et.

USFS 504 : Biological Science – V

Sr. No.	Suggested Reading
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 Analysic 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 RozinskiUniversalAthenaeum (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.
17	Molecular Biology By Watson.
18	Genome Analysis By Primrose.
19	Genome Analysis By Richard Reiss.
20	Biotechnology By B.D. Singh
21	Genetics By C.B. Pawar
22	Taxidermy : step by step by W.F. McFall.

23	Wildlife-Crime-use-of-forensics-FWG-April-2014.pdf
24	Wildlife Specimen Collection, Preservation, and Shipment Chapter 4 of Section C, Techniques in Disease Surveillance and Investigation Book 15, Field Manual of Wildlife Diseases
25	https://lsa.umich.edu/ummz/herps/collections/preservation-techniques.html
26	Forensic biology by Dr.R.Krishnamurty
27	A laboratory Manual of Human Blood Analysis by M.K.Bhasin
28	A guide to Forensic DNA profiling by Allan.
29	Gene Cloning and DNA analysis by T.A. Brown.

USFS 505 : Psychology - V

Sr. No.	Suggested Readings
1	Diagnostic and Statistical Manual of Mental Disorders (DSM) (5th Edition) by American Psychiatric Association (2013).
2	'Criminal Profiling-An Introduction to Behavioural Evidence analysis', Brent Turvey, Edition 2nd, 2006, Elsevier Academic press.
3	'Handbook of Forensic Psychology', Prof Dr. Vimala Veeraraghwan, Edition 1st, 2009, Selective and Scientific Books Publications, New Delhi.
4	'Handbook of Forensic Psychology', Irving B. Weiner, Allen K. Hiss, Edition 3rd, 2006, Wiley Publication.
5	'Theoretical Psychology', Moazziz Ali Beg, Sangeeta Gupta Beg, Vol [03], Edition 2nd, 2013, Global Vision Publishing House, New Delhi.
6	'Theoretical Psychology', Moazziz Ali Beg, Sangeeta Gupta Beg, Vol [04], Edition 2nd, 2013, Global Vision Publishing House, New Delhi.
7	'Abnormal Psychology-The Problem of Maladaptive Behaviour', Irwin G. Sarson, Barbara R. Sarson, Editon 11th, 2012, PHI Publication, New Delhi.
8	'Abnormal Psychology', James N. Butcher, Susan M. Mineka, Jill M. Hooley, Edition 15th, 2014, Pearson.
9	'Stress Management', Ruth Baer, Edition 1st 2010, Global Vision Publication House,New Delhi.
10	'Handbook of Stress, Coping and Health', Virginia Hill Rice, Edition 1st, 2000, SagePublications, Inc.
11	'Juvenile and Crime In Indian', Dr. Rajesh S. Vyas, Dr. Ashok M. Shroff, Edition 1st,2013, Shri Niwas Publications, Jaipur.
12	Parental development-Social & Emotional development- 'A Textbook of Child

	Psychology', D. N. Prabhakar, Editon 1st, 2014, Astha Publication, New Delhi.

USFS 506 : Computer Science – V

Sr. No.	Suggested Readings
1	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	Handbook of Digital Forensics and Investigation, Edited by Eoghan Casay, Elsevier Academic Press, ISBN 13: 978-0-12-374267-4.
5	Computer Forensics : A Field Manual for Cancelling, Examining, and Preserving Evidence of Computer Crimes by Albert J. Marcella.
6	Cyber Crime Investigator's Field Guide by Bruce Middleton
7	Digital Forensics : Digital Evidence in Criminal Investigation by Angus M. Marshall

USFS 507 : Law – V

Sr. No.	Suggested Readings
1	The Indian Evidence Act, 1872, Bare Act.
2	Criminal manual, (Major Acts), Justice M.R.Mallick, Professional Publication, 2014.
3	The Law of Evidence/Batuklal.
4	Law of Evidence/Vepa P. Sarthi.
5	Textbook on The Law of Evidence - M. Monir.
6	Sarkar's Commentary on Law of Evidence (Dwivedi Law Agency).
7	C.D. Field's Commentary on Law of Evidence Act/Gopal Chaturvedi.
8	Principles of the Law of Evidence/ Avtar Singh.
9	C.D. Field's expert evidence: expert evidence and opinions of third person (medical and non-medical)/Rajesh Gupta.
10	Expert evidence and criminal justice/Radmayne.

T.Y.B.Sc. (Forensic Science) (Semester VI) Credits
To be implemented from Academic Year 2017-2018

Class	Title	Class Room Instruction Face to Face						50 Hours = 1 Credit				
T.Y.B.Sc. Sem. VI		Per Week		15 Weeks (Per Sem)		Per Sem (Hours)		Notional (Hours)		Credits		Total Credits
		L (50 Min)	P (50 Min)	L	P	L	P	L	P	L	P	
USFS 601	Forensic Science – VI	3		45		36		100		2		2
USFS 602	Chemical Science – VI	3		45		36		100		2		2
USFS 603	Physical Science – VI	3		45		36		100		2		2
USFS 604	Biological Science – VI	3		45		36		100		2		2
USFS 605	Psychology – VI	3		45		36		100		2		2
USFS 606	Computer Science – VI	3		45		36		100		2		2
USFS 607	Law – VI	3		45		36		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
Total	**--**	**21**	**18**	**305**	**270**	**252**	**316**	**700**	**300**	**14**	**6**	**20**

B.Sc. (FORENSIC SCIENCE)

Semester VI – Theory

USFS 601	Forensic Science – VI	2 Credits (45 Lect.)

Course Overview: The course covers core modules in the field of forensic science namely, forensic medicine, fire and arson investigation and questioned documents.

Course Objectives :

- To understand the objectives, procedure of medical autopsy and medico legal aspects of injuries.
- To introduce chemistry of fire and investigation procedure in arson case.
- To learn principle and examination of questioned documents.

Course Outcomes :

- Understand the collection procedure of samples during post-mortem and to differentiate between various types of injuries.
- Carry out the extraction and analysis in arson cases.
- Examine various questioned documents including secret writings, security documents and printed documents and their subsequent decipherment.

Unit I	**Forensic Medicine-II** Medical Autopsy: Introduction and objectives. Precautions while conducting autopsy. External and internal examination of body, examination of clothing and other artifacts. Collection of post-mortem samples: viscera, blood, CSF, vitreous humor, hair, urine. Injury: Introduction and classification of injuries. Medico legal aspects of injuries. Mechanical injuries-Abrasions, contusions, lacerations, incised wounds, stab wounds, defense wound and self-inflicted wounds. Thermal injuries-Burn and its type, rule of nine, cause of death from burn, antemortem and postmortem burns.	**15 L**
Unit II	**Fire and Arson Evidence** Introduction to fire and arson and their evidentiary value. Chemistry of Fire, classification of fire, phases of fire, causes of fire. Processing of fire/arson scene. Pattern of charring. Determination of seat/origin of fire. Types of ignitable liquid residues. Field testing of fire debris. Extraction of incendiary material from fire debris. Instrumental analysis of fire debris. National and international scenario of fire and arson investigation along with	**15 L**

	case studies.	
Unit III	**Forensic Document Examination-II** Examination of paper: Paper size, thickness, opacity, color, watermarks and fibers. Examination of Ink: Types of inks and their chemical analysis for identification. Decipherment of secret writings. Decipherment of indented writings and charred documents. Examination of seal, rubber stamps and other mechanical evidences. Examination of security documents: Passports, currency and stamp papers. Examination of printed documents: Photocopies, laser prints. Examination of computer generated documents.	**15 L**

USFS 602	Chemical Science –VI	2 Credits (45 Lect.)

Course Overview : The course covers three major domains in the field of Forensic Chemistry namely elemental analysis and spectroscopic techniques, food adulteration, and polymers.

Course Objectives :

- To introduce the basic principles and applications of elemental and spectroscopic analysis used in Forensic Chemistry.
- To introduce the students to various types of food adulterants and their analysis.
- To understand various polymers and their examination.

Course Outcomes :

- Handle and operate various instruments based on elemental and spectroscopic principles.
- Classify and identify various food adulterants by performing various tests used in their detection and devise new and effective methods in their analysis.
- Classify polymers based on their composition by conducting various tests and develop new methods to identify their source.

Unit I	**Instrumental Techniques:** **Atomic Absorption Spectroscopy :** Introduction, basic principle, instrumentation and Forensic applications. **Flame Spectrometry :** Principle, instrumentation and working, Forensic applications. **UV Spectroscopy :** Introduction**,** Beer-Lambert's law, energy absorption and electronic excitation, terms used in U.V. Spectroscopy**,** Woodward and Fieser Rules, λ_{max} calculation, colour and visible spectrum, Forensic applications. **IR Spectroscopy :** Introduction, principle**,** types of molecular vibrations, condition of absorption of I.R. region, sample handling, working and instrumentation, I.R. frequencies of function group, factor affecting I.R. frequencies, interpretation of I.R. spectrum, applications of IR in Forensics.	**15 L**
Unit II	**Adulteration in Food** Introduction : Adulterants, types of adulterants Food additives : Preservatives, antioxidant, sweeteners, colouring agents, flavouring agents Adulteration in dairy products Adulteration in common food items such as vegetable oil, beverages (such as tea, coffee, cold drinks, fruit juices etc.) spices (such as red chilli powder, turmeric powder, etc.) Adulteration in drugs and medicines Preliminary examination, chemical and instrumental analysis of adulterants in food items.	**15 L**
Unit III	**Polymers** **Introduction:** Definition and types of polymerization with examples, preparation and applications of Polyethylene (Ziegler-Natta process), Teflon, PVC, Polystyrene.	**15 L**

	Dyes: Definition, Otto – Witt theory of dye, classification of dyes, chemical synthesis of indigo, methyl orange, phenolphthalein, crystal violet and methylene blue, Forensic application of dyes. **Ink:** Introduction, different types, properties, sampling and analysis (chemical and instrumental: UV-visible, IR, GC-MS).	

USFS 603	Physical Science – VI	2 Credits (45 Lect.)
Course Overview : The course covers core modules of Footwear Impressions, Forensic Microscopy and Forensic applications in Trace Analysis. **Course Objectives :** • To familiarize different methods of footwear impression analysis. • To understand principle, construction working, application of different microscopes. • To understand and learn physical properties of glass, soil, fibre, paint and plastics. **Course Outcomes :** • To learn, apply and evaluate the different footwear impressions and methods of casting at the crime scene. • To apply the knowledge of microscopy in analysis of various forensic evidences. • To learn, apply and interpret the knowledge about various trace evidences viz. glass, soil, fibre, paint, plastic etc.		
Unit I	**Footwear Impressions-** **Casting 3-D Footwear Impressions** : Introduction to casting, Importance of casting, Benefits of casts over photographs, Casting materials, Methods of casting with dental stone, Casting footwear impressions in snow. **Treatment of 2-D Footwear Impressions:** 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. **Enhancement of Footwear Impressions:** Specialized lighting and photographic methods, Chemical enhancement, Other enhancement techniques.	**15 L**
Unit II	**Forensic Microscopy-** Basics of microscope, common terms used in microscopy, Construction, working, applications and limitations of -Compound microscope, Comparison microscope, Stereomicroscope, Polarizing microscope ,Micro spectrophotometer, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM).	**15 L**

Unit III	**Forensic Applications in Trace Analysis-** **Physical properties of materials:** temperature, weight and mass, density, refractive index and their forensic importance. **Glass:** 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. **Soil:** Significance of soil evidence, Variations in soil, Collection and preservation of soil evidence, Forensic examination of soil. **Fibre:** 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. **Paint:** 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.	**15 L**

USFS 604	Biological Science - VI	2 Credits (45 Lect.)

Course overview : The course in the field of Forensic biology covers Forensic Anthropology, Forensic Odontology and Forensic Entomology

Course Objectives :

- To understand, identify and distinguish between anthropological features for the determination of age, sex, race, stature and species.
- To understand the concepts of odontology with reference to crime scene investigations.
- To identify, classify forensically significant insects and understand their role in forensic investigations.

Course Outcomes :

- Identification of individual and population characteristics from bone remains.
- Application of their knowledge of teeth/oral structure to explain death associated with crime and mass disasters.
- Development of collection procedures for entomological evidence, and calculation of PMI from entomological evidence.

Unit I	**Forensic Anthropology** **Anthropology :** Introduction, history and branches. **Crime scene processing and Identification of remains**: Human or Non-human / Old or New, Sex Determination from human bones, Age estimation from long bones and skull, Population Ancestry determination, Stature estimation from long bones, Individual characteristics of the remains, Documentation and Expert Witness Testimony. **DNA analysis from bones**: Sources, processing, extraction methods, profiling. **Bertillon's Portrait Parle system**	**15 L**
Unit II	**Forensic Odontology:** **Odontology**: Introduction and History, Chronological eruption of teeth in humans. **Role of odontology in forensics**: Age estimation from teeth by Gustafson method, Body Identification by Dental Records :Post Mortem Examination and Records, Ante mortem examination and records, Record Analysis and Processing, Forensic odontology in Mass Disasters. **Bite Mark Analysis** – Time of Death, Response of Assailant or Victim, Collection of Bite mark evidence form living and dead and comparison, Case studies.	**15 L**
Unit III	**Forensic Entomology :** **Collection of Entomological Evidence:** Methods of collection, Factors	**15 L**

	affecting entomological evidence, Stages of Decomposition in terrestrial and aquatic environment, Dipterans Larval Development, Successional Colonization of Corpse, Challenges encountered in Entomology, Report Submission, Testifying in Court. **Role of Forensic Entomology**: Determination of PMI, Determination of displacement and disturbance of the body, Presence and Position of wounds, Drugs consumption antemortem, Human and Animal neglect or abuse, Role of entomology in civil cases, Case studies.	

USFS 605	Psychology – VI	2 Credits (45 Lect.)
Course Overview : The course covers the post examination steps carried out after detection namely the various therapies used in psychology for treating offenders, rehabilitation, counseling and courtroom psychology. **Course Objectives :** • To understand the various psychological therapies used in treatment of offenders. • To understand the concepts and importance of counseling, practice of rehabilitation and the possible causes for tendency to return to criminal behavior(Recidivism) • To explain the final step in investigation; dealing with detailed courtroom procedure followed in the field of forensic psychology. **Course Outcome:** • Understand the procedure and select from the various psychological therapies as per the offenders need. • Understand the various types of rehabilitation, counseling process, design new strategies and apply them as per the case for prevention of crime. • Document and create detailed report of the psychological findings for the courtroom at the end of the investigation.		
Unit I	**Psychological Therapies** **Psychoanalytical therapy:** Free Association, Dream analysis, Therapeutic transference, Interpretation. **Behavior therapy:** Cognitive behavior therapy (REBT, Albert Ellis, Aaron Beck), Flooding, System desensitization, Aversion therapy.	**15 L**
Unit II	**Rehabilitation, Recidivism and Counseling Psychology** **Rehabilitation:** Types of rehabilitation, process, techniques and skills in rehabilitation, rehabilitation of offenders, rehabilitation of victims of crime. **Recidivism:** Introduction, Criminal recidivism, Recidivism measures and models. **Counseling:** Definition, aims and fields of counseling, skills of a counselor, nature and goal of correctional counseling, theories of counseling, Methods - Directive and Non-directive ethics in counseling.	**15 L**
Unit III	**Psychology and Court** Courtroom psychology, Psychologist as an expert witness, Mc Naughten's rule and Insanity, Competency to stand trial, eye witness, risk Assessment, Sentencing Evaluation, Mental Health Act 1987 (Reception Order, Object, Establishment or Maintenance of Psychiatric Hospitals and Psychiatric Nursing Homes, Procedures on Production of Mentally ill person in front of Magistrate).	**15 L**

USFS 606	Computer Science – VI	2 Credits (45 Lect.)
Course Overview : The course covers core modules in the field of digital and cyber forensics namely, internet and file related artifacts, mobile forensics, and cyber crime. **Course Objectives :** • To recall and compare internet artifacts, and file analysis. • To classify and experiment with mobile forensics, mobile operating systems. • To explain and formulate cybercrime prevention. **Course Outcomes :** • Find and illustrate investigation of internet and file related artifacts. • Organize and analyze Smartphone investigation. • Evaluate and devise counter measures to prevent cyber crimes.		
Unit I	**Internet Artifacts**: Browser Artifacts, Mail Artifacts. **File Analysis:** File Analysis Concepts**,** Images**,** Audio**,** Video**,** Archives.	**15 L**
Unit II	**Introduction to Mobile Forensics**: The Cellular Network , Base Transceiver Station, Evolution of Wireless Telecommunications Technologies, Mobile Station, SIM card, SIM file system. **Mobile Operating Systems:** Android OS, Symbian OS, RIM, Windows Phone, iOS, other Mobile Operating System. **Understanding Mobile Forensics:** Standard Operating Procedures for Handling Handset Evidence, National Institute of Standards and Technology, Preparation and Containment, Wireless Capabilities, Documenting the Investigation.	**15 L**
Unit III	**Cyber Crime Prevention:** Ways to Prevent Cyber Crime Targeted at You**,** Ways to Prevent Cyber Crime Targeted at the Family**,** Ways to Prevent Cyber Crime Targeted at Personal Property**,** Ways to Prevent Cyber Crime Targeted at a Business, Ways to Prevent Cyber Crime Targeted at an Organization**,** Ways to Prevent Cyber Crime Targeted at a Government Agency. **Understanding Cybercrime Prevention:** Understanding Security Concepts**,** Understanding the Technical Aspects of Network Security**,** Making the Most of Hardware and Software Security**,** Understanding Firewalls**,** Deploying an Incident Response Team**,** Designing and Implementing Security Policies.	**15 L**

USFS 607	Law – VI	2 Credits (45 Lect.)

Course Overview : The course covers core modules in Criminal Procedure Code,1973, viz. Constitution of Courts, Powers of Police and Trial Procedure.

Course Objectives :

- To introduce various Sections of CrPC related to organization and power of courts.
- To learn various Sections of CrPC related to Police, Power of police for arrest, preventive action and investigation.
- To understand various Sections of CrPC related to proceedings before magistrate and trial procedure.

Course Outcomes :

- Understand and determine admission of cases in various courts
- Understand the powers of police and apply Sections of CrPC during the investigation by the Police.
- Evaluate the trial procedure with respect to complaint, judgment, appeal and bail provisions.

Unit I	**Constitution of Criminal Courts and Powers of Courts (Sec 1-35)** Preliminary, constitution of criminal courts and offices, classes of criminal courts, metropolitan magistrate, court of session, courts of judicial magistrates, public prosecutors, power of courts, sentences which high courts and sessions judges may pass.	**15 L**
Unit II	**Powers of Police and arrest of persons and production person and things (Sec 36 - 105)** Powers of superior officers of police, power of police for arrest, power of search of arrested persons, seize offensive weapons, examination of arrested person by medical practitioner, production, custody and discharge of arrested person, proclamation and attachment, serving summons and warrant. **Jurisdiction of Criminal Courts (Sec 105-189)** Security for keeping the peace and for good behavior **Police officers powers of preventive Action and Investigation (Sec 154-176)** Preventive action of the police, information to the police and their powers to investigate, information in cognizable and non-cognizable cases (FIR), police officer's power to investigate cognizable and non-cognizable cases, Jurisdiction of the criminal courts in inquiries and trials, ordinary place of inquiry and trial, high courts power to decide different district of inquiry or trial, offence committed outside India.	**15 L**
Unit III	**Proceeding before magistrate and Trial Procedure (Sec 204-265)** Commencement of proceedings before magistrates, charge, trial before a court of session, trial of warrant-cases by magistrates, trial of summons-cases by magistrates, summary trials. **Complaint, Judgment, Appeal and Bail Provisions (Sec 200-204, Sec 353-371, Sec 372-394 and Sec 436-450)** Complaints to magistrates, judgment, appeals, bail, anticipatory bail, special	**15 L**

	powers of high court or court of session regarding bail, bail bond, surety, order for disposal of property at conclusion of trial, procedure by police upon seizure of property.	

B.Sc. (FORENSIC SCIENCE)

Semester VI – Practical

Note: Every Department is advised to arrange maximum number of experiments from list provided or experiments based on theory syllabus having forensic relevance. However, minimum seven experiments should be reported in journal for the purpose of certification.

USFS 6P1	Forensic Science and Chemical Science Practical	Credits: 02 Practical/Week: 06

USFS 6P1	Forensic Science Practical
1	To differentiate various types of paper.
2	To perform TLC of ink from various writing instruments.
3	To decipher indented writing.
4	To decipher invisible writing.
5	To decipher writing from a charred document.
6	To examine various rubber stamps, seal impressions and postal cancellation stamps.
7	To examine given currency notes.
8	To examine various signatures.
9	To identify incendiary material from fire debris.
10	To observe morgue analysis of a corpse for describing wounds/putrefaction and other artifacts.

USFS 6P1	Chemical Science Practical
1	Extraction of Caffeine from tea leaves.
2	Identification of adulterant in given milk sample.
3	Identification of adulterant in given vegetable oil.
4	Identification of adulterant in given spices.
5	To determine acid value of given oil sample.
6	To determine saponification value of given oil sample.
7	To determine iodine value of given oil sample.
8	Interpretation of given IR spectrum.
9	Interpretation of given UV-visible spectrum.
10	To determine Na/K from given sample using Flame Photometer.
11	To characterize given dye sample using UV- visible spectroscopy.
12	To determine the λmax for unknown $KMnO_4$ sample.
13	Synthesis of Phenolphthalein.
14	Synthesis of Methyl orange/ Methyl Red.
15	Synthesis of Azo – dye.
16	Analysis of paint.

USFS 6P2	Physical Science and Biological Science Practical	Credits: 02 Practical/Week: 06

USFS 6P2	Physical Science Practical
1	Photography of 3-D /2- D shoe/bear foot prints.
2	Casting of 3-D Shoeprint using plaster of Paris/dental stone in mud or clay.
3	Footwear sizing.
4	Study of forensic sample under stereomicroscope.
5	Examination of fibers.
6	Examination of soil sample.
7	Particle size of soil.
8	Study of glass fractures due to impacts.
9	Study of glass fractures due to heat.
10	Physical fit/match.
11	Determination of density of solid material by volume displacement method.
12	Microscopic examination of paint sample.
13	Examination of plastic evidences.
14	Refractive Index of transparent liquid by using laser.
15	Refractive Index of liquids by using Abbey Refractometer.

USFS 6P2	Biological Science Practical
1	Study of Bertillon's Portrait parle
2	Estimation of stature from long bones
3	Somatoscopic measurements on humans
4	Examination of dental radiogram
5	Bitemark analysis
6	Preparation of Dental Chart
7	Differentiation of Calliphoridae and Sarcophagidae ➢ Adult flies ➢ Larvae based (anterior and posterior spiracle) ➢ Pupa based
8	Dissection of larva(3^{rd} instar)
9	Rearing of blow fly and flesh fly in lab
10	Study of cephalopharyngeal skeleton of 2^{nd} ,3^{rd} instar larvae
11	Determination of PMI with the help of insect evidence
12	Study of life cycle of fly (upto adult)
13	Study of life span of fly (upto death of adult)

USFS 6P3	Psychology and Computer Science Practical	Credits: 02 Practical/Week: 06

USFS 6P3	Psychology Practical
1	Self Concept Questionnaire – *Dr. Rajkumar Saraswat.*
2	Bender-Gestalt Test.
3	Social Motive Test.
4	Social Distance Scale.
5	Wechsler Child Intelligence Test.
6	Differential Aptitude Test.
7	Self-Expression Inventory.
8	State trait anxiety anger expression inventory- Charles D., Spielberger.
9	State trait anxiety inventory (adult)- Charles D., Spielbergers.
10	House Tree Person Test/Family Drawing test/Children Apperception test.
11	Mental Depression Scale.

USFS 6P3	Computer Science Practical
1	Browser analysis-I.
2	Browser analysis –II.
3	File analysis-I.
4	File analysis –II.
5	File analysis-III.
6	Study of PyFlag-I.
7	Study of PyFlag-II.
8	Mobile Forensic Basics.
9	Firewall configuration.
10	IDS configuration.
11	CCTV footage analysis.

B.Sc. (FORENSIC SCIENCE)

Semester VI – References

USFS 601: Forensic Science – VI

Sr. No.	Suggested Readings
1	Rai Bahadur Jaising P. Modi, Modi's Medical Jurisprudence and Toxicology, Elsevier.
2	C. K. Parikh, Forensic Medicine and Toxicology, CBS Publishers & Distributors Pvt. Ltd., India.
3	Anil Aggrawal, APC Insight into Textbook of Forensic Medicine and Toxicology, Avichal Publishing Company.
4	R.K. Sharma, Concise Textbook of Forensic Medicine & Toxicology, Elsevier, India, 2007.
5	John J. Lentini, Scientific Protocols for Fire Investigation, CRC Press.
6	John D. DeHaan, David J. Icove, Kirk's Fire Investigation, Pearson Education.
7	José R. Almirall and Kenneth G. Furton, Analysis and Interpretation of Fire Scene Evidence, CRC Press.
8	Niamh Nic Daeid, Fire Investigation, CRC Press.
9	Jan Seaman Kelly and Brian S. Lindblom, Scientific Examination of Questioned Documents,Second Edition, Taylor and Francis, 2006.
10	Jan A.Lewis, Forensic Document Examination: Fundamentals and Current Trendsm, Elsevier, 2014.
11	Ordway Hilton, Scientific Examination of Questioned Documents, Revised Edition,CRC Press,South Carolina, 1992.
12	Wilson R. Harrison, Suspect Documents: Their Scientific Examination, Burnham Inc Pub, 1981.

USFS 602: Chemical Science – VI

Sr. No.	Suggested Reading
1	Qualitative organic analysis by Vogel.
2	Organic Spectroscopy by P. S. Kalsi.
3	Introduction to Organic Spectroscopy, Donal L. Pavia, Gary M.
4	Spectroscopic Identification of Organic compounds, Robert M. Silverstein.
5	Analytical Chemistry, 4^{th} edition, Gary G. Christian.
6	Principles of Instrumental Analysis, 5^{th} edition, Skoog, Holler and Nieman.
7	Basic concepts of Analytical Chemistry by S. M. Khopkar.
8	Instrumental methods of Chemical Analysis, Chatwal and Anand, Himalaya Publications.
9	Applied Chemistry Theory and Practice, O. P. Vermani and A. K. Narula.
10	Textbook of Polymer Science, Fred W. Billmeyer Jr.
11	Principles of Polymer Science, 2^{nd} edition, P. Bahadur and N. V. Sastry.
12	Outlines of Polymer Technology: Manufacture of Polymers, R. Sinha.
13	Organic Chemistry: A Modern Approach, vol. II, C. T. Bhastana, D. P. Nabar and H. D. Upadhyaya, S. Chand Publications.
14	Fierz – David and Blangey, Fundamental Process of Dye Chemistry, Interscience Publishers (1949, translated by Vittum).
15	LUBS (edition), The Chemistry of Synthetic Dyes and Pigments, Reinhold, (1955).
16	College Practical Chemistry by Ahluwalia and Dhingra.
17	Introductory Practical Biochemistry, S. K. Sawhney, R Singh, Narosa Publication House.
18	Lab Manual in Biochemistry, J. Jayaraman, New Age International Publishers, 2^{nd} edition.

USFS 603: Physical Science - VI

Sr. No.	Suggested Readings
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	Building Materials By P. C. Varghese.
7	Trace Evidence By Max M. Houck.

USFS 604: Biological Science - VI

Sr. No.	Suggested Readings
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 Analysic 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 RozinskiUniversalAthenaeum (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.
17	Molecular Biology By Watson.
18	Genome Analysis By Primrose.
19	Genome Analysis By Richard Reiss.
20	Biotechnology By B.D. Singh.
21	Genetics By C.B. Pawar.
22	Gene Cloning and DNA analysis by T.A. Brown.
23	Recombinant DNA: Genes and Genomes - A Short Course, Third Edition (Watson, Recombinant DNA) by James D. Watson, Richard M. Myers, Amy A. Caudy and Jan A. Witkowski (Dec 8, 2006)

USFS 605: Psychology- VI

Sr. No.	Suggested Readings
1	Bull, R. (2011).Forensic Psychology(Four volume set). LA: Sage publications.
2	Davies, G. &Beech,A. (2012).Forensic Psychology : Crime, Justice, Law, Interventions (2 nd 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. Volume ed. Weiner, I.B. Series ed. (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. NJ: J.Wiley and Sons.
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, Edition 3rd, 2012, Elsevier Academic press.
11	'Forensic Psychology and Neuropsychology for Criminal and Civil Cases', Harold V.Hall, Edition 1st, 2008, CRC Press.
12	'Criminology' [2005] S. M. A. Qadri, fifth edition, EBC Publication, Lucknow 'Stress Management', Walt Schafer, Edition 4th Cengage Learning India Private Ltd.,New Delhi.

USFS 606: Computer Science – VI

Sr. No.	Suggested Readings
1	Cory Altheide and Harlan Carvey, Digital Forensics with open source tools, *Syngress.*
2	Cyber Crime investigations.
3	Debra Littlejohn Shinder and Ed Tittel, Scene of Cyber Crime-Computer_forensics_handbook, Syngress Publishing.
4	Dr, Darren R. Hayes, Practical Guides to Computer Forensics Investigation, Pearson Publication.
5	Digital Forensics for Network, Internet and Cloud Computing by Clint P. Garrison.
6	Practical Mobile Forensics, Satish Bommisetty, Rohit Tamma, Heather Mahalik, Packt Publishing Ltd., 2014, ISBN 978-1-78328-831-1.
7	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	Andriod Forensic, Investigation, and Security by Andrew Hogg, Publisher Synergy.

USFS 607: Law – VI

Sr. No.	Suggested Readings
1	The Code of Criminal Procedure, 1973 Bare Act.
2	The Criminal Procedure Code/Takwani.
3	The Criminal Procedure Code/Ratanlal and Dhirajlal.
4	Criminal manual, (Major Acts), Justice M.R.Mallick, Professional Publication, 2014.