

AC 27/2/13 Item no. 4.128

UNIVERSITY OF MUMBAI



Syllabus for Semester III &IV

Program: M.Sc.

Course: Forensic Science

(Credit Based Semester and Grading System with
Effect from the academic year 2013–2014)

M. Sc. Forensic Science

		M.Sc.Sem III		Class Room Instruction Face to Face						50 Hrs. = 1 Credit				
Course Code		Per Week		15 Week (Per Sem.)		Per Sem. (Hrs.)		Notinal Hrs.		Total Hrs.		Credits		Total Credits
		L (60 min)	P(60 min)	Lect.	Pra.	Lect.	Pra.	Lect.	Pra.	Lect.	Pra.	Lect.	Pra.	
Theory Code	Practical Code													
PSFS301	PSFS3P1	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFS302	PSFS 3P2	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFS303	PSFS 3P3	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFS304	PSFS 3P4	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFSP305/ PSFSC305/ PSFSB305	PSFSP3P5/ PSFSC3P5/ PSFSB3P5	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFSP306/ PSFSC306/ PSFSB306	PSFSP3P6/ PSFSC3P6/ PSFSB3P6	4	4	60	60	60	60	40	40	100	100	2	2	4
Total		24	24	360	360	360	360	240	240	600	600	12	12	24

M. Sc. Forensic Science

		M.Sc.Sem IV		Class Room Instruction Face to Face						50 Hrs. = 1 Credit				
Course Code		Per Week		15 Week (Per Sem.)		Per Sem. (Hrs.)		Notinal Hrs.		Total Hrs.		Credits		Total Credits
		L (60 min)	P(60 min)	Lect.	Pra.	Lect.	Pra.	Lect.	Pra.	Lect.	Pra.	Lect.	Pra.	
Theory Code	Practical Code													
PSFS401	PSFS4P1	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFS402	PSFS 4P2	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFS403	PSFS 4P3	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFS404	PSFS 4P4	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFSP405/ PSFSC405/ PSFSB405	PSFSP4P5/ PSFSC4P5/ PSFSB4P5	4	4	60	60	60	60	40	40	100	100	2	2	4
PSFSP406/ PSFSC406/ PSFSB406	PSFSP4P6/ PSFSC4P6/ PSFSB4P6	4	4	60	60	60	60	40	40	100	100	2	2	4
Total		24	24	360	360	360	360	240	240	600	600	12	12	24

M. Sc. FORENSIC SCIENCE
Semester III – Theory
PSFS301: Emerging Trends in Forensic Science
(Compulsory Subjects)

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	No. lectures
Unit I : Forensic Engineering I	15
What is forensic engineering; Learning from failures; Basic Fire and explosion investigation; Industrial accidents; Structural failures, product liability engineering; Traffic accident reconstruction; Transportation disaster investigation; Civil engineering investigation; Investigation report; The engineer as an expert witness.	
Unit II: Forensic Radiology	15
Introduction; Definitions in forensic radiology; Forensic radiology in historical perspective; scope of forensic radiology; Identification of the dead; Radiological anthropological parameters and applications in forensic dentistry, bite marks, the perpetrator, individual remains and in mass casualty situations; Gunshot wounds and it radiology; Pitfalls in the radiology of gunshot wounds. Radiology in non-violent crimes; Smuggling and larceny; The radiology of fakes and forgery in art; The radiology of abuse, child abuse, spousal abuse, civil rights abuse and abuse of the aged; Research and new modalities and its applications; Use of post-mortem cranial MRI in evaluation of suspected child abuse; Stereo-lithography as a useful tool in forensic radiology; Courts and expert witnessing.	
Unit III Forensic Nursing	15

Scope, Evolution of Forensic Nursing, Model of Forensic Nursing, career opportunities, clinical Forensic Nurse Specialist, Forensic case Management, Responsibilities of Hospitals in Evidence collection and preservation, Status of Forensic Nursing, Future of Forensic Nursing	
Unit IV Forensic Nanotechnology & Textile Forensics	15
Application nanotechnology forensic science such as in fingerprinting development, explosives, narcotics, drugs and other areas. Textile Fibers, Yarns, Fabric construction, Fabric characteristics, Fabric manufacture, Microscopy characteristic, Birefringence, Fluorescence Microscopy, Colors in textile, Color Assessment, Chemical properties, Paint: analysis(Organic, TLC, colorimeter Analysis , Inorganic)	

PSFS302: Modern Instrumental Techniques – I

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	Total Lectures
Semester- III	
Unit –I: Spectral Techniques	15
<ul style="list-style-type: none"> • Ultra violet and visible Spectroscopy: - Principle, Types of sources and stability, wavelength selection, filters-cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection, Applications. • Fluorescence and phosphorescence Spectroscopy: - Principle, Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods, Applications. • Infrared Spectroscopy: - Principle, Dispersive and Fourier Transform Spectrophotometry, sample handling, quantitative analysis and interpretation of IR spectra, Applications. 	
Unit-II: Separation Techniques	15

<ul style="list-style-type: none"> Thin Layer Chromatography:- Introduction, Theory, Instrumentation, Various types of TLC, High Performance Thin Layer Chromatography, Applications. High Performance Liquid Chromatography: - Introduction, Plate Theory, Principle, Instrumentation, Types of Columns & Detectors, Applications. Gas Chromatography:- Introduction, Principle, Theory, Instrumentation, Types of detectors Hyphenated techniques, Applications. 	
Unit-III: Thermal Methods of Analysis	
<ul style="list-style-type: none"> Thermogravimetric Analysis:- Introduction, Thermogravimetric curve, Instrumentation, Factors affecting TGA, Applications. Differential Thermal Analysis:- Introduction, Instrumentation, Principle of working, DTA & TGA Curves, Factors affecting DTA, Applications. Thermometric Titrations:- Introduction, Theory, Instrumentation, Techniques of Thermogravimetric titrations, Applications. 	15
Unit-IV : Miscellaneous Techniques	
<ul style="list-style-type: none"> Radiochemical techniques:- Basic principles and theory, introduction about nuclear reactions and radiations, Neutron sources, Neutron Activation Analysis (NAA), Applications. Electron Diffraction and Neutron Diffraction:- Basic principles, Theory, Introduction, Instrumentation, Neutron diffraction, Applications of neutron diffraction, Applications.. 	15

PSFS303: Biometric Technology

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	No. lectures
Unit I: Introduction and Biometric Technologies.	15
Introduction, Biometric systems: Enrollment and recognition phases, sensor module, feature extraction module, database module, matching module, Biometrics Functionality:	

Verification & Identification, Biometrics system errors performance measures, Design cycle of biometric System: Nature of the application, Choice of biometric trait, Data collection, Choice of features and matching, Application of biometric system, Security and privacy issues	
Unit II: Security of Biometric System	15
Introduction to Security of Biometric System, Adversary attacks: Insider Attacks, Infrastructure attacks, Attacks on user Interface: Impersonation, Obfuscation, Spoofing, Countermeasure of spoof detection, Attacks on biometrics processing : On system modules & at interconnections, Attack on template database & Countermeasures in biometric template security.	
Unit III An Introduction to Statistical Measures of Biometrics	15
Recommended Biometric for Network Security: Introduction, Implementation of Biometrics for Network Security. Finger Biometrics, Voice Biometric, Definition & applications of FAR, FRR, FTE, EER. Biometric Transaction: User, Biometric reader, Matching location, Biometric Reader: Trusted, Non-Trusted.	
Unit IV : Types of Biometric Technology and Verification Systems	
Introduction, Biometric verification, Use of Biometric, Biometric Technologies for Personal Identification, Retina recognition, Signature Dynamics or Recognition, Keystroke Dynamics, Speaker recognition, RFID Chip implant, Business and Federal Applications of Biometric Technologies, Challenges and Issues in Using Biometrics, Risk Management Is the Foundation of Effective Strategy, Barriers to Future Growth, Biometric technologies under development: Blood pulse, Nailbed Identification, Body salinity Identification, Palm print, Palm print, vein Pattern, Facial thermography, Skin Luminescence, Brain Wave Pattern, Electronic Nose Identification, Foot Dynamics.	15

PSFS304: Law, Psychology and Case studies

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with description	Total lectures
UNIT I – Neuropsychology and Crime	15 Lectures
<ul style="list-style-type: none"> • Clinical and Cognitive Neuropsychology • Brain damage (Types) and Personality/ Behavioral issues • Neuropsychological evaluation, Brain scans • Neuropsychology of offending 	
Unit II - Psychology and Law (Legal Psychology)	15 Lectures
<ul style="list-style-type: none"> • Psychological issues concerned with courts • Credibility of witnesses • Eyewitness testimony • Police Interrogation and Pre-Trial Publicity 	
Unit III: Forensic Evidence: International perspective	15 Lectures
<ul style="list-style-type: none"> • Salient features of Indian Constitution and Preamble. • Admissibility of forensic evidence and Indian constitutional provisions (Art. 20, 21 and 22) (Lie detector, Narco-analysis, DNA test etc.) • Constitutionality of forensic evidence: national and international aspect: Comparative approach and criticism. 	
Unit IV: Forensic Evidence and Human Rights	15 Lectures

<ul style="list-style-type: none"> • Human rights meaning and concept • Investigations of human rights violations and forensic evidence, • International war crimes and forensic evidence, • Contribution of forensic science for protection of human rights and barriers to its effective application. 	
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Optional Group I:

PSFSP305: Forensic Physics

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	No. lectures
<p>Unit-1 Crystal Physics</p> <p>Crystal Lattice 25, Unit cell and its lattice parameters 26-27, overview of seven basic crystal systems and their characteristics 79-90, Bravais lattices: comparative ideas of axial lengths 49, inter-axial angles 49, lattice points and unit cell 25; Miller Indices: procedure of finding Miller Indices of crystal planes, representation of crystal planes in cubic unit cell with some illustrative examples, procedure of sketching crystal planes from the given Miller Indices with some illustrative examples, presentation of crystal direction in a cubic unit cell, procedure of sketching crystal directions from the given Miller Indices 28-32, Interplanar spacing 145-148, comparative study of simple cubic (SC), body centered (BCC) and face centered (FCC) cubic structures in respect of atomic radii, number of atoms in unit cell, number of atoms per square millimeter of a crystal plane, atomic packing factor, number of nearest neighbours, introductory ideas of various crystal defects 109-112, Bragg's Law 142-144</p>	15
<p>Unit-II Crystal Absorption, Diffraction and Fluorescence Spectroscopy</p> <p>Introduction 2.303, General Theory 2.303-2.309, X-ray Absorption Apparatus 2.309-2.314, Non-Dispersive X-ray Absorption Method 2.314, Applications of X-ray Absorption Methods 2.315-2.318, X-ray Diffraction Methods, Energy</p>	15

dispersive X ray fluorescence spectroscopy 2.318-2.326, Applications of X-ray Diffraction 2.326, Fluorescence Methods 2.332-2.338	
Unit III Basics of Atomic and molecular spectra Qualitative discussion of atomic spectra, energy levels, designation of states, selection rules. Molecular spectra: Qualitative discussion of molecular binding, molecular orbital, types of molecular energies, qualitative discussions of rotational, vibrational and electronic spectra, spectra of polyatomic molecules, Beer-Lambert's law, derivation and deviations from the law, errors in photometric measurements, photometric accuracy, high precision measurements, calibration of instruments	15
Unit-IV Geo-forensics Global positioning system: Basic principles and its usage, Induced couple Plasma (ICP): Basic principle, applications for analysis of rock and soil materials, Laser ablation ICP-MS for analysis of rocks and mineral grains, resistivity meter: basic principle and application for searching of buried materials.	15

PSFSP306: Forensic Ballistics

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	No. lectures
Unit I: Statistics and interpretation in forensic Ballistics Applications of statistics in Forensic Ballistics, Statistical evaluation of data regarding Forensic Ballistics obtained by instrumental methods. Mathematical considerations of striation matching, etc. Presentation of evidence 480 - 484 Expert, exhibits language of the expert, cross examination, court and the expert	15
	15

Unit II:	
Range of Firing Estimations and Bullet Hole Examinations 211 Introduction 211 The Use of X-ray Photography 212 Range of Firing Estimations for Pistols and Rifles 219 Chemical Tests for Range of Firing Estimations and Bullet Entry/Exit Hole Identification 227 Range of Firing Estimations for Shotguns 233	
Unit III:	15
Examination of telegraph, traction wire and cables Introduction; collection of evidence; method of analysis: measurement of gauge wires, matching of cut ends for tool marks, physical matching of ends, examination of die marks, measurement of electrical resistance, chemical analysis, testing/examination of electronic meters, Analysis of sealing material	
Unit IV: Restoration of Erased Numbers 277 Introduction 277 Methods Used for Removal of Serial Numbers 277 Theory behind Number Restoration 278 Non-recoverable Methods of Number Removal 279 Practice of Number Restoration 280 Chemical Methods of Restoration 280 Reagents Used for Various Metals 281 Electrolytic Methods of Restoration 283 Reagents Used 283 Ultrasonic Cavitation for Restoration 284 Magnetic Particle Method for Restoration 284 Other Methods of Restoration 285 Laser-Etched Serial Numbers and Bar Codes and Their Restoration 286	15

Optional Group II:**PSFSC305: Forensic Toxicology-I**

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	Total Lectures
Semester- III	
Unit –I: Micro-chemistry of Poisons and their Medico legal Aspects	15
<ul style="list-style-type: none"> • Concept and Scope of Toxicology, Classification of Poisons, Route of Administration, Route of Elimination of Poisons, Actions of Poisons (Local, Remote, Systemic and General). • Inorganic Poisons: Alkali – Potash, Soda, NH₃, Mineral Acids – H₂SO₄, HNO₃, HCl, Medico legal aspects of toxicology. • Physical poisons: Glass powder, Diamond, Sand, Dust, Hair etc 	
Unit-II: Forensic Pharmacology	15
<ul style="list-style-type: none"> • Drugs-Effect and metabolism, Adverse drug reactions, Drug concentration and post-mortem redistribution, Preliminary testing of drugs, Clandestine laboratories, Scheduled and Non scheduled drugs, Drug doping analysis. 	
Unit-III: Detailed study of Plant Poisons and Animal Poisons	15
<ul style="list-style-type: none"> • Plant Poisons: Ricinus communis, Crton tiglium, Abrus precatoris, Catropis gigaantea, Papaver somniferum, Semecarpus anacardium, Canabis sativa, Datura fastuosa, Lobelia digitalis, Quinine, Ergot, 	

Brucine.	
<ul style="list-style-type: none"> Animal Poisons: Cantharides, Snakes (Ophidia), Scorpio, Poisonous insects, Food poisoning, Food allergy, Botulism. 	
Unit-IV :Toxicant Analysis and Quality Assurance Principles	
<ul style="list-style-type: none"> Introduction, General Policies Related to Analytical Laboratories, Standard Operating Procedures (SOPs), QA/QC Manuals, Procedural Manuals, Analytical Methods Files, Laboratory Information Management, System (LIMS), Analytical Measurement System Analytical Instrument Calibration, Quantitation Approaches and Techniques, Quality Assurance (QA) Procedures, Quality Control (QC) Procedures. 	15

PSFSC306: Forensic Chemistry-I

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	Total Lectures
Semester- III	
Unit –I: Titrimetric Analysis And Gravimetric Analysis Of Compounds	
<ul style="list-style-type: none"> Titrimetric Analysis: Therotical Consideration, Classification Of Reactions In Titrimetric Analysis, Neutralistion Titration, Complexometric Titration, Precipitation Titration, Redox Titration. Conductometry: Introduction, Principle, Conductometric Titration, Applications. Potentiometry: Introduction, Principle, Potentiometric Titration, Applications. P^HMetry: Introduction, Principle, P^Hmetric Titration, Applications Gravimetric Analysis: Introduction, Fundamentals, Precipitation Reagent, Determination Of Metal Ions. 	15
Unit-II: Conceptual Organic Synthesis	15

<ul style="list-style-type: none"> • Introduction Of Organic Synthesis, Basic Principle • Disconnection Approach, • Types Of Organic Reactions • Synthesis Of Amines, Alcohol, Acids, Esters And Amides • Derivative Synthesis Of Amines, Alcohol, Acids, Esters And Amides etc 	
Unit-III Advanced Analytical Techniques In Chemical Analysis	
<ul style="list-style-type: none"> • Neutron Activation Analysis: Introduction, Review, Theory, Principle, Instrumentation-Various Neutron Sources, Detection And Measurement Of Gamma-Rays For Qualitative And Quantitative Analysis. Applications • Mass Spectroscopy: Introduction, Review Of Mass Spectroscopy, Principle, Theory, Instrumentation And Technique, Ionization Methods, Fragmentations, Selected Ion Monitoring, Atomic Mass Spectroscopy, Fast Atom Bombardment Mass Spectroscopy, Stable Isotope Ratio Mass Spectroscopy, Applications • NMR Spectroscopy: Introduction, Review, Theory, Principle, Instrumentation, Types Of Protons, Number Of Signals, Chemical Shift, Spin-Spin Coupling, Applications. 	15
Unit-IV: Purification And Micro Extraction Techniques In Chemical Analysis	
<ul style="list-style-type: none"> • Purification techniques: Distillation, fractional distillation, steam distillation, crystallization, centrifugation etc. • Micro Extractions: Liquid-liquid extraction, salting out, extractive derivatisation ,solid phase micro extraction. 	15

Optional Group III:**PSFSB305: Forensic Serology and Biology**

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	Total no. of Lectures
UNIT I: Identification of blood from particular source.	
<ul style="list-style-type: none">• Identification of Menstrual Blood• Identification of Retro placental Blood, Blood Shed at Parturition and in Abortion and the Forensic Diagnosis of Pregnancy• Identification of Fetal Blood and Blood from Children.• Kidds Blood Grouping System.	15 lectures
UNIT II: Identification of Body fluids other than blood	
<ul style="list-style-type: none">• Identification of semen: Immunological Methods (Precipitin Tests) Crystal Tests (Florence Test, BarberioTest, Puranen's Test), Chromatographic and Electrophoretic Methods, Creatine Phosphokinase, Lactic Dehydrogenase-X Isoenzyme, Sperm and Seminal Fluid Esterases, γ-Seminoprotein, Sperm Cell Antigens, Seminal Plasma Proteins and Antigens, Seminal Protein p30• Identification of saliva: Identification of Inorganic Ions (Thiocyanate, Nitrite), Alkaline Phosphatase, Immunological Methods, Microscopical Methods, Fluorescence of Saliva Stains under Ultraviolet Light.• Identification of urine, faecal matter, other body fluids and secretions.	15 lectures
UNIT III: Anthropology and Odontology In Human Identification	

<ul style="list-style-type: none"> • Genocide, Exhumation • Skeletal Trauma (antemortem, perimortem, postmortem, pseudomortem) • Pathologic Changes in Bone • Use of DNA in Forensic Dentistry • Reconstructive determination using dental remains (age, race, gender) • Problems Encountered When Using Teeth for Postmortem Identification Purposes • Dental Charts and Charting Systems, • Dentures and Denture Marking ,Surface Marking Techniques ,Inclusion Marking Technique • Dental Profiling. 	15 lectures
UNIT IV: Quality Management:	
<ul style="list-style-type: none"> • Quality Assurance, Proficiency Testing. • ISO/ IEC guidelines • Management requirements: Control of Records • Technical Requirements: Personnel, Accommodation and environmental conditions, Test and calibration methods and method validation, Equipment, Measurement traceability, Sampling, Reporting • Types of QA standards and Accreditation schemes. • Biohazard Safety Precautions. 	15 lectures

PSFSB306: Forensic DNA Analysis

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	Total no. of Lectures
UNIT I: Forensic Genetics:	

<ul style="list-style-type: none"> • Non-human DNA testing: Sources, Domestic animal DNA testing (cat DNA, dog DNA), Canine STR Loci and assays, Canine mtDNA Testing, • Species Identification: (mtDNA cytochrome b gene, mtDNA 12S rRNA gene, mtDNA COI gene) • Wildlife DNA testing: Genetic markers, Geographic origin identification (Divergent populations with gene exchange, populations with high gene-exchange, and populations with low gene-exchange.) Biosensors, use of remote sensing techniques for population study of endangered plants and animal species. • DNA banks for endangered animals and DNA database controversies. 	<p>15 lectures</p>
<p>UNIT II: Quality Management</p>	
<ul style="list-style-type: none"> • Collection, Preservation, storage & transportation of physical evidence. • Characterisation of DNA samples: Presumptive and Confirmatory tests to determine biological origin, contamination concerns (secondary transfer studies, fake DNA and Sample Authentication) • Forensic Challenges • Quality assurance of DNA laboratory • DAB guidelines. 	<p>15 lectures</p>
<p>UNIT III: Techniques in DNA Analysis</p>	
<ul style="list-style-type: none"> • DNA extraction techniques for different forensic samples (early techniques , solid phase extraction, differential extraction, chelex extraction, automated techniques, commercial extraction kits) • RNA extraction from different forensic samples. • Determining quality and Quantity of DNA and RNA, Gel elution technique. • DNA Amplification: Types of PCR: Inverse PCR, Nested PCR, Touchdown PCR, Stepdown PCR, Stepout PCR, Gradient PCR , Hotstart PCR, Quantitative PCR, multiplex PCR. 	<p>15 lectures</p>
<p>UNIT IV: Numerical calculation in Forensic DNA Analysis</p>	

<ul style="list-style-type: none"> • Data types, population, sampling, dispersion, probability, normal distribution, correlation, regression, conditional probability, evidence evaluation, errors in interpretation. • DNA as evidence, Paternity index, Likelihood of paternity , ANOVA analysis • Simple case genotypic frequencies, Simple case allelic frequencies, Matching of DNA profiles 	15 lectures
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PRACTICALS
M. Sc. FORENSIC SCIENCE
Semester III - Practicals
PSFS3P1: Emerging Trends in Forensic Science

Marks: 50	
Period per Week (60 Min. Each)	Credits
4	2

S.No.	Name of Practicals	No. of Practicals
1.	To detect adulteration in cement samples.	1
2.	To check the quality of cement samples.	1
3.	To identify the nature of adulterants used in cement samples.	1
4.	To find out the cement content in mortar (mixture of cement and sand) i.e. the ratio of cement and sand in mortar.	1
5.	To find out the cement content in concrete (mixture of cement, sand and aggregate) i.e. the ratio of cement, sand and aggregate in concrete.	1
6.	Collection and preservation of samples in hospitals (MLR)	1
7.	Study of Radiographs of Bite Marks.	1
8.	Examination of fibers: Fiber Color(s), Number of Fibers, Fabric Type.	1
9.	Microscopic examination & Visible Spectroscopic examination of Textile Fibers.	1
10.	Thin-Layer Chromatographic examination of Nonreactive Dyes in Textile Fibers.	1

PSFS3P2: Modern Instrumental Techniques – I

Total Marks	Credit
50	02

SEMISTER-III		
PRACTICAL		Marks
1	a) Topic approval for synopsis b) Objectives and work plan	25
2	Presentation	25

PSFS3P3: Biometric Technology

Total Marks	Credit
50	02

PRACTICALS	
1. Field Visit	25 marks
2. Field visit Report	25 marks

PSFS3P4: Law, Psychology and Case studies

	Total Marks	Credit
	50	2
Project Work - Review of Literature	25 Marks	
Project Work - Progress Report	25 Marks	

Optional GroupI:**PSFSP3P5: Forensic Physics**

Total Marks 50	
Lecture Per Week	Credit
4	2

LIST OF PRACTICALS:	No of Practicals
1. Sketching of crystal planes from the given Miller Indices.	1
2. Presentation of crystal direction from the given Miller Indices.	1
3. Determination of number of atoms per mm^2 in a plane of unit cell.	1
4. Determination of crystal parameters from given XRD pattern.	1
5. Indexing of XRD pattern using JCPDS data sheets.	1
6. Intensity analysis of XRD pattern.	1
7. Determination of crystallite size of given XRD pattern using Debye-Scherrer method.	1
8. Determination of lattice constant and Bravais lattice using Photographic/graphical XRD pattern.	1
9. Study of absorption spectrum of a conjugated dye by a spectrophotometer.	1
10. Identification of various rocks.	1
11. Investigation of buried materials using resistivity meter.	1
12. Identification of buried materials using self-potential method.	1
13. To analyze the given compound using FTIR spectra	1
14. To find out the unknown concentration of the given sample using UV/Vis	1
15. Spectrophotometer	
16. Peak determination of Quartz, Beryl, Anthracite etc. stones using XRD	1

REQUIREMENTS:

Crystal Models and graph papers, XRD patterns of various samples and JCPDS data sheets, Raman Spectrometer, constant deviation spectrometer/spectrograph, Constant deviation quartz prism spectrograph, Plane diffraction grating (15000 LPI), simple spectrometer, Glass tube with uniform 4 cm bore and 1 meter length containing Iodine vapours, High wattage filament lamp or auto vehicle head lamp of 48 watt, bull lens, KMnO₄ solution, Beckman model DU spectrophotometer, various organic dyes. Induced Coupled Plasma (ICP), Laser Ablation ICP-MS, Various types of Rocks, Minerals, Resistivity meter, GPS, Arial Photograph, satellite image.

PSFSP3P6: Forensic Ballistics

Total Marks 50	
Lecture Per Week	Credit
4	2

Practicals

LIST OF PRACTICALS:	No of Practicals
1. Barrel wash examination	1
2. Examination for serviceability/working condition of firearm	1
3. Examination of firearm or parts thereof/ manufacturing tool	1
4. Examination of firearm, prone to accidental discharge	1
5. Restoration of erased marking on firearm	1
6. Identification of shots and pellets	1
7. Linkage of fired bullet/bullet fragments with rifled firearm	1
8. Linkage of fired bullet/bullet fragments with unrifled firearm	1
9. Measurement of wound ballistic parameters	1
10. Test Firing: To ascertain whether the firearm is in working order or liable to accidental fire. To obtain test cartridges and test fired bullets for linkage. To obtain test targets for range determination (also angle of fire/direction of fire).	1

	To measure the trajectory parameters.	
11.	To obtain test specimens of relevant firing marks for linkage	1
12.	Automatic examination and comparison of fired bullets/ cartridge cases and creation of a National Database.	1
13.	Study of restoration of erased numbers on documents.	1
14.	Physical examination of wires,cables.	1

Optional Group II:

PSFSC3P5: Forensic Toxicology-I

Total Marks 50	
Lecture Per Week	Credit
4	2

PRACTICAL		No. of Practicals
1	Separation of ternary organic mixture.	02
2	Extraction of plant poisons (cannabis, dhatura) from plant material – Method development and analysis by TLC.	02
3	Analysis of plant poison by IR spectroscopy for functional group detection.	02
4	Analysis of plant material (poison) by HPLC, GC-MS analysis.	02
5	Drug extraction from urine and UV- visible, GC-MS analysis.	02

PSFSC3P6: Forensic Chemistry-I

Total Marks 50	
Lecture Per Week	Credit

4	2
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PRACTICAL		No. of Practicals
1	Examination of paints and pigments by microscopic method, micro-chemical tests, TLC.	02
2	Examination of paints and pigments by microscopic method by FTIR.	02
3	Identification of narcotic drugs, opium and alkaloids, morphine and heroine, cannabis by colour test, TLC and instrumental techniques.	02
4	Experiment of FTIR spectra of benzodiazepines	02
5	Analysis of bromine content in cold drinks by chemical and instrumental method.	02

Optional Group III:

PSFSB3P5: Forensic Serology and Biology

Marks 50	
Period per Week	Credits
4	2

PRACTICAL		No. of Practicals
1	To perform a tetramethylbenzidine test for blood detection	1
2	To perform ABA card Hematrace test for detection of human blood	1
3	To perform Luminol test for blood detection.	1
4	Jaffe Test for urine detection.	1

5	Urobilinogen test for fecal matter detection.	1
6	Identification of semen using Seratec PSA Semiquant.	1
7	Christmas Tree staining for spermatozoa detection.	1
8	Blood Grouping using biological fluids other than blood by Absorption Elution Technique.	2
9	Preparation of Dental Chart.	1
10	Recording of Bite marks by Photography & Casting.	1
11	Examination of dental radiogram	1
12	Examination of skeletal trauma using x- ray results	1

PSFSB3P6: Forensic DNA Analysis

Marks 50	
Period per Week	Credits
4	2

Practical		No. of Practicals
1	Preparation & storage of various Molecular biology reagents	1
2	Extraction of DNA from Envelope Flaps and Stamps	1
3	Extraction of DNA from Cigarette Butts	1
4	Extraction of DNA from Hair Samples	1
5	Extraction of DNA from Chewing Gum	1
6	RNA extraction from various forensic samples	1
7	Quantitative estimation of DNA / RNA	2
8	To perform a hot- start PCR, Nested PCR, Touch-Down PCR	3

9	Extraction of mitochondrial DNA from forensic samples	1
10	To perform a gel-elution and purification of extracted DNA	1
11	Extraction of DNA from soil sample	1

M. Sc. FORENSIC SCIENCE
Semester IV - Theory
PSFS401: Emerging Trends in Forensic Science
(Compulsory Subjects)

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	No. lectures
Unit I : Forensic Engineering II	15
Forensic photogrammetry ; Introduction; Materials in distress; Establishing the load transfer path; Engineering forensic tools; Failure due to manufacturing fault; Fluid transport; Failure of storage vessels; Accidents in the workplace; Failure of medical implements; Component failure in road accidents; Fraudulent insurance claims; Criminal cases; Intellectual property cases.	
Unit II: Forensic Archaeology	15
Introduction, Forensic archaeologist's role, Archaeological methods & Principles in searches; Crime scene, and applications of forensic archaeology; Stratigraphic excavation of evidential data from forensic excavation, Accurate recording of bodies, body parts and ballistics; Recording context of remains for accurate interpretation of events; Applications.	
Unit III Geological and Soil Forensics	15
Introduction; Types of soil evidence; Color analysis; Particle analysis; Mineralogical analysis; Major and trace element composition; Size and type analysis; Analysis of individual particles; Pollen analysis; diatom analysis; Other microfossils;	

Water and air samples; Procedures for soil and sediment sampling and storage; Analysis of gems/ colored stones Evaluation of the significance of geological evidence.	
Unit IV Forensic Art Illustration	15
Forensic art – the foundation; Introduction to forensic art illustration; History of forensic art; The human face; Drawing the face; Finding and identifying the living; The interview; Composite imagery; Age progression and aging; Image assessment and modification; Postmortem drawing; Skull protection and preparation for reconstruction; Two-and-three dimensional facial reconstruction on the skull; Methods of superimposition; Additional responsibilities; Professional ethics and conduct; Printing and graphics reproduction; Dealing with the news media; The forensic artist in court.	

PSFS402: Modern Instrumental Techniques – II

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	Total Lectures
Semester- IV	
Unit –I: Spectral Techniques	15
<ul style="list-style-type: none"> • Atomic absorption Spectroscopy: - Instrumentation and techniques, interference in AAS, background correction methods, and quantitative analysis, Applications. • Raman Spectroscopy:- Instrumentation, sample handling and illumination, structural analysis, polarization measurements and Dispersive & FT analysis, Applications. • X-ray Spectroscopy:- X-ray absorption and fluorescence methods, X-ray diffraction, Auger mission spectroscopy (AES), electron spectroscopy for chemical analysis (ESCA), Applications. 	
Unit-II: Separation Techniques	
<ul style="list-style-type: none"> • Solvent Extraction:- Introduction, Methods of separation, Distribution Ratio, Techniques for solvent Extraction, Principle of separation, Applications. 	15

<ul style="list-style-type: none"> Electrophoresis:- Introduction, Principle, Types of Electrophoresis, Instrumentation, Factors affecting migration of ions, Applications. 	
Unit-III: Microscopy	
<ul style="list-style-type: none"> Microscope:- Main Parts and Functions, Types – Simple & Compound, Illumination, Condenser, Lens, Abbreviations, Eye Piece and their types, Resolution, Magnification, Numerical Aperture. Special Types of Microscopes, Instrumentation & Applications:- Polarizing Microscope, Phase Contrast Microscope, Phase Contrast Microscope, Fluorescent Microscope, Electron Microscope – SEM & TEM. 	15
Unit-IV : Miscellaneous Techniques	
<ul style="list-style-type: none"> Polarography:- Introduction, Principle, Polarographic Apparatus, Applications Amperometry:- Introduction, Methodology, Titration Curves, Applications Measurement of Potential & pH:- Electrode Potential, Electrochemical Cell, Reference Electrode, Indicator Electrode, Method of detecting End Point. 	15

PSFS403: Speaker Identification

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	No. lectures
Unit I: The Speech Signal: Production, Perception, and Acoustic-Phonetic Characterization. Introduction to speech recognition, The paradigm for speech Recognition, The process of speech production and perception in human being ,The speech production process, Representing speech in the time and frequency domains ,Speech sounds and features (The vowels, Diphthongs, Semivowels, Nasal consonants, unvoiced fricatives, Voiced fricatives, Voiced and unvoiced stops) Approaches to automatic Speech Recognition by machine	15
Unit II: Forensic speaker identification	15
Why voices are difficult to discriminate forensically	

<ul style="list-style-type: none"> o Between-speaker and within-speaker variation o Probabilities of evidence o Distribution in speaker space o Multidimensionality o Discrimination in forensic speaker identification o Dimensional resolving power o Ideal vs. realistic conditions o Lack of control over variation o Reduction in dimensionality o Representativeness of forensic data o Legitimate pooling of unknown samples 	
Unit III Forensic-phonetic parameters	15
Types of parameters Acoustic vs. auditory parameters Traditional vs. automatic acoustic parameters Linguistic vs. non-linguistic parameters Linguistic sources of individual variation Forensic significance: linguistic analysis Quantitative and qualitative parameters Discrete and continuous parameters Requirements on forensic-phonetic parameters	
Unit IV Characterizing forensic speaker identification	15
Speaker recognition ,Speaker identification and verification Relationship between forensic speaker identification and speaker identification/verification ,Summary: Verification and identification , Naive and technical speaker recognition Technical speaker recognition ,Conditions on forensic-phonetic speaker identification experiments ,Naive speaker recognition ,Naive speaker recognition: Discussion, Familiarisation in auditory forensic analysis Aural-spectrographic (voiceprint) identification ,Linguistic controversy ,Legal controversy	

PSFS404: Law, Psychology and Case studies

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with description	Total lectures
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UNIT I – Forensic Psychology in India	15 Lectures
<ul style="list-style-type: none"> • Ethical issues of “Informed Consent” • NHRC Guidelines For Forensic Psychology • Indian Courts Perspective • Rehabilitation Program 	
UNIT II- Research Methodology and Statistics	15 Lectures
<ul style="list-style-type: none"> • Significance and relevance in Psychology • Test development, conceptualization, pilot- work, writing items, item format • Reliability, Validity, and its types • Parametric and Non-parametric tests 	
Unit III: Medical Jurisprudence and Law- I	15 Lectures
<ul style="list-style-type: none"> • Meaning, concept and scope of medical jurisprudence. • Privileged communication • Consent: Informed and implied • Malpractice and negligence in medical practice (Illegal abortions, Prenatal Diagnostic Techniques) • Liability arising out of medical negligence (Tort, Criminal and Contractual, Vicarious liability) 	
Unit IV: Medical Jurisprudence and Law- II	15 Lectures
<ul style="list-style-type: none"> • Evidence and legal aspect: <ul style="list-style-type: none"> a. Insanity b. Poisons c. Injury d. Identity: DNA, race, age, religion, sex. e. Deaths (Brain Death) and Autopsy 	

<ul style="list-style-type: none"> • Medical jurisprudence in Civil (Abortion, Marriage, legitimacy and inheritance etc.) and Criminal cases (Murder, rape, assault etc.) • Benefits of medical jurisprudence, Role of Medico legal experts in various criminal cases. 	
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Optional Group I:

PSFSP405: Forensic Physics

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	No. lectures
Unit – I	15
<p>Examination of counterfeit coins and currency Introduction; definition: coin, counterfeiting; manufacture and circulation of Indian coins; minting process of genuine coins; types of counterfeit coins: cast, counterfeit process using moulds, powder moulds, metal moulds; detection of cast counterfeit coins; struck counterfeit coins its detection; collection of evidence</p> <p>Counterfeit Currency Introduction; production of government currency notes; characteristics of genuine currency notes; methods employed by counterfeiters: process made forgery, hand engraved blocks, photographic process, lithographic process, hand drawn forgery; methods for detecting counterfeit notes, search for evidence</p>	
Unit II:	15
<p>Forensic Photography Exposing, development and printing, different kinds of developers and fixtures, Modern developments in photography, linkage of cameras and film negatives, digital photography, digital water marking and digital imaging, photogrammetry, videography / high speed videography, crime scene and laboratory photography.</p>	
Unit III	
<p>Microtraces Glass: - Glass: Types of Glass-Soda lime glass, borosilicate glass, safety glass, Laminated, Light sensitive glass, Tampered/toughened glass, Wire glass, Coloured glass. Matching; Physical parameters: Fluorescence under UV radiation, Density or Specific gravity, Density measurements for bigger fragments of glass, Density comparison by flotation and density gradient tubes. Refractive Index Measurement (RI): Immersion method, Becke line concept, RI using the mixture of miscible liquids and hot stage microscope, Elemental analysis, Glass fracture identification. Gem Stones: Analysis of crystalline</p>	15

<p>substances, radial and circumferential cracks, forensic examination of glass fractures under different conditions, determination of direction of impact and sequence of shots; cone-fracture, rib marks, hackle marks, backward fragmentation. Case study of glass, Energy dispersive x-ray fluorescence spectroscopy of glass</p> <p>Soil: Formation and types of soil, composition and colour of soil, particle size distribution, turbidity test, microscopic examination density gradient analysis, ignition loss, differential thermal analysis, elemental analysis, interpretation of solid evidence, Energy dispersive x-ray fluorescence spectroscopy of soil</p>	
Unit IV:	15
<p>Paint: - Types and their composition, macroscopic & microscopic studies, pigment distribution micro-chemical analysis solubility test, pyrolysis chromatographic techniques, TLC, Colorimeter, IR spectroscopy & X-ray diffraction elemental analysis, collection and interpretation of paint evidence. Energy dispersive x-ray fluorescence spectroscopy of paint</p>	

PSFSP406: Forensic Ballistics Explosives and Fire.

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	No. lectures
Unit I:	15
<p>Ballistics</p> <p>Gunshot residue analysis Nature, collection, evaluation 233 - 242 Fraudulent manipulations 260 – 264</p> <p>Elementary ballistics 154 - 164 General, heat problems, pressure, recoil, vibration and jump, barrel fouling</p>	
Unit II:	15
<p>Arm - Ammunition Linkage 197- 212</p> <p>Test exhibits: test bullets, test marks from smooth bore, Examination : stereo microscopy, comparison microscopy, comparison, comparison camera, periphery camera, scanning electron microscopy, striagraphy, cast, macro-photography</p>	
Unit III:	15
<p>Explosives 428 – 443</p> <p>Explosive devices</p>	

Improvised Explosive Devices Non-Explosive Explosions Hidden Explosives	
UNIT IV	15
<u>Fires and Arson</u> <u>fire</u> Importance 955 Nature 956-963 Collection of Clues and Problems 963-969 Evaluation 963-975 Experts Testimony 975-977 Case Law 977-981 Arson Arson motives; Building construction – fire problems and precautions; Chemical and behaviour of fire; searching the crime scene, Determining origin and cause; Eliminating accidental causes, collection and preservation of Arson evidence, Analysis of flammable residue	

Optional Group II:

PSFSC405: Forensic Toxicology-II

Total Marks 100	
Lecture Per Week	Credit
4	2

Units with Description	Total Lectures
Semester- IV	
Unit –I: Study Of Spinal Poisons And Cardiac Poisons	15
<ul style="list-style-type: none"> • Spinal Poisons: Kuchila, Strychnine ($C_{21}H_{22}O_2N$), Calabar Bean, Physostigmine ($C_{15}H_{21}N_3O_2$), Carolina Jessamine Or Jasmine • Cardiac Poisons: Tobacco, Lobelia, Betel Nut, Foxglove, Strophanthus, Quinine ($C_{20}H_{24}N_2O_2$), Oleanders, Cerbera Odeollam, Aconite, Monk’s Hood, Blue Rocket, Hydrocyanic Acid Or Hydrogen Cynide (HCN). 	

Unit-II: Study Of Asphyxiants, Peripheral Poisons And Miscellaneous Poisons	15
<ul style="list-style-type: none"> • Asphyxiants: Carbon Dioxide, Carbon Monoxide, Carbon Disulphide, Hydrogen Sulphide, Nitrogen Monoxide, Sulphur Dioxide, War Gases. • Peripheral Poisons: Spotted Hemlock, Curare (Curara, Woorara, Woorali) • Miscellaneous Poisons: Mycotoxins, Poisoning By Hormones. 	
Unit-III: Forensic Pharmacology	15
<ul style="list-style-type: none"> • Principles Of Toxicology, Occupational & Environmental Toxicology: Introduction, Hazards And Risks, Routes & Duration Of Exposure, Computational Toxicology: Introduction, Methodologies • Toxicogenomics: Aims & Scope, Evolution Of The Field, Biomarkers And Signatures. 	
Unit-IV: Forensic and Clinical Toxicology	15
<ul style="list-style-type: none"> • Introduction, Foundations of Forensic Toxicology, Courtroom Testimony, Investigation of Toxicity-Related Death/Injury, Documentation Practices, Considerations for Forensic Toxicological Analysis, Drug Concentrations and Distribution, • Laboratory Analyses: Colorimetric Screening Tests, Thermal Desorption, Thin-Layer Chromatography (TLC), Gas Chromatography (GC), High-Performance Liquid Chromatography (HPLC), Enzymatic Immunoassay, Analytical Schemes for Toxicant Detection, • Clinical Toxicology: History Taking, Basic Operating Rules in the Treatment of Toxicosis, Approaches to Selected Toxicoses. 	

PSFSC406: Forensic Chemistry-II

Total Marks 100	
Lecture Per Week	Credit
4	2

Units With Description	Total Lectures
Unit –I: Adulteration Of Food Products	
<ul style="list-style-type: none"> • Introduction, Preservation of Food , Food Additives (Regulation For Preservatives, Antioxidant, Sweeteners, Colouring Agents, Flavoring Agents), Adulterants, Adulteration in vegetable Oil, Milk, Soft Drinks, Fruit Juices, Red Chilli Powder, Coffee, Tea. • Determination of Toxicants and Adulterants In Food: Sampling, Sample Preparation For Analysis By Distillation, Extraction, Solid Phase Extraction, Analysis By Colour Test, TLC, GC, HPLC. • Study of Law Cases. 	15
Unit-II: Chemical analysis of Biomolecules	
<ul style="list-style-type: none"> • Carbohydrates: Classification, Structural Chemistry, Purification Methods, Characterization. • Proteins: Classification, Structural Chemistry, Purification Methods, Characterization • Lipids: Classification, Structural Chemistry, Purification Methods, Characterization • Enzymes: Classification, Structural Chemistry, Purification Methods, Characterization 	15
Unit-III: Fire, Arson And Bride Burning Cases	
<ul style="list-style-type: none"> • Introduction Of Fire , Arson, Crime Related Bride Burning Cases, Crime Scene Management In Arson And Bride Burning Cases • Chemistry Of Fire, Scientific Investigation And Evaluation Of Clue Materials, Collection, Preservation Of Evidence. • Analysis: Visual And Microscopic Examination Of Debris From Scene. Distillation And Extraction Of Flammable Residue Analysis By GC, GC-MS, And IR Spectroscopy. Law Related Case Studies. 	15
Unit-IV: Aspects Of Explosive Detection	
<ul style="list-style-type: none"> • Detection Problems, Threat And Materials, Colourimetric Detection, Nuclear Technologies, X-Ray Technologies, CT Technology, Detection Of Explosives By Amplified Fluorescence Polymer, Explosive Law Cases. 	15

Optional Group III:

PSFSB405: Forensic Serology and Biology

Marks 100	
Lectures per Week	Credits
4	2

Units with Description	Total no. of Lectures
UNIT I: Forensic Medicine	15 lectures
<ul style="list-style-type: none">• Medico-legal autopsies: Definitions of medico-legal and clinical/pathological autopsies, Objectives, procedures, formalities of medico-legal autopsies, Preservation of articles of importance, during autopsy, Preservation of body fluids & viscera in suspected poisoning.• Sexual Jurisprudence : Potency and impotency, Fertility and Sterility, criminal abortion, paternity, incest, rape, sodomy, lesbianism, buccal coitus, bestiality, Fetichism, sadism necrophagia, masochism• Medico legal aspects of : Still born and dead born and their causes , Live born and Neonatal deaths, Infanticide, Cot death – Sudden infant death syndrome, Battered Baby Syndrome	
UNIT II: Recent trends in forensic investigation	

<ul style="list-style-type: none"> • Radiography in the Identification of Human Remains , Human Profiling and Radiography , Radiogenic Trace Element Isotopes in Human Tissue • Current and developing technologies for bioweapon detection: Processing of samples, challenges to detection, quantification of viruses, phage display techniques, Bioluminescence based detection, Sensor based detection systems, FAME analysis, Immunological detection devices, BV technology, DELFIA, SPR- based biosensors. 	15 lectures
UNIT III: Soft Tissue Pathology in Biological Human Identification	
<ul style="list-style-type: none"> • Age-Related Changes and Soft Tissue Pathology(Skin, Central Nervous System, Cardiovascular System, Respiratory System , Gastrointestinal System, Biliary System, Genitourinary System, Lymphoreticular System, Endocrine System Musculoskeletal system). • Occupational Disorders, Pathology of Industrial Disease. • Drug Misuse, Toxicology. • Sex Identity and Soft Tissue Pathology. 	15 lectures
UNIT IV: Biostatistics in forensic Biology & Serology	
<ul style="list-style-type: none"> • Gene frequencies, bi-allelic system • Hardy- Weinberg equilibrium, measurement of frequency distribution, closeness of fit with HWE, combined frequency of occurrence, probability of match and discrimination, discrimination power, power of exclusion, • Paternity index, likelihood of paternity. 	15 lectures

PSFSB406: Forensic DNA Analysis

Marks 100	
Lectures per Week	Credits
4	2

Units with Description	Total no. of Lectures
UNIT I: Instrumentation	

<ul style="list-style-type: none"> • Principle , Working, Maintenance, Application and Troubleshooting of various laboratory Instruments: Microplate reader, Water-Bath, Centrifuge , Refrigerators , PH meter ,digital balance, Gel documentation unit, Microscope, Thermal cycler,Automated DNA sequencer ,Biological safety cabinet , Micropipette UV-Visible spectrophotometer , colorimeter, homogenizer , hybridization unit, 	15 lectures
UNIT II: Advanced techniques:	
<ul style="list-style-type: none"> • Easy DNA, uniparentally inherited genetic markers in ethnic and geographical origin detection, • DNA fingerprinting of degraded samples, Slot-blot, DNA , DNA-DNA Hybridization , in situ hybridization (FISH) in gender identification , footprinting , pyrosequencing, biochip technology. • Oligonucleotide probe synthesis, artificial gene synthesis, primer designing • CODIS and NDIS 	15 lectures
UNIT III: Recent trends in forensic DNA analysis	
<ul style="list-style-type: none"> • Nano- particle technology in PCR, Drug DNA interaction , SNP microarray for supplementary paternity testing. • Genetic analysis of chromosome X (pentaplex/heptaplex PCR assay), multicopy Y-STR analysis, mitochondrial DNA analysis, DNA multi-reverse parental analysis, cytochrome b analysis, eDNA • Personal Effects and DNA analysis(sources and problems) 	15 lectures
UNIT IV: Forensic DNA evidence interpretation:	
<ul style="list-style-type: none"> • Interpretation of DNA typing results: Complicating Factors (Multiple contributors, degradation, extraneous substances), System-specific Interpretational Issues (RFLP, PCR systems) • Assessing strength of evidence: Determination of Genetic Concordance, Evaluation of Results, Frequency Estimate Calculations, Population Substructure, Likelihood Ratios, and Uniqueness of DNA Profile. • Admissibility standards: Frye, Daubert, and the Federal Rules of Evidence, Landmark cases, The State of Debate. • Prosecutor's fallacy, defendant's fallacy. • Ethics of DNA analysis and Post conviction DNA analysis. 	15 lectures

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M. Sc. FORENSIC SCIENCE
SEMESTER IV- PRACTICALS
PSFS4P1: Emerging Trends in Forensic Science

Marks: 50	
Period per Week (60 Min. Each)	Credits
4	2

S.No.	Name of Practicals	No. of Practicals
1.	Reconstruction of different crime scenes using photogrammetry techniques	1
2.	Analysis and measurement of Water Quality- suspended solids, dissolved oxygen and oxygen demand, Total Organic Carbon, pH, Acidity	1
3.	Analysis of archeological samples.	1
4.	Analysis of Soil: pH Measurement, Microscopic Examination, Microscopical Observation with Chemical Regents, Particle Size Distributions ,Ignition Test, Density gradient test.	1
5.	To determine composition of soil.	1
6.	Analysis of gems/ colored stones.	1
7.	Facial Sketching based on verbal description	1

PSFS4P2: Modern Instrumental Techniques – II

Total Marks	Credit
50	02

PRACTICAL		Marks
1	Final Project Work Presentation / Poster	25
2	Vice-Voce	25

PSFS4P3: Speaker Identification

Total Marks	Credit
50	02

PRACTICALS	No. of practicals
1. Collecting Audio Samples from different sources.	1
2. Auditory Analysis of a given Speech Sample.	1
3. Open Set and Close Set Comparisons of given Speech Samples	1
4. Spectrogram Analysis.	2

PSFS4P4: Law, Psychology and Case studies

Total Marks 50	
Lecture Per Week	Credit
4	2

Final Project Work	50 Marks
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Optional Group I:

PSFSP4P5: Forensic Physics

Total Marks 50	
Lecture Per Week	Credit
4	2

Practicals:

LIST OF PRACTICALS:	No of Practicals
1. To find out the refractive index of the mixture of solution.	1
2. Radial, Concentric, hackle and Rib Marks identification on Glass fracture	1
3. Measurement of physical parameters (colour, density, refractive index) on glass samples	1
4. Comparison of Compression, striated and combination of both marks.	1
5. Comparison of paint chips under microscope	1
6. Microscopic examination of various fibres	1
7. Measurements of physical parameters of fibers (Number of strands, Diameter of strand, Dye marks, Twist, Colour, thickness)	1
8. Soil comparison using density gradient tubes	1
9. Restoration of erased numbers on metallic surfaces	1
10. Restoration of registration numbers on plates	1
11. Anthropometric measurements in facial recognition from a still image/ photograph.	1
12. Identification of cameras from film negatives	1
13. Identification of genuine and counterfeit coins	1

PSFSP4P6: Forensic Ballistics Explosives and Fire

Total Marks 50	
Lecture Per Week	Credit
4	2

Practicals:

LIST OF PRACTICALS:	No of Practicals
1. Colour test for nitrate explosives (Griess, DPA, Brucine sulphate)	1
2. Colour test for TNT& Tetryl (Alcoholic KOH, Sodium sulphite)	1
3. Colour test and analysis of Black powder (Griess, DPA, Sodium	1
4. cobaltinitrate, NaOH, Sodium nitroprusside, Flame test)	1
5. Analysis of Pyrotechnique mixtures	1
6. Analysis of components of crackers	1
7. Measurement of wound ballistic parameters	1

Optional Group II:

PSFSC4P5: Forensic Toxicology-II

Total Marks 50	
Lecture Per Week	Credit
4	2

PRACTICAL		No. of Practicals
1	Identification of common plant kaner, dhatura and Nux vomica, aconite by colour test and instrumental techniques.	02
2	Analysis of animal and inset toxins.	02
3	Detection and identification of ammonium drugs and poison in pharmaceutical preparation by colour test and instrumental technique.	02
4	Systematic analysis of Viscera and blood in case of poisoning	02
5	Extraction of poisons and drugs from hair samples	02

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PSFSC4P6: Forensic Chemistry-II

Total Marks 50	
Lecture Per Week	Credit
4	2

PRACTICAL		No. of Practicals
1	Analysis of viscera and food material in case of food poisoning by chemical microscopic and instrumental techniques.	02
2	Determination of phosphine in poisoning cases due to Aluminium phosphide and zinc phosphide in Viscera by chemical and instrumental techniques.	02
3	Analysis of pharmaceutical sample by UV IR and NMR spectroscopy.	02
4	Explosive analysis by spot tests and IR	02
5	Analysis of residue material in fire and arson cases by TLC, UV spectrophotometer and GC.	02

Optional Group III:

PSFSB4P5: Forensic Serology and Biology

Marks 50	
Period per Week	Credits
4	2

PRACTICAL	No. of Practicals
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1	To determine the combined frequency of occurrence.	1
2	To determine the discrimination power and power of exclusion.	1
3	To determine paternity index using serum profile.	1
4	Case study based on Sudden Infant Death Syndrome.	1
5	Case study based on unnatural sexual offences	2
6.	Case study based on deaths due to occupational hazards.	2

PSFSB4P6: Forensic DNA Analysis

Marks 50	
Period per Week	Credits
4	2

PRACTICAL		No. of Practicals
1	To perform Calibration of refrigerator, centrifuge, micropipette, digital balance.	1
2	To perform primer designing using bioinformatics tools.	1
3	To perform Homogenization of various forensic sample.	1
4	Case study based on mass disasters.	2

5	Case study based on sexual assaults.	2
6.	Case study based on homicide.	2
7.	Case study based on paternity disputes.	2

PSFS301

Text Books

1. James, SH and Nordby, J.J., Forensic Science- An Introduction to Scientific and investigative Techniques, Second Edition, CRC Press, USA. Page no. 27- 42 , 471- 487.
2. B G Brogdon, M.D, Forensic Radiology, CRC Press INC, 2001.
3. Kenneth L. Carper – 2001, Forensic Engineering, Second Edition, CRC Press, 2001.
4. Virginia A. Lync, Janet Barber Duval , Forensic Nursing Science, Second Edition , Elsevier Mosby, 2006.

Reference Books:

1. Parikh's textbook of Medical Jurisprudence, Forensic Medicine & toxicology, Sixth Edition, CBS Publications & Distributors. Page no 1.61-1.65.
2. Gary L. Lewis, Guidelines for Forensic Engineering Practice, ASCE Publications, 01-Jun-2003.
3. Brian S. Neale, Forensic Engineering: The Investigation of Failures : Proceedings of the Second International Conference on Forensic Engineering Organized by the Institution of Civil Engineers and Held in London, UK, on 12-13 November, 2001, Thomas Telford, 2001.
4. Randall Noon, Forensic Engineering Investigation, CRC Press INC, 2001.
5. Donna M. Garbacz Bader, L. Sue Gabriel, Forensic Nursing: A Concise Manual, CRC Press, 2010

PSFS302

Text Books

1. A Textbook of Pharmaceutical Analysis (Instrumental Methods), Vol-2, Nirali Prakashan by Dr. A.V. Kasture, Dr. K.R. Mahadik, Dr. S.G. Wadodkar & Dr. H.N. More (pg. 169-168, 207-221). (pg. 169-168, 207-221). (pg. 18-30, 48-57, 58-75). (pg. 258-263)
2. Instrumental Methods of Chemical Analysis, Ed. 3, Pragati Prakashan by Dr. H. Kaur (pg. 814-825, 798-813, 826-841).(pg. 737-747, 748-755, 756-760). (pg. 946-965, 939-945).

3. P.S. Kalsi, Organic spectroscopy
4. Y.R. Sharma, Organic spectroscopy.
5. W. Kemp, Organic spectroscopy.

PSFS303

References:

1. Introduction to Biometrics, By Anil K. Jain, Arun A. Ross, Karthik (Chapter 1).
2. Introduction to Biometrics, Anil K. Jain, Arun A. Ross, Karthik (Chapter 7)
3. Paul Reid, Biometrics for network security (Chapter 3, 9, 10, 11).
4. Biometric Technologies and Verification Systems By: John R. Vacca (Chapter 1 & 2).

PSFS304

Textbooks:

- 1) 'Criminology' by Larry Siegel
- 2) 'Introduction to Forensic Psychology' by Bruce Arrigo. (Page 115-140)
- 3) 'Forensic & Criminal Psychology' by Dennis Howitt. (Page 55-58)
- 4) 'Handbook of Forensic Psychology' by Prof. Dr.VimalaVeeraraghavan. (Page 17-31, 215-218, 198-217)
- 5) 'Forensic Psychology' by Graham Towel & David Crighton (Page 73-87)
- 6) 'Psychological Testing' by Anne Anastasi, Susana Urbina, Seventh Edition. (Page 85-112, 114-136, 173-200)
- 7) 'Psychological Testing' by Cohen & Swerdlik. (Page 426-438)
- 8) Introduction to the Constitution of India, 4th Edition, By Sharma B.K (Page- 27 to 33, 42 to 48)
- 9) Forensic Evidence: Science and the Criminal Law, By Terrence F. Kiely, 2006, second edition, (Page- 1 to 39)
- 10) Forensic Medicine: Clinical and Pathological Aspects by Jason Payne-James, Anthony Busuttill, William S. Smock, 2003 (Page 39 to 48)
- 11) Forensic Archaeology and Human Right Violations by Roxana Ferllini, 200, (Page 3 to 21, & 55 to 61)
- 12) The Challenge of Human Rights: Past, Present and Future by David Keane, Yvonne McDermott, 2012, (Page 114 to 139)
- 13) Law & Medicine, by Dr. Lily Srivastava, 2010, Universal law Publishing Co, New Delhi, (Page 36 to 72)
- 14) Textbook of Forensic Medicine & Toxicology: Principles & Practice, 4th edition, 2009, by Krishan Vij, (Page 466 to 481)
- 15) Textbook of Forensic Medicine & Toxicology: Principles & Practice, Krishan Vij, 4th Edition, 2009, (Page 25, 26, 49, 50, 57, 58, 74, 75, 83, 94, 95, 96, 103, 104, 494, 495, 496, 520 to 524)
- 16) Field's Medico-Legal Guide: For Doctors and Lawyers by George W. Field
- 17) Parikh's Textbook of Medical Jurisprudence, Forensic Medicine & Toxicology for Classrooms and Courtrooms, 6th edition, 2010, CBS Publishers & Distributors, (Page- 1to2 to 1to58)

Reference Books:

- 1) 'Abnormal Psychology' by Halgin & Whitbourne.
- 2) 'Abnormal Psychology', by Robert C. Carson, James N. Butcher, Susan Mineka, Jill M. Hooley thirteenth Edition, Thirteenth Edition.
- 3) 'Encyclopedia of Forensic Science' by Jay A. Siegel, PekkaJ. Saukko, Geoffrey C. Knupfer, Volume-1 to Volume-5.
- 4) 'Mental Disorders and Treatment' by Katherine Marsland.
- 5) 'Handbook of Polygraph Testing' by Murray Kleine.
- 6) 'Brain Mapping-The Methods' by Arthur W. Toga & John C. Mazziotta, Second Edition.
- 7) 'Criminal Profiling and Introduction to Behavioural Evidence Analysis' by Brent Turve Second Edition.
- 12) Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
- 14) Serial Crime, Theoretical & Practical issues in Behavioral Profiling, Petherick, Woodworth Publication.
- 16) Diagnostic & Statistical Manual-IV TR, American Psychological Association
- 17) DSM-IV Mental Disorders Diagnostics, Etiology and Treatment, by Michael, Allan.
- 19) 'Psychological Testing' by Robert J. Gregory, Fourth Edition.
- 20) No Magic Wand: The Idealization of Science in Law by David Stanley Caudill, Lewis H. LaRue, 2006.
- 23) Encyclopedia of War Crimes and Genocide by Leslie Alan Horvitz, Christopher Catherwood, 2006.
- 24) Forensic Medicine and Toxicology By Rabindra Nath Karmakar, 2007
- 25) Medical Law for the Dental Surgeons by George Paul, 2004.
- 26) Textbook of Forensic Medicine & Toxicology: Principles & Practice, 5th edition, 2011, by Krishan Vij.
- 27) Forensic Toxicology: Medico-Legal Case Studies by Kalipatnapu N. Rao

Optional Groups I

PSFSP305:

Text Books :

1. Instrumental Methods of Chemical Analysis Gurdeep R. Chatwal and Sham K. Anand, Himalaya Publishing House.
2. Gurdeep R. Chatwal & Sham K. Anand; Instrumental Methods of Chemical Analysis, Himalaya Pub. House(2004).
3. Hobart H. Willard, Lynne L. Merrett Jr, John A Dean Frank A. Settle Jr.; Instrumental Methods of Analysis, 7th Edn. CBS pub. & Distributors (1986)
4. James, SH and Nordby, J.J., Forensic Science- An Introduction to Scientific and investigative Techniques, Second Edition, CRC Press, USA.
5. Douglas A. Skoog, F.James Holler & Timothy A. Nieman; Principles of Instrumental Analysis, 5th Edn. Thomas Books Co. (2003)

6. H. E. White, Introduction to Atomic Spectra, McGraw-Hill (1934)
7. Introduction to Solid State Physics Charles Kittel 7th edition Wiley India PVT LTD.
8. Solid State Physics S.O.Pillai 6th edition New Age Publication.
9. Modern Physics by S.L.Kakani, Shubhera Kakani, Viva Books PVT LTD New Delhi.
10. Engineering Physics by R.K.Gaur and S.L.Gupta, Dhanapat Rai Publications LTD New Delhi.
11. Engineering Physics by M.N.Avadhanulu and P.G.Kshirsagar, S.Chand Pblcation.
12. Solid State Physics P.K.Palanisamy, Sci-Tech Publication.
13. Condensed Matter Physics by Kumar and Gupta Meerut Publication.
14. Fundamentals of Molecular Spectroscopy 4th edition by Colin Banwell, Elaine Mccash Mc-Graw Hill Publishing Company
15. X-ray Methods Clive Whiston Wiley India PVT LTD John Wley and Sons, Newyork.
16. Advanced Practical Physics Vol. I by Dr. S.P.Singh Pragati Prakashan, Meerut.
17. Instrumental Methods of Analysis seventh edition Willard Merritt Dean Settle CBS Publishers and Distributors PVT.LTD New Delhi.
18. Pye, K., Croft, D.J. (eds) Forensic Geoscience: principles, techniques and applications.Special Publications of the Geological Society of London. (2004)
19. Houck, M.M. (Ed.). (2003). *Mute Witnesses*. Academic Press, London. 188 pp.
20. Jarvis, K.E., Gray, A.L., and Houk, R.S. (2003). *Inductively Coupled Plasma Spectrometry*. Viridian Publishing,
21. *Journal of Forensic Sciences*
22. Murray, R.C. and Tedrow, J.C.F. (1975). *Forensic Geology*. Rutgers University Press, New Brunswick, New Jersey.
23. Murray, R.C. and Tedrow, J.C.F. (1992). *Forensic Geology*, 2nd ed. Prentice Hall Inc., Englewood Cliffs, New Jersey.
24. Murray, R.C. (2004). *Evidence from the Earth: Forensic Geology and Criminal Investigation*. Mountain Press, Publishing Company, Missoula, Montana.
25. Petraco, N., Kubic, T. (2000). A density gradient technique for use in forensic soil analysis. *Forensic Science International*.
26. Reynolds, J.M. (1997). *An introduction to applied and environmental geophysics*. John Wiley & Sons, Ltd, Chichester.
27. Pye, K. (2007). *Geological and soil evidence forensic applications*, CRC Press, Taylor & Francis group.
28. Ruffell, A., McKinely, J. (2005). Forensic geoscience: applications of geology, geomorphology and geophysics to criminal investigations. *Earth-Science Review*.,
29. Ruffell, A., McKinely, J. (2008). *Geoforensics*. John Wiley & Sons, Ltd.
30. Saferstein, R.E. (2002). *Forensic Science Handbook*. Prentice Hall, New Jersey.
31. Sheriff, R.E. (1994). *Encyclopedic dictionary of exploration geophysics*. Society of Exploration Geophysics, Tulsa.

32. Srodon, J., Drits, V.A., McCarty, D.K., Hsieh, J.C.C., Eberl, D.D. (2001). Quantitative X-ray diffraction analysis of clay-bearing rocks from random preparations. *Clays and Clay Minerals*.

PSFSP306

Reference:

- 1 Arms Act, 1959. and Arms Rule, 1962.
- 2 Beyer, J. (Ed) (1962) Wound Ballistics, Office of Surgeon General, Dept. of Army, Washington DC.
- 3 Bhattacharyya C.N., (2000) Particle Analysis for Detection of Gunshot Residues –A State-of-the-Art Technique, *The Indian Police Journal, BPR&D, Vol.XLVII, No. 4, pp. 113-127*
- 4 Burrad, G., (1951) *The Identification of Firearm and Forensic Ballistics*, Herbert Jenkins, London.
- 5 J.S. Bates, (Feb, 1973) *Cleaning of Rusted Firearms*, *AFTE Journal*, Vol 5, no. 1, p.11.
- 6 Smith, W.H.B., (1968) *Book of Pistols and Revolvers*, The Stackpole Book Co., Harrisburg, USA.
- 7 *Text Book of Small Arms*, (1929) The Holland Press, Harrisburg, Pennsylvania, USA.
- 8 Whelen, T., (1946) *Small Arms Design and Ballistics*, Small Arms Technical Publishing Company, Georgetown, South Carolina, USA, Vol. I & II.
- 9 Williams, Sorensen; (April 1971), *Barrel Corrosion and it's Effect on Identification*, *AFTE Journal*, N.L. #13, pp. 34-41.
- 10 Sellier, K.G., & Kneubu, B.P., (1994) *Wound Ballistics and Scientific Background*, Elseveir, Netherlands, Canada, USA.
- 11 J.K. Sinha et al., (1977) *Unusual Rifling Marks for identifying Lead Core and Non-Identifiable Jacket Pieces*, *Forensic Science*, (Elsevier), 9 pp. 139-144.
- 12 Hogg, I.V., (1993) *The Cartridge Guide*, Arms & Armour Press, London, UK.
- 13 Hatcher, J.S., Jury, F.J. & Weller, J., (1957) *Firearms Investigation, Identification and Evidence*, The Stackpole Co., Harrisburg, Pennsylvania, USA.
- 14 Gander, T.J. and Hogg, I.V., 25th Edition, *Jane's Infantry Weapons*, Biddles Ltd, Guildford, UK.
- 15 Feigl, F., (1962) *Spot Tests in Inorganic Analysis*, Elsevier Publishing Co.,
- 16 Dominic Denio, (July 1981), *Making a Rusted Barrel Functional*, *AFTE Journal*, Vol. 13, pa 3; pp. 29-30.
- 17 DiMaio, J.M., (1985) *Gunshot Wounds*, Elseveir, USA.
- 18 Davis, J.E., (1958) *An Introduction to Toolmarks, Firearms and the Striagraph*, Charles C Thomas, Springfield, Illinois, USA.
- 19 Cowgill, J.P., (1975) *The Newest Look of Handgun Ballistics*, *The American Rifleman*, Vol. 123, No. 10.
- 20 Cordell G. Brown, (Oct, 1981), *Non-Destructive Rust Removal From Ferrous Objects*, *AFTE Journal*, Vol 13, no. 4; pp. 85-89.
- 21 Jauhari, M., (1980) *Identification of Firearms, Ammunition and Firearm Injuries*, Bureau of Police Research and Development, Govt. of India, New Delhi, India.
- 22 . Kumar, K., (1987) *Forensic Ballistics in Criminal Justice*, Eastern Book Co., Lucknow, India.
- 23 Maiti, P.C., (1973) *Powder Pattern around Bullet Hole in Blood Stained Articles*, *Journal of Forensic Science Society*, p 147.
- 24 . Mathew, J.H., (1962) *Firearms Identification*, Vol. I, The University of Wisconsin Press, Madison, USA.
- 25 Mattoo, B.N. & Wani, A.K., (1969) *Causality Criteria for Wounds from Firearms with special reference to Shot Penetration*, *Journal of Forensic Sciences*, Vol. 14, No. 1.

- 26 Proof Marks, Firearms Identification, Interpol, ICPO, General Secretariat, Paris, France.
- 27 Saferstein, R., (1995) Criminalistics – An Introduction to Forensic Science, Prentice Hall, Englewood Cliffs, NJ 07632, USA.

Group II: PSFSC305:

Text Books

1. Modi's Medical Jurisprudence and Toxicology-23rd Ed. Publisher-Lexis Nexis Butterworths Wadhwa. (P, 9-18, 217-289,401-459,261-277).
2. Prevention of Food Adulteration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act.
3. Text book of Micro chemistry of poisons including their physiological, pathological and legal relation.-Theodore George Wormley: Internet ref: book.google.co.in.
4. Parikh's Textbook of Medical Jurisprudence, Forensic medicine and Toxicology- C.K. Parikh, CBS Publishers and Distributors.6th Ed. Pages: 2.1-2.9, 19-22.
5. Casarett & Doll Toxicology, The basic Science of Poisons.
6. Clark, E.G.C.; Isolation and Identification of Drugs, Vol. I and Vol. II, Academic Press, (1986).
7. A Textbook Of Modern Toxicology by Ernest Hodgson

Reference Books

8. Sunshine I; Year book of Toxicology, CRC Press Series, USA (1989 – 93).
9. Michael J. Deverlanko etal: Hand Book of Toxicology CRC Press, USA (1995).
10. Prakash M. et.al; Methods in Toxicology Anmol Publication, New Delhi (1998).
11. Balraj S. Parmar etal; Pesticide Formulation, CBS Publishers, New Delhi (2004).
12. Reiss C et.al; Advance in Molecular Toxicology, Utrecht, Netherlands (1998).
13. Morgan B.J.T; Statistics in Toxicology, Clarendon Press, Oxford (1996).
14. Jorg Rombke etal; Applied & Ecotoxicology Lewis publishers NY (1995).
15. Shayne C.Gad etal; Acute Toxicology Testing Academic Press California USA (1998).
16. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004) Semester-II FS-10832.
17. Turner Paul; Recent Advances in Pharmacology & Toxicology, Churchill Livingstone, Elenburgh (1989).
18. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004) Semester-II FS-10832.
19. Cravey R.H, Baselt, R.C; Introduction to Forensic Toxicology, Biochemical Pub. Davis C A (1981).
20. S. N. Tiwari, Analytical Toxicology, Govt. of India publications, New Delhi 1987.
21. Willard H. H. et. al : Instrumental Methods of Analysis 1974.
22. Moonesens A. A. et. al. : Scientific Evidence in Criminal Cases 1973.
23. Lundquist and Curry: Methods of Forensic Sciences 1963.
24. Arena Poisoning, Chemistry Symptoms and treatment.
25. Analysis of Plant Poisons, Dr. M P Goutam.
26. Drug Abuse Handbook, Karch.s.

27. Constitution of India.
28. Indian Evidence Act.
29. Criminal Procedure code.
30. Indian Penal Code.
31. Bare Acts with short notes on the following: Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act.

PSFSC306:

Text Books

1. J Mendham,R.C.Denney, J D Barenas,M J K Thomas, Vogel's textbook of quantitative chemical analysis, ,6th edition(P.312-495)
2. Jerry March,Advanced organic chemistry.
3. S.Warren,Organic synthesis,the disconnection approach.
4. M.Boyd,Organic chemistry.
5. Skoog,Hollaer,Nieman,Principles of Instrumental analysis
6. Dr.R. Krushnamurti, Forensic science in crime investigation, (p.317).
7. B.S.Nabar, Forensic science in crime investigation, (p.267).
8. James E.Girad, Criminalistics, Forensic science in crime.
9. Dr.M.S.Rao, Dr.B.P.Maithil, K.V.Ravikumar, Crime scene management(p.162,264).
10. P.S. Kalsi, Organic spectroscopy.
11. Y.R. Sharma, Organic spectroscopy.
12. W. Kemp, Organic spectroscopy.

References Books

13. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004) Semester-II FS-10832.
14. Turner Paul; Recent Advances in Pharmacology & Toxicology, Churchill Livingstone, Elenburgh (1989).
15. Cravey R.H, Baselt, R.C; Introduction to Forensic Toxicology, Biochemical Pub. Davis C A (1981).
16. Working Procedure Manual - Toxicology, BPR&D Publication (2000).
17. Ballantyne B; General and Applied Toxicology Vol-1-3 2nd Ed., Macmillan, NY (2000).
18. Gossel T.A; Principles of Clinical Toxicology 3rd Ed., Roven, NY (1994).
19. Grossel S S; Handbook of Highly Toxic Materials handling and Management, Marcel Dekker NY (1995).
20. Niesink RJM; Toxicology- Principles and Applications, CRC Press (1996).
21. Organic Electronic spectral data; Vol.-I; Mortiman Kamlet.
22. Organic Electronic spectral data; Vol.-III; Mortiman Kamlet.
23. Inorganic Semi micro qualitative analysis; Griffin & Plunky.
24. Peerson's Chem. Analysis of food; H.Egan, Kirk.
25. Vogel's Book of Macro & Semi micro qualitative inorganic Analysis; G.Svehla.
26. Explosive (4th Rev.Ed); J.Kohler, Redolf.
27. Clerk's Analysis of Drugs & Poisons VOL.-I & II; Clerk.
28. Development & Validation of Analytical Methods; Christopher, M.Riley, Thomas W.
29. Scientific protocols for fire investigation; John J. Lentini.

30. Steroid analysis by HPLC; Marie P. Kautsky.
31. TLC VOL.-II; Jork, Funk & Others.
32. Settle F. A.: Handbook of Instrumental Technique for Analytical Chemistry, Prentice Hall 1997.
33. Borrow: Molecular Spectroscopy 1980.
34. Willard H. H. et. al : Instrumental Methods of Analysis 1974.
35. Moonesens A. A. et. al. : Scientific Evidence in Criminal Cases 1973.
36. Lundquist and Curry: Methods of Forensic Sciences 1963.
37. Micro-Extraction Techniques In Analytical Toxicology:Short Review, R. J. Flanagan, P. E. Morgan, E. P. Spencer, R. Whelpton, Biomedical Chromatography, *Biomed. Chromatogr.* 20: Wiley Interscience ,530–538 (2006)
38. Basheer C, Lee HK and Obbard JP. Application of liquid-phase microextraction and gas chromatography-mass spectrometry for the determination of polychlorinated biphenyls in blood plasma. *Journal of Chromatography A* 2004; **1022**: 161–169.
39. Bhamra RK, Flanagan RJ and Holt DW. High-performance liquid chromatographic method for the measurement of mexiletine and flecainide in blood plasma or serum. *Journal of Chromatography* 1984; **307**: 439–444.
40. Blanchard J. Evaluation of the relative efficacy of various techniques for deproteinizing plasma samples prior to high-performance liquid chromatographic analysis. *Journal of Chromatography* 1981; **226**: 455–460.

Group III:

PSFSB305:

Text books:

1. Sourcebook in Forensic Serology, Immunology and Biochemistry, publication of National Institute of Justice, R. E. Gaennslen, page 73-120, 149-180, 183-199.
2. Nabar B.S., Forensic Science in Crime Investigation, page 119-121, 122-126
3. Analytical Molecular Biology: Quality and Validation, edited by Ginny Saunders, page 15-26
4. Forensic Science -2008, Embar-Seddon, A and Pass A (Ed), Volumes 1-3, page (431, 555, 670)
5. Pickering R., Bachman D., The Use of Forensic Anthropology, Second edition, page 145-159).

References:

1. Sourcebook in Forensic Serology, Immunology and Biochemistry, publication of National Institute of Justice, R. E. Gaennslen
2. Guidelines for Forensic Science laboratories ILAC-G19:2002
3. White T.D., Folkens P.A., The Human Bone Manual.
4. An Analysis of Forensic Anthropology Cases submitted to the Smithsonian Institution by FBI from 1962-1994, Gretchen A. Grisbaum and Douglas H. Ubelaker.

5. Pickering R., Bachman D., The Use of Forensic Anthropology, Second edition.
6. Forensic biology by Rechar d li

PSFSB306:

Text books:

1. Butler J. M., Advanced topics in Forensic DNA Typing, page 1-28, 29-48
2. Butler J. M., Fundamentals of Forensic DNA Typing, page 291-313
3. James S. And Nordby J., Forensic Science: An Introduction to Scientific and Investigative Techniques, page 683
4. Rudin N. and Inman K, Introduction to Forensic DNA Analysis, page 69-70
5. Lucy D., Introduction to statistics for forensic scientists, page 7-14, 17-27, 29-42, 55-69, 155-159,161-176
6. Forensic Science -2008, Embar-Seddon, A and Pass A (Ed), Volumes 1-3 (page 365, 366,

Reference:

1. Sourcebook in Forensic Serology, Immunology and Biochemistry, publication of National Institute of Justice, R. E. Gaennslen.
2. Butler J. M., Advanced topics in Forensic DNA Typing
3. Guidelines for Forensic Science laboratories ILAC-G19:2002
4. Marzilli A., DNA Evidence.
5. Missing people, DNA analysis and Identification of Human Remains, ICRC.
6. Fundamentals of forensic science, 2nd edition, Max M. Houck, Jay A. Seigel.
7. Methods in Molecular Biology: Mitochondrial DNA – Methods and protocols, William C. Copeland.
8. Molecular Cloning Laboratory manual (Vol 1, 2, 3), Sambrook, Russell.
9. PCR protocols, 2nd edition, John M.S. Bartlett, David Stirling.
10. Essential Molecular Biology, Vol. one , 2nd edition, T. A. Brown
11. CRC Handbook for Laboratory safety, 5th edition, A. Keith Furr.
12. Forensic biology by Rechar d li

PSFS401

Text Books

5. James, SH and Nordby, J.J., Forensic Science- An Introduction to Scientific and investigative Techniques, Second Edition, CRC Press, USA. Page no. 27- 42 , 471- 487.
6. Kenneth L. Carper – 2001, Forensic Engineering, Second Edition, CRC Press, 2001. Page no. 10- 56, 176-200.
7. Reeve Roger, Introduction to Environmental Analysis, Wiley India Pvt. Ltd., 2010. Page No. 35- 73, 77- 128, 146- 154, 175- 206.
8. Forensic Ecology Handbook: From Crime Scene to Court (2012), By Nicholas Márquez-Grant, Julie Roberts, Wiley Publishers, Pg. (23-48).

References:

6. James, SH and Nordby, J.J., Forensic Science- An Introduction to Scientific and investigative Techniques, Second Edition, CRC Press, USA.
7. Forensic Ecology Handbook: From Crime Scene to Court (2012), By Nicholas Márquez-Grant, Julie Roberts, Wiley Publishers, Pg. (153-167) & (23-48).
8. Forensic Ecology Handbook: From Crime Scene to Court (2012), By Nicholas Márquez-Grant, Julie Roberts, Wiley Publishers, Pg. (23-48).
9. Kenneth L. Carper – 2001, Forensic Engineering, Second Edition, CRC Press, 2001.
10. Gary L. Lewis, Guidelines for Forensic Engineering Practice, ASCE Publications, 01-Jun-2003.
11. Brian S. Neale, Forensic Engineering: The Investigation of Failures : Proceedings of the Second International Conference on Forensic Engineering Organized by the Institution of Civil Engineers and Held in London, UK, on 12-13 November, 2001, Thomas Telford, 2001.
12. Randall Noon, Forensic Engineering Investigation, CRC Press INC, 2001.
13. Reeve Roger, Introduction to Environmental Analysis, Wiley India Pvt. Ltd., 2010. Page No. 35- 73, 77- 128, 146- 154, 175- 206

PSFS402

Text Books

- 1) A Textbook of Pharmaceutical Analysis (Instrumental Methods), Vol-2, Nirali Prakashan by Dr. A.V. Kasture, Dr. K.R. Mahadik, Dr. S.G. Wadodkar & Dr. H.N. More (pg. 156-168, 234-239). (pg. 250-257). (pg. 134-143, 144-147, 106-123).
- 2) Instrumental Methods of Chemical Analysis, Ed. 3, Pragati Prakashan by Dr. H. Kaur (pg. 407-420, 439-456, 518-542, 319-384). (pg. 859-857). (pg. 668-690, 658-666, 691-705).
- 3) P.S. Kalsi, Organic spectroscopy.
- 4) Y.R. Sharma, Organic spectroscopy.
- 5) W. Kemp, Organic spectroscopy.

PSFS403

References

1. Fundamentals of Speech Recognition Lawrence Rabiner, Biing-Hwang Juang (chapter 1 and 2)
2. Forensic Speaker Recognition, Philip Rose, Publisher, Taylor & Francis (Chapter 2)
3. Forensic Speaker Recognition, Philip Rose, Publisher, Taylor & Francis (Chapter 3)
4. Forensic Speaker Recognition, Philip Rose, Publisher, Taylor & Francis (Chapter 5)
5. Part I Forensic Case Work

6. Historical and Procedural Overview of Forensic Speaker Recognition as a Science 3
Kanae Amino, Takashi Osanai, Toshiaki Kamada, Hisanori Makinae and Takayuki Arai
7. Automatic Speaker Recognition for Forensic Case Assessment and Interpretation 21
Andrzej Drygajlo
8. Aural/Acoustic vs. Automatic Methods in Forensic Phonetic Case Work 41 Anders
Eriksson
9. Speaker Profiling: The Study of Acoustic Characteristics Based on Phonetic Features of
Hindi Dialects for Forensic Speaker Identification 71
10. Manisha Kulshreshtha, C. P. Singh and R. M. Sharma Part II Speech Signal Degradation:
Managing Problematic Conditions Affecting Probative Speech Samples
11. Speech Under Stress and Lombard Effect: Impact and Solutions for Forensic Speaker
Recognition 103 John H. L. Hansen, Abhijeet Sangwan and Wooil Kim
12. Speaker Identification over Narrowband VoIP Networks 125 Hemant A. Patil, Aaron E.
Cohen and Keshab K. Parhi
13. Noise Robust Speaker Identification: Using Nonlinear Modeling Techniques 153
Raghunath S. Holambe and Mangesh S. Deshpande
14. Robust Speaker Recognition in Noisy Environments: Using Dynamics of Speaker-
Specific Prosody 183 Shashidhar G. Koolagudi, K. Sreenivasa Rao, Ramu Reddy,
Vuppala Anil Kumar and Saswat Chakrabarti

PSFS404

Textbooks:

- 1) 'Criminology' by Larry Siegel
- 2) 'Introduction to Forensic Psychology' by Bruce Arrigo. (Page 115-140)
- 3) 'Forensic & Criminal Psychology' by Dennis Howitt. (Page 55-58)
- 4) 'Handbook of Forensic Psychology' by Prof. Dr. Vimala Veeraraghavan. (Page 17-31, 215-218, 198-217)
- 5) 'Forensic Psychology' by Graham Towel & David Crighton (Page 73-87)
- 6) 'Psychological Testing' by Anne Anastasi, Susana Urbina, Seventh Edition. (Page 85-112, 114-136, 173-200)
- 7) 'Psychological Testing' by Cohen & Swerdlik. (Page 426-438)
- 8) Introduction to the Constitution of India, 4th Edition, By Sharma B.K (Page- 27 to 33, 42 to 48)
- 9) Forensic Evidence: Science and the Criminal Law, By Terrence F. Kiely, 2006, second edition, (Page- 1 to 39)
- 10) Forensic Medicine: Clinical and Pathological Aspects by Jason Payne-James, Anthony Busuttill, William S. Smock, 2003 (Page 39 to 48)
- 11) Forensic Archaeology and Human Right Violations by Roxana Ferllini, 200, (Page 3 to 21, & 55 to 61)
- 12) The Challenge of Human Rights: Past, Present and Future by David Keane, Yvonne McDermott, 2012, (Page 114 to 139)
- 13) Law & Medicine, by Dr. Lily Srivastava, 2010, Universal law Publishing Co, New Delhi, (Page 36 to 72)

- 14) Textbook of Forensic Medicine & Toxicology: Principles & Practice, 4th edition, 2009, by Krishan Vij, (Page 466 to 481)
- 15) Textbook of Forensic Medicine & Toxicology: Principles & Practice, Krishan Vij, 4th Edition, 2009, (Page 25, 26, 49, 50, 57, 58, 74, 75, 83, 94, 95, 96, 103, 104, 494, 495, 496, 520 to 524)
- 16) Field's Medico-Legal Guide: For Doctors and Lawyers by George W. Field
- 17) Parikh's Textbook of Medical Jurisprudence, Forensic Medicine & Toxicology for Classrooms and Courtrooms, 6th edition, 2010, CBS Publishers & Distributors, (Page- 1to2 to 1to58)

Reference Books:

- 1) 'Abnormal Psychology' by Halgin & Whitbourne.
- 2) 'Abnormal Psychology', by Robert C. Carson, James N. Butcher, Susan Mineka, Jill M. Hooley thirteenth Edition, Thirteenth Edition.
- 3) 'Encyclopedia of Forensic Science' by Jay A. Siegel, PekkaJ. Saukko, Geoffrey C. Knupfer, Volume-1 to Volume-5.
- 4) 'Mental Disorders and Treatment' by Katherine Marsland.
- 5) 'Handbook of Polygraph Testing' by Murray Kleine.
- 6) 'Brain Mapping-The Methods' by Arthur W. Toga & John C. Mazziotta, Second Edition.
- 7) 'Criminal Profiling and Introduction to Behavioural Evidence Analysis' by Brent Turve Second Edition.
- 12) Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
- 14) Serial Crime, Theoretical & Practical issues in Behavioral Profiling, Petherick, Woodworth Publication.
- 16) Diagnostic & Statistical Manual-IV TR, American Psychological Association
- 17) DSM-IV Mental Disorders Diagnostics, Etiology and Treatment, by Michael, Allan.
- 19) 'Psychological Testing' by Robert J. Gregory, Fourth Edition.
- 20) No Magic Wand: The Idealization of Science in Law by David Stanley Caudill, Lewis H. LaRue, 2006.
- 23) Encyclopedia of War Crimes and Genocide by Leslie Alan Horvitz, Christopher Catherwood, 2006.
- 24) Forensic Medicine and Toxicology By Rabindra Nath Karmakar, 2007
- 25) Medical Law for the Dental Surgeons by George Paul, 2004.
- 26) Textbook of Forensic Medicine & Toxicology: Principles & Practice, 5th edition, 2011, by Krishan Vij.
- 27) Forensic Toxicology: Medico-Legal Case Studies by Kalipatnapu N. Rao

PSFSP405:

Text Books:

1. Forensic Science in Criminal Investigation and Trials Forth edition B. R. Sharma.
2. Reference : forensic science in criminal investigation by B.S. Nabar, 3rd edition, ASIA law house publication, page 227-239

References:

1. Forensic science hand book by Richard Saferstein
2. Forensic examination of glass and paint, Brian Caddy, Taylor & Francis.
3. Forensic Science Progress, A. Maehly et all, Vol.1 to 5.
4. Crime Investigation by P.L. Kirk.
5. Forensic Science Hand Book, Vol.-III Chapter-3 (1993), R Saferstein, Prentice Hall International, London.
6. Methods of Chemical Analysis of Hydraulic Cement, Bureau of Indian Standards,IS: 4032-1985.
7. Elements of X-ray Diffraction, B.D. Cullity, Addison- Weseley Publ. Comp. Inc.
8. ASTM standards, Vol.15-09.
9. Forensic examination of fibres, James Robertson.
10. Gem Testing, B. W. Anderson.
11. Annual Book of ASTM standard, Vol.04.01:1985
12. Precious stones, Max Bauer (Vol.I and II).
13. The chemistry of cement and concrete, Lea, F.M.1971, Chemical Publication. Comp.Inc. New York (USA).

PSFSP406

References:

- 1 Arms Act, 1959. and Arms Rule, 1962.
- 2 Beyer, J. (Ed) (1962) Wound Ballistics, Office of Surgeon General, Dept. of Army, Washington DC.
- 3 Bhattacharyya C.N., (2000) Particle Analysis for Detection of Gunshot Residues –A State-of-the-Art Technique, The Indian Police Journal, BPR&D, Vol.XLVII, No. 4, pp. 113-127
- 4 Burrad, G., (1951) The Identification of Firearm and Forensic Ballistics, Herbert Jenkins, London.
- 5 J.S. Bates, (Feb, 1973) Cleaning of Rusted Firearms, AFTE Journal, Vol 5, no. 1, p.11.
- 6 Smith, W.H.B., (1968) Book of Pistols and Revolvers, The Stackpole Book Co., Harrisburg, USA.
- 7 Text Book of Small Arms, (1929) The Holland Press, Harrisburg, Pennsylvania, USA.
- 8 Whelen, T., (1946) Small Arms Design and Ballistics, Small Arms Technical Publishing Company, Georgetown, South Carolina, USA, Vol. I & II.
- 9 Williams, Sorensen; (April 1971), Barrel Corrosion and it's Effect on Identification, AFTE Journal, N.L. #13, pp. 34-41.
- 10 Sellier, K.G., & Kneubu, B.P., (1994) Wound Ballistics and Scientific Background, Elsevier, Netherlands, Canada, USA.
- 11 J.K. Sinha et al., (1977) Unusual Rifling Marks for identifying Lead Core and Non-Identifiable Jacket Pieces, Forensic Science, (Elsevier), 9 pp. 139-144.
- 12 Hogg, I.V., (1993) The Cartridge Guide, Arms & Armour Press, London, UK.
- 13 Hatcher, J.S., Jury, F.J. & Weller, J., (1957) Firearms Investigation, Identification and Evidence, The Stackpole Co., Harrisburg, Pennsylvania, USA.
- 14 Gander, T.J. and Hogg, I.V., 25th Edition, Jane's Infantry Weapons, Biddles Ltd, Guildford, UK.
- 15 Feigl, F., (1962) Spot Tests in Inorganic Analysis, Elsevier Publishing Co.,
- 16 Dominic Denio, (July 1981), Making a Rusted Barrel Functional, AFTE Journal, Vol. 13, pa 3; pp. 29-30.
- 17 DiMaio, J.M., (1985) Gunshot Wounds, Elsevier, USA.
- 18 Davis, J.E., (1958) An Introduction to Toolmarks, Firearms and the Striagraph, Charles C Thomas, Springfield, Illinois, USA.

- 19 Cowgill, J.P., (1975) The Newest Look of Handgun Ballistics, The American Rifleman, Vol. 123, No. 10.
- 20 Cordell G. Brown, (Oct, 1981), Non-Destructive Rust Removal From Ferrous Objects, AFTE Journal, Vol 13, no. 4; pp. 85-89.
- 21 Jauhari, M., (1980) Identification of Firearms, Ammunition and Firearm Injuries, Bureau of Police Research and Development, Govt. of India, New Delhi, India.
- 22 . Kumar, K., (1987) Forensic Ballistics in Criminal Justice, Eastern Book Co., Lucknow, India.
- 23 Maiti, P.C., (1973) Powder Pattern around Bullet Hole in Blood Stained Articles, Journal of Forensic Science Society, p 147.
- 24 . Mathew, J.H., (1962) Firearms Identification, Vol. I, The University of Wisconsin Press, Madison, USA.
- 25 Mattoo, B.N. & Wani, A.K., (1969) Causality Criteria for Wounds from Firearms with special reference to Shot Penetration, Journal of Forensic Sciences, Vol. 14, No. 1.
- 26 Proof Marks, Firearms Identification, Interpol, ICPO, General Secretariat, Paris, France.
- 27 Saferstein, R., (1995) Criminalistics – An Introduction to Forensic Science, Prentice Hall, Englewood Cliffs, NJ 07632, USA.

PSFSC405:

Text Books

32. Modi's Medical Jurisprudence and Toxicology-23rd Ed. Publisher-Lexis Nexis Butterworths Wadhwa. (P, 435-515).
33. Lange's Basic and Clinical Pharmacology, 10th Ed. (2007) by Bertram G. Katzung, McGraw-Hill Publishers, Pg. (934-943).
34. Computational Toxicology: Risk Assessment for Pharmaceutical and Environmental Chemicals (2007) by Sean Ekins, Willey Interscience Publication, Pg. (3-20) & (99-115).
35. Goodman & Gillman's Manual of Pharmacology and Therapeutics (2008) by Laurance Brunton, Keith Parker, Donald Bluementhal , Iain Buxton, McGraw-Hill Publishers, Pg. (1119-1129).
36. Text book of Micro chemistry of poisons including their physiological, pahalogical and legal relation.-Theodore George Wormley: Internet ref: book.google co.in.
37. Parikh's Textbook of Medical Jurisprudence, Forensic medicine and Toxicology- C.K. Parikh, CBS Publishers and Distributors.6th Ed. Pages: 2.1-2.9, 19-22.
38. A TEXTBOOK OF MODERN TOXICOLOGY by Ernest Hodgson

Reference Books

39. Casarett & Doll Toxicology, The basic Science of Poisons.
40. Clark, E.G.C.; Isolation and Identification of Drugs, Vol. I and Vol. II, Academic Press, (1986).
41. Sunshine I; Year book of Toxicology, CRC Press Series, USA (1989 – 93).
42. Michael J. Deverlanko etal: Hand Book of Toxicology CRC Press, USA (1995).
43. Prakash M. et.al; Methods in Toxicology Anmol Publication, New Delhi (1998).
44. Balraj S. Parmar etal; Pesticide Formulation, CBS Publishers, New Delhi (2004).
45. Reiss C et.al; Advance in Molecular Toxicology, Utrecht, Netherlands (1998).
46. Morgan B.J.T; Statistics in Toxicology, Clarendon Press, Oxford (1996).
47. Jorg Rombke etal; Applied & Ecotoxicology Lewis publishers NY (1995).

48. Shayne C.Gad etal; Acute Toxicology Testing Academic Press California USA (1998).
49. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004) Semester-II FS-10832.
50. Turner Paul; Recent Advances in Pharmacology & Toxicology, Churchill Livingstone, Elenburgh (1989).
51. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004) Semester-II FS-10832.
52. Cravey R.H, Baselt, R.C; Introduction to Forensic Toxicology, Biochemical Pub. Davis C A (1981).
53. S. N. Tiwari, Analytical Toxicology, Govt. of India publications, New Delhi 1987.
54. Willard H. H. et. al : Instrumental Methods of Analysis 1974.
55. Moonesens A. A. et. al. : Scientific Evidence in Criminal Cases 1973.
56. Lundquist and Curry: Methods of Forensic Sciences 1963.
57. Arena Poisoning, Chemistry Symptoms and treatment.
58. Analysis of Plant Poisons, Dr. M P Goutam.
59. Drug Abuse Handbook, Karch.s.
60. Constitution of India.
61. Indian Evidence Act.
62. Criminal Procedure code.
63. Indian Penal Code.
64. Bare Acts with short notes on the following: Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act.

PSFSC406

Text Books

41. B.R.Sharma,Forensic science in criminal investigation and trials.4th Ed.(P.858-902)
42. Forensic science in criminal investigation and trials(p.858-902)
43. Dr.R. Krushanamurti, Forensic science in crime investigation.
44. B.S.Nabar, Forensic science in crime investigation.
45. James E.Girad, Criminalistics, Forensic science in crime.
46. Dr.M.S.Rao, Dr.B.P.Maithil, K.V.Ravikumar, Crime scene management(p.162,264).
47. P.S. Kalsi, Organic spectroscopy.
48. Y.R. Sharma, Organic spectroscopy.
49. W. Kemp, Organic spectroscopy.
50. M.Chattergee and R.Shinde, Text book of medical biochemistry, 6th Ed., Jypee publication.
51. Michael M,Cox,David L,Nelson.,Lehninger Principles of biochemistry.
52. Bergmeyer, Methods of enzymatic analysis.

Reference Books

53. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004) Semester-II FS-10832.
54. Turner Paul; Recent Advances in Pharmacology & Toxicology, Churchill Livingstone, Elenburgh (1989).

55. Cravey R.H, Baselt, R.C; Introduction to Forensic Toxicology, Biochemical Pub. Davis C A (1981).
56. Working Procedure Manual - Toxicology, BPR&D Publication (2000).
57. Ballantyne B; General and Applied Toxicology Vol-1-3 2nd Ed., Macmillan, NY (2000).
58. Gossel T.A; Principles of Clinical Toxicology 3rd Ed., Roven, NY (1994).
59. Grossel S S; Handbook of Highly Toxic Materials handling and Management, Marcel Dekker NY (1995).
60. Niesink RJM; Toxicology- Principles and Applications, CRC Press (1996).
61. Quantitative inorganic analysis; Vogel.
62. Organic Electronic spectral data; Vol.-I; Mortiman Kamlet.
63. Organic Electronic spectral data; Vol.-III; Mortiman Kamlet.
64. Inorganic Semi micro qualitative analysis; Griffin & Plunky.
65. Peerson's Chem. Analysis of food; H.Egan, Kirk.
66. Vogel's Book of Macro & Semi micro qualitative inorganic Analysis; G.Svehla.
67. Explosive (4th Rev.Ed); J.Kohler, Redolf.
68. Clerk's Analysis of Drugs & Poisons VOL.-I & II; Clerk.
69. Development & Validation of Analytical Methods; Christopher, M.Riley, Thomas W.
70. Scientific protocols for fire investigation; John J. Lentini.
71. Steroid analysis by HPLC; Marie P. Kautsky.
72. TLC VOL.-II; Jork, Funk & Others.
73. Settle F. A.: Handbook of Instrumental Technique for Analytical Chemistry, Prentice Hall 1997.
74. Borrow: Molecular Spectroscopy 1980.
75. Willard H. H. et. al : Instrumental Methods of Analysis 1974.
76. Moonesens A. A. et. al. : Scientific Evidence in Criminal Cases 1973.
77. Lundquist and Curry: Methods of Forensic Sciences 1963.
65. Modi's Medical Jurisprudence and Toxicology-23rd Ed. Publisher-Lexis Nexis Butterworths Wadhwa. (P, 9-18, 217-289,401-459,261-277).
66. Prevention of Food Adulteration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act.
67. Text book of Micro chemistry of poisons including their physiological, pahalogical and legal relation.-Theodore George Wormley: Internet ref: book.google co.in.
68. Parikh's Textbook of Medical Jurisprudence, Forensic medicine and Toxicology- C.K. Parikh, CBS Publishers and Distributors.6th Ed. Pages: 2.1-2.9, 19-22.
69. Casarett & Doll Toxicology, The basic Science of Poisons.
70. Clark, E.G.C.; Isolation and Identification of Drugs, Vol. I and Vol. II, Academic Press, (1986).
71. A Textbook Of Modern Toxicology by Ernest Hodgson
72. Sunshine I; Year book of Toxicology, CRC Press Series, USA (1989 – 93).
73. Michael J. Deverlanko etal: Hand Book of Toxicology CRC Press, USA (1995).
74. Prakash M. et.al; Methods in Toxicology Anmol Publication, New Delhi (1998).
75. Balraj S. Parmar etal; Pesticide Formulation, CBS Publishers, New Delhi (2004).
76. Reiss C et.al; Advance in Molecular Toxicology, Utrecht, Netherlands (1998).
77. Morgan B.J.T; Statistics in Toxicology, Clarendon Press, Oxford (1996).
78. Jorg Rombke etal; Applied & Ecotoxicology Lewis publishers NY (1995).
79. Shayne C.Gad etal; Acute Toxicology Testing Academic Press California USA (1998).

80. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004) Semester-II FS-10832.
81. Turner Paul; Recent Advances in Pharmacology & Toxicology, Churchill Livingstone, Elenburgh (1989).
82. Chadha PV; Hand Book of Forensic Medicine and Toxicology, Jaypee Brothers New Delhi (2004) Semester-II FS-10832.
83. Cravey R.H, Baselt, R.C; Introduction to Forensic Toxicology, Biochemical Pub. Davis C A (1981).
84. S. N. Tiwari, Analytical Toxicology, Govt. of India publications, New Delhi 1987.
85. Willard H. H. et. al : Instrumental Methods of Analysis 1974.
86. Moonesens A. A. et. al. : Scientific Evidence in Criminal Cases 1973.
87. Lundquist and Curry: Methods of Forensic Sciences 1963.
88. Arena Poisoning, Chemistry Symptoms and treatment.
89. Analysis of Plant Poisons, Dr. M P Goutam.
90. Drug Abuse Handbook, Karch.s.
91. Constitution of India.
92. Indian Evidence Act.
93. Criminal Procedure code.
94. Indian Penal Code.
95. Bare Acts with short notes on the following: Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act.

PSFSB405:

Text books:

1. Parikh's textbook of medical jurisprudences, forensic medicine, and toxicology, Sixth edition, page no. 5.1 to 5.88.
2. Thompson, Forensic human identification: an introduction, page 99-113,177-198, 221-228
3. Daniel V. Lim, Current and developing technologies for monitoring agents of bioterrorism and biowarfare.
4. DFS practical manual.

References:

1. Daniel V. Lim, Current and developing technologies for monitoring agents of bioterrorism and biowarfare.
2. K. Mathiharan, Medical jurisprudence and toxicology.
3. Parikh's textbook of medical jurisprudences, forensic medicine, and toxicology, Sixth edition.
4. Thompson, Forensic human identification: an introduction.
5. Forensic Pathology Reviews (Volume 1,2,3,4.), edited by Michael Tsokos, MD
6. Forensic Radiology, B.G. Brogdon, M.D.
7. Forensic Medicine for the police, B. Umadethan

8. Forensic Anthropology and Medicine, Aurore Schmitt.
9. Forensic Medicine of lower extremity, Jeremy Rich, Dorothy Dean.
10. Forensic Emergency Medicine, Jonathan S. Olshaker, M. Christine Jackson.
11. Forensic biology by Richard li

PSFSB406:

Text books:

1. WHO, Maintenance manual for laboratory equipment, 2nd ed (page 1-155)
2. Rudin N. and Inman K, Introduction to Forensic DNA Analysis, page 97-131, 139-150, 183-195.
3. Progress in Forensic Genetics 10, Proceedings of the 20th International ISFG Congress held in Arachon, France, September 2003.
4. Forensic Science -2008, Embar-Seddon, A and Pass A (Ed), Volumes 1-3 (page 424, 754, 832).

References:

1. Progress in Forensic Genetics 10, Proceedings of the 20th International ISFG Congress held in Arachon, France, September 2003.
2. Buckleton J., Triggs C.M., Walsh, Forensic DNA evidence Interpretation.
3. The FBI DNA Laboratory: A review of Protocol and Practice Vulnerabilities, U.S. Department of Justice.
4. Drug-DNA interaction protocols, 2nd edition, Keith R. Fox.
5. Molecular Cloning Laboratory manual (Vol 1, 2, 3), Sambrook, Russell.
6. PCR protocols, 2nd edition, John M.S. Bartlett, David Stirling.
7. Essential Molecular Biology, Vol. one, 2nd edition, T. A. Brown
8. Fundamentals of forensic science, 2nd edition, Max M. Houck, Jay A. Seigel.
9. Biophysical Chemistry: Principle and Techniques, Upadhyay, Upadhyay and Nath.
10. CRC Handbook for Laboratory safety, 5th edition, A. Keith Furr.
11. Forensic biology by Richard li