

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,  
AURANGABAD**



**STRUCTURE AND CURRICULAM  
FOR**

**M.Sc. (Forensic Science) Programme  
(Choice Based Credit System)**

**Effective from Academic Year**

**2015-16**

## **Structure and Curriculum for M.Sc. (Forensic Science) Programme (Choice Based Credit System)**

### **Preamble :-**

The M.Sc. Forensic Science course is divided in four semesters with total 102 credits. For, M.Sc.- I i.e. semester I and II there shall be six theory papers and six theory based practical papers dedicated to various disciplines of Forensic Science viz. Core Forensic Science, Forensic Chemistry, Forensic Physics, Forensic Biology, Forensic Psychology, Cyber & Digital Forensics and related laws. These papers will be compulsory for all the admitted students.

For M. Sc.-II i.e. semester III and IV there will be specializations in various subjects offered by the concerned Institution(s). Four Specializations viz. Finger print and Questioned Document, Forensic Chemistry and Toxicology, Forensic Biology, Serology and DNA Finger Printing, Cyber Space, IT Security and Cyber Forensic may be offered subject to the availability of students as mentioned in the preceding Para/ regulation. Each semester will have four theory papers and two theory based practical papers related to specialization. Two papers namely, Research Methodology (Paper No. XXV) and Constitution of India (Paper No. XXVI), shall be taught commonly to the students of all specializations in semester-III. In the fourth semester students will carry out Research project/ Dissertation. **Selection of the research project/ dissertation to be carried out in semester-IV shall be made while in semester –III. During semester III student shall carry out literature review under the guidance of the guide teacher and shall keep the separate record of it. While assigning the internal marks to this paper i.e. Paper No. XXXIX of each specialization, in semester IV, this record/work of student shall be taken into account along with other parameters like, performance of the student in experimental work, field work required to carry out project etc.** Institution(s) offering this course shall arrange study visit /field visit / on-site training etc. during the course.

**Eligibility:-** B.Sc. Forensic Science, with all papers dedicated to various disciplines of Forensic Science.

**Intake Capacity :-** 25 Seats to be filled as per following criterion.

- I) Eighty (80%) seats shall be reserved for the eligible candidates those have obtained the B.Sc. Forensic Science degree from Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- II) Ten (10%) seats shall be reserved for the eligible candidate who has obtained the B.Sc. Forensic Science degree from the other University within the State of Maharashtra. One seat will be for open and the other seat will go for student having higher percentage from any reserved category.
- III) Ten (10%) seats shall be reserved for the eligible candidate who has obtained the B.Sc. Forensic Science degree from the other State Universities and will be filled on the basis of merit.

- Note: 1. The marks obtained by candidate from criteria II & III shall not be less than the marks of the last candidate admitted in respective category from criteria I above .If candidates with such marks are not available then these seats will be filled up by candidate pertaining to criteria I.*
- 2. If any seat remains vacant then it will be allotted to candidate pertaining to criteria I) above further vacant seat/s if any will be allocated to waitlist candidate belonging to criteria II or then to criteria III.*
- 3. Prevailing reservation policies of Maharashtra state and Dr. Babasaheb Ambedkar Marathwada University will be applicable.*
- 4. Admissions will be strictly on the basis of merit. If required, the Institution(s) offering this Post Graduate program may conduct a separate entrance examination at their level and may give the proportionate weightage.*

**Minimum intake capacity for each specialization (M.Sc.-II):-** There shall be minimum 25% of the intake capacity of the students for each specialization.

**Allotment of specialization:-** The specialization to the students shall be allotted on the basis of choice and merit (M.Sc.-I, semester I and II taken together) of the students. However, if the criterion of minimum intake capacity for a particular specialization as mentioned above is not full filled, in such case the students will be diverted to other specialization strictly based on the marks obtained by him/her at M.Sc.-I examination. In such situation the decision of the Head of the concerned Institution shall be final.

**Choice Based Credit System (CBCS):-**

The choice based credit system has been adopted. This provides flexibility to make the system more responsive to the changing needs of our students, the professionals and society. Students will have to earn 102 credits for the award of M.Sc. (Forensic Science) degree.

**Credit-to- contact hour Mapping:-**

One contact hour per week is assigned 1 credit for theory and 0.5 credits for laboratory courses/ research project. Thus a 3 credit theory paper corresponds to 3 contact hours per week and a 1.5 credit practical paper corresponds to 3 contact hours per week.

**Attendance:-**

Students must have minimum of 75 % attendance in each theory, practical paper for appearing examination otherwise he / she will not be strictly allowed for appearing the University examination. However, students having 65 % attendance may request Head of the concerned Institution for the condonation of attendance on medical ground.

**Evaluation Methods:-**

The assessment will be based on continuous internal assessment (CIA) and semester end examination (SEE).

There shall be Continuous Internal Assessment for each theory paper. In semester I and II, 20% (i.e. 15) marks shall be for CIA and 80% (i.e. 60) marks for SEE. In semester III and IV, 25% (i.e. 25) marks shall be for CIA and 75% (i.e. 75) marks for SEE. Marks obtained by the student in all heads viz. CIA and SEE shall be added while declaring the final result.

**Continuous Internal Assessment (CIA):-**

The internal marks shall be assigned on the basis of tutorials/ home assignment /seminar presentation and weekly tests/preliminary examination to be conducted by the concerned Institution. These marks shall be communicated to the University before commencement of semester end examination.

**Semester End Examination (SEE) :**

- The semester end examination for each theory and practical paper shall be conducted by the University at the end of each semester.
- Duration of theory examination shall be of three hours for a paper of 75 marks and two and half hour for a paper of 60 / 50marks. Practical examinations shall be of three and four hour duration for semester I/II and semester III/IV examinations respectively.
- The respective departments are advised to arrange maximum number of experiments from the list of experiments provided with the syllabus or experiments based on theory syllabus. However, a minimum of 06 and 12 experiments shall be reported in the journal for the purpose of certification for each practical paper of semester I/II and semester III/IV respectively.
- Students without certified journal shall not be allowed to appear for the practical examination.

**Results Grievances / Redressal and ATKT rules :-**

Result Grievances / redressal /revaluation and ATKT rules shall be as made applicable by the University from time to time.

**Earning Credits:-**

At the end of every semester, a letter grade will be awarded in each course for which a student had registered. A student's performance will be determined by the number of credits that he/she earned by the weighted Grade Point Average (GPA). The SGPA (Semester Grade Point Average) will be awarded after completion of respective semester and the CGPA (Cumulative Grade Point Average) will be awarded at the end of the 4<sup>th</sup> semester by the University.

**Grading System:-**

- A ten point rating scale shall be used for the evaluation of the performance of the students to provide letter grade for each course and overall grade for the Master Programme. Grade points are based on the total number of marks obtained by him / her in all heads of the examination of the course. The grade points and their equivalent

range of marks are shown in the following Table.

**Table : Ten point grade and grade description**

Marks Obtained (%)	Grade Point	Letter Grade	Description
90-100	9.00- 10	O	Outstanding
80-89	8.00-8.90	A <sup>++</sup>	Exceptional
70-79	7.00-7.90	A <sup>+</sup>	Excellent
60-69	6.00-6.90	A	Very Good
55-59	5.50-5.90	B <sup>+</sup>	Good
50-54	5.00-5.40	B	Fair
45-49	4.50-4.90	C <sup>++</sup>	Average ( Above)
41-44	4.1-4.49	C	Average
40	4.0	P	Pass
< 40	0.0	F	Fail ( Unsatisfactory
	0.0	AB	Absent

- Non appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.
- Minimum P grade (4.00 grade points) shall be the limit to clear / pass the course / subject. A student with F grade will be considered as ‘failed’ in the concerned course and he / she has to clear the course by appearing in the next successive semester examinations.
- Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10 point scale). Based on the grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given on the completion of M. Sc. programme.

**Computation of SGPA (Semester Grade Point Average) and CGPA ( Cumulative Grade Point Average)**

Grade in each subject / paper will be calculated based on the summation of marks obtained in internal and semester end examination.

The computation of SGPA and CGPA will be as below

- Semester Grade Point Average ( SGPA) is the weighted average points obtained by the students in a semester and will be computed as follows

$$\text{Sum (Course Credit X Number of Grade Points in concern Course Gained by the Student )}$$

$$\text{SGPA} = \text{-----}$$

Sum (Course Credit)

The SGPA will be mentioned on the mark sheet at the end of every semester.

- The Cumulative Grade Point Average (CGPA) will be used to describe the overall performance of a student in all semester of the course and will be computed as under.

$$\text{CGPA} = \frac{\text{Sum ( All four Semester SGPA)}}{\text{Total Number of Semester}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

#### **Grade Card:-**

Results will be declared and the grade card (containing the grades obtained by the student along with SGPA) will be issued by the university after completion of every semester. The grade card will be consisting of following details.

- Title of the courses along with code opted by the student.
- Credits associated with the course.
- Grades and grade points secured by the student.
- Total credits earned by the student in a particular semester.
- Total credits earned by the students till that semester.
- SGPA of the student.
- CGPA of the student ( at the end of the 4<sup>th</sup> semester).

#### **Cumulative Grade Card:-**

The grade card sheet showing details grades secured by the student in each subject in all semester along with overall CGPA will be issued by the University at the end of 4<sup>th</sup> semester.

**Distribution of Marks and Credits:-** The number of theory / practical papers and marks / credit allotted for M. Sc. Forensic Science course shall be as under.

Year	Semester	No. of papers		Total Marks			Total Credits		
		Theory	Practical	Theory	Practical	Total	Theory	Practical	Total
M.Sc. – I (Common)	Sem.-I	06	06	450	150	600	18	09	27
	Sem.-II	06	06	450	150	600	18	09	27
M.Sc. – II (Specialization)	Sem.-III	06	02	500	100	600	20	04	24
	Sem.-IV	04	03	400	200	600	16	08	24
TOTAL		22	17	1800	600	2400	72	30	102

**Course Structure of M.Sc. | Forensic Science|:-****M.Sc.- I (Semester I & II )**

<b>SEMESTER – I</b>					<b>Marks</b>		
<b>Paper No.</b>	<b>Paper Code</b>	<b>Title</b>	<b>No. of Credits</b>	<b>Hrs. /week</b>	<b>Internal (CIA)</b>	<b>External (SEE)</b>	<b>Total</b>
<b>I</b>	MFS1T1	Advance Criminalistics	3	3	15	60	75
<b>II</b>	MFS1T2	Toxicology & Forensic Chemistry	3	3	15	60	75
<b>III</b>	MFS1T3	Trajectory Physics and Forensic Ballistics	3	3	15	60	75
<b>IV</b>	MFS1T4	Cellular Biochemical & Molecular aspects	3	3	15	60	75
<b>V</b>	MFS1T5	Criminal Psychology and Forensic Related Law	3	3	15	60	75
<b>VI</b>	MFS1T6	Forensic Computing & Offenses	3	3	15	60	75
<b>VII</b>	MFS1P1	Practical based on MFS1T1	1.5	3	--	25	25
<b>VIII</b>	MFS1P2	Practical based on MFS1T2	1.5	3	--	25	25
<b>IX</b>	MFS1P3	Practical based on MFS1T3	1.5	3	--	25	25
<b>X</b>	MFS1P4	Practical based on MFS1T4	1.5	3	--	25	25
<b>XI</b>	MFS1P5	Practical based on MFS1T5	1.5	3	--	25	25
<b>XII</b>	MFS1P6	Practical based on MFS1T6	1.5	3	--	25	25
<b>TOTAL</b>			<b>27</b>	<b>36</b>	<b>90</b>	<b>510</b>	<b>600</b>
<b>SEMESTER – II</b>					<b>Marks</b>		
<b>Paper No.</b>	<b>Paper Code</b>	<b>Title</b>	<b>No. of Credits</b>	<b>Hrs. /week</b>	<b>Internal (CIA)</b>	<b>External (SEE)</b>	<b>Total</b>
<b>XIII</b>	MFS2T1	Questioned Documents & Handwriting Analysis	3	3	15	60	75
<b>XIV</b>	MFS2T2	Chemistry of Drugs and Petroleum Products	3	3	15	60	75
<b>XV</b>	MFS2T3	Motor Vehicle Crimes & Forensic Physics	3	3	15	60	75
<b>XVI</b>	MFS2T4	Genetic Engineering, Bioinformatics and Applied Forensics	3	3	15	60	75
<b>XVII</b>	MFS2T5	Forensic aspects of Behavioral Science	3	3	15	60	75
<b>XVIII</b>	MFS2T6	Information Security, Network Forensics & IPR	3	3	15	60	75
<b>XIX</b>	MFS2P1	Practical based on MFS2T1	1.5	3	--	25	25
<b>XX</b>	MFS2P2	Practical based on MFS2T2	1.5	3	--	25	25
<b>XXI</b>	MFS2P3	Practical based on MFS2T3	1.5	3	--	25	25
<b>XXII</b>	MFS2P4	Practical based on MFS2T4	1.5	3	--	25	25
<b>XXIII</b>	MFS2P5	Practical based on MFS2T5	1.5	3	--	25	25
<b>XXIV</b>	MFS2P6	Practical based on MFS2T6	1.5	3	--	25	25
<b>TOTAL</b>			<b>27</b>	<b>36</b>	<b>90</b>	<b>510</b>	<b>600</b>

## SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER –I

Paper No.	Code	Title	Marks	Credits
I	MFS1T1	ADVANCE CRIMINALISTICS	75	3

### Unit I : Crime Scene Investigation & Management

Crime Scene Investigation (CSI): Types of crime scenes: indoor, outdoor, mobile, & hydro. Physical evidences, Crime scene search methods, Recovery & packaging of evidences, Crime scene documentation: Notes taking, Sketching, Photography & Videography. Preservation of evidences. Various Crime Scenes: Homicide, Suicide, Accidents (Vehicular, Train, Air-crash, Industrial etc), Mass Murders, House Breaking and Theft (HBT), Dacoity, Cybercrimes, Terrorism, etc. Crime Scene Management (CSM): Introduction & Components: Information, Manpower, Technology & Equipment and Logistics Management. Role of various experts at crime scene. Security, safety and preservation of crime scene. Contamination control. Scene Survey and initial documentation. Co-ordination amongst various agencies involved in investigation. Co-ordination of Interstate investigation agencies. Evidence recovery log. Chain of custody. Forwarding & Authorization letters and relevant paper work. National & International scenario on Crime Scene Investigation (CSI) and Crime Scene Management (CSM). Report Writing and Evidence Evaluation: Components of reports and Report formats in Crime Scene and Laboratory findings. Constitutional validity of Forensic Evidence, Expert Testimony: Admissibility in court of law, Pre-Court preparations & Court appearance,

### Unit II : Fingerprinting & Other Impressions

History and development of fingerprints. Formation and variation of ridges at various stages of life. Factors affecting fingerprint patterns. Classification of fingerprints; Henry system, single digit, extension of Henry system. Fingerprint bureau. Poroscopy & Edgescopy. Sweat analysis. Conventional methods of latent fingerprint development: fluorescent method, magnetic power method, fuming method, chemical method etc. Recent techniques: digital imaging and enhancement, Laser and other radiation based techniques, Metal deposition method. Development and preservation of latent print on skin: Living and Dead. Photography and image processing of fingerprints. Comparison of fingerprints: Class characteristics, individual characteristics, ridge tracing and ridge counting. Automated fingerprint identification system (AFIS): History, developments and components, Latent print and high quality image processing. Types of AFIS searches and reports. Footprints: Importance, Gait pattern analysis, Evaluation and analysis of various casts. Electrostatic lifting of latent footprints and comparison with reference sample. Tyre marks / prints and skid marks and comparison with control samples. Cheiloscopy: Nature, location, collection and evaluation of lip print. Ear prints: Introduction, growth & development, evaluation and analysis of ear print. Tool marks & Mechanical fits:



Introduction, nature, location, collection and comparison of tool marks. Introduction and types of mechanical fits. Forensic significance of various impression marks and its accountability in criminal investigation.

### **Unit III: Bloodstain Forensics & Crime Scene Reconstructions**

Bloodstain Pattern Analysis (BPA): History perspective of bloodstain evidence, Introduction, Terminologies and classification, Biological and physical properties of human blood, Droplet Dynamics in Flight and on Impact, Droplet Directionality from bloodstain patterns, Determination of Point of Convergence and Point of Origin. Impact spatter and mechanisms. Concept of Preponderant Stain size, Spatter associated with a projection mechanism. Altered bloodstain patterns. Formation of spatter and spatter associated with a secondary mechanism. Documentation and Evaluation of bloodstain evidence. Importance and Legal aspects of BPA. Manual and Computer-assisted reconstruction of BPA. Dealing with risk of bloodborne pathogens. Crime Scene Reconstruction(CSR): Nature & Importance of CSR. Basic Principles & Stages involved: Data Collection, Conjecture, Hypothesis formulation, Testing & Theory formation. Types & classification of reconstruction. Pattern evidence & Shooting scene reconstruction. Role of Logic in CSR. Writing a Reconstruction report. Correlation of crime scene analysis with behavioral analysis. Cases of Special Importance pertaining to forensic examination.

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### **SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>II</b>	MFS1T2	<b>TOXICOLOGY&amp; FORENSIC CHEMISTRY</b>	<b>75</b>	<b>3</b>

#### **Unit I: Toxicology- Organic Poisons**

**Pesticides & Insecticides** (Organo phosphates, Organo chlorine compounds, Carbamates, Pyrethroids, Bipyridyl derivatives) : Chemical composition and sub-types, Signs and symptoms of poisoning, Site and mechanism of toxic action, Biotransformation and distribution, Antidote Analysis: Collection & preservation of toxicological sample, Extraction of poisons from visceral material, Analysis by TLC, GC, HPLC and comparing results with standard.

**Animal Poisons**: Snake venom, composition, site of action, mode of action, effect on the body as a whole, and tests for identifications

**Carbon monoxide poisoning**: significance, signs and symptoms, methods of diagnosis, tests for identification.

#### **Unit II : Prohibition.**

Introduction, Definition of alcohol and illicit liquor, Alcoholic and non-alcoholic beverages and their composition, Proof spirit, absorption, de-toxification and excretions of alcohol, Crime scene management in illicit liquor cases, problems in alcohol cases and difficulties in diagnosis, Alcohol and prohibition, Consequences of drunken driving, Breath analysis, blood alcohol analysis by GC-HS.

Analysis of Beverages:, Analysis of alcoholic beverages as per BIS and PFA Act, Detection and determination of ethanol, furfural, organic acids, aldehydes, chloral hydrate, methanol and ethylene glycol in liquors by colour tests, TLC, GC, and GC-MS methods, Distinction between licit and illicit liquors.

### **Unit III: Explosive.**

Classification, Composition and characteristics of Explosive, Commonly used Explosive devices Explosion process and affects, types of hazard, effect of blast wave on structures, human etc. Crime scene management in explosive cases, post-blast residue collection,

Analytical Techniques for the analysis of exhibits involved in Explosive cases:-

Separation of Explosive in a mixture, Analysis by wet tests, Ion chromatography, Capillary electrophoresis, ED-XRF, Thin layer Chromatography (TLC), IR-Spectrophotometer, GC-Ion Scan, LC-MS.

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## **SYLLABUS FOR M.Sc-I FORENSIC SCIENCE - SEMESTER -I**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>III</b>	MFS1T3	<b>TRAJECTORY PHYSICS AND FORENSIC BALLISTICS</b>	<b>75</b>	<b>3</b>

### **Unit I : Physics of the Trajectory-**

Review of the projectile motion and relevant equations, Free fall and governing equations, Vertical trajectory, Horizontal launch and general ballistic trajectory, time of flight, Range and Rang as a function of angle of launch, Height of trajectory, Time of flight, Launch velocity, Angle of launch, Inter-relations and estimation of various parameters governing projectile motion, Derivation of maximum altitude of projectile in Cartesian, polar coordinates and using equation of parabola. Maximum range in Cartesian and polar coordinates, Maximum altitude at maximum range. Conditions at the final position of the projectile, Conditions at an arbitrary distance, Angle required to hit the coordinate (target), Trajectory of a projectile with air resistance, Ideal projectile motion, Landing of vertically fired bullets, Jumping projectiles.

## **Unit II : Firearms, Ammunition**

Review of history and background of firearms; Their classification and characteristics, various component of small arms, smooth bore and class characteristics, purpose of rifling, types of rifling and methods to produce rifling, trigger and firing mechanism, cartridge-firing mechanism, Shotguns; Classification, chocking, determination of bore. Techniques of dismantling / assembling of firearm, identification of origin, improvised / country-made / imitative firearm and their constructional features. Misconceptions about fired bullets.

Types and classification of ammunition, Constructional features and characteristics of different types of cartridges, types of primers and priming composition, propellants and their compositions, various types of bullet and compositional aspects, latest trends in their manufacturing and design projectile, identification of origin, improvised ammunition and safety aspects for handling firearm and ammunition.

**Unit III: Internal, External and terminal Ballistics:-** Definition, ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting. Muzzle velocity; Barrel length and velocity, effect of quantity of gun powder, effect of bullet weight, twist versus muzzle velocity. Strength of barrel and other parts, Recoil, jump and vibration.

Principal problems of exterior ballistics, vacuum trajectory, effect of air resistance on trajectory, base drag, yaw, shape of projectile and stability, trajectory computation, ballistics coefficient and limiting velocity, Ballistics tables, measurements of trajectory parameters, introduction to automated system of trajectory computation and automated management of ballistics data. Velocity and pressure characteristics under different conditions

Effect of projectile on hitting the target: function of bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of intermediate targets, influence of range Cavitations:- Temporary and permanent cavities, Ricochet and its effects, stopping power, Wound Ballistics; Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, penetrative in gel block and other targets, nature of wounds of entry, exit, initial with various ranges and velocities with various types of projectiles, explosive wounds, evaluation of injuries caused due to shot-gun, rifle, handguns and country made firearms, methods of measurements of wound ballistics parameters, post-mortem and anti-mortem firearm injuries.

Recovery of fired shots / projectiles, Measuring velocities of projectiles, Pattern testing of fired shots, Evaluation of target groups and determination of mean point of impact.

Principle and working of various components of Integrated Ballistics Identification System (IBIS).

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## SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I

Paper No.	Code	Title	Marks	Credits
IV	MFS1T4	CELLULAR BIOCHEMICAL & MOLECULAR ASPECTS	75	3

### Unit I: Metabolism, biochemical techniques

#### Basic concepts of Metabolism:

Concept of catabolism and anabolism: metabolic strategies, organization, clustering of enzymes. Regulation of Metabolic Pathways: energy charge, phosphorylation potential etc.

#### Carbohydrate metabolism

Glycolysis, glycogenolysis, gluconeogenesis, pentose phosphate pathway, glucuronic acid pathway. Dark reactions of Photosynthesis: CO<sub>2</sub> fixation: C<sub>3</sub>, C<sub>4</sub> and CAM pathways. Cyclic overview and reactions. Metabolic sources of acetyl CoA. Regulation and amphibolic nature of the cycle. Glyoxylate cycle.

#### Lipid metabolism

$\beta$  oxidation of unsaturated and saturated fatty acid and its regulation. Significance of ketone bodies, Biosynthesis of palmitate and its regulation. Mitochondrial and microsomal pathways of chain elongation, long term dietary changes and enzyme level. Metabolism of cholesterol: Biosynthesis of cholesterol and its regulation, lipoprotein metabolism, chylomicrons, LDL, HDL, VLDL. Transamination, deamination, Fate of amino acid skeleton, urea cycle, precursors for compounds other than proteins, Genetic diseases. Salvage and *de novo* pathways of purine and pyrimidine nucleotide biosynthesis. Formation of deoxyribonucleotides, origin of thymine. Biosynthesis of Nucleotide coenzymes. Nucleotide degradation: catabolism of purines and pyrimidines, fate of uric acid. Vitamins: Types, structure Biosynthesis, deficiencies Affinity chromatography, gel exclusion, Immunoelectrophoresis, complement fixation, RIA, ELISA & Types, Fluorescence immunoassay, flow cytometry, immunohistochemical techniques, Immunoprecipitation, Elispot assay, immunoelectron microscopy, isoelectric focussing techniques.

### UNIT II: Molecular Biology

Central dogma of Molecular biology, process of DNA replication, properties of DNA polymerases, chromosome replication initiation at ori C & termination at ter C, concept of replicon, replicating linear DNA in eukaryotes, multiple origins of replication eukaryotic chromosomes.

Transcription of genes: terminologies- eukaryotic genome, cistrons, coding sequence & ORF, RNA polymerases types & function, Activators, repressors, regulatory proteins. Transcription in eukaryotes, transcription of r RNA, t RNA & protein encoding genes in eukaryotes, enhancer control of transcription.

Protein Synthesis: Initiation, elongation & termination of protein synthesis, transcription , translation coupled in bacteria, initiation of protein synthesis in eukaryotes, role of molecular chaperon in protein folding, post translation modification,

Regulation of transcription in prokaryotes: Significance of gene regulation, alternative sigma factor in prokaryotes: Heat shock sigma factors, sigma factor in *Bacillus* spore formation, activators & repressors in positive & negative regulation. Crp protein-global control in protein synthesis. Antitermination.

Regulation of transcription in eukaryotes: Enhancers and insulator sequences. Heterochromatin, methylation & acetylation in gene expression, gene silencing, X –chromosome inactivation.

### **UNIT III: Microbial Forensics**

Defining the microbial forensics program, epidemiology, Microbial forensic tools. Dynamics of disease transmission , Outbreak Investigation. Deliberate introduction of a biological agent.

Emerging Microbial Forensic Techniques- PCR, Terminal Restriction Fragment Length Polymorphism (TRFLP), Amplified Fragment Length Polymorphism (AFLP), Single Stranded Conformation Polymorphism Analysis (SSCP), Thermal and Denaturing Gradient Gel Electrophoresis (TGGE, DGGE), Amplified Ribosomal DNA Restriction Analysis (ARDRA), Randomly Amplified Polymorphic DNA (RAPD). Non-PCR DNA Fingerprinting Techniques with Applicability in Forensic Studies- Restriction Fragment Length Polymorphisms (RFLP) and Ribotyping.

Forensic Interpretation of DNA Data, Isotopic Testing and Correlation to Contaminant Source

Microbes of forensic importance: *Bacillus anthracis*, *Yersinia pestis*, *Francisella tularensis*, *Brucella spp.*, *Burkholderia Pseudomallei*, *Clostridium botulinum*, *Listeria monocytogenes* and their morphological & biochemical studies. DNA of microbes in soil for crime detection.

Fungi of forensic importance: Opportunistic mycoses, *Chytridiomycota zygomycota*, *Aspergillus fumigates*, *microsporidium*, *pneumocytosis jiroveci*, *Asp.flavus* & *Candida* sp, epidemiology, Antifungal agents.

Food borne – shigella, salmonella.

Forensic Aspects of Biological Toxins and fungal toxins.

Microbial Forensic Analysis of Trace and Unculturable Specimens

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## SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I

Paper No.	Code	Title	Marks	Credits
V	MFS1T5	<b>CRIMINAL PSYCHOLOGY AND FORENSIC RELATED LAW</b>	<b>75</b>	<b>3</b>

### **UNIT I – Forensic Psychology and Criminal Behavior:**

Review of Forensic Psychology: Introduction, definition, History, development. Scope of Forensic Psychology, Ethics of Forensic Psychology, Psychopathology and Abnormal behavior/model of abnormal behavior/abnormal behavior. Biological factors & Crime, Social Learning theories, Psychosocial Factors, Abuse. Intelligence & Crime, Effects of Media, Gender & Crime. Psychology of Terrorism.

### **UNIT II - Juvenile Delinquency:**

Theories of Offending: Social Cognition, Moral Reasoning. Child Abuse: Physical, Emotional, Sexual,/ types of abuse [‘Criminology’, Digumarti Bhaskara Rao, 2012 Discovery publishing house, New Delhi.], Juvenile Sex Offenders/ Juvenile Sex Offenders, Prevention of Delinquency **Areas under Forensic Psychology-** Competency to stand trial/ Competency to stand trial, Sentence Litigation, Criminal Responsibility, Civil Commitmen, Guardianship and Conservatorship

### **UNIT III**

#### **Legal aspects**

- Relevant provisions of The Poisons Act, 1919.
- Case Studies and Relevant Provisions of-
  1. Indian Penal Code, 1860.
  2. The Bureau Of Indian Standards Act, 1986
  3. Prevantion of Food Adultration Act, 1954.
- Case Studies and Relevant Provisions of –
  1. Explosives Act 1884
  2. Explosive Substances Act
- Case studies and relevant provisions of Arms Act, 1959.  
Legal Aspects of Ammunition
- Juvenile in conflict with Law: (Juvenile Justice Act, 2000. Bail of Juvenile, Court orders regarding Juvenile, Penalties and Case-studies)

## SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I

Paper No.	Code	Title	Marks	Credits
VI	MFS1T6	FORENSICS COMPUTING AND OFFENSES	75	3

### UNIT I: Evolution of Computer Technology & Cyberspace

Computer Programming:

Programming Cycle, Basics of Programming, Interpreter, and Compiler, Various programming languages and their special features, Programming in C, Object Oriented Programming, Java programming, JSP and Servlet .

Internet & Web Technologies:

Role of Networking in IT, Evolution and Impact of Internet, Internet Services, Internet Process Concept of World Wide Web, History of World Wide Web, Purpose of Web, Functioning & Mechanism of Web, Web Hosting & Development, Website Legal Issues

HTML ( Elements, Attributes, Headings, Paragraphs, Formatting, Fonts, Styles, Links, Images, Tables, Lists, Forms, Frames, Iframes, Colors, Colornames, Colorvalues, Layout, Doctypes, CSS, Head, Meta ,Scripts, Entities, URLs, URL Encode, Webserver ) XML, PHP, Installing PHP on wamp server

PHP( Syntax, Variables, String, Operators, If...Else, Switch, Arrays, While Loops, For Loops, Functions, ,forms, GET, POST, Date, Include, PHP File, File Upload, Cookies, Sessions, E-mail, Secure E-mail, Error, Exception Filter)

Cyberspace: Concept of Cyberspace, Emergence of Cyberspace, Nature & Meaning of Cyberspace, Attributes of Cyberspace, Classification of Cyberspace, Legal Framework for Cyberspace.

### UNIT II: Wireless Networks and Internet Forensics.

**Wireless Networks:**

Wireless Infrastructure, Difference between wired and wireless networks. Wireless Transmission, Telecommunication Systems

Wireless LAN: IEEE 802.11 (Architecture Physical Layer MAC Layer Addressing mechanism)

Cellular Telephony: Frequency reuse principal, Transmitting- Receiving Handoff roaming, First Second and Third Generation.

Satellite Networks: Orbits, Footprints, three categories of satellites (GEO, MEO, LEO)

**Internet Forensic:**

Obfuscation: Anatomy of URLs, IP Addresses in URLs, Usernames in URLs, Encoding the Entire Message, Similar Domain Names, Making a form look like a URL, Bait and Switch-URL Redirection, JavaScript, Browsers and Obfuscation

Websites:

Capturing Web Pages, Viewing HTML Source, Comparing Pages, Non-Interactive Downloads Using wget, Mapping out the entire website, Hidden Directories, In Depth Example- Directory

Listing, Dynamic WebPages, Filling Out Forms, In depth Example-Server side Database, Opening the Black Box

Web Servers: Viewing HTTP Headers, Understanding Header Information, Cookies, Redirection, Web Server Statistics, Controlling HTTP Headers

### **UNIT III: Cyber crimes and related offences and penalties.**

Introduction to Cybercrimes, Classification of cybercrimes, Distinction between cyber crime and conventional crimes, Reasons for commission of cyber crime, Kinds of cyber crimes – cyber stalking; cyber pornography; forgery and fraud; crime related to IPRs; Cyber terrorism; Spamming, Phishing, Privacy and National Security in Cyberspace, Cyber Defamation and hate speech, computer vandalism etc., Relevant provisions under Information Technology Act, 2000, Indian Penal Code, 1860., Jurisdictional challenges in cyberspace., Investigation challenges in cyberspace, Emerging trends in Information Technology Act, 2000.

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### SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I

Paper No.	Code	Title	Marks	Credits
VII	MFS1P1	PRACTICAL BASED ON MFS1T1	25	1.5

#### LIST OF EXPERIMENTS

1. Crime scene protection and security
2. Photographing the scene of crime using 3 angle views – Birds-eye view, mid range, close-up
3. Sketching the scene of crime – Rough and Finished
4. Sketching the crime scene using Rectangular coordinates, Baseline and Triangulation method
5. Collection and Packaging of various Physical evidences
6. To obtain class characteristics of fingerprints
7. To obtain individual characteristics of fingerprints
8. Study of pores on friction ridges
9. Sweat Analysis of palmer and plantar surfaces.
10. To perform ridge tracing and ridge counting.
11. To develop latent finger Prints with Powder methods.
12. To develop latent finger Prints with Fuming methods.
13. To develop latent finger Prints with Chemical methods.
14. Fingerprint classification using Henry system
15. Crime scene report writing
16. Forensic Result report writing
17. To measure the Gait of Individuals under various circumstances
18. To study various wear and tear characteristics on footwear
19. To examine anatomical difference in footprints of individuals. Under various circumstances.
20. To study bloodstain impact pattern at different velocity
21. To determine point of convergence and point of origin using string method in BPA
22. To study droplet dynamics of blood on various surfaces and different heights and angles.
23. Reconstruction and evaluation of various scenes of crime.
24. Tyre print tracing, casting and comparison
25. Footprint tracing, casting and comparison
26. Examination of Ear print and lip print found at the crime scene
27. To study and examine toolmarks and mechanical fits

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**SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>VIII</b>	MFS1P2	PRACTICAL BASED ON MFS1T2	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

1. Analysis of alcoholic liquor as per BIS specifications.
2. Determination of methanol and ethanol in alcoholic liquors.(wet test, GC,TLC)
3. Analysis of gasoline as per BIS specifications.
4. Estimation of ethyl alcohol in blood sample by wet test, TLC, GC-HS.
5. Analysis of viscera (simulated sample) for organo-chloro /organo-phosphorus pesticides by TLC.(2 Nos
6. Adulteration of vegetable oils by GC & HPLC.
7. Systematic analysis of pharmaceutical products as per IPC specification by using HPLC
8. Systematic analysis of pharmaceutical products as per IPC specification by using GC.
9. Analysis of explosion residues (Preliminary analysis, GC, GC-MS, ion chromatography {for inorganic explosive}).(2 Nos.)
10. analysis of fire arson samples (extraction, GC, GC-MS) (2 Nos)

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**SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>IX</b>	MFS1P3	PRACTICAL BASED ON MFS1T3	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

1. Study of calibre and rifling characteristics
2. Examination of firearm(s).
3. To study assembling and dismantling of firearms.
4. To study the working mechanism of firearm(s).
5. Examination of air guns / rifles as per Arms Act 1959.
6. Determination of shot number from size and weight of shots.
7. Physical examination of propellant of ammunition.
8. Examination of choking in shotgun.
9. Study of constructional features of improvised firearms.
10. To study proof mark of firearm.
11. Study of constructional features of cartridge.
12. To study proof mark of cartridge.
13. To study lands and grooves in rifled weapons.

14. Study of pressure on metal disc and its co-relation with barrel pressure.
15. Recoil velocity of a gun.
16. Velocity of a bullet / projectile from penetration depth.
17. Study of cavitation effect by using Gel blocks / soap blocks.
18. Measurements of wound ballistic parameters.
19. Study of entry and exit hole caused projectile.
20. Simulation/ sample calculations of various parameters governing projectile motion.
21. Simulation/ sample calculations of various parameters governing free fall motion.

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#### SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I

Paper No.	Code	Title	Marks	Credits
X	MFS1P4	PRACTICAL BASED ON MFS1T4	25	1.5

#### LIST OF EXPERIMENTS

1. Chromosome banding technique.
2. pH, Buffers, Buffering capacity
3. To perform serum electrophoresis.
4. Extraction and isolation, estimation of DNA from buccal swabs, blood, semen and other biological samples (from Cows, Bulls, Buffalos, Chicken fishes, other wild animals etc.)
5. Restriction digestion of DNA from above samples.
6. DNA fingerprinting for testing of paternity disputes and rape cases.
7. To perform Western Blotting
8. Estimation of Amino Acid (Tyrosine)
9. Estimation of Nitrogenous Base (Guanine)
10. Detection of Ag/ Abs by ELISA and immunohistostaining.
11. Isolation of Pathogenic Bacteria from suspected food samples
12. Study of pathogenic fungi of forensic value
13. Isolation of DNA from Bacteria of forensic significance
14. Squash preparation of giant chromosome of salivary gland
15. Extraction and isolation of Aflatoxin from fungi.
16. Study of bacterial endotoxins.

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**SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XI</b>	MFS1P5	PRACTICAL BASED ON MFS1T5	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

- 1.NEO-PI
- 2.Minnesota Multiphasic Personality Inventory-2/A (MMPI-2/A)
- 3.Rorschach Test
- 4.Bhatia's Battery for Intelligence
- 5.Thematic Apperception Test
6. Social intelligence Test
- 7.Free association test

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**SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -I**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XII</b>	MFS1P6	PRACTICAL BASED ON MFS1T6	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

1. C Program Structure, data input and output, control statements, functions arrays etc
2. Basics of Java programming. Servlet and JSP Programs and Java Script
3. Structure of HTML, XML and PHP : Creating webpage using Structure of HTML, XML and PHP
4. study of wireless devices
5. study of wireless networks and wireless network analysis.
6. Understanding dynamic and static pages, Viewing HTML Source and HTTP Headers, Understanding Header Information
7. Working with wireshark for Network analysis
8. Studying of packets and packet formats.
9. Log Collections and analysis
10. Network evidence collection offline and online

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## SYLLABUS FOR M.Sc.-I, FORENSIC SCIENCE - SEMESTER -II

Paper No.	Code	Title	Marks	Credits
XIII	MFS2T1	QUESTIONED DOCUMENTS & HANDWRITING ANALYSIS	75	3

### Unit I: Document Examination & Counterfeiting

Importance & Nature of Forensic Document Analysis. Types & Classification of Questioned Documents: Historical Documents, financial Documents, orders, records, tickets, books, exam papers, wills, posters, etc. Guidelines for collection of standard admitted/specimen writing. Procedures of Handling and marking of documents. Preliminary examination of documents. Indented and Charred Documents: its care and restoration. Photographic evidence. Documentation & Submitted evidence. Question Document Examiner's Qualification and Trainers. Role of a Forensic Document Examiner & Effective Court presentation. Determination of age of documents: Potential applications & limitations. Introduction & definition of Counterfeiting. Types: Currency, coins, Government Bonds, Documents, Consumer Goods, certificates, etc. Manufacture & Circulation of Government coins & currency. Minting Process of Genuine coins. Types of counterfeit coin processes and their detection: Cast process and struck process. Characteristics of Genuine currency notes of various countries. Plastic currency: Examination of credit cards and similar material, security features, holographic marks and other characteristics. Methods employed by counterfeiters and methods for detection of counterfeits. Advanced Printing technology: Offset lithography, thermography, Intaglio, Letter press and screen printing. Global scenario on growth of counterfeiting and relevant Provisions of Indian Penal Code, 1860.

### Unit II: Handwriting & Signature Analysis

Principles of identification of handwriting. Individual characteristics & Factors affecting handwriting. Physiology of writing: Rules and physiological principles of handwriting. Definition & different handwriting systems. Influence of individuality on letter construction, connecting strokes, beginning and ending strokes. Features & Qualities of writing: Line quality, abbreviations, alignment, arrangement, connections, initial strokes, pen lifts, pressure, punctuations, rhythm, shading, size, slope, terminal strokes, tremor, etc. Writing instruments & materials and their influence on writing. Relative speed of writing: Right & Left tendencies. Relative slant, Relative spacing between words, names & initials in a signature, letters within a word, lines of writing in an extended body of writing. Relative pressure and placement habits. Relative height and width relationship between letters. Relative relationship between letters and baseline. Identification in a practical situation and typical problems involving handwriting analysis. Identification of Genuine signatures. Accidental variations. Receipt signatures. Influence of drugs, alcohol, age, illness on handwriting and signature. Assisted or guided signatures. Identification of initials and illiterates' marks. Examination of class and individual

characteristics of numerals. Source, collection, preparation of standards. Advanced techniques: Stereomicroscopy, Video spectro comparator, ESDA, TLC, Spectrographic analysis of metals in ink, Electrophoresis, Image enhancement using photography and scanning method. Working mechanism and analysis of various printing technologies and their limitations.

### Unit III: Forgeries & Secret Writing

Ancient forgeries and their methods of detection. Types of forgeries and identification of genuine and forged documents. Introduction to Forensic Stylistics and its application in identification of anonymous writer. Evaluation of Erasures and Alterations: Chemical and mechanical erasure, Addition, Interlineation, Obliteration, Deletion, Substitution, Trimming, Cutting Overwriting, Insertion. Deciphering alterations & erasures. Disguised writing and methods of identification. Forged and disguised or distorted signatures. Methods of producing forged signatures and its identification. Factors affecting forgeries: defects of free hand and traced forgeries. Anonymous letters: its content and authorship. Historical perspective of secret writings: Invisible inks, miniature writings, Hieroglyphics, Ciphers, cryptograms, etc. Terminologies of secret writing and Types of cipher: Autokey, Cipher, Ciphertext, Code, Cryptanalysis, Cryptography, Decrypt, Encrypt, Key, Monoalphabetic substitution, Plaintext, Polyalphabetic substitution, Steganography, Transposition, Alphabetic substitution, Caesar Cipher, Alberti Discus, Trimethius Cipher table, Vigenere Cipher. Relevant Provisions of Indian Penal Code, 1860 (Fraud and Forgery).

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### SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -II

Paper No.	Code	Title	Marks	Credits
XIV	MFS2T2	<b>CHEMISTRY OF DRUGS AND PETROLEUM PRODUCTS</b>	<b>75</b>	<b>3</b>

### Unit I : General Drugs, Other Chemicals

Introduction, Pharma drugs (barbiturates, benzodiazepine & other pharma drugs), Drug abuse in sports & Date rape drugs: Introduction, common prohibited substances, analytical approach, Forensic Pharmacological studies, Ingestion of drugs, absorption, distribution, metabolism, pathways of drug metabolism, drug metabolism and drug toxicity, excretion of drugs, detection of drugs on the basis of their Metabolic studies.

**Solvent Abuse** (chlorinated hydrocarbons, Aromatic hydrocarbons, alcohols, glycols, fuel and fuel additives): absorption, distribution, and metabolism, psychological & clinical effects.

Analysis: collection of sample, distillation & extraction, Analysis by GC, HPLC.

### Unit II : Narcotic Drugs

Introduction to narcotic drugs, Classification of narcotic drugs, analysis of NDPS evidence by various procedures prescribed by U.N. Manual, DFS manual, spot tests, microcrystal tests, extraction methods, TLC, UV-Vis spectrophotometry, IR spectrophotometry, GC-HPLC, MS, GC-MS, NMR and XRD as exemplified by cocaine, cannabis, amphetamines, opiates and hallucinogens (LSD, psilocybine and mescaline), evidence handling & sampling techniques, clandestine laboratory investigation and designer drugs.

### **Unit III : Petroleum Products**

Introduction, Analysis of petroleum products and residues: Distillation and fractionation, Various fractions and their commercial uses, Adulteration of petroleum products, Methods of commercial analysis of petroleum products as per ASTM and BIS standard, Comparison of petroleum products, Analysis of traces of petroleum products in forensic exhibits, characterisation of petroleum products by flash point, aniline point, cloud point, pour point, GC & GC-DHA.

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## **SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -II**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XV</b>	<b>MFS2T3</b>	<b>MOTOR VEHICLE CRIMES &amp; FORENSIC PHYSICS</b>	<b>75</b>	<b>3</b>

### **Unit I: Motor Vehicle Crimes**

Crimes and vehicles, Road accidents, Theft of Vehicle, Abandoned Vehicles Vehicle involved in terrorism and Investigation. Evidentiary clues; the vehicle, the scene, the culprit/victim. Collection and Evaluation of; Tyre, tyre marks, tyre residues, tyre bursts. Mechanical failure. Crime Scene Management in motor vehicle cases, Forwarding Exhibits in Motor vehicle cases, Important Crime cases:-Vehicle involved in Explosion

Legal Aspects:-

Case studies and relevant provisions of offences under Motor Vehicle Act, 1988 .

### **Unit II: Hit and Run cases and investigation:**

Nature and causes, Collection of evidence; paint, automobile window glass, Head light- tail light, scratch marks, bulb filament, fibre and rubber, chassis and engine number, RTO registration number and related documentary clues.

Analytical Technique for the analysis of evidence involved in Hit and Run cases; Types of glass and their composition, forensic examination of glass fractures under different conditions, determination of direction of impact cone- fracture, rib marks hackle marks, backward fragmentation, colour and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis and interpretation of glass

evidence by Atomic Emission spectroscopy, XRD of glass, Raman and IR spectroscopic analysis of Paints, Restoration of erased serial numbers and engraved marks, Document examination by VSC, Microscopic examination, Micro chemical tests, Differential solubility.

### **Unit III: Vehicular Accident Reconstruction:**

Introduction, Analytical tools used, Converting Scene data into an event sequence, Basic energy methods, Basic momentum methods, Accident analysis; Post crash movements, Collision model and Accident reconstruction calculations, Skid marks and evaluation of speed , Occupant kinematics, Biomechanics of injuries, Tips and solution strategies.

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## **SYLLABUS FOR M.Sc-I FORENSIC SCIENCE - SEMESTER -II**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XVI</b>	<b>MFS2T4</b>	<b>GENETIC ENGINEERING , BIOINFORMATICS &amp; APPLIED FORENSICS</b>	<b>75</b>	<b>3</b>

### **Unit I: Recombinant DNA Technology & Genetic Manipulations**

Techniques in Recombinant DNA Technology: Nucleic acid purification, detection & hybridization, pulse field gel electrophoresis, measuring concentration of DNA & RNA with UV, radioactive labelling of Nucleic acids, detection of radio labelled DNA, fluorescence in detection of DNA & RNA, chemical tagging with biotin & Digoxigenin, hybridization of DNA & RNA, southern, northern, & western blotting, FISH, molecular beacons. (Ref: Mol bio D.P. Clark) PCR: Types: inverse, RT PCR, differential display PCR, PCR in Genetic engineering, directed mutagenesis, real-time PCR, RAPD, and RACE. Genomics & DNA sequencing: General Principal, the chain termination method for sequencing DNA, DNA polymerase for sequencing DNA, producing template DNA for sequencing, DNA for sequence, primer walking along strand of DNA, automated sequencing , Mapping of sequence tagged sites, shotgun sequencing, survey of human genome, sequence polymorphism: SSLP 's& SNP's, gene identification by exon trapping. Restriction endonucleases & types, ligases, Alkaline phosphatases, types, S1 nuclease& application. Cloning vectors: plasmids, cosmids, phagemids, YAC, BAC, construction & properties. DNA libraries: g DNA, cDNA , Screening library by hybridization , screening of library by Immunological procedure, chromosome walking , expression vectors, Analysis of gene expression, reporter genes for monitoring gene expression. Reporter system: luciferase, Green Fluorescent Protein, gene fusion. Transcriptome analysis, DNA microarrays for gene expression, serial analysis of gene expression (SAGE).

### **Unit: III : Bioinformatics**

Introduction of bioinformatics: Definition & History, Biological Databases: NCBI, Genbank, EMBL, Protein databases: Genpept, tremble, uniprot. Biological resources: Expasy, NCBI, Data



analysis tools: BLAST, CLUSTALw (Multiple sequence alignment tools). Methods for microbial detection & forensic diagnostic design: Nucleic acid diagnostics: Handheld advanced nucleic acid analyses (HANAA), luminex, and molecular beacons. Proteomics: Protein structure, tools for protein structure modelling: Pairwise sequence alignment (BLAST, FASTA, Smith-waterman) Multiple sequence alignment (PSI-BLAST). Protein detection diagnostic: Monoclonal antibodies & High affinity ligands (HAL)

Genomics: Nucleic acid signature, Annotation, tools used for annotation, comparative genomics, Alignment tools: Introduction, significance and types (DIALIGN, MUMmer) Primer & probe selection to target sequence.

#### **Unit IV: Environmental Forensics and Forensic Medicine**

Introduction to Environmental Forensics. Mercury- Natural and anthropogenic sources, detecting mercury in indoor environment and mercury forensics. Asbestos- sources and detection in air, water, fibres etc. Sewage, Lead- sources, compounds, analytical methods and lead forensics.

Arsenic- sources, compounds, analytical methods and arsenic forensics.

Pesticides- Types, analytical testing and forensic techniques.

Polycyclic aromatic hydrocarbons (PAHS)- sources, types and analytical techniques.

Crude oil and refined products- oil analysis methods, oil spill analysis protocols.

**Forensic Medicine:** Death: Signs of death and changes after death, Somatic death, molecular death, early changes and late changes after death. Injuries : types and medicolegal aspects of injuries.

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#### **SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -II**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XVII</b>	<b>MFS2T5</b>	<b>FORENSIC ASPECT OF BEHAVIOURAL SCIENCE</b>	<b>75</b>	<b>3</b>

#### **UNIT I – Investigative Interviewing:**

Importance of Investigative Interviewing, Influence of Psychology, P.E.A.C.E Model of Interviewing, Cognitive Interviewing, Ethical Interviewing, Other Interview Techniques

#### **UNIT II – Psychological Investigation of Crime:**

Psychological Profiling, Polygraph (Lie-Detector), Brain Electrical Oscillation Signature Profiling (BEOS), Narco-analysis, Voice-Stress Analysis/ Layered Voice Analysis, Brain Fingerprinting/ Brain-Mapping.

#### **Offender Profiling and Criminal Behavior Analysis:**

History: Serial Killers, Signature (Modus Operandi), Crime Scene Analysis [‘Criminal Profiling’, Brent Turvey, 2002, Elsevier Ltd. Chapter-11, 189], Psychological Autopsy, Behavior

Profiling, Nature of Crime (Organized, Disorganized[‘Criminal Profiling’, Brent Turvey,2002, Elsevier Ltd. Chapter-12, 219], Planned, Spontaneous), Victimology, Stages and Types of Offender Profiling. Psychometric Assessment tools used in Forensic Psychology. Assessment of Offenders. Rehabilitation & Correctional Treatment of Offenders. Techniques, Strategies and Types of Treatment.

### UNIT III

#### Legal Aspects

- Case Studies and Relevant Provisions of –
  1. The Drugs Control Act, 1940.
  2. The Drugs and Cosmetics Act, 1940.
- Case Studies and Relevant Provisions of –
  1. NDPS Act,1985.
  2. Prevention of Illicit Trafficking in NDPS Act,1985.
- Case Studies and Relevant Provisions of – Petroleum Act, 1934.
- Case studies and relevant provisions of (Hit and run cases) Indian Penal Code,1860.
- Mental Health Act, 1987: (Object, Relevant Definitions, Central & State authority, Reception Orders, Human Rights of Mentally ill persons, Penalties & Case-Studies)
- Indian Penal Code, 1860 : Relevant general exceptions

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#### SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -II

Paper No.	Code	Title	Marks	Credits
XVIII	MFS2T6	<b>INFORMATION SECURITY, NETWORK FORENSICS &amp; IPR</b>	<b>75</b>	<b>3</b>

#### UNIT I : Information security and Network Forensics

**Information security** : Information Security IT Managers,(Scope, Domains, Common Attacks, Impact of Security Breaches)Protecting Critical Systems( Information Risk Management, Risk Analysis etc) Information Security in Depth Physical security (Data security Systems and network security , Business communications security , Wireless security, Web and application security , Security policies and procedures, Security employee training and awareness)

Program Security: Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats

Operating System Security: Protected objects and methods of protection, Memory address protection, Control of access to general objects, File protection mechanism, Authentication: Authentication basics, Password, Challenge-response, Biometrics.

Database Security: Introduction to Database, Basics of SQL, Security requirements, Reliability and integrity, Sensitive data, Interface, Multilevel database, Proposals for multilevel security

Security in Networks: Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec

**IDS:** Network based Intrusion Detection and Prevention Systems, Host based Intrusion Prevention System

**Network Forensics:** Scientific Overview, Principles of network forensics, Attack Traceback and attributes, Critical Needs Analysis.

## **UNIT II : Live and network based evidence collection, Open source tools and Registry forensics.**

Where Evidence Resides on Windows systems, Conducting a Windows investigation, File Auditing and Theft of information, Handling the Departing Employee

Steps in a Unix Investigation, Reviewing Pertinent Logs, Performing Keywords Searches, Reviewing Relevant Files, Identifying Unauthorized User Accounts or Groups, Identifying Rogue Processes, Checking for Unauthorized Access Points, Analyzing Trust Relationships, Detecting Trojan Loadable Kernel Models.

Finding Network based Evidence, Generating Session data with TCP Trace, Reassembling sessions using TCP flow and Ethereal

### **Open source tools for digital forensics and Registry Forensic**

What is open source, Open source examination platform, preparing the examination system, using LINUX and Windows as host,

Study of Sleuth Kit: Installing Sleuth Kit, Sleuth Kit tools (Volume layer tools, File system Layer tools, Data unit Layer tools, Metadata Layer Tools)

Registry Analysis, Understanding Windows Registry and Registry Structure

## **UNIT III : Intellectual Property Rights in Cyberspace-I**

**Copyright an overview-** Meaning, Object, and Concept of Copyright. Rights of Copyright Owner. Fair Use in Copyrighted work

**Copyright in Cyberspace-** Linking, Inlining, Framing, Protection of content on web site, Computer Software and Copyright Protection, Reverse Engineering and Fair Use in Copyright, Open Source, Shareware, Freeware Software and Copyright Protection.

**Patent Law an Overview-** Meaning, Object, and Concept of Patent, Patentable and Non-Patentable Inventions, Patent Agent, Patent Issues in Cyberspace: Software Patenting and Business Method and Mathematical Patents

**Trade Mark an Overview-** Origin and Development of Indian Law on Trade Marks, Registration of Trade marks, Rights of Trade Mark Holders, Infringement and Passing off, Legal Remedies for Trade Mark Violations

**Trademark Issues in cyberspace-** Concept of domain name, Registration of Domain Name, Domain Name Disputes, Cybersquatting, Typosquatting, Reverse Hijacking, Meta-tags and Key words, Uniform Dispute Resolution Policy, International Treaties.

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**SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -II**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XIX</b>	MFS2P1	PRACTICAL BASED ON MFS2T1	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

1. Identification of General Characteristics of Handwriting
2. Study of Natural variations in Handwriting
3. Study of disguised writing using stereomicroscope and VSC
4. Detection of simulated forgery and traced forgery
5. Handling and preserving of charred documents
6. Examination of forged documents using VSC
7. Examination of alteration, erasures, overwriting, additions and obliteration
8. Decipherment of secret writings using VSC
9. Decoding cryptogram
10. Study of handwriting on different surfaces
11. Study of signatures and initials under various circumstances
12. Thin Layer Chromatography of types of inks
13. Examination of security documents, currency notes, lottery tickets, stamp papers, etc. using VSC 6000
14. Examination of Age of Document and ink
15. Examination of typescript variations of different printing devices
16. Study sequence of intersecting strokes using VSC
17. Examination of watermarks in documents
18. Comparison of documents examined on VSC with those examined on Stereomicroscope
19. To study the indented and invisible writings.
20. Examination of rubber stamp and other mechanical impression.

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**SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -II**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XX</b>	MFS2P2	PRACTICAL BASED ON MFS2T2	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

1. Steroid(Anabolic) analysis by HPLC. (2 Nos.)
2. Estimation Analysis of Petroleum Products by a)density b)viscosity c)flash point d)distillation e)GC-DHA f)HPTLC (2 Nos)

3. Systematic identification of Narcotic Drugs and Psychotropic substances (opiates, cannabis and barbiturates,) by spot colour tests. TLC, UV, HPLC. (2 Nos.)
4. Systematic identification of Narcotic Drugs and Psychotropic substances (benzodiazepines and amphetamines) by spot colour tests. TLC, UV, HPLC .(2 Nos)
5. Systematic extraction and identification of acidic and basic drugs from viscera (simulated sample).by wet test & GC.( 2 Nos)
6. Systematic extraction and identification of acidic and basic drugs from viscera (simulated sample).by wet test & GC.( 2 Nos)
7. Systematic analysis of cosmetic products as per IPC specification by using HPLC
8. Systematic analysis of cosmetic products as per IPC specification by using GC.

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#### SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -II

Paper No.	Code	Title	Marks	Credits
XXI	MFS2P3	PRACTICAL BASED ON MFS2T3	25	1.5

#### LIST OF EXPERIMENTS

Accident reconstruction sample calculations.

1. Photographs and plans of accident scene.
2. Velocity estimation from skid marks.
3. Restoration of erased / obliterated marks.
4. To study brake action of various automobiles.
5. To study the working mechanism of important components of automobile engine.
6. Study of speedometer.
7. To measure turning diameter of a vehicle.
8. Measurement of peripheral vision.
9. Examination and analysis of paint chips collected from hit and run cases.
10. Examination and analysis of glass pieces collected from hit and run cases.
11. Comparison of head light glass and automobile window glass.
12. Examination of vehicle identification numbers..
13. Examination of bulb filament.
14. Automobile related Document Examination using VSC.
15. Physical examination of tyre.
16. To study class characteristics of various tyres.
17. Wear and tear of tyre.
18. Wheelbase and tire tread stance measurements
19. Lifting of tyre impressions.
20. Casting of tyre impressions.
21. Evaluation of tyre impressions.
22. Restoration of erased serial numbers using physical / chemical methods

**SYLLABUS FOR M.Sc-I FORENSIC SCIENCE - SEMESTER -II**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XXII</b>	MFS2P4	PRACTICAL BASED ON MFS2T4	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

1. PCR amplification of DNA.
2. RFLP
3. To Perform RAPD
4. Accessing DNA Databases: NCBI, DDBJ, Ensemble
5. Accessing Protein Databases: Swissprot , Genpept, tremble, uniprot.
6. Bioinformatics softwares: Clustal V, Clustal W 1.7. RasMol, Oligo, Molscrip, Treeview, Alscript, Genetic analysis software
7. Comparing different Gene sequences using BLAST
8. Detection of mercury, arsenic, lead, petroleum products with the help of HPLC and GC-MS techniques.
9. Culture and identification of important microbes for forensic studies.
10. Etiological study of forensic plant pathological pathogens.
11. Detection of Pesticides in soil and water sample.
12. Study of various water samples for pollutants
13. Visit to Mortuary
14. Study of injuries
15. Extraction of plasmid and transformation in bacterial cell.
16. Southern hybridization

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**SYLLABUS FOR M.Sc-I FORENSIC SCIENCE - SEMESTER -II**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XXIII</b>	MFS2P5	PRACTICAL BASED ON MFS2T5	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

1. Taking Case History
2. Mental Status Examination
3. Criminal Behavior Analysis
4. Polygraph: Formulating Relevant, Irrelevant and Control questions.
5. BEOSP: Formulating the Probes.
6. WAIS/WAPIS
7. Study of antisocial personality disorder.

**SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER -II**

<b>Paper No.</b>	<b>Code</b>	<b>Title</b>	<b>Marks</b>	<b>Credits</b>
<b>XXIV</b>	MFS2P6	PRACTICAL BASED ON MFS2T6	<b>25</b>	<b>1.5</b>

**LIST OF EXPERIMENTS**

1. Covert collection techniques and remote collections
2. configuring and study of servers(Linux or windows server) 2 nos
3. Study and understanding of various networking devices.(routers,switches,hubs,gateways)
4. Working with Sleuth Kit
5. Registry Analysis
6. Studying of packets and packet formats..
7. Practical Study of Intrusion Detection System(Hardware and software)
8. Network analysis using watchguards for security purposes 2 Nos
9. Study of computer forensics and cyber crime investigations/work being used by developed nations like USA, UK and their investigating agencies like FBI

## REFERENCES

### **1) Advance Criminalistics AND Questioned Documents & Handwriting Analysis (MFS 1T1 & MFS 2T1)**

1. Bevel, T., Gardner, M. R., Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction, Third Edition.
2. Bevel, T., Gardner, M. R., Practical Crime Scene Analysis and Reconstruction
3. Lee, C. H., Palmbach, T., Miller, T. M., Henry Lee's Crime Scene Handbook
4. Moenssens : Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.
5. Mehta, M. K. : Identification of Thumb Impression & Cross Examination of Finger Prints, 1980 N. M. Tripathi (P) Ltd. Bombay.
6. Bridges : Practical Finger Printing, 1942, Funk and Washalls Co. New York.
7. Holt : Genetics of Dermal Ridges.
8. William J. Bodziak (1989) Footwear Impression Evidence Elsevier Science Publishing Co. New York, 1989.
9. James, S.H and Nordby, J.J.. (2003) Forensic Science : An introduction to scientific and investigative techniques CRC Press, USA.
10. Saferstien : Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA.
11. Kirk : Criminal Investigation, 1953, Interscience Publisher Inc. New York.
12. Cummins & Midlo : Finger Prints, Palms and Soles, 1943, The Blakiston office London.
13. O'Hara & Osterburg : Introduction to Criminalistics, 1949, The MacMillan Co., 1964.
14. Saferstein : Forensic Science Handbook, Vol I, II & III, Prentice Hall Inc. USA.
15. Sharma B. R. : Footprints, Tracks and Trials. 1980. Central Law Agency. Allahabad.
16. C.G.G. Aitken and D.A Stoney; The use of statistics in Forensic Science, Ellis Horwood Limited, England 1991.
17. Nanda, B.B. and Tewari, R.K. (2001) : Forensic Science in India : A vision for the twenty first century Select Publisher, New Delhi.
18. Cherril, F.R. : The Finger Prints. System at Scotland Yard, 1954; Her Majestuy's office, London.
19. Saferstein : Criminalistics, 1976, Prentice Hall Inc., USA.
20. Deforest, Gansellen & Lee : Introduction to Criminalistics.
21. Sharma, B.R. : Forensic Science in Criminal Investigaion and Trials, Central Law Agency, Allahabad, 1974.
22. Wentworth & Wilder : Personal Identification, 1948. R. G. Badger. Boston.
23. Lundquest & Curry : Forensic Science, Vol I to IV, 1963, Charls C. Thomas, Illinois, USA.



24. Visweswara Rao. K: Biostatistics, A Manual of Statistical Methods for Use in Health, Nutrition & Anthropology.
25. Sokal, R.R & Rolf, F.J: Biometry, Principles & Practices of Statistics in Biological Research
26. Rao, C. R Advanced Statistical Methods in Biometric Research.
27. Iannarelli, A V; Ear Identification, Forensic Identification series, Paramount (1989)
28. Henry C. Lee & R. E. Ganesslen; Advances in Finger Print Technology, CRC Press, London (1991)
29. James, H. Stuart, Kish, E. Paul, T. Paulette Sutton, Principles of Bloodstain Pattern Analysis: Theory and Practice
30. Stuart, H. J., Scientific and Legal Applications of Bloodstain Pattern Interpretation
31. E. Roland Menzel; Fingerprint Detection with Lasers, 2nd Ed., Marcel Dekker, Inc. USA (1999)
32. Menzel, E Roland; Fingerprint detection with lasers, Marcel Dekker, NY (1999)
33. Ratha Nalini; Automatic Fingerprint recognition system, Springer Pub., NY (2004)
34. C. G. G. Aitken and D. A. Stoney; The use of statistics in Forensic Science, Ellis Harwood Limited, England (1991)
35. Kasprzak J; Possibilities of Cheiloscopy in Forensic Science (1980)
36. Mehta, M. K. : The identification of Handwriting & Cross Examination of Experts, N.M. Tripathi, Allahabad. 1970.
37. Sulner, H.F. : Disputed Document, 1966 Oceana Publications Inc., New York.
38. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
39. Quirke, A.J. : Forged, Anonymous & Suspect Documents, 1930, Reorge Rontledge & Sons Ltd., London.
40. Osborn, A. S. : Questioned Documents 1929, Boyd Printing Co., Chicago.
41. Ellen David; Questioned Documents- Scientific Examination, Taylor & Francis, Washington (1997)
42. Roy A Huber, A.M. Headrick; Handwriting Identification- Facts and Fundamental, CRC Press (1999)
43. Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
44. Madinger J. and zalopany, A.R. (1999) : Money Laundering CRC Press.
45. Manning, C.A (1999) : Financial Investigations and Forensic Accounting CRC Press.
46. Harrison, W.R. : Suspect Documents & their Scientific Examination, 1966, Sweet & Maxwell Ltd., London.
47. Roy A. Huber and A.M. Headrick; Handwriting Identification:- Facts and fundamentals, CRC LLC, 1999.
48. Conway, J.V.P. : Evidential Documents, 1959, Charles C. Thomas, Illinois.

49. Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsevier North Holland Inc., New York.
50. Brewster, F, : Contested Documents and Forgeries, The Eastern Law House, Calcutta. 1932.
51. Ordway Hilton; Scientific Examination of Questioned Documents, Rev ED, Elsevier, NY (1982)
52. Mcmenamin, Gerald R; Forensic Linguistics- Advances in Forensic Stylistics, CRC Press, Washington, D.C. (2002)Ellen, D (1997) : The scientific examination of Documents, Methods and techniques. 2nd ed., Taylor & Francis Ltd.
53. Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
54. Constitution of India.
55. Indian Evidence Act, 1872.
56. Indian Penal Code, 1860.

## **2) Toxicology &Forensic Chemistry and Chemistry of Drugs and Petroleum Products-(MFS 1T2 & MFS 2T2)**

1. Curry A.S; Analytical Methods in Human Toxicology, Part II, CRC Press Ohio (1986)
2. Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
3. Clark, E.G.C.; Isolation and Identification of Drugs, Vol. I and Vol. II, Academic Press, (1986).
4. Sunshine I; Year book of Toxicology, CRC Press Series, USA (1989 – 93).
5. Michael J. Deverlanko etal: Hand Book of Toxicology CRC Press, USA (1995)
6. Prakash M. etal; Methods in Toxicology Anmol Publication, New Delhi (1998)
7. Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology. CBS Pub. New Delhi (1999)
8. Balraj S. Parmar etal; Pesticide Formulation, CBS Publishers, New Delhi (2004)
9. Reiss C etal; Advance in Molecular Toxicology, Utrecht,Netherlands (1998)
10. Morgan B.J.T; Statistics in Toxicology, Clarendon Press, Oxford (1996)
11. Jorg Rombke etal; Applied & Ecotoxicology Lewis publishers NY (1995)
12. Shayne C.Gad etal; Acute Toxicology Testing Academic Press California USA (1998)
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. Modi, Jaisingh P; Textbook of Medical jurisprudence & Toxicology, M.M. Tripathi Pub. (2001)
16. Cravey R.H, Baselt, R.C; Introduction to Forensic Toxicology, Biochemical Pub. Davis C A (1981)
17. Working Procedure Manual - Toxicology, BPR&D Publication (2000)
18. Ballantyne B; General and Applied Toxicology Vol-1-3 2<sup>nd</sup> Ed., Macmillan, NY (2000)
19. Gossel T.A; Principles of Clinical Toxicology 3rd Ed., Roven, NY (1994)
20. Grossel S S; Handbook of Highly Toxic Materials handling and Management, Marcel Dekker NY (1995)
21. Niesink RJM; Toxicology- Principles and Applications, CRC Press (1996).

**Practical References:**

1. Practical Organic chemistry; J.B. COHEN
2. Spot test in Organic chemistry; Feigl
3. Handbook of Organic Analysis; Clark H.T.
4. Practical Organic chemistry; Vogel
5. Identification of Organic; G.G. Neave, Heilbran
6. Quantitative inorganic analysis; vogel
7. The Merck index; Stetchar & others
8. Organic Electronic spectral data; Vol.-I; Mortiman Kamlet
9. Organic Electronic spectral data; Vol.-III; Mortiman Kamlet
10. Inorganic Semi micro qualitative analysis; Griffin & Plunky
11. Food Adulteration & we; V.C.Sane
12. Pearson's Chem. Analysis of food; H.Egan, Kirk
13. Vogel's Book of Macro & Semi micro qualitative inorganic Analysis; G.Svehla
14. Explosive (4<sup>th</sup> Rev.Ed); J.Kohler, Redolf
15. Clerk's Analysis of Drugs & Poisons VOL.-I & II; Clerke
16. Handbook of Laboratory Safety; A.Keith. Furr.
17. Development & Validation of Analytical Methods; Christopher, M.Riley, Thomas W
18. Petroleum solvents & Their functions & Handling; Esso Standard Estern inc.
19. Scientific protocols for fire investigation; John J. Lentini
20. Tech.Handbook of Oil Fat & waxes; Weston
21. Steroid analysis by HPLC; Marie P. Kautsky
22. TLC VOL.-II; Jork, Funk & Others
23. Medical Jurisprudence; J. P. Modi

**2) 3) Trajectory Physics & Forensic Ballistics AND Motor Vehicle Crimes & Forensic Physics (MFS 1T3 & MFS 2T3)**

1. Brian J Heard, Handbook of Fire arm and ballistics.
2. B R Sharma, Fire arms in criminal investigation and trials
3. Dr. Rukmani Krishnamurthy, Introduction to Forensic Science in Crime Investigation.
4. Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
5. Barry A J Fisher, Techniques of Crime scene investigation
6. Kausalendra Kumar, Forensic ballistics in Criminal Justice
7. A J R Cormack, The world encyclopaedia of modern guns
8. Staut H James; John J Nordby, Forensic Science: An introduction to scientific and investigative techniques
9. Tom Warlow, Firearm, the law, and Forensic Ballistics
10. High school Physics/projectile motion-Wikibooks, open books for an open world. [en.wikibooks.org/wiki/High\\_school\\_Physics/projectile\\_motiontrajectory](http://en.wikibooks.org/wiki/High_school_Physics/projectile_motiontrajectory)
11. Trajectory-wikipedia, the free encyclopedia - [en.wikipedia.org/wiki/trajectory](http://en.wikipedia.org/wiki/trajectory)
12. Trjectories: [hyperphysics.phy.astr.gsu.edu/hbase/traj.html](http://hyperphysics.phy.astr.gsu.edu/hbase/traj.html)
13. J A Siegel, Pekka J Saukko et al. ; Encyclopaedia of Forensic Science Vol.1.
14. Laboratory Procedural manual , Physics Section, DFSL, Mumbai.
15. Laboratory Procedural Manual, Forensic Ballistics, DFS, New Delhi.
16. Dr. M.S. Rao et al Crime Scene Management (A Forensic Approach)
17. Forensic Science in Crime investigation by Dr. (Mrs) Rukmani Krishnamurthy Selective and Scientific Books Publishers and distributors.
18. Footwear Impressions Evidence Detection, Recovery, and Examination Second Edition by William J. Bodziak CRC Press.
19. Brian J Heard, Handbook of Fire arm and ballistics.
20. B R Sharma, Fire arms in criminal investigation and trials
21. Kausalendra Kumar, Forensic ballistics in Criminal Justice
22. S N Gaur et al., Fire Arms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence.
23. Norman R Dalrymple et al, The Encyclopaedia of Criminalistics Analysis.
24. J A Siegel, Pekka J Saukko et al. ; Encyclopaedia of Forensic Science Vol.1.
25. Tire Imprint Evidence by Peter McDonald CRC Press
26. Staut H James; John J Nordby, Forensic Science: An introduction to scientific and investigative techniques
27. Integrated Ballistics Identification System (IBIS) operating Manual.
28. Dr. M.S. Rao et al Crime Scene Management (A Forensic Approach)

#### **4) Cellular Biochemical & Molecular Aspects of Cell AND Genetic Engineering, Bioinformatics & Applied Forensics (MFS 1T4 & MFS 2T4)**

1. Biochemistry by Stryer
2. Biochemistry by Zubay
3. Biochemistry by Satyanarayan
4. Forensic Biology by Mr. Srikant Ladha, Dr. Trupti Khedkar and Dr. Rukmani Krishnamurthy
5. Krishnamurthy, R., Introduction to Forensic Science in Crime Investigation, 2011, Selective & Scientific Books, New Delhi.
6. Biotechnology by B.D. Singh
7. Biotechnology by S.N. Jogdand
8. Encyclopaedia of Forensic Science by Jay Siegel (Vol 1 to 5 )
9. Medical Laboratory techniques by Godkar
10. Medical laboratory techniques by Mukherjee (vol1 to 3)
11. Medical Laboratory Science theory & Practise by J Ochei & Kolhatkar
12. Clinical Biochemistry by Lexton
13. Practical Biochemistry by Sadashivam
14. Practical Biochemistry by Plummer
15. Dr.M.S.Rao etal Crime Scene Management(A Forensic Approach)
16. Forensic Biology by Mr.Srikant Ladha, Dr.Trupti Khedkar and Dr.Rukmani Krishnamurthy
17. Molecular Biology by David Friefilder
18. Molecular Biology by Clark
19. Molecular Biology of Gene by Watson
20. Molecular biology by T.A. Brown
21. Lehninger Biochemistry by Nelson & Cox
22. Immunology by Kuby
23. Immunology by Riott
24. Immunology by Tizard
25. Microbiology by Prescott
26. Microbiology by Tortora
27. Microbiology by Pelzcar
28. Microbiology by Anantnarayan
29. Principles of enzymology by Trevor & Palmer
30. Recombinant DNA technology by Glick
31. Practical Microbiology by Dubey & Maheshwari
32. Forensic Science by Alan Gunn
33. Handbook of forensic Science by Richard Saferstein
34. Human Physiology by Gytton
35. Microbial Forensics by Roger Breeze & Bruce Budowle

36. ISSUES IN ENVIRONMENTAL SCIENCE AND TECHNOLOGY- Environmental Forensics (2008)- R.E. Hester and R.M. Harrison. The Royal Society of Chemistry
37. Microbial Forensics (2005) - Second Edition Bruce Budowle, Steven E. Schutzer, Roger G. Breeze, Paul S. Keim and Stephen A. Morse. Elsevier
38. Introduction to Bioinformatics Lesk, A.
39. Introduction to Bioinformatics Attwood.
40. Instant notes in Bioinformatics Westhead, Parish & Twyman.
41. Bioinformatics: A practical guide to the analysis of genes and proteins—Baxevanis, Quellet, John Wiley & Sons, NY.
42. Environmental Forensics - contaminant specific guide (2006) Ed- Robert D. Morrison and Brian L. Murphy. Elsevier.
- 5) Criminal Psychology and Forensic Aspects Behavioral Science- (MFS 1T5 & MFS 2T5)**

- 1) 'Criminology' by Larry Siegel
- 2) 'Introduction to Forensic Psychology' by Bruce Arrigo
- 3) 'Forensic & Criminal Psychology' by Dennis Howitt.
- 4) 'Abnormal Psychology' by Halgin & Whitbourne.
- 5) 'Abnormal Psychology', by Robert C. Carson, James N. Butcher, Susan Mineka, Jill M. Hooley thirteenth Edition, Thirteenth Edition.
- 6) 'Encyclopedia of Forensic Science' by Jay A. Siegel, Pekka J. Saukko, Geoffrey C. Knapfer, Volume-1 to Volume-5.
- 7) 'Mental Disorders and Treatment' by Katherine Marsland.
- 8) 'Handbook of Forensic Psychology' by Prof. Dr. Vimala Veeraraghavan.
- 9) 'Handbook of Polygraph Testing' by Murray Kleine.
- 10) 'Brain Mapping-The Methods' by Arthur W. Toga & John C. Mazziotta, Second Edition.
- 11) '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.
- 13) 'Forensic Psychology' by Graham Towel & David Crighton
- 14) Serial Crime, Theoretical & Practical issues in Behavioural Profiling, Petherick, Woodworth Publication.
- 15) 'Introduction to Forensic Psychology', by Bruce Arrigo.
- 16) Diagnostic & Statistical Manual-IV TR, American Psychological Association
- 17) DSM-IV Mental Disorders Diagnostics, Etiology and Treatment, by Michael, Allan.
- 18) 'Psychological Testing' by Anne Anastasi, Susana Urbina, Seventh Edition.
- 19) 'Psychological Testing' by Robert J. Gregory, Fourth Edition.
- 20) 'Mental Health Act' 1987.
- 21) 'Juvenile Justice Act' 2000.

## **6) Forensic Computing & Offenses AND Information Security, Network Forensics & IPR (MFS 1T6 & MFS 2T6)**

1. Yeshwant Kanetkar, Let us C
2. Balguruswami, Programming with C
3. Balguruswami, Programming with JAVA
4. Michael Morrison, Faster Samrter HTML & XML, Microsoft Press
5. William McCarty, PHP 4: A Beginners Guide, McGraw Hill
6. Gonzalez & Woods, Digital Image Processing, Pearson Education Publication
7. Tinku Acharya and Ajay K Ray, Image Processing Principal and Application, Wiley Publication
8. Computer Forensic Investigating Data and Image Files, EC Council Press
9. Forouzan Data Communication and Networking McGraw Hill
10. Jochen Schiller Mobile Communication Addison Wisely Pearson Eduction
11. Robert Jones, Internet Forensics Using Digital Evidence to Solve Computer Crimes, *O'Reilly Media Publication*
12. John R. Vacca, Network and System Security, Syngrees Publication
13. Stallings, "Cryptography And Network Security: Principles and practice"
14. C. P. Pfleeger, and S. L. Pfleeger, "Security in Computing", Pearson Education.
15. Matt Bishop, "Computer Security: Art and Science", Pearson Education.
16. Kevin Mandia, Chris Prosis and Matt Pepe, Incident response and computer forensics, *McGraw Hill Publication*
17. Stallings, "Cryptography And Network Security: Principles and practice"
18. C. P. Pfleeger, and S. L. Pfleeger, "Security in Computing", Pearson Education.
19. Matt Bishop, "Computer Security: Art and Science", Pearson Education
20. Cory Altheide, Harlan Carvey, Digital Forensics with Open source Tools, Syngress Publication
21. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003
22. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.
23. Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 2003
24. Matt Bishop, " Computer Security Art and Science", Pearson/PHI, 2002.'
25. Indian Patents Law and Procedure, D. P. Mittal, 2002, New Delhi, Allied Services (P) Ltd. 1999
26. Patent Act,1970.
27. Copyright Act, 1957.
28. Trade Mark Act,1999.
29. Information Technology Act,2000.

