DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

AURANGABAD

STRUCTURE AND CURRICULAM
FOR

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

Effective from Academic Year

2016-17

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 Fxamination, Forensic Chemistry and Toxicology, Forensic Biology, Serology and DNA Finger Printing, Digital and Cyber Forensics 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 theories based practical papers related to specialization. One paper namely, Research Methodology and Statistics (Paper No. XXV) 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 thee 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 condonance of attendance on medical ground.

Evaluation Methods:-

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

There shall 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^{th} 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^{++}	Exceptional
70-79	7.00-7.90	A^{+}	Excellent
60-69	6.00-6.90	A	Very Good
55-59	5.50-5.90	B^{+}	Good
50-54	5.00-5.40	B	Fair
45-49	4.50-4.90	C^{++}	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

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

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.

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

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 4th 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 4th 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	05	02	500	100	600	20	04	24
	Sem.-IV	04	03	400	200	600	16	08	24
TOTAL		**21**	**17**	**1800**	**600**	**2400**	**72**	**30**	**102**

Course Structure of M.Sc. [Forensic Science]:-

M.Sc. - I (Semester I & II)

SEMESTER – I					Marks		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal (CIA)**	**External (SEE)**	**Total**
I	MFS1T1	Advance Criminalistics	3	3	15	60	75
II	MFS1T2	Toxicology & Forensic Chemistry	3	3	15	60	75
III	MFS1T3	Trajectory Physics and Forensic Ballistics	3	3	15	60	75
IV	MFS1T4	Cellular Biochemical & Molecular aspects	3	3	15	60	75
V	MFS1T5	Criminal Psychology and Forensic Related Law	3	3	15	60	75
VI	MFS1T6	Forensic Computing & Offenses	3	3	15	60	75
VII	MFS1P1	Practical based on MFS1T1	1.5	3	--	25	25
VIII	MFS1P2	Practical based on MFS1T2	1.5	3	--	25	25
IX	MFS1P3	Practical based on MFS1T3	1.5	3	--	25	25
X	MFS1P4	Practical based on MFS1T4	1.5	3	--	25	25
XI	MFS1P5	Practical based on MFS1T5	1.5	3	--	25	25
XII	MFS1P6	Practical based on MFS1T6	1.5	3	--	25	25
		TOTAL	**27**	**36**	**90**	**510**	**600**

SEMESTER – II					Marks		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal (CIA)**	**External (SEE)**	**Total**
XIII	MFS2T1	Questioned Documents & Handwriting Analysis	3	3	15	60	75
XIV	MFS2T2	Chemistry of Drugs and Petroleum Products	3	3	15	60	75
XV	MFS2T3	Motor Vehicle Crimes & Forensic Physics	3	3	15	60	75
XVI	MFS2T4	Genetic Engineering, Bioinformatics and Applied Forensics	3	3	15	60	75
XVII	MFS2T5	Forensic aspects of Behavioral Science	3	3	15	60	75
XVIII	MFS2T6	Information Security, Network Forensics & IPR	3	3	15	60	75
XIX	MFS2P1	Practical based on MFS2T1	1.5	3	--	25	25
XX	MFS2P2	Practical based on MFS2T2	1.5	3	--	25	25
XXI	MFS2P3	Practical based on MFS2T3	1.5	3	--	25	25
XXII	MFS2P4	Practical based on MFS2T4	1.5	3	--	25	25
XXIII	MFS2P5	Practical based on MFS2T5	1.5	3	--	25	25
XXIV	MFS2P6	Practical based on MFS2T6	1.5	3	--	25	25
		TOTAL	**27**	**36**	**90**	**510**	**600**

Course Structure of M.Sc. [Forensic Science]:- M.Sc. - II (Semester III & IV)

Common papers to all specializations – Semester III

Paper No.	Paper Code	Title	No. of Credits	Hrs. /week	Internal (CIA)	External (SEE)	Total
XXV	MFS 301	Research Methodology and Statistics	4	4	25	75	100
		TOTAL	**4**	**4**	**25**	**75**	**100**

Specialization-I: Fingerprint and Questioned Document Examination

SEMESTER – III					**Marks**		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal (CIA)**	**External (SEE)**	**Total**
XXVI	MFSQD3T1	Advanced Fingerprint Technology	4	4	25	75	100
XXVII	MFSQD3T2	Paper, ink and printing technology	4	4	25	75	100
XXVIII	MFSQD3T3	Advanced Handwriting Examination	4	4	25	75	100
XXIX	MFSQD3T4	Document Image Processing	4	4	25	75	100
XXX	MFSQD3P1	Practical based on MFSQD3T1& MFSQD3T2	2	4	--	50	50
XXXI	MFSQD3P2	Practical based on MFSQD3T3& MFSQD3T4	2	4	--	50	50
TOTAL			**20**	**24**	**100**	**400**	**500**
SEMESTER – IV					**Marks**		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal (CIA)**	**External (SEE)**	**Total**
XXXII	MFSQD4T1	Advanced Document Examination	4	4	25	75	100
XXXIII	MFSQD4T2	Microscopy and Photography	4	4	25	75	100
XXXIV	MFSQD4T3	Advanced Instrumentation	4	4	25	75	100
XXXV	MFSQD4T4	Forensic Pattern Recognition	4	4	25	75	100
XXXVI	MFSQD4P1	Practical based on MFSQD4T1& MFSQD4T2	2	4	-	50	50
XXXVII	MFSQD4P2	Practical based on MFSQD4T3& MFSQD4T4	2	4	--	50	50
XXXVIII	MFSQD4P3	Research Project / Dissertation	4	8	25	75	100
TOTAL			**24**	**36**	**125**	**475**	**600**

M.Sc. - II (Semester III & IV)
Specialization-II: Forensic Chemistry and Toxicology

SEMESTER – III					Marks		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal (CIA)**	**External (SEE)**	**Total**
XXVI	MFSCT3T1	Forensic Toxicology	4	4	25	75	100
XXVII	MFSCT3T2	Spectroscopic instrumentation in forensic Analysis	4	4	25	75	100
XXVIII	MFSCTT3	Separation techniques: Chromatographic	4	4	25	75	100
XXIX	MFSCT3T4	Trace evidences and its analysis	4	4	25	75	100
XXX	MFSCT3P1	Practical based on MFSCT3T1& MFSCT3T2	2	4	--	50	50
XXXI	MFSCT3P2	Practical based on MFSQD3T3& MFSCT3T4	2	4	--	50	50
TOTAL			**20**	**24**	**100**	**400**	**500**

SEMESTER – IV					Marks		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal (CIA)**	**External (SEE)**	**Total**
XXXII	MFSCT4T1	Forensic Pharmacology	4	4	25	75	100
XXXIII	MFSCT4T2	Elemental instrumentation techniques	4	4	25	75	100
XXXIV	MFSCT4T3	Explosives and Drugs	4	4	25	75	100
XXXV	MFSCT4T4	Forensic analysis of dyes, petroleum products, and fertilizers.	4	4	25	75	100
XXXVI	MFSCT4P1	Practical based on MFSCT4T1& MFSCT4T2	2	4	-	50	50
XXXVII	MFSCT4P2	Practical based on MFSCT4T3& MFSCT4T4	2	4	--	50	50
XXXVIII	MFSCT4P3	Research Project / Dissertation	4	8	25	75	100
TOTAL			**24**	**36**	**125**	**475**	**600**

M.Sc. - II (Semester III & IV)

Specialization-III: Forensic Biology, Serology and DNA fingerprinting

SEMESTER – III					Marks		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal (CIA)**	**External (SEE)**	**Total**
XXVI	MFSBS3T1	Bioinstrumentation	4	4	25	75	100
XXVII	MFSBS3T2	Eukaryotic genetics and DNA fingerprinting	4	4	25	75	100
XXVIII	MFSBST3	Enzymology, Serology & bioinformatics	4	4	25	75	100
XXIX	MFSBS3T4	Advanced techniques in forensic anthropology	4	4	25	75	100
XXX	MFSBS3P1	Practical based on MFSBS3T1& MFSBS3T2	2	4	--	50	50
XXXI	MFSBS3P2	Practical based on MFSBS3T3& MFSBS3T4	2	4	--	50	50
TOTAL			**20**	**24**	**100**	**400**	**500**

SEMESTER – IV					Marks		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal (CIA)**	**External (SEE)**	**Total**
XXXII	MFSBS4T1	Forensics in botany, entomology, wildlife and environment	4	4	25	75	100
XXXIII	MFSBS4T2	Forensic microbiology and quality assurance	4	4	25	75	100
XXXIV	MFSBS4T3	DNA Profiling and interpretation	4	4	25	75	100
XXXV	MFSBS4T4	Biological evidences, Forensic Medicine and anthropology	4	4	25	75	100
XXXVI	MFSBS4P1	Practical based on MFSBS4T1& MFSBS4T2	2	4	-	50	50
XXXVII	MFSBS4P2	Practical based on MFSBS4T3& MFSBS4T4	2	4	--	50	50
XXXVIII	MFSBS4P3	Research Project / Dissertation	4	8	25	75	100
TOTAL			**24**	**36**	**125**	**475**	**600**

M.Sc. - II (Semester III & IV)

Specialization-IV: Cyber Security and Cyber Forensic

SEMESTER – III					Marks		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal**	**External**	**Total**
XXVI	MFSCF3T1	OOPs using java	4	4	25	75	100
XXVII	MFSCF3T2	Forensic Image Processing	4	4	25	75	100
XXVIII	MFSCFT3	Advance Operating System	4	4	25	75	100
XXIX	MFSCF3T4	Data Structure	4	4	25	75	100
XXX	MFSCF3P1	Practical based on MFSCF3T1& MFSCF3T2	2	4	--	50	50
XXXI	MFSCF3P2	Practical based on MFSCF3T3& MFSCF3T4	2	4	--	50	50
TOTAL			**20**	**24**	**100**	**400**	**500**

SEMESTER – IV					Marks		
Paper No.	**Paper Code**	**Title**	**No. of Credits**	**Hrs. /week**	**Internal**	**External**	**Total**
XXXII	MFSCF4T1	Data Communication network and Network Security	4	4	25	75	100
XXXIII	MFSCF4T2	Pattern Recognition and **B**iometrics	4	4	25	75	100
XXXIV	MFSCF4T3	Digital Forensics And Incident Response	4	4	25	75	100
XXXV	MFSCF4T4	Mobile And Digital Forensics	4	4	25	75	100
XXXVI	MFSCF4P1	Practical based on MFSBS4T1& MFSBS4T2	2	4	-	50	50
XXXVII	MFSCF4P2	Practical based on MFSBS4T3& MFSBS4T4	2	4	--	50	50
XXXVIII	MFSCF4P3	Research Project / Dissertation	4	8	25	75	100
TOTAL			**24**	**36**	**125**	**475**	**600**

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

Common paper to all specializations

Paper No.	Code	Title	Marks	Credits
XXV	MFS301	Research Methodology and Statistics	100	4

Unit I: Fundamentals of research

Definition and basic concepts; objectives of research; research approaches, types and techniques of research; hypothesisation; literature survey; selection of topic, compiling records; different types of scientific documents; review papers; book reviews; research paper; thesis; project reports (for the scientific community and funding agencies) and conference report. A brief idea about government research agencies including DBT, DFSS, DST, ICMR, CSIR, UGC, BPR&D, and DRDO.

Unit II: Writing and presenting research

Components of research paper the IMRAD system, title, authors and addresses, abstract, acknowledgements, references, tables and illustration; preparation for publication, submission of manuscript, ordering reprints; presentation of research: oral and poster presentations, presentation in conferences and symposia; presentation and submission of research proposals to the funding agencies.

Plagiarism: definition, forms, consequences, unintentional plagiarism, copyright infringement, collaborative work.

Unit III: Basic concepts of Statistics and data analysis

Basic definitions and applications of statistics, sampling: Representative sample, sample size, sampling bias and sampling techniques. Data collection and presentation: Types of data, methods of collection of primary and secondary data. Methods of data presentation-graphical representation by histogram, polygon, ogive curves and pie diagram.

Measures of central tendency: mean, median and mode; measures of dispersion: range, mean deviation, standard deviation, variance, quartile, standard error and coefficient of variation; correlation and regression: Positive and negative correlation and calculation of Karl-Pearsons co-efficient of correlation, skewness and kurtosis.

Unit IV: Probability and Test of hypothesis

Introduction to probability theory, various definitions of probability, Basic terms: random experiments, event, trial, sample space, independent and mutually exclusive events; conditional probability, Addition and multiplication theorem, Baye's theorem, likelihood ratio and discriminating power. Distribution of data: normal, binomial and Poisson distribution.

Test of hypothesis: introduction and concepts; test for small and large sample: Z-test, t-test, chi-square test, F-test and ANOVA.

***

Suggested readings:-

1. Statistics in biology, (1967) Vol. 1: Bliss, C.I.K. McGraw Hill, NewYork.
2. Practical Statistics for experimental biologist (1985): Wardlaw, A.C.
3. Statistical Methods in Biology (2000): Bailey, N.T. J. English Univ. Press.
4. Biostatistics - 7th Edition : Daniel
5. Fundamental of Biostatistics : Khan
6. Bio-statistical Methods : Lachin
7. Statistics for Biologist (1974):Campbell R.C. Cambridge
8. Research Methodology Tools And Techniques : H.C Purohit
9. Research Methodology: An Introduction : Wayne Dean Goddard, Stuart Melville
10. Research Methodology in the Medical and Biological Sciences: PetterLaake (Author) Haakon Breien Benestad (Author) Bjorn Reino Olsen (Editor)
11. Research Methodology For Biological Science : Gurumani N Gurumani
12. Research Methodology- G.R. Basotia and K.K. Sharma.
13. Research Methodology- C.H. Chaudhary, RBSA Publication
14. Research Methodology: An Introduction - Wayne Goddard & Stuart Melville
15. Research Methodology - Ranjit Kumar
16. Research Methodology: Methods & Techniques - Kothari, C.R.

***

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

Specialization in Fingerprint and Questioned Documents Examination

Paper No.	Code	Title	Marks	Credits
XXVI	MFSQD3T1	Fingerprint Development Technology	100	4

Unit I: Origin and classification of fingerprints

Anatomy of human skin, morphogenesis of friction ridge skin-primary and secondary ridge formation, volar pad development, differentiation of friction ridges, pattern formation, factors affecting ridge formation, effect of timing and symmetry on ridge formation, role of genetics, persistence of ridges-aging, wound healing.

Classification systems: Johannes Purkinje, tripartite classification, Argentine system, Henry's classification, Battley single fingerprint system, NCIC.

Palmprints : classification systems & significance.

Edgeoscopy : Chatterjee classification

Poroscopy : significance in personal identification.

Unit II: Fuming and optical detection techniques

Principle, chemistry & mechanism, pretreatments, reagent application, limitations, environmental conditions, fixation and enhancement, applications: Iodine fuming, Cyanoacrylate fuming (vacuum, atmospheric, fluorescent CA fuming), Hydrogen fluoride, osmium/ruthenium tetroxide, soot method, disulphur dinitride.

Alternate light sources: luminescence, diffused reflection, UV imaging.

Unit III: Chemical techniques

Principle, chemistry & mechanism, pretreatments, reagent application, limitations, environmental conditions, fixation and enhancement, applications: Silver nitrate, Ninhydrin and its analgoues, DMAC, silver physical developers, SPR,

Metal deposition techniques:Principle, chemistry & mechanism, pretreatments, reagent application, limitations, environmental conditions, fixation and enhancement, applications : vacuum metal deposition, multimetal deposition.

Development of prints on challenging surfaces (thermal paper, gloves, guns, cartridges, wet surfaces, adhesive tape, and skin)

Unit IV: Comparison and Examination

Fundamentals of comparison: print-to-print, trace-to-record, trace-to-print, trace-to-trace comparison. ACE-V examination method, Latent print development on items of evidence, documentation (Primary, secondary & tertiary custody documentation). Age estimation of latent prints. Enhancement of bloody prints. Effect of fingerprint detection techniques on subsequent DNA profiling.

***

Suggested Readings:

1. E. Roland Menzel; Fingerprint Detection with Loseres; Second edition; Marcel Dekker, Inc.1999.
2. Fingerprint and other ridge skin impressions, Christophe Champod, Chris J. Lennard, Pierre Margot, Milutin Stoilovic
3. James F. cowger; Friction Ridge skin CRC Press London, 1993.
4. Cummins & Midlo : Finger Prints, Palms and Soles, 1943, The Blakiston office London.
5. Moenssens : Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.
6. Allison : Personal Identification.
7. Chatterjee S.K. and Hagne R.V. (1988) : Finger Print or Dactyloscopy and Ridgeoscopy.
8. H.C. Lee and R.E. Gaensslen eds “Advances in Fingerprint Technology”, second ed. New York: CRC Press, 2001.
9. The fingerprint sourcebook, US Department of Justice.
10. Quantitative – Qualitative Friction ridge Analysis. David R. Ashbough. By CRC Press LLC 1999.
11. The Science of Fingerprints. Federal Bureau of Investigation. Rev. 12-84 by U.S. Government Printing Office Washington D.C.
12. Bailey’s Textbook of Histology 16th Edition pg. 366 – 377.

13. Poroscopy, Identification News November 1982. D.R. Ashbaugh CPL pg 3-8.
14. Ridgeology, Journal of forensic Identification. 16/41 (1) 1991 by David R. Ashbaugh.

***

Paper No.	Code	Title	Marks	Credits
XXVII	MFSQD3T2	Paper, Ink and Printing Technology	100	4

Unit-I: Paper

Introduction to paper, types of paper, basic component of paper, chemical component of wood, hard wood, soft wood, fiber, cellulose alpha and beta, hemicelluloses, lignin, polysaccharides etc.

paper making process: history of paper making, raw materials, chemicals required for paper making, Pulping: introduction, methods of pulping, mechanical pulping, chemical pulping, pulp bleaching, pressing, drawing and sheet formation process.

Forensic examination of paper: physical properties of paper: size, color, thickness, optical, porosity, pore size distribution, gas permeability, wetting and penetration of liquids, thermal, water mark and wire marks etc., microscopic examination: color reaction to different fibers, Herzberg staining and C stain.

Paper aging and environmental effect on paper: humidity, Chemical degradation, oxidation reaction to polysaccharides, cellulose, lignin.

Unit-II: Ink

Introduction to ink, history of ink, types of ink: negrosine ink, logwood ink, iron nut gall ink, fountain pen ink, ball pen ink, gel pen ink, chemical ingredients of ink: resin, colorant: pigment and dye, solvent, lubricants, sequestrants, pH adjusting agents etc. resources of ink, ink formulation.

Ink analysis: introduction, preliminary examination: pen line microscopy, ink color assessment, microscopic specular reflectance, video spectral analysis, laser induce fluorescence, identification and comparison of ink by TLC and densitometry, instrumental analysis of ink: UV Visible, FTIR, Raman spectroscopy, HPLC, Mass spectroscopy etc.

Ink aging or dating: first date production method, ink tag method, relative age comparison method, R-ratio method, p-extraction method, dye ratio method. Admissibility of report on ink dating in court.

Unit-III: Printer technologies

Introduction to printer, history of printer, types of printer: impact and non impact printer and their classification, dot matrix printer (DMP), sub systems of DMP: print head, carriage, ribbon system etc., working mechanism of DMP. Non impact printing technologies: electrolytic, electro photographic, electrostatics, ink jet continuous and drop on demand (DOD), thermal, laser printer etc., Ink jet printer: sub systems: print head, electrical control device etc., working

mechanism of ink jet. Laser printer, sub systems: light source, photosensitive drum etc., working mechanism: Charging, exposing, developing, transferring, fusing, cleaning process. Forensic examination of dot matrix, ink jet and laser print.

Unit-IV: Photocopier and examination of photocopy

Photocopier: xerography, history of xerography, sub part of photocopier: electrostatics drum, roller, light source, developer, fusing system etc. Working process: charging, exposing, developing, transferring, fusing and cleaning. Kinds of forgery by photocopy, inquiry related to photocopy, forensic investigation of photocopy as document and copy: toner type, fusion method, splattering effect of toner, trash marks etc., investigation of photocopier.

***

Suggested Readings:

1. Ellen, D (1997): The scientific examination of Documents, Methods and techniques. 2nd ed., Taylor & Francis Ltd.
2. Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
3. Harrison, W.R.: Suspect Documents & their Scientific Examination, 1966, Sweet & Maxwell Ltd., London.
4. Hilton, O: The Scientific Examination of Questioned Document, 1982, Elsaevier North Holland Inc., New York.
5. Sulner, H.F.: Dispated Document, 1966 Oceana Publications Inc., New York.
6. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
7. Quirke, A.J. : Forged, Anonymous & Suspet Documents, 1930, Reorge Rontledge & Sons Ltd., London.
8. Osborn, A. S. : Questioned Documents 1929, Boyd Printing Co., Chicago.
9. Levinson, J: Questioned Documents, 2000, Academic Press, Tokyo.
10. Kelly,J.S and Lindblom, B.S: Scientific Examination of Questioned Documents, 2006, Taylor & Francis, New York.
11. Brunelle, R.L. and Reed, R.W: Forensic Examination of Ink and Paper, 1984, Charles C Thomas Publisher, U.S.A.
12. Baker, J.N: Law of Disputed and Forged Documents, 1955, The Michie Company, Virginia.

***

Paper No.	Code	Title	Marks	Credits
XXVIII	MFSQD3T3	Advanced Handwriting Analysis	100	4

Unit-I: Neuromuscular Basis of Handwriting

Brain Function for Hand Motor Control, Neuroanatomical Bases of Hand Motor Control, Frontal-Subcortical Neural Circuits and Motor Function, The Cerebellum and Brain Stem.
Handwriting as a Motor Program, Hierarchical Models of Handwriting Motor Control, Models of handwriting motor control. Neurological Disease and Motor control, Drugs and Motor control, Aging and motor control.

Unit-II Handwriting Systems

History of Questioned Document Examination, Origin of Alphabet, Teaching of writing and writing system, Development of handwriting, Factors affecting the development of handwriting, Basis of handwriting Identification, Handwriting Characteristics.

Unit-III Factors influencing Handwriting

Factors influencing handwriting: Different writing systems, Physical impedance, Genetic factors, State of health and medication, mental state and Age. Accidental, Circumstantial, Deliberate.

Unit-IV Handwriting Examination

Handwriting examination: Understanding the objectives, Scope of handwriting examination, Sources of document examination, Forged and disguised handwriting, Science and art behind handwriting examination, Standard guidelines for handwriting analysis, Collection of specimen.
Signature, Process of evolving a signature, Signature forgery, Method of examination.

***

Suggested Readings:

1. Huber, A. R. and Headride, A.M. (1999) : Handwriting identification : facts and fundamental CRC LLC
2. Ellen, D (1997) : The scientific examination of Documents, Methods and techniques. 2nd ed., Taylor & Francis Ltd.
3. Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
4. Harrison, W.R. : Suspect Documents & their Scientific Examination, 1966, Sweet & Maxwell Ltd., London.
5. Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsaevier North Holland Inc., New York.
6. Sulner, H.F. : Dispated Document, 1966 Oceana Publications Inc., New York.
7. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
8. Quirke, A.J. : Forged, Anonymous & Suspet Documents, 1930, Reorge Rontledge & Sons Ltd., London.
9. Osborn, A. S. : Questioned Documents 1929, Boyd Printing Co., Chicago.
10. Levinson, J: Questioned Documents, 2000, Academic Press, Tokyo.
11. Kelly,J.S and Lindblom, B.S: Scientific Examination of Questioned Documents, 2006, Taylor & Francis, New York.

12. Brunelle, R.L. and Reed, R.W: Forensic Examination of Ink and Paper, 1984, Charles C Thomas Publisher, U.S.A.
13. Baker, J.N: Law of Disputed and Forged Documents, 1955, The Michie Company, Virginia.

Paper No.	Code	Title	Marks	Credits
XXIX	MFSQD3T4	Document Image Processing	100	4

Unit-I: Fundamentals

Matrix Algebra: definition, matrix arithmetic, transposes powers, trace and determinant of matrices.

Set Theory: definition and representation of set, subset and power set, associative, commutative and distributive properties of set, definition and concepts of function.

Basic concepts of co-ordinate geometry, complex numbers and derivatives.

Image Fundamentals: definitioin and types of image, co-ordinate convention, Human visual system and computer vision system, digitization and Shannon sampling theorem, zooming and shrinking of an image, relationship between pixels: neighbors, adjacency, connectivity and path, Distance measures between pixels.

Unit-II MATLAB Programming

Introduction to MATLAB programming, data type and its representation, indexing and its importance in MATLAB programming, representation of an Image in MATLAB.

Unit-III Image Enhancement

Introduction and scope of image enhancement, Image enhancement in spatial domain: point processing-basic point operators, histogram normalization and histogram equalization, thresholding, Mask processing-mean filter, median filter, Gaussian and laplacian filter. Image enhancement in frequency domain-concepts of Fourier transform and enhancement in frequency domain, power spectrum and phase angle, Low pass, high pass and band pass filters, homomorphic filtering, correspondence of filtering in the spatial and frequency domain.

Edge detection operators: Sobel, prewitt, Roberts, Canny and Laplacian operators.

Unit-IV Description and representation of images

Mathematical morphology: basic morphological concepts, binary dilation and erosion, opening and closing, hit-or-miss transformation, gray-scale dilation and erosion, opening and closing, top hat and geodasic transformation.

Feature Extraction: Basic concepts of feature extraction and description of images.

Concepts of image processing through editing software, like Photoshop.

***

Suggested Readings:

1. Digital Image Processing- Gonzalez and Woods
2. Digital Image Processing- Chanda and Majumdar
3. Image Processing through MATLAB programming: Gonzalez and woods

4. Digital Image Processing-Ionis Pitas

Paper No.	Code	Title	Marks	Credits
XXX	**MFSQD3P1**	**Practical based on MFSQD3T1& MFSQD3T2**	**50**	**2**

List of Experiments

(Minimum 12 experiments)

1. To study the initials and handwriting written on unusual surfaces.
2. To perform TLC of inks used in printing documents.
3. To study alterations in the document.
4. To study the indented and invisible writings.
5. To photograph watermarks in the document.
6. To examine currency notes.
7. To study the type scripts and printed matter from various computer printing devices.
8. To study sequence of intersecting strokes.
9. To perform Cyno-acrylate method to develop latent finger prints.
10. To classify the fingerprints from Primary classification to Key classification.
11. Examination of computer printouts.
12. Examination of photocopies and scanned documents.
13. Examination of fax copies.
14. Examination of Security Documents – Indian Bank Notes.
15. Examination of Travel Documents – Indian Passports and Visas.

***

Paper No.	Code	Title	Marks	Credits
XXXI	**MFSQD3P2**	**Practical based on MFSQD3T3& MFSQD3T4**	**50**	**2**

List of Experiments

(Minimum 12 experiments)

1. To perform examination of handwriting with the given samples
2. To perform examination of handwriting on various surfaces
3. To examine handwriting influenced by age
4. To examine handwriting samples of a twin
5. To examine forged signatures
6. To examine simulated handwriting
7. To examine the handwriting numerals

8. To examine disguise in handwriting
9. To read and write a document image using MATLAB
10. To enhance a document image using MATLAB
11. To perform forgery of document using Photoshop
12. To perform examination of electronic forgery
13. To segment the region of interest in a document image
14. To segment line in a document image
15. To correct skew of a word in document image

***

SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER –III
Specialization in Forensic Chemistry and Toxicology

Paper No.	Code	Title	Marks	Credits
XXVI	MFSCT3T1	Forensic Toxicology	100	4

Unit-I Introduction to Toxicology

Introduction of Toxicology**:** Branches of Toxicology: Introduction & Scope, Classification of poisons, based on their origin, mode of action, chemical nature, poisons and poisoning in India, Classification of poisoning: accidental, homicidal, suicidal and miscellaneous, sign and symptoms of poisons and antidotes. Factors affecting the intensity of poisoning.

Laws related to Poisons. Poison Act 1919, Drugs Act 1940 and 1955, Drug and Cosmetic Act 1940 and amendments

Interpretation of toxicological finding and preparation of reports, limitation of method and trouble shooting in toxicological analysis, disposal of analysis samples, some interesting and their importance in view of specific approach in examination.

Unit-II Extraction and Isolation Methods

Extraction and isolation**:** Different methods of extraction for volatile poisons of organic and inorganic nature: Solvent extraction, distillation /steam distillation, micro diffusion, dialysis, dry ashing, wet digestion, modified star-otto method, ammonium sulphate method, extractions for gases, Isolation and clean up procedure, separation of poisons and drugs using chromatographic and electrophoresis techniques identification and estimation of poisons and drugs using chromatographic and spectrophotometric and other instrumental methods, significance of analytical studies with forensic examination.

Unit-III Metallic and non-metallic poisons

Introduction of Metallic and non metallic poison, their nature and toxic effect on human body, Extraction and identification of toxic metals: Arsenic, antimony, mercury, bismuth, lead, thallium, zinc, copper, aluminum, barium, chromium, nickel etc. by dry ashing method and wet

digestion method from biological sample, microwave digestion methods, Extraction and identification of non metallic anions: halides, nitrate, nitrite, sulphite and sulphates, sulphide, phosphates from biological sample.

Unit IV: Gaseous and volatile poisons

Introduction of gaseous and volatile poisons, their nature and toxic effect on human body, extraction and identification of volatile poisons- alcohols, aldehydes, ketones, hydrocyanic acid, chlorinated hydrocarbon, benzene nitro benzene, turpentine in Biological matrices exhibits.
Extraction and identification of gaseous poisons, ammonia, phosphine, sulfur dioxide, hydrogen sulphide, chlorine in Biological matrices and exhibits.

Suggested Readings:

1. Forensic Science in Criminal Investigation and Trials by B. R. Sharma, *Fourth Edition*, Universal Law Publishing Co.
2. Modi's: Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabd, 1988.
3. S. N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
4. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
5. Arena Poisoning: Chemistry, Symptoms and Treatment.
6. Borrow : Molecular Spectroscopy, 1980.
7. Wouldard, H. H., et al : Instrumental Methods of Analysis, 1974.
8. Moonesens A.A. et al : Scient ific Evidence in Criminal Cases, 1973.
9. Lundquist & Curry : Methods of Forensic Science, 1963.
10. Lee & Gaensslen : Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
11. Spectroscopy of Organic compounds by P. S. Kalsi.
12. Settle,F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997
13. Lurie and Witturer : High Performance Liquid chromatography in Forensic Chemistry,1983.
14. Brown, P.R: Advance in chromatography
15. Howard: Forensic Analysis by Gas Chromatography
16. Grahm D.: The use of X-ray Techniques in Forensic Investigation, 1973.
17. Industrial chemistry: B.K. Sharma, Goel publishing house, Meerut.
18. The British Glass Website- Types of Glass: http:/wwwbritglass.org.uk.

19. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th ed., Prentice Hall of India Pvt. Ltd (1993).
20. G.D. Christian, Analytical Chemistry, 6th ed, John Wiley & Sons (2001)

Paper No.	Code	Title	Marks	Credits
XXVII	**MFSCT3T2**	**Spectroscopic instrumentation in forensic analysis**	**100**	**4**

Unit I: Basic concepts of Spectroscopy

Basic concepts-Atomic and molecular spectroscopy-Interaction of electromagnetic radiation with matter and its consequences. Reflection, absorption, transmission, scattering, emission, fluorescence, phosphorescence.

Atomic spectra**:** energy levels, quantum numbers and designation of states, selection rules, qualitative discussions of atomic spectra.

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

UV/VIS-Spectroscopy: Introduction, UV-Visible spectroscopy- Fundamental laws of spectrophotometery, Deviation from Beer's Law, Instrumentation and techniques, qualitative and quantitative methods in UV-Visible spectroscopy, Forensic applications

Unit II: IR and Raman Spectroscopy

IR-Spectroscopy: Introduction, Principle of FTIR, Modes/types of vibrations, functional group and fingerprint region, Review of IR spectroscopy, Dispersive and Nondispersive IR spectrophotometers, Fourier transform IR spectrophotometers, Instrumentation and Techniques, Interpretation of IR spectra, Forensic applications.

Raman Spectroscopy**:** Basic principles, Theory of Raman spectroscopy, Instrumentation, Analytical applications of Raman spectroscopy. , Forensic applications

Unit III: NMR-Spectroscopy

Introduction, Nuclear Spin States, Resonance, Basic principle, Chemical Shift and Shielding effect, Chemical equivalence, Spin-spin splitting (n+1 Rule), Problem based on NMR, Forensic analysis by NMR tools.

Unit IV: Mass Spectroscopy

Introduction, Review of Mass spectrometry, Basic Principles and Theory, Instrumentations and technique, Ionization methods, Fragmentations in Mass spectrometry. Combined problem based of UV, IR, Mass H^1NMR and C^{13} NMR.

Suggested Readings:

1. Forensic Science in Criminal Investigation and Trials by B. R. Sharma, *Fourth Edition*, Universal Law Publishing Co.
2. Modi's: Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabd, 1988.
3. S. N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
4. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
5. Arena Poisoning: Chemistry, Symptoms and Treatment.
6. Borrow : Molecular Spectroscopy, 1980.
7. Wouldard, H. H., et al : Instrumental Methods of Analysis, 1974.
8. Moonesens A.A. et al : Scient ific Evidence in Criminal Cases, 1973.
9. Lundquist & Curry : Methods of Forensic Science, 1963.
10. Lee & Gaensslen : Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
11. Spectroscopy of Organic compounds by P. S. Kalsi.
12. Settle,F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997
13. Lurie and Witturer : High Performance Liquid chromatography in Forensic Chemistry,1983.
14. Brown, P.R: Advance in chromatography
15. Howard: Forensic Analysis by Gas Chromatography
16. Grahm D.: The use of X-ray Techniques in Forensic Investigation, 1973.
17. Industrial chemistry: B.K. Sharma, Goel publishing house, Meerut.
18. The British Glass Website- Types of Glass: http:/wwwbritglass.org.uk.
19. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th ed., Prentice Hall of India Pvt. Ltd (1993).
20. G.D. Christian, Analytical Chemistry, 6^{th} ed, John Wiley & Sons (2001)

Paper No.	Code	Title	Marks	Credits
XXVIII	**MFSCT3T3**	**Separation Techniques: Chromatographic**	**100**	**4**

Unit I: Basic Tools for Analytical Chemistry

Basic tools and operatios of analyticatical chemistry, sampling techniques, processing the samples for analysis. Extraction and purification of analytes, precision, accuracy errors their types statistical treatment for error analysis: null hypothesis, students t-test, F-test, criteria for rejection of observation, Q-test, control charts correlation and regression, linear regression analysis

Unit II: Paper Chromatography

Principle, technique, Selection of solvents, preparation of samples and loading, Separation of various metal ions, Forensic Applications.

Column chromatography: Principle, technique, column packing material, Selection of solvents, column preparation and loadings, Column efficiency, Flash chromatography, Forensic applications.

Unit III: Liquid Chromatography

Introduction, Review of basic principles and types of chromatography.

TLC and HPTLC: Principle, Theory and instrumentation, visualization, Qualitative and Quantitative concepts and Forensic applications.

Ion exchange chromatography Ion exchange resins, technique of Ion exchange chromatography Separation, Factors affecting separation factor, packing of the column, Analysis of eluate, Forensic applications**.**

Unit IV: Gas Chromatography

Principles, theory, instrumentations and technique, columns, stationary phases, detectors, Pyrolysis GC, GC-MS and its Forensic applications.

HPLC: Theory, Instrumentation Technique, column, detectors, with special reference to LC-MS, Forensic applications.

Suggested Readings:

1. Forensic Science in Criminal Investigation and Trials by B. R. Sharma, *Fourth Edition*, Universal Law Publishing Co.
2. Modi's: Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabd, 1988.
3. S. N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
4. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
5. Arena Poisoning: Chemistry, Symptoms and Treatment.

6. Borrow : Molecular Spectroscopy, 1980.
7. Wouldard, H. H., et al : Instrumental Methods of Analysis, 1974.
8. Moonesens A.A. et al : Scient ific Evidence in Criminal Cases, 1973.
9. Lundquist & Curry : Methods of Forensic Science, 1963.
10. Lee & Gaensslen : Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
11. Spectroscopy of Organic compounds by P. S. Kalsi.
12. Settle,F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997
13. Lurie and Witturer : High Performance Liquid chromatography in Forensic Chemistry,1983.
14. Brown, P.R: Advance in chromatography
15. Howard: Forensic Analysis by Gas Chromatography
16. Grahm D.: The use of X-ray Techniques in Forensic Investigation, 1973.
17. Industrial chemistry: B.K. Sharma, Goel publishing house, Meerut.
18. The British Glass Website- Types of Glass: http:/wwwbritglass.org.uk.
19. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th ed., Prentice Hall of India Pvt. Ltd (1993).
20. G.D. Christian, Analytical Chemistry, 6th ed, John Wiley & Sons (2001)

Paper No.	Code	Title	Marks	Credits
XXIX	**MFSCT3T4**	**Trace evidences and its analysis**	**100**	**4**

Unit I:

Paint: General introduction of paints and pigments, types of paints and pigments-paints for building and automotive paint, and their chemical composition, forensic importance of paints and pigments especially in hit and run case, transfer on tools in dacoity, authenticity of brand of paint. Method of collection of paint and preservation of evidence. Inorganic analysis of paint by chemical and microscopic examination and instrumental methods of analysis IR spectrophotometer, X ray fluorescence, SEM- EDX and organic component analysis by pyrolysis gas chromatography coupled with mass spectrometer, Case- studies.

Unit II:

Trap case:- trap chemicals: phenolphthalein & anthracene, forensic signification of trap chemicals, Mechanism of color reaction, factor affecting the color, detection of phenolphthalein

and alkali, method of detection of degraded product on conversion of pink color to colorless solution by TLC and UV visible spectrophotometer. Photo and videography and voice recording as supporting evidence.

Unit III:

Cement: Cement, Concrete and Motor: Chemical compositions Portland cement, and other type of cements, building materials, Methods of samplings of cements, mortar and concrete Common adulterant of cement and their detection. Methods of analysis-Chemical analysis of cement, mortar and concrete, Instrumental method of analysis of by ICP, AAS and XRD.

Ceramic: Introduction, classification, porous and non-porous materials wastes, clay and its properties, primary and secondary clays. Manufacturing process, glass ceramics, forensic detection of ceramic and cement material.

Unit IV:

Cosmetics Products

Introduction to cosmetic product, types of cosmetics product, chemical constituents in cosmetics product: talcum powder, lipstick, fairness cream etc., forensic significance of cosmetics products. Drug and Cosmetic Act 1940 and amendments Extraction & Identification of cosmetic products by color test, TLC, instrumental analysis etc.

Suggested Readings:

1. Forensic Science in Criminal Investigation and Trials by B. R. Sharma, *Fourth Edition*, Universal Law Publishing Co.
2. Modi's: Medical Jurisprudence & Toxicology, M. M. Trirathi Press Ltd. Allahabd, 1988.
3. S. N. Tiwari: Analytical Toxicology, Govt. of India Publications, New Delhi, 1987.
4. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
5. Arena Poisoning: Chemistry, Symptoms and Treatment.
6. Borrow : Molecular Spectroscopy, 1980.
7. Wouldard, H. H., et al : Instrumental Methods of Analysis, 1974.
8. Moonesens A.A. et al : Scient ific Evidence in Criminal Cases, 1973.
9. Lundquist & Curry : Methods of Forensic Science, 1963.
10. Lee & Gaensslen : Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
11. Spectroscopy of Organic compounds by P. S. Kalsi.
12. Settle,F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997

13. Lurie and Witturer : High Performance Liquid chromatography in Forensic Chemistry,1983.
14. Brown, P.R: Advance in chromatography
15. Howard: Forensic Analysis by Gas Chromatography
16. Grahm D.: The use of X-ray Techniques in Forensic Investigation, 1973.
17. Industrial chemistry: B.K. Sharma, Goel publishing house, Meerut.
18. The British Glass Website- Types of Glass: http:/wwwbritglass.org.uk.
19. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th ed., Prentice Hall of India Pvt. Ltd (1993).
20. G.D. Christian, Analytical Chemistry, 6th ed, John Wiley & Sons (2001)

***

Paper No.	Code	Title	Marks	Credits
XXX	**MFSCT3P1**	**Practical based on MFSCT3T1 and MFSCT3T2**	**50**	**2**

List of Experiments

(Minimum 12 practical)

1. M.P, B.P and flash point determination (2 Nos.).
2. TLC, GC and GC-MS separation of anabolic steroids.
3. TLC, UV-Visible, HPLC Analysis of phenolphthalein in trap cases.
4. Analysis of alcohol content in sample by derivitzation into known organic compounds and its
   analysis by GC, GCMS, HPLC.
5. Determination of Mercury in biological materials by spectrophotometry.
6. Analysis of animal and insect toxins
7. U.V/Vis spectrophotometric, GC and GC-MS analysis of barbiturates, benzodiazepine and amphetamines .
8. Detection of metallic poisons (arsenic and mercury) in viscera and food stuff (simulated samples).

9. Detection and identification of pesticide in a given formulation by colour test, TLC and UV-visible spectrometer
10. Identification of writing inks by TLC.
11. Spectrophotometric/ Colorimetric determination of nickel.
12. Spectrophotometric/ Colorimetric determination of hexavalent chromium.

***

Paper No.	Code	Title	Marks	Credits
XXX	**MFSCT3P2**	**Practical based on MFSCT3T3 and MFSCT3T4**	**50**	**2**

List of Experiments

(Minimum 12 practical)

1. Estimation of paints and pigments by spectrophotometry (UV, FTIR, etc) (2 Nos.)
2. Comparison of polythene films by IR spectrophotometry.
3. Separation of sample of forensic interest by column chromatography as a separation technique.
4. Analysis of viscera for volatile poisons (Organic and Inorganic).
5. Analysis of non- metallic (anionic) poisons in viscera.
6. Analysis of viscera for organochloro, organophosphoro, carbamates and pyrethroids by colour
   test TLC/HPTLC and UV-visible spectrometry method.
7. Determination of alcohol in blood and urine sample.
8. Detection & estimation of carbonmonoixide /carbon dioxide in blood by chemical and spectrophotometric method.
9. Analysis of blood, urine, stomach wash in emergency cases of poisoning.
10. Comparison of fibres by chemical analysis, TLC/HPTLC/ FTIR
11. Gas chromatography analysis of Ganja and Charas

12. Analysis of viscera and food material for in case of food poisoning by chemical, microscopic and instrumental techniques.

SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER –III
Specialization in Forensic Biology, Serology and DNA fingerprinting

Paper No.	Code	Title	Marks	Credits
XXVI	MFSBS3T1	Bioinstrumentation	100	4

Unit I: Microscopy

Principle, working and forensic applications of different types of microscopes:light, Fluorescence, Comparison microscope, Phase contrast microscope, Stereoscopic microscope, Polarizing microscope, Fluorescent microscopy, Infra-red microscopy, Scanning Electron Microscope (SEM) & Transmission Electron Microscope (TEM), Laser scanning confocal microscopy, Differential interference microscopy, Atomic force microscope

Unit II: Spectroscopy

Ultra violet and visible spectrophotometry: Types of sources, wavelength selection, filters-cells and sampling devices, detectors, resolution, qualitative and quantitative methods for detection, Fluorescence and phosphorescence spectrophotometry, Atomic absorption spectrometry, Atomic emission spectrometer, X-ray spectroscopy, Infrared spectrophotometry, Raman Spectroscopy, Mass spectrophotometer, NMR and ESR spectroscopy, Molecular structure determination using X-ray diffraction, surface plasma resonance methods and their applications in forensic biology

Unit III: Chromatography General principles, applications and forensic significance of following types of chromatography, paper chromatography, column chromatography, Thin Layer Chromatography (TLC), adsorption chromatography, partition chromatography, gas chromatography, gas-liquid chromatography, ion-exchange chromatography, exclusion (permeation) chromatography, affinity chromatography, HPLC, LC-MS, HPTLC, Capillary chromatography, UPLC.

Unit IV: Electrophoresis & Centrifugation

Theory and general principles, Various factors affecting electrophoresis, low and high voltage electrophoresis, horizontal and vertical Electrophoresis. Electrophoretic techniques – Sodium dodecyl sulphate (SDS), Agarose Gel Electrophoresis (AGE), Polyacrylamide Gel Electrophoresis (PAGE), 2-D gel electrophoresis, Western blotting, Iso-electric focusing (IEF), Gel immuno-diffusion, complement fixation, radio immuno assay (RIA), ELISA, and

fluorescence immunoassay for detection of viruses including Hepatitis, Influenza, HIV and others, Immuno-assays: SRID, ELISA-PCR, Immunofluorescence and their applications.

Centrifugation: Preparative: Differential centrifugation, Density gradient centrifugation: Rate-Zonal, Isopycnic. Types of centrifuge machines; preparative and analytical centrifuges; differential centrifugation, sedimentation velocity, sedimentation equilibrium, density gradient methods and their applications, Ultra centrifugation.

Suggested readings:

1. Biophysical chemistry Principles and techniques: Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath.
2. Instrumental Methods of Analysis6th Edition. (1986): H.H. Willard, L.L. Merritt Jr. and others.CBS Publishers and Distributors.
3. Instrumental Methods of Chemical Analysis. (1989): Chatwal G and Anand, S. Himalaya Publishing House, Mumbai.
4. A Biologists Guide to Principles and Techniques of Practical Biochemistry. (1975): Williams, B.L. and Wilson, K.
5. Spectroscopy. (Vol. 1): Edited by B.B. Straughan and S. Walker. Chapman and HallLtd.
6. Gel Electrophoresis of Proteins- A Practical Approach: Hanes.
7. Chromatography: Concepts and Contrasts- 1988 by James Miller. John Wiley and Sons. Inc., New York.
8. Analytical Biochemistry: Holme.
9. Introduction to High Performance Liquid Chromatography: R. J. Hamilton and P. A.Sewell.
10. Spectroscopy: B.P. Straughan and S. Walker.
11. Practical aspects of Gas Chromatography and Mass Spectrometry (1984) by Gordon M.Message, John Wiley and Sons, New York.
12. Gel Chromatography by Tibor Kremmery.
13. Principles and Techniques of Biochemistry and Molecular Biology: Edt. Keith Wilson, John Walker

***

Paper No.	Code	Title	Marks	Credits
XXVII	**MFSBS3T2**	**Eukaryotic genetics & DNA fingerprinting**	**100**	**4**

Unit I Mendelian genetics and Chromosomal inheritance:

Mendelian laws of inheritance and its deviations, Types of **inheritance (**Dominant inheritance, recessive inheritance, sex-linked inheritances, and polymorphic traits) Population genetics (Mendelian Population, gene pool, Hardy- Weinberg equilibrium, deviation from H-W equilibrium, genotypes, phenotypes, multiple alleles, genetic variants), Mitosis, meiosis, sex chromosomes, sex linkage, nondisjunction of X chromosomes, genotypic sex determination,

genic sex determination, X –linked recessive inheritance, X-linked Dominant inheritance, Y-linked inheritance.

Unit II: Genome organization

Structure of DNA (A,B,Z forms of DNA) Structure of chromatin, chromosome, centromere, telomere, nucleosome, genome organization, chromatin remodeling; types of histones, histone modifications-methylation, acetylation, phosphorylation and its effect on structure and function of chromatin, DNA methylation, repetitive and non-repetitive DNA sequence, Law of DNA constancy, C value paradox and genome size, Karyotype and ideogram, chromosome banding pattern, types of chromosomes, Giant chromosomes- polytene and lamp brush chromosome

UNIT III: Mutations & Repair

(Mutations and their causes, types of mutation (Chromosomal and Gene), mutagens , induced-mutagenesis (UV, nitrosoguanidine, ethyl methane sulfonate) mutation rate, genetic load).

Disorders: Metabolic disorders: introduction and examples (Amino acid metabolism - Phenylketonuria, Carbohydrate metabolism: lactose intolerance, genetic disorders and examples (Hemophilia, thalessemia, sickle cell anemia, Down's syndrome, Turners syndrome), molecular Basis and detection of inherited disease, gene mapping and genetic risk assessment, Repair mechanisms (Photoreactivation, Base excision, Mismatch, Nucleotide excision, SOS repair)

Unit IV: **Introduction to Forensic Genetics and Non-human DNA testing**

Human genetic variations, human chromosomes, Normal chromosome set, Genetic markers and their forensic significance, Types of STR markers, STRs used in forensic DNA typing, core and common STR markers.

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.

Suggested readings:

1. Genetics a conceptual approach: Fourth edition by Benjamin Pierce.
2. An Introduction to Forensic Genetics: William Goodwin, Adrian Linacre, SibteHadi
3. Forensic DNA Typing : Biology, Technology, and Genetics behind STR Markers by John M. Butler
4. An Introduction to Forensic Genetics, (2007): Goodwin William, John Wiley & Sons Ltd,
5. Basic human genetics (1991) :Kapur V, Jaypee Brothers
6. Essentials of Human Genetics (2009): Kothari, Manu L, Universities Press (India) Pvt .Ltd.
7. Fundamentals of Genetics,(2006) :Singh, B.D., Kalyani Publishers

8. Genes IX,(2008): Lewin, Benjamin Jones and Bartlett Publishers
9. Genetic influences on neural and behavioral functions. (2000): Pfaff, Donald W CRC Press
10. Genetic Markers in Human Blood,(1969): Giblett, Eloise R. Blackwell Scientific Publications
11. Genetics, (2003): Winter, P.C; Viva Books Pvt. Ltd.,
12. Genetics Altenburg, (1970): Edgar, Oxford& IBH Publishing Co.
13. Genetics Strickberger, (2005): Monroe, Prentice Hall of India Ltd
14. Genetics, (1998): Hartl, Daniel L Jones and Bartlett Publishers
15. Genetics of populations,(2005):Hedrick, Philip W Jones and Bartlett publishers,
16. Genomic Imprinting, (1995): Ohlsson, R.; Cambridge University Press
17. Human Genetics, (1987): Vogel, Friedrich; Springer –Verlag Berlin Heidelberg,
18. Human Genome methods, (1998): Adolph, Kennetth W CRC Press,
19. Human population genetics in India,(1974): Sanghvi, L.D; Orient Longman Ltd,
20. Concepts of Genetics: Klug W.S. & Cummings M.R., Prentice-Hall
21. An Introduction to Genetic Analysis, Griffith A.F. et al., Freeman
22. Statistical Methods in Human Population Genetics, (1998): K.C. Malhotra Indian Statistical Institute, Calcutta

***

Paper No.	Code	Title	Marks	Credits
XXVIII	**MFSBS3T3**	**Enzymology, serology and bioinformatics**	**100**	**4**

Unit I: Introduction of Enzymology:

Enzyme as biocatalysts, properties, classification, denaturation; enzyme substrate interactions, Energetics of enzyme catalysed reactions, transition state; Mechanism of enzyme action; Regulation of enzyme activity; Iso-enzymes, co-factors and co-enzyme. Enzyme kinetics: Michaelis-Menten equation and its derivatives; Ribozymes and Catalytic antibodies; Multienzyme systems: Occurrence, polygenic nature of multi-enzyme systems, Enzymes of forensic significance (with one example): Oxido-reductases: Glucose oxidase, Peroxidases, Catalase, Transferases, Hydrolases, Proteases: Animal proteases, Trypsin, Chymotrypsin, Pepsin, Chymosin, Plant proteases: Papain, Keratinases, alpha amylases.

Bioinformatics: Protein structure prediction (Secondary and Tertiary) Chou-Fasman Algorithm, GOR methods, Homology Modelling, *Ab initio* structure modelling, *In silico* DNA profiling, DNA cloning (SnapGene), *In silico* Docking studies (Autodock, Argus Lab).

Unit II: Body fluid analysis:

Types and distribution of body fluids, urine formation, composition, properties, abnormal constituents and clinical significance, Beta HCG; CSF, lymph, amniotic fluid, sweat,

composition, formation and function; semen, synovial fluid, gastrointestinal secretions composition, formation and function; serous fluid, tears, milk, faeces; saliva, aqueous humour.

Unit III: Blood and its variants

Blood composition , Blood group antigens the classification of blood cell antigens, Blood transfusions and the immune ,disease diagnosis based on blood examination, Transfusion reactions: Immune-mediated, Transfusion reactions: Non-immune, Haemolytic disease of the new-born (HDN), significance of maternal antibodies, Coombs test, Background information, Basic biochemistry, Molecular information , Clinical significance of ABO blood group , Hh blood group, Rh blood group, Kell blood group, Duffy blood group, Kidd blood group, Diego blood group, MNS blood group

Unit IV: Antigen-Antibody interactions

Antigen-antibody interactions; Major Histocompatibility complex and MHC restriction, structure and functions; B-cell receptor and T-cell receptor, generation of diversity; Complement system; Transplantation, graft vs host reaction, mixed lymphocyte reaction; Cytokines, Hypersensitivity, immunity to microbes (protozoa, bacteria, fungi, intracellular parasites, Helminthes & viruses); AIDS and other immune-deficiencies. Hybridoma technology and monoclonal antibodies; Vaccine: natural, synthetic & genetic, Problem and prospect associated with development of vaccine for diseases like AIDS, Cancer and Malaria. Immunodiagnostics and immunotherapy in virology.

Suggested readings:

1. Understanding enzymes 3rd ed. (1991): Trevor Palmer, Prentice Hall
2. Enzyme structure and mechanism: Alan Fersht.
3. Methods in Enzymology : S. Berger, A. Kimmel.
4. Fundamentals of Enzymology; N. Price, L. Stevens.
5. Immobilization of Enzymes and cells. Gordon Bickerstaff
6. Immunology: An Introduction by I.R. Tizard.
7. Kuby Immunology: Kindt, Goldsey, Osborne.
8. Immunology: Roitt, Brostoff, male.
9. The elements of Immunology: FahimHalim Khan
10. Fundamental immunology William E. Paul
11. Microbial Forensics : Roger G Breeze, Bruce Budowle, Steven E Schutzer
12. Handbook of computational molecular biology: Edt by SrinivasAluru
13. S.C. Rastogi, N. Mendiratta & P. Rastogi; Bio-informatics- Methods & Applications, PHI learning pvt. Ltd., (2009)

14. Dr. Westhead, J.H. Parish & R.M. Twyman, Bio-informatics, Viva Books Pvt Ltd., (2003)
15. Introduction to bioinformatics : Lesk
16. Blood biochemistry : Nicholas J Russell
17. Human blood groups-Chemical and biochemical basis of antigen specificity (Second edition): Helmut Schenkel –Brunner, Springer Wein New York
18. Blood: Principles and practice of hematology (2003): Robert L Handin, Samuel Lux, Thomas Stossel
19. Medical laboratory techniques: Godkar and Godkar
20. Blood group typing: Danford and bowly.
21. Blood grouping on man: R.R. Race and Sanger.
22. Blood grouping techniques: Boorman, Dodd. B, Lincoln. PB
23. Typing of blood stains: Callifird, Bryan
24. Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins. 2nd Edition by Baxevanis.
25. Bioinformatics: Sequence, structure and Data Bank: A Practical Approach by Higgis.
26. Bioinformatic methods and protocols:Misener.
27. Introduction to Bioinformatics by Altwood.
28. Bioinformatics sequence and genome analysis 2nd ed.: David Mount.

Paper No.	Code	Title	Marks	Credits
XXIX	**MFSBS3T4**	**Advanced Techniques in Forensic Anthropology**	**100**	**4**

Unit I: Forensic Taphonomy I

Definition, trauma analysis (time and method of trauma), post-depositional movements of bones : Sequence of disarticulation or disintegration, influence of gravity and space, taphonomic factors in commingling (animal chewing, bone density, excavation factors, curation practices, number of individual), analysis of commingled remains (morphological techniques, fluorescence, trace element analysis), taphonomic factors affecting mass graves, taphonomy in disaster cases (aircraft accidents, explosion, earthquakes, fires, floods)

Unit II: Forensic Taphonomy II

Factors affecting cadaver decomposition (aboveground & belowground decomposition), taphonomic modifications in water environment (decomposition, disarticulation, behavior of single bones) thermal alteration of buried bones, effect of animal scavenging, effect of cultivation, (chemical change, mechanical change, osteological examination, site analysis) , effect of weathering, decomposition of textile materials, metals associated with buried remains.

Unit III: Forensic dentistry II

Age estimation from tooth in prenatal, neonatal and early postnatal child, Age estimation in adults : Gustafson method, Root transparency, cementum annulations, tooth wear, third molar formation, aspartic acid racemization, ante-mortem and postmortem dental records, forensic odontology in mass disasters, dental trauma and its forensic application, individualization from odontological samples, ABFO guidelines and standards.

Unit IV: Bite-mark analysis

History of bite-mark analysis, anatomy of human bite-mark, types of bite-marks, collection of bite-mark evidences : non-invasive (forensic dental photography) & invasive techniques, differential diagnosis of bite-marks including carnivore bite-marks, bite-mark as biological evidence, factors affecting bite-mark in perishables, histopathology of bite-mark, microscopic examination of human bite, comparison of bite-marks, factors affecting bite-mark diagnosis, ABFO bite-mark scoring guide, reliability of bite-mark evidences.

Suggested Readings:

1. Forensic Taphonomy : The post-mortem fate of human remains, Marcella H. Sorg, William D. Haglund
2. Advances in Forensic Taphonomy, Method theory and Archaeological perspective, William D. Haglund, Marcella H. Sorg
3. Manual of Forensic Taphonomy, James Pokines, Steven A. Symes
4. Soil analysis in Forensic Taphonomy: Current methods & practices, Angi M. Christensen, Nicholas V. Passalacqua, Eric J. Bartelink.
5. Death, decomposition & detector dogs, Susan M. Stejskal
6. Application areas of anthropology, Anil Mahajan & Surinder Nath Reliance Publishing house,
7. The use of Forensic Anthropology, Robert Pickering & David Bachman CRC Press,
8. Physical Anthropology, B.R.K. Shukla & Sudha Rastogi Palaka Prakashan,
9. The Forensic Anthropology Laboratory, Michael W. Warren, Heather A.Haney& Laurel E. Freas; CRC Press,(2008)
10. Forensic dentistry, Paul G. Stimson, Curtis A. Mertz
11. Forensic Dentistry, second edition, David R. Senn, Paul G. Stimson
12. Bitemark evidences:colored atlas and text, Robert B.J. Dorion

Paper No.	Code	Title	Marks	Credits
XXX	**MFSBS3P1**	**Practical Based on MFSBS3T1 and MFSBS3T2**	**50**	**2**

List of Experiments

(Minimum 12 experiments)

1. Chromosome staining by Giemsa.
2. Polytene chromosome staining from salivary glands of chironomous larvae
3. Preparation of Human Genomic DNA: Cell breakage, Removal of proteins, (Using organic solvents, using enzymes), Removal of RNA, Concentrating the DNA.
4. Determination of purity and quantity of DNA.
5. Problems on population genetics
6. Extraction of mitochondrial DNA from forensic samples
7. Isolation of Plasmid DNA & Transferring plasmid DNA into bacterial cell
8. Preparation and transformation of competent *E. Coli* using calcium chloride
9. DNA detection method: Fluorescent and silver staining
10. Demonstration of mutation on the basis of bacterial pigmentation
11. Detection of phenylketonuria
12. Study of UV absorption spectra of macromolecules (protein, nucleic acid, bacterial pigments).
13. Separation of bacterial lipids/amino acids/sugars/organic acids by TLC
14. Paper electrophoresis.
15. Studies on pH titration curves of amino acids/ acetic acid and determination of pKa values and Handerson-Hasselbach equation.
16. Quantitative estimation of hydrocarbons/pesticides/organic Solvents /methane by Gas chromatography.
17. Separation of bacterial cells from culture media by differential centrifugation
18. Separation of serum proteins by density gradient centrifugation
19. Separation of serum protein by horizontal submerged gel electrophoresis.
20. Separation of haemoglobin by gel filtration.
21. Spectrophotometric analysis of dispersible tablets (Paracetemol, dispirin, etc).

Paper No.	Code	Title	Marks	Credits
XXXI	**MFSBS3P2**	**Practical Based on MFSBS3T3 and MFSBS3T4**	**50**	**2**

List of Experiments

1. Blood examination for diseases
2. Estimation of hemoglobin percentage
3. Microscopic study of abnormal RBC's
4. To determine blood group from stains of blood and various body fluids with Absorption-inhibition, mixed agglutination and absorption-elution techniques.
5. To perform precipitin test for species of origin determination.
6. Rocket immunoelectrophoresis
7. Microscopic study of sperm using compound microscope
8. Sperm counting by hemocytometer
9. Western blotting analysis
10. Effect of temperature on enzyme activity
11. Effect of Substrate concentration on enzyme activity (alpha amylase, starch hydrolysis, Sumner's method) Proteases (Rosen's method)
12. Effect of pH on Enzyme activity
13. Effects of cofactors on rate of enzyme activity (Calcium ions with amylase)
14. Demonstration of catalase, papain ,
15. Chemical estimation of milk protein - Casein
16. Microscopic detection of Fat globules for milk
17. Detection of semen
18. Determination of Km and V max
19. WIDAL Test
20. VDRL
21. Spot Elisa
22. Ouchterlony Double diffusion
23. Cross Over Electrophoresis
24. Examination of blood stains: physical and chemical tests; spectroscopic examination.
25. Examination of seminal stains: crystal tests, chemical, biochemical, Microscopical and electro-immuno-diffusion test.
26. Examination of saliva and its stains: microscopical and chemical tests.
27. Fecal stains: Physical, chemical and microscopical examination, testing of urine and sweat.
28. Molecular docking studies using Argus labs.
29. Evaluation of in silico gene cloning (SnapGene, Geneious, DNASTAR)
30. Application of I-TASSER (standalone), HHpred,

31. Application of Raptor X, PEP-FOLD, QUARK
32. Analysis of method of trauma.
33. Analysis of commingled remains.
34. Analysis of decomposition of textile materials.
35. Age estimation from teeth samples.
36. Forensic photography of bitemarks.
37. Identification of the type of bitemarks.
38. Factors affecting Bitemarks on perishables
39. Comparison of bitemarks.
40. Examination of human bite.
41. Individualization form odontological evidences.

***

SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER –III
Specialization in Digital and Cyber Forensics

Paper No.	Code	Title	Marks	Credits
XXVI	MFSDC3T1	OOPs using Java	100	4

Unit I

Introduction: History and features of Java, Difference between C, C++ & JAVA. JAVA and Internet, WWW, Web Browsers, java supports system, Java Environment. JDK, JVM, Byte code

Java Programming Basics: Structure of Java program, JAVA tokens and Statements, Constants & Variables, Data types, Operators, Command line arguments.

Control Statements & Arrays: if and switch statement. While, do-while and , for. Introduction to arrays, types of arrays, new operator, Strings. String class & its methods, Vectors.

Classes & Objects: Specifying classes, Methods and fields, creating objects. Passing objects to methods, returning objects, static fields & methods. Constructors, Garbage collection, Overloading methods & constructors, this keyword.

Unit II

Inheritances: Specifying sub class, types of inheritance, visibility control: public, private, protected, package. super keyword, Overriding methods, Dynamic method dispatch, Abstract methods and classes, final methods & classes

Packages & Interfaces : Introduction to packages, naming conventions, package statement, creating packages, import statement, accessing package, use of CLASSPATH, adding class to package, hiding classes. Interface, implementing interfaces, multiple interfaces.

Multithreading: Creation threads, Extending Thread class, implements Runnable interface, stopping and blocking thread, Thread life cycle, thread priorities & Thread synchronization, using Thread methods.

Unit III

Exception Handling: Managing errors, types of errors, exceptions, syntax of exception handling code. try, catch, throw, throws and finally statements, multiple catch & nested try statements. Java

Input Output: Java I/O package, Byte/Character Stream, Buffered reader / writer, File reader / writer, File Sequential / Random. Reading numeric, character & strings data from keyboard. Applet

programming: Applet Vs. Application, Creating applets, life cycle, local & remote applets.

Unit IV

Abstract Windows Toolkit (AWT): Components and Graphics, Containers, Frames and Panels, Layout Managers, Border layout, Flow layout, Grid layout, Card layout, AWT components. Event delegation Model, Event source and handler, Event categories, Listeners, Interfaces, Controls such as text box, radio buttons, checkboxes, lists, choice, command buttons, text area etc.

JDBC: Java database connectivity, Types of JDBC drivers, Writing JDBC applications, Types of statement objects(Statement, PreparedStatement and CallableStatement), Types of resultset, Inserting and updating , records, JDBC and AWT

Servlets: Introduction Servlet API Overview, Writing and running Simple Servlet, Servlet Life cycle, Generic Servlet, HTTPServlet, ServletConfig, ServletContest, Writing Servlet to handle Get and Post methods.

Suggested Readings:-

1. Java The Complete Reference, Ninth Edition
2. Core JavaTM2, Vol.1&2, 7th edition, Horstman Cay, Cornell Gary,Pearson Education.
3. The Complete Reference, seventh edition, [TMH], Herbert Schildt,
4. Programming with JAVA – A Primer by E. Balguruswamy (TMH)

5. JAVA 2 Programming Black Book, Steven Holzner, Wiley India.
6. Beginning Java 2, JDK 5 Ed, Ivor Horton,Wiley India.
7. Java database Programming – Maithew Siple – THM
8. Instant Java ,John A. Few, Stephen G. Rew (Sun Microsystems)
9. Experiments in JAVA - S.A. Relsel Shy – AWL

Paper No.	Code	Title	Marks	Credits
XXVII	**MFSDC3T2**	**Forensic Image Processing**	**100**	**4**

Unit-I: Mathematics preliminaries and Image Fundamentals

Matrix Algebra: Definitions, matrix arithmetic, transpose, powers, trace and determinant of matrices.

Set Theory: definition and representation of set, subset and power set, associative, commutative and distributive properties of set, definition and concepts of function.

Basic concepts of co-ordinate geometry, complex numbers and derivatives.

Image Fundamentals: definition and types of image, co-ordinate convention, Human visual system and computer vision system, digitization and Shannon sampling theorem, zooming and shrinking of an image, relationship between pixels: neighbors, adjacency, connectivity and path, Distance measures between pixels.

Unit-II: Image Enhancement

Introduction and scope of image enhancement, Image enhancement in spatial domain: point processing-basic point operators, histogram normalization and histogram equalization, thresholding, Mask processing-mean filter, median filter, Gaussian and laplacian filter. Image enhancement in frequency domain-concepts of Fourier transform and enhancement in frequency domain, power spectrum and phase angle, Low pass, high pass and band pass filters, homomorphic filtering, correspondence of filtering in the spatial and frequency domain.

Edge detection operators: Sobel, prewitt, Roberts, Canny and Laplacian operators

Unit-III: Image Description and Representation

Mathematical morphology: basic morphological concepts, binary dilation and erosion, opening and closing, hit-or-miss transformation, gray-scale dilation and erosion, opening and closing, top hat and geodesic transformation.

Compression: basic concepts of image compression, redundancy and fidelity criteria, image compression models, lossy compression: vector qunatization, loss less compression: run length coding, huffman transformation, JPEG compression.

Wavelet: Basic concepts pf wavelet and multiresoltion processing
Feature Extraction: Basic concepts of feature extraction and description of images.

Unit-IV: Image Forensics

Introduction and scope of image forensics, Source Identification: overview of image source identification, digital camera and image sensors, identification based on sensor defets and physical defects. Authentication of image evidence: image tampering and its type, detection of image tampering based on scene, optics, sensor, processing and image property.

Steganography and digital watermarking: introduction and scope of steganography and digital watermarking, comparative study steganography and digital watermarking, basic concepts of steganography and digital watermarking models, basic concepts of digital watermarking security and steganalysis.

Suggested readings:

1. Digital Image Processing by Gonzalez and Woods
2. Digital Image Processing and Analysis by Chanda and Majumdar
3. Feature Extraction and Analysis by Mark Nixon
4. Digital Image Processing by Ionis Pitas
5. Digital Image Processing by Anil K Jain
6. Image Forensics by N Hussain

Paper No.	Code	Title	Marks	Credits
XXVIII	**MFSDC3T3**	**Operating System**	**100**	**4**

Unit I

Introduction: Basics of Operating Systems: Definition – Generations of Operating systems – Types of Operating Systems, OS Service, System Calls.

OS structure: Layered design, Monolithic, Microkernel Operating Systems ,Kernel based OS, Concept of Virtual Machine.

Processes: Definition , Process Relationship , Process states , Process State transitions , Process Control Block , Threads – Concept of multithreads , Benefits of threads – Types of threads

Unit II

Memory Management :Basic Memory Management: Definition, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable

partition – Internal and External fragmentation and Compaction , Paging : Principle of operation – Page allocation – Hardware support for paging –,Protection and sharing – Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging (Concepts only) – Page Replacement policies : Optimal (OPT) , First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU)

Unit III

I/O Management

Principles of I/O Hardware: I/O devices, Device controllers , Direct memory access Principles of I/O Software: Goals of Interrupt handlers , Device drivers , Device independent I/O software , Secondary-Storage Structure: Disk structure ,Disk scheduling algorithm

File Management

File concept, Aaccess methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table),efficiency & performance.

Process Scheduling: Definition , Scheduling objectives ,Types of Schedulers ,Scheduling criteria : CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only) ,

Scheduling algorithms : Pre emptive and Non , pre emptive , FCFS – SJF – RR , Multiprocessor scheduling : Types , Performance evaluation of the scheduling. Interprocess Communication.

Unit IV

Deadlocks: Definition, Deadlock characteristics , Deadlock Prevention , Deadlock Avoidance :banker's algorithm, Deadlock detection and Recovery.

Recovery and Fault Tolerance : Recovery Concept ,Recovery Data, Tolerance and Faults,

Unix/Linux Operating System

Development Of Unix/Linux, Role & Function Of Kernel, System Calls, Elementary Linux command & Shell Programming, Directory Structure, System Administration Case study: Linux, Windows Operating System

Windows 2008 Operating system: Installation and create Active directory

Suggested Readings:

1. Operating System Concepts (8th Edition) by Silberschatz, Peter B.Galvin and Greg Gagne, Wiley Indian Edition (2010).
2. Modern Operating Systems (Third Edition) by Andrew S Tanenbaum, Prentice Hall India (2008).
3. Principles of Operating Systems by Naresh chauhan, Oxford Press (2014).
4. Operating Systems by D.M. Dhamdhere, Tata McGraw Hill 2nd edition.
5. Operating Systems (5th Ed) – Internals and Design Principles by William Stallings, Prentice Hall India, 2000.
6. UNIX Concepts and Applications(4th Edition)– by Sumitabha Das, Tata McGraw Hill.
7. Unix Shell Programming – by Yashwant Kanetkar, BPB publications.

Paper No.	Code	Title	Marks	Credits
XXIX	**MFSDC3T4**	**Data Structure**	**100**	**4**

Unit I

Overview: Introduction to algorithm, analysis of algorithm, designing of algorithm, the correctness and complexity of algorithm, Searching and sorting

Unit II

LINEAR DATA STRUCTURES AND ALGORITHM ANALYSIS: Array ,Stack, Queue , Priority Queue, Linked list, Doubly linked list, circular link list operations addition , deletion, traversing.

Unit III

Graphs: introduction to graph theory, graph isomorphism's, graph data structure: Adjacency lists, Adjency matrices, elementary graph, algorithm: BFS, DFS, Topological sort, strongly connected components.

Trees: introduction to trees, Tree traversal – preorder. Post order, inorder. Binary tree.

Balanced tree: B and B+ trees, Application of trees, minimum spanning tress, single source shortest path , all pair shortest path, heap

Unit IV

Hashing : Hash functions, collision resolution ,Dynamic programming and greedy algorithms NP Vs P: The spaces P and NP, Polynomial reduction, NP Complete Problem.

Suggested Readings:

1. Data Structures : By Seymour Lipschutz, Tata Mcgraw- Hill Publication.
2. Introduction to Algorithm, Thomas Cormen
3. Data structures and Algorithms – Alfred V. Aho
4. Fundamentals of Data Structure in C++- Ellis Horowitz
5. Fundamentals of Data structures, by Horowitz and Sahani (Galgotia publications).
6. .An introduction to data structures and application, by Jean Paul Tremblay & Pal G. Sorenson (McGraw Hill).
7. Data Structures, by Tannenbaum, (PHI).

Paper No.	Code	Title	Marks	Credits
XXX	**MFSDC3P1**	**Practical Based on MFSDC3T1 and MFSDC3T2**	**50**	**2**

List of Experiments

(Minimum 12 experiments)

Section A

1. Write a Java program print addition of two numbers
2. Write a program in java to calculate factorial of given number
3. Write a program in java to find largest number in between three numbers
4. Program for single inheritance.
5. Program for multilevel inheritance.
6. Program to demonstrate the subclass constructor (use of super keyword)
7. Program for abstract class and methods.
8. Program for implementing interfaces.
9. Program for creating and importing user defined packages.
10. Program for exception handling. (try/catch block)
11. Program using throw and throws clause.
12. Banner applet program
13. Program to demonstrate the parameter passing in applet
14. Program to draw simple shapes (use of colors/fonts) using Graphics class methods
15. Program to draw Frame
16. Program to create form using AWT controls.

Section B

1. Write a MATLAB code for read and write of a digital image
2. Write a MATLAB code for enhancement of image using mean and median filters
3. Write a MATLAB code for enhancement of image using low pass and high pass filters
4. Write a MATLAB code for edge detection using Sobel and Prewitt operators
5. Write a MATLAB code for edge detection using Canny operator
6. Write a MATLAB code for implementing gray-scale morphological operators
7. Write a MATLAB code implementing binary morphological operators.
8. Write a MATLAB code for image tampering detection

Paper No.	Code	Title	Marks	Credits
XXXI	**MFSDC3P2**	**Practical Based on MFSDC3T3 and MFSDC3T4**	**50**	**2**

List of Experiments:

(Minimum 12 Experiments)

Section A

1. Program for implementing CPU Scheduling algorithms (Min.-03)
2. Program for implementing Deadlock detection
3. Program for Page replacement algorithms (Min.-04)
4. Program for File Allocation Methods (Min.-02)
5. Shell Scripts (Min.-03)

Section B

6. Program for implementing sorting techniques
7. Program for implementing searching techniques
8. Program for implementing operations on array (min 2 operations)
9. Program for implementing operations on stack (min 2 operations)
10. Program for implementing operations on queue (min 2 operations)
11. Program for implementing operations on list(min 2 operations)
12. Program for implementing operations on tree (min 2 operations)

Paper No.	Code	Title	Marks	Credits
XXXII	MFSQD4T1	Advanced Document Examination	100	4

Unit I: Forensic Accounting and auditing

Basic concept on account: accounting process, recording of transactions, financial statements etc., Fraud, brief history of fraud, types of fraud: employee fraud and financial statement fraud, Forensic accounting, application of forensic accounting, fraud detection, role of forensic accountant**,** sources of information, bank and financial institutions fraud, insurance fraud, cheque and credit card fraud, payroll fraud and their investigation etc., introduction to forensic auditing.

Unit II: Forensic linguistic and stylistic

History, Definition of Forensic linguistics, disciplines of forensic linguistics: Auditory phonetics, acoustic phonetics, semantics, Discourse and pragmatics, dialect and idiolect, plagiarism detection, psycholinguistics. Language, variation in language, Stylistics: Introduction, style in language, linguistic stylistic, qualitative and quantitative analysis of style, style markers- text format, number and symbol, abbreviation, punctuation, capitalization, spelling, word formation, syntax, error and correction, high frequency word and phrases.

Unit III: Numismatic forgery

Numismatic forgery- Introduction, tool, equipments and other resource, method of forgery-alteration, tooling, embossing, application and plating, Casting: Rubber mold model, wax model from mold, Burn out wax, treatment of casting, Creating dye- Cutting by hand, plating,. Forensic identification of fake coins.

Unit IV: Quality assurance in questioned document

Quality management in document laboratory, NABL guideline for accreditation of QD lab, report writing: expert intro, received document details, query, reason for opinion, opinion/report etc., importance of qualified opinion, no opinion, expert testimony: introduction, purpose, preparation for trail in court, sequence for examination of expert: examination in chief, cross examination, re-examination, Daubert guidelines, debonair of expert, limitation to forensic questioned document examiner.

Suggested Readings:

1. Tommie W. Singleton, Aaron J. Singleton – 2010 Fraud Auditing and Forensic Accounting.
2. Mark Nigrini - 2011 Forensic Analytics: Methods and Techniques for Forensic Accounting.
3. Joseph Petrucelli – 2013 Detecting Fraud in Organizations: Techniques, Tools, and Resources.

4. Mary-Jo Kranacher, Richard Riley, Joseph T. Wells – 2010 Forensic Accounting and Fraud Examination.
5. Steven L. Skalak, Thomas W. Golden, Mona M. Clayton – 2011 A Guide to Forensic Accounting Investigation
6. Larry E. Rittenberg, Karla M. Johnstone, Audrey A. Gramling – 2011 Auditing: A Business Risk Approach
7. George A. Manning, Ph.D, CFE, EA - 2010 Financial Investigation and Forensic Accounting, Second Edition
8. Saurav K. Dutta – 2013 Statistical Techniques for Forensic Accounting
9. K. H. Spencer Pickett – 2010 The Internal Auditing Handbook
10. Joseph T. Wells – 2007 Corporate Fraud Handbook: Prevention and Detection
11. Walter J. Pagano, Thomas A Expert Witnessing in Forensic Accounting
12. Jack Bologna, Robert J. Lindquist - 1995 Fraud auditing and forensic accounting: new tools and techniques
13. Xenia Ley Parker, Lynford Graham – 2007 Information Technology Audits

Paper No.	Code	Title	Marks	Credits
XXXIII	**MFSQD4T2**	**Microscopy and Photography**	**100**	**4**

Unit-I: Review of Basic Optics:

Light and its properties, Refraction and refraction from different surfaces, Fundamental of Light and vision, Aberration.

Application of optics: Contact lens, Eyeglass, Magnifying lens, Microscopes, Camera, CD's and DVD's.

Unit-II: Optical Microscopy

Polarizing Microscope, Reflected Light Microscope, Phase contrast Microscope, Fluorescence Microscope, Polarized microscope, Fluorescence microscope, Phase contrast, Differential interference contrast microscope, TIR fluorescence microscope, Laser microscope, structured illumination microscope.

Unit-III: Electron Microscopy

Scanning Electron microscope, Transmission electron microscope, Scanning transmission electron microscope, Electron tomography, CryoSEM, Electron backscatter diffraction, Reflection electron microscope,.

Unit-IV: Photography

Definition and basic principles, history and development of photography, Camera and its essential parts, Types of camera essentials.

Camera Controls: Effect of aperture, Shutter speed and ISO on photograph.

Film Photography: Types of film, Development of film and photograph, Linkage of camera and negatives.

Digital Photography: Types of sensors, Colour theory, image formats.

Forensic Application: Photogrammetry, Filter photography, specialized photography, Photography on challenging surfaces.

Suggested Readings:

Paper No.	Code	Title	Marks	Credits
XXXIV	**MFSQD4T3**	**Advanced Instrumentation**	**100**	**4**

Unit I: Basics of Spectroscopy

Introduction to spectroscopy, electromagnetic radiations, atomic and molecular spectroscopy-Interaction of electromagnetic radiation with matter and its consequences. Reflection, absorption, transmission, scattering, emission, fluorescence, phosphorescence.

Atomic spectra**:** energy levels, quantum numbers and designation of states, selection rules, qualitative discussions of atomic spectra.

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

Unit II: Spectrophotometers

UV/VIS-Spectroscopy: Introduction, fundamental laws of spectrophotometer, Deviation from Beer's Law, Instrumentation and techniques, qualitative and quantitative methods in UV-Visible spectroscopy, Forensic applications

IR-Spectroscopy: Introduction, Principle of FTIR, Modes/types of vibrations, functional group and fingerprint region, Review of IR spectroscopy, Dispersive and Non-dispersive IR spectrophotometers, Fourier transform IR spectrophotometers, Instrumentation and Techniques, Interpretation of IR spectra, Forensic applications.

Raman Spectroscopy**:** Basic principles, Theory of Raman spectroscopy, Instrumentation, Analytical applications of Raman spectroscopy. , Forensic applications

Unit-III Chromatographic Techniques

Introduction, review of basic principles and types of chromatography, paper chromatography, TLC and HPTLC: Principle, Theory and instrumentation, visualization, Qualitative and Quantitative concepts and Forensic applications.

Principle, theory, instrumentation and applications of HPLC and GC

Unit-IV Mass spectrophotometers and Hyphenated Techniques

Introduction to mass spectrometry, principle, theory and instrumentations. Introduction to hyphenated techniques: GC-MS, LC-MS and other hyphenated techniques

Suggested readings:

1. Arena Poisoning: Chemistry, Symptoms and Treatment.
2. Borrow : Molecular Spectroscopy, 1980.
3. Wouldard, H. H., et al : Instrumental Methods of Analysis, 1974.
4. Moonesens A.A. et al : Scient ific Evidence in Criminal Cases, 1973.
5. Lundquist & Curry : Methods of Forensic Science, 1963.
6. Lee & Gaensslen : Advances in Forensic Science, (Vol. 2) Instrumental Analysis.
7. Spectroscopy of Organic compounds by P. S. Kalsi.
8. Settle,F.A.: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997
9. Lurie and Witturer : High Performance Liquid chromatography in Forensic Chemistry,1983.
10. Brown, P.R: Advance in chromatography
11. Howard: Forensic Analysis by Gas Chromatography
12. Grahm D.: The use of X-ray Techniques in Forensic Investigation, 1973.

Paper No.	Code	Title	Marks	Credits
XXXV	MFSQD4T4	Forensic Pattern Recognition	100	4

Unit-I: Basics of Pattern Recognition

Introduction to pattern recognition, features and feaure vectors, concepts of learning: supervised, unsupervised and reinforced. Basic concepts of clustering and classification, classifiers: based on Bayseian decision theory, perceptron model, artificial neural networks, support vector machine, nearest neighbours. Principal component analysis and Linear Descriminant analysis.

Unit-II: Automated Document Examination

Introduction to automated document examination, modules for document examination, automated analysis of ink and paper, automated analysis of torn documents, automated analysis of charred documents

Unit-III: Automated Handwriting Examination

Introduction to automated handwriting examination, acquisition of handwriting data, pre-processing and enhancement of handwriting, features for handwriting identification, feature selection and analysis, recognition of handwriting, performance evaluation and comparative study of existing handwriting examination software.

Unit-IV: Automated Fingerprint Identification System (AFIS)

Introduction of AFIS, history of automated identification system: global as well as Indian perspective, ANSI standards: transmission and compression standadards. Components and working of AFIS. Types of AFIS searches: Ten print to Ten print search, Latent to ten print search, Latent to latent search.

Suggested Readings:

1. Pattern Recognition by Theodiridus
2. David R. Ashbaugh; Quantitative and Qualitative Friction Ridge Analysis, CRC Press, 1999.
3. E. Roland Menzel; Fingerprint Detection with Loseres; Second edition; Marcel Dekker, Inc. 1999.
4. James F. Cowger; Friction Ridge skin CRC Press London, 1993.
5. Cummins & Midlo : Finger Prints, Palms and Soles, 1943, The Blakiston office London.

Paper No.	Code	Title	Marks	Credits
XXXVI	**MFSQD4P1**	**Practical Based on MFSQD4T1 and MFSQD4T2**	**50**	**2**

List of Experiments:

(Minimum 12 experiments)

1. Document photographic techniques – Close up photography , UV , IR, Transmitted and oblique light photography
2. Contact and trick photography.
3. Preparation of Juxtapose charts.
4. Photography of Watermarks and wire marks.
5. Photography of secret writings.
6. Identification of normal / disguised writings.
7. Detection of Forgeries including freehand and traced forgery.
8. Detection of simulated forgery.
9. Detection of built-up documents.

10. Examination of anonymous letters
11. Application of Forensic Stylistics in personal identification.
12. Effect of writing instruments, posture and emotions on handwriting.
13. Examination of alterations, additions, obliterations, overwriting and erasures.
14. Examination of rubber stamp impressions and other mechanical impressions.
15. Examination of typescripts and printed matters.

Paper No.	Code	Title	Marks	Credits
XXXVII	**MFSQD4P2**	**Practical Based on MFSQD4T1 and MFSQD4T2**	**50**	**2**

List of Experiments:

(Minimum 12 experiments)

1. Examination of ink using TLC
2. Examination of dyes using TLC
3. Examination of dyes using UV-VIS
4. Examination of tonar using FTIR
5. Examination of ink using FTIR
6. Examination of ink using UV-VIS
7. Examination of paper using FTIR
8. Enhancement of fingerprint image
9. Implementation of basic pattern recognition operators
10. Study of AFIS
11. Study of Automated Handwriting system
12. Study of Automated signature verification system
13. Study of automated ink examination system

Paper No.	Code	Title	Marks	Credits
XXXVIII	**MFSQD4P3**	**Dissertation**	**100**	**4**

Dissertation will be compulsory to all students. Students will carry out dissertation work individually or in the group of not more than three students. Concerned department shall provide all required infrastructure to carry out dissertation work. The format for dissertation report will be similar to the research thesis style; incorporating chapters on: Introduction, Review of Literature, Materials and Methods, Results and Discussion and References / Bibliography. The dissertation will be submitted in a typewritten and bound form. Copy of each dissertation will be submitted to the respective department and the centre will store it permanently. Project work on

forensically significant and need based problems in the area of Questioned Document, Handwriting analysis and Fingerprint examination etc.

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

Specialization in Forensic Chemistry and Toxicology

Paper No.	Code	Title	Marks	Credits
XXXII	MFSCT4T1	Forensic Pharmacology	100	4

Unit-I

Forensic Pharmacology: Pharmacology and its branches, Forensic Pharmacological studies, Physicochemical factors in transfer of drugs across membranes, Drug absorption, bioavailability and routes of administration, Distribution of drugs.

Unit-II

Excretion of drugs, Metabolism of drugs Clinical pharmacokinetics, Clearance-distribution, Half-life, Extent and rate of bioavailability, Therapeutic drug monitoring.

Unit-III Narcotic Drugs and Psychotropic Substances

Introduction of Drugs of Abuse, Drug dependence, drug addiction and its problems.
Source of Narcotic Drugs: Opium and its alkaloids, Depressants: Barbiturates, methaqulone, benzodiazepines, Stimulants: Cocaine and amphetamines and related derivatives,
Hallucinogens: ganja, hashish (Charas), LSD, their metabolic actions on human body and their symptoms, collection of sample, identification by field test, chemical test, TLC and instrumental analysis

Unit-IV: Sport Drugs

Introduction of Drugs abuse in sport, Prohibited classes of substances, prohibited substances in Sport (alcohol and Beta Blockers), in competition (Narcotics, Stimulants, Cannabinoids, Gluococorticosteroids). Introduction of WADA, doping control policies and operational guidelines, identification of sport drugs by Instrumental, techniques such as GC, GC-MS, and HPLC

Suggested Readings:

1. L.L. Brunton, J.S. Lazo, K.L. Parker, The Pharmacological Basis of Therapeutics, 11th ed., Magraw Hill, US, (2006).
2. Hollinger Manfred; Introduction to Pharmacology, Taylor & Francis (1997).

3. Turner Paul; Recent Advances in Pharmacology and toxicology, Churchill Living Stone (1998).
4. Sethi P D; Quantitative Analysis of Drugs in Pharmaceutical Formulations 3rd Edn. CBS Publ. (2005).
5. Clark E.G C; Isolation and Identification of drugs Vol. I and Vol.2, Academic Press (1986).

Paper No.	Code	Title	Marks	Credits
XXXIII	**MFSCT4T2**	**Elemental Instrumentation Techniques**	**100**	**4**

Unit I: Neutron Activation Analysis: Introduction, Review, Basic theory and principles, Instrumentation-Various neutron sources, Detection and measurement of Gamma-rays for qualitative and quantitative analysis, Forensic Applications.

X-ray Techniques: Introduction, Properties of X-Rays, Overview of various X-Ray techniques, X-ray Diffraction (XRD), X-ray Fluorescence (XRF), Energy dispersive EDXRF, Basic theory and principles, Instrumentation, Forensic applications.

Unit II: Flame Photometry: Introduction, General Principle, Instrumentation, Effects of solvents, Interference in flame photometry, Determination of non-metals, limitations, Forensic Applications.
Atomic Emission spectroscopy: Introduction, Principles and Instrumentation, Interferences and background correction, techniques, Graphite electrodes spark emission, Inductively Coupled Plasma atomic emission spectroscopy (ICP-AES), Forensic applications

Unit IV Ions selective electrodes: Introduction, types of ions selective electrode ions selective membrane in electrode and forensic application
Electrophoresis: Introduction, Migration of ions, types of electophoratic methods and forensic application.
Atomic Absorption Spectroscopy: Introduction, Basic principles, Instrumentation and Techniques, Interference in AAS-Background correction methods, Forensic applications.

***

Suggested Readings:

1. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
2. Casarett & Doll Toxicology: The Basic Science of poisons.
3. Curry, A.S.: Poison Detection in Human Organs, 1976.
4. Arena Poisoning: Chemistry, Symptoms and Treatment.
5. Sharma, B.R.: Forensic Science in Criminal Investigation & Trials, 2003.

6. Systematic Quality Management Gary B Clark. 1995 Practical Laboratory Management Series.
7. Turner : Drugs & Poisons.
8. Samford : Poisons Their Isolation Identification.
9. Dubois and celling: Textbook of Toxicology.
10. Froede, R. C.: The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
11.Gurudip R. Chatwal, Sham K. Anand, Instrumental Methods of Chemical Analysis, First Edition Reprint 2010, Himalaya Publication.
12. Skoog, Holler, Crouch, Instrumental Analysis, *India Edition* 2009.
13. Willard, Merritt, Dean, Settle, Instrumental Method of Analysis, *Seventh Edition*.
14. Gleason, M.N. et. Al.: Clinical Toxicology of Commercial products.
15. DFS –Working Procedure Manual- Chemistry, Explosives and Narcot ics.
16. Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi (2005)
17. Jehuda Yinon; Forensic and Environmental Detection of Explosives
18. Yinon Jitrin; Modern Methods & Application in Analysis of Explosives, John Wiley & Sons England (1993)
19. Houck, M. M. & Siegel, JA; Fundamentals of Forensic Science, Acadamic Press, London, 2006.
20. Asthana N.C and Nirmal Anjali; The Ultimate Book Of Explosives, Bombs and I E Ds ,Pointer Publishers (2008).
21. Suceska, T; Test Methods for Explosives, Springer (1995).

Paper No.	Code	Title	Marks	Credits
XXXIV	**MFSCT4T3**	**Explosives and Drugs**	**100**	**4**

Unit I: Explosives: Introduction, Temperature of chemical explosion, Force and pressure of explosion, Kinetics of explosive reactions. Development of explosives : Black powder, Nitro Cellulose, Nitro Glycerin, Dynamite, Ammonium nitrate, Commercial explosives (permitted

explosives, ANFO and slurry explosives), Military explosives (picric acid, TNT, Nitro guanidine, PETN, RDX, HMX and polymer bonded explosives)
Role of Forensic scientist in Post blast investigation, Disposal of bombs, Explosions effects, Collection of samples, Technical report frame work, Homemade crude bombs, Evaluation and assessment of explosion site and reconstruction of sequence of events, General methods of manufacture of explosives, Analysis of explosive by TLC, HPLC, IR And GC-MS

Unit II: Arson and Fire: Chemistry of fire, difference between Arson and Fire, Material and Chemicals used in initiating fire and arson Examination of scene of fire/arson recognition and collection of evidences, packing labelling and forwarding of exhibits, methods of extraction from exhibit- direct extraction, distillation and micro diffusion methods, analysis of arson exhibits by colour test, TLC, GC-MS.

Unit III:
Methods of analysis of drugs and poison in viscera, stomach wash, vomit, urine and blood like methaqulone, atropine, strychnine, brucine cocaine, opium alkaloid, LSD, amphetamine, report writing and interpretation of result.

Unit IV: Extraction of common barbiturates, major (phonthaizines) and minor (benzodiazapines) tranqulizer from tissues stmoch wash, urine, vomit, blood, stained garments, stained soil, suspect drink , their methods of detection and quantation. Report writing and interpretation of results.

***

Suggested Readings:

1. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
2. Casarett & Doll Toxicology: The Basic Science of poisons.
3. Curry, A.S.: Poison Detection in Human Organs, 1976.
4. Arena Poisoning: Chemistry, Symptoms and Treatment.
5. Sharma, B.R.: Forensic Science in Criminal Investigation & Trials, 2003.
6. Systematic Quality Management Gary B Clark. 1995 Practical Laboratory Management Series.
7. Turner : Drugs & Poisons.
8. Samford : Poisons Their Isolation Identification.
9. Dubois and celling: Textbook of Toxicology.
10. Froede, R. C.: The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
11. Gurudip R. Chatwal, Sham K. Anand, Instrumental Methods of Chemical Analysis, First Edition Reprint 2010, Himalaya Publication.

12. Skoog, Holler, Crouch, Instrumental Analysis, *India Edition* 2009.

13. Willard, Merritt, Dean, Settle, Instrumental Method of Analysis, *Seventh Edition*.

14. Gleason, M.N. et. Al.: Clinical Toxicology of Commercial products.

15. DFS –Working Procedure Manual- Chemistry, Explosives and Narcot ics.

16. Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi (2005)

17. Jehuda Yinon; Forensic and Environmental Detection of Explosives

18. Yinon Jitrin; Modern Methods & Application in Analysis of Explosives, John Wiley & Sons England (1993)

19. Houck, M. M. & Siegel, JA; Fundamentals of Forensic Science, Acadamic Press, London, 2006.

20. Asthana N.C and Nirmal Anjali; The Ultimate Book Of Explosives, Bombs and I E Ds ,Pointer Publishers (2008).

21. Suceska, T; Test Methods for Explosives, Springer (1995).

Paper No.	Code	Title	Marks	Credits
XXXV	**MFSCT4T4**	**Forensic analysis of dyes, petroleum products and fertilizers**	**100**	**4**

Unit I:

Dyes: Different type of dyes, role of dyes in crime investigation, food colours (edible and non-edible dyes), dyes used in cosmetic and pharmaceutical. Chemical analysis and instrumental methods of analysis of dyes.

Analysis of trace evidence: cosmetics, dyes, Trap related evidence materials, fibers, oils, fats, greases, industrial dusts, chemicals and plant material.

Unit II: Quantitative and qualitative forensic analysis of organic and inorganic Industrial products, chemical fertilizers, insecticides, metallic and non metallic products, consumer items such as gold, silver, tobacco, tea, sugars, salts, acids and alkalis etc.

Unit III: Fertilizers: Introduction to fertilizer, different type of fertilizers and classification, substandard and sub-standard adulterated fertilizers, common adulterants. Chemical and instrumental methods of analysis of fertilizers.

Unit IV:

Classification of reaction in volumetric analysis, redox titration, their use in determination of arsenic, cyanides and mercury, complexometric titration, metal-ion indicators, precipitation

titration, Mohr's titration, Volhard's titration, adsorption indicators, Fajan's titration, Forensic applications.

Suggested readings:

1. Curry: Analytical Methods in Human Toxicology, Part II, 1986.
2. Casarett & Doll Toxicology: The Basic Science of poisons.
3. Curry, A.S.: Poison Detection in Human Organs, 1976.
4. Arena Poisoning: Chemistry, Symptoms and Treatment.
5. Sharma, B.R.: Forensic Science in Criminal Investigation & Trials, 2003.
6. Systematic Quality Management Gary B Clark. 1995 Practical Laboratory Management Series.
7. Turner : Drugs & Poisons.
8. Samford : Poisons Their Isolation Identification.
9. Dubois and celling: Textbook of Toxicology.
10. Froede, R. C.: The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
11. Gurudip R. Chatwal, Sham K. Anand, Instrumental Methods of Chemical Analysis, First Edition Reprint 2010, Himalaya Publication.
12. Skoog, Holler, Crouch, Instrumental Analysis, *India Edition* 2009.
13. Willard, Merritt, Dean, Settle, Instrumental Method of Analysis, *Seventh Edition*.
14. Gleason, M.N. et. Al.: Clinical Toxicology of Commercial products.
15. DFS –Working Procedure Manual- Chemistry, Explosives and Narcot ics.
16. Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi (2005)
17. Jehuda Yinon; Forensic and Environmental Detection of Explosives
18. Yinon Jitrin; Modern Methods & Application in Analysis of Explosives, John Wiley & Sons England (1993)
19. Houck, M. M. & Siegel, JA; Fundamentals of Forensic Science, Acadamic Press, London, 2006.
20. Asthana N.C and Nirmal Anjali; The Ultimate Book Of Explosives, Bombs and I E Ds ,Pointer Publishers (2008).
21. Suceska, T; Test Methods for Explosives, Springer (1995).

Paper No.	Code	Title	Marks	Credits
XXXVI	**MFSCT4P1**	**Practical Based on MFSCT4T1 and MFSCT4T2**	**50**	**2**

List of Experiments:

(Minimum 12 Practical)

1. Thin layer chromatographic, GC and GC-MS analysis of NDPS drugs (2 Nos.)
2. Extraction and identification of acidic and basic drugs from viscera (simulated sample), TLC, GC and GC-MS
3. GC examination of arson products and alcohol.
4. Identification and comparison of explosives by FTIR.
5. Study of thermal behaviour of hair and fibre threads, polymers and other materials by DSC, TGA (2 Nos.)
6. Comparison of component of cosmetic stain from crime scene and suspect is clothing by spectrophotometry method UV/FTIR.
7. Chemical analysis of given fertilizer by chemical test and instrumental techniques.
8. Analysis of dyes by TLC and UV-visible spectrometer.
9. Determination of poisonous metals in biological materials by AAS.
10. Extraction, Systematic identification of Narcotic Drugs and Psychotropic substances (opiates, cannabis and barbiturates, benzodiazepines and amphetamines) by spot colour tests
11. Analysis of Na and K contents in soil sample by Flame Photometry.
12. GC-MS, HPLC analysis of explosive residues.
13. Detection of adulteration in oils and fats by chemical analysis and TLC/ HPTLC.

Paper No.	Code	Title	Marks	Credits
XXXVII	**MFSCT4P2**	**Practical Based on MFSCT4T3 and MFSCT4T4**	**50**	**2**

List of Experiments:

1. Detection and identification of metallic poisons in viscera and food material by chemical test and instrumental technique.
2. Systematic extraction, and identification and non–volatile drugs and poisons by various techniques.
3. Study of the extraction methods of Drugs and poisons from viscera samples.
4. Analysis of alcohol by methanol/ethanol by gas chromatography
5. Analysis of drugs (Diazepam, Paracetamol) by UV-VIS spectrophotometer
6. Extraction and identification of volatile organic poison from the given tissue
7. Extraction , purification and identification of the pesticides from the given tissue
8. Extraction and detection of hydrocarbon residue in fire and arson samples
9. Extraction, Purification and identification of metallic poisons from the given tissue
10. Extraction, Purification and identification of the explosive in the given debris
11. Extraction, Purification and identification of tranquillizers from the given tissue
12. Visit to Forensic Science laboratory and preparation of report
13. Determination of alkali content of antacid tablets using HCl.
14. Quantative of glucose/sucrose using Fehling's solution.
15. Determination of available Chlorine in Bleaching power

Paper No.	Code	Title	Marks	Credits
XXXVIII	**MFSCT4P3**	**Dissertation**	**100**	**4**

Description

This course covers the application of analytical chemistry within the field of forensic science. Students learn the fundamental principles behind the analyses of chemical and physical evidence for drugs, combustion and arson, colorants, documents, and fibres. Qualitative analysis is presented by examining the chemical details of presumptive testing from a mechanistic approach. An analytical chemistry perspective is used to explain modern laboratory instrumentation and proper statistical treatment of collected data for quantitative analysis. An overview of chemical toxicology is covered with an emphasis on understanding biochemical pathways and pharmacokinetics.

Objectives

To introduce students to research in various areas of Forensic chemistry by engaging them to carry out a project under the supervision of a faculty. The main objective of this course is to teach students how to use critical thinking skills and fundamental scientific principles to approach and solve problems in forensic science. Students should learn how to create an unbiased sampling of evidence and select proper methods to process that evidence. Finally, students should be able to communicate and support the technical details of their findings in a clear, logical manner that can easily be understood in a court of law.

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

Specialization in Forensic Biology, Serology and DNA Fingerprinting

Paper No.	Code	Title	Marks	Credits
XXXII	**MFSBS4T1**	**Forensics in botany, entomology, wildlife and Environment**	**100**	**4**

Unit I: **Forensic botany**: Plant systematics, Botanical evidences: Introduction, types, location, collection evaluation and forensic significance of fungi and plants in forensic science, wood and pollen grains, Methods of identification and comparison, various types of planktons and diatoms and their classification and forensic importance; Limnology, Diatoms types and morphology, methods of isolation from different tissues. Study and identification of pollen grains.

Poisonous plants- (Classification , active constituent, lethality and effects) *Abrus precatorius, Argemone mexicana, Calotropis, Atropa belladonna, Gloriosa superba, Jatropha curcas, Nerium indicum, Nicotiana tabacum, Ricinus communis.* Types of plants yielding drugs of abuse – opium, cannabis, coco, tobacco, Dhatura, Psilocybin mushrooms.

Unit II: Forensic Entomology: Collection of entomological evidence during legal investigations; collection of : meteorological data, specimens before body removal, ground-crawling arthropods on and around the body, entomological samples from the body, entomological samples during autopsy, specimens form buried remains, from enclosed structures, aquatic habitats, Laboratory rearing of forensic insects: Larval rearing, rearing containers, monitoring growth, larval dispersal in laboratory, Adult emergence, rearing aquatic insects, unique species requirements, rearing beetles in the laboratory, External factors affecting insect succession on carrion (Attraction to the remains, geographical differences in succession, Season, Sun exposure, Urban versus rural scenarios, bodies found inside buildings, effects of burial, bodies in water, bodies in vehicles, bodies in enclosed spaces, hanged bodies, burnt remains, wrapped remains). Role of aquatic insects in forensic investigations, estimating the postmortem interval, soil environment and forensic entomology, Entomo-toxicology, molecular methods for forensic entomology.

Unit III: Importance of wild life and Environment; Protected and endangered species of animals and plants; Sanctuaries and their importance; Relevant provision of wild life and environmental act; Types of wildlife crimes, different methods of killing and poaching of wildlife animals; Enforcement of wildlife protection policy, Development of wildlife forensic laboratories, Wild animals as pharmacopeias . Recovering evidence at poaching scenes, Locating the burial: Anomalies on the surface international trade in reptile skins.

Unit- IV: Environment and Ecosystems. Concept of biosphere, communities and ecosystems; Ecosystem characteristics structure and function; Xenobiotic and recalcitrance, Bioremediation using microorganisms and plants, Genetically Modified Organisms to treat effluents; introduction to BOD and COD, use of biosensors , bioremediation of solid waste, industrial effluent containing organic pollutants and metal ions. Environmental Management Introduction and scope of environmental management, basic concepts of sustainable development, Environmental Impact Assessment . Wildlife Protection Act 1972, Forest Conservation Act 1981, Environment (protection) Act 1986.

***

Suggested reading:

1. Concept in wildlife Management, Hosetti, B.B Daya publishing 103House
2. Forensic science in wild life investigation, Linarce, Adrian CRC Press, Taylor & Francis
3. The wild life (protection) act, Baalu, T.R.1972, Nataraj Publication
4. Wild life (Protection act, 1972), Universal Publication
5. Wildlife protection act, 1972; Natraj Publishers
6. Timber Identification, N. Clifford; Leonard Hill ltd.,
7. A manual of wood identification, Herbert L. Edlin Viking Press,
8. Man-made fibres, R.W. Moncrieff Newness butter worth
9. Identification of vegetable fibres,. Dorothy catling & John Grayson Chapman & hall ltd
10. Pollen morphology & Plant taxonomy: angiosperms (an introduction to palynology), Erdtman, G Hafner Publishing Co.,
11. Forensic botany, Coyle, Heather Miller CRC Press,
12. College botany, Gangulee, Hirendra Chandra New Central Book Agency,
13. Plant anatomy, Esau, Katherine Wiley Eastern Ltd,
14. Plant anatomy, Chandurkar, P J Oxford & IBH Publishing Co,
15. Systematic botany for degree students, Singh, Jagjit S Chand & Co.,
16. The poisonous plants, H.C. Long Asiatic Publishing House,
17. Plant Anatomy, B.P. Pandey S. Chand& Co., New Delhi, (1998)
18. Environmental Law- The Law & policy relating to protection of environment, Ball Simon Universal Law Pub Co, Delhi,

19. Environmental Forensic Principles and Applications, Morrison Robert D, CRC Press, NY
20. Forensic Entomology: Jason H Byrd & James L Castner
21. Insect Biology : Hovard Evan
22. Fundamentals of Entomology, Richard J. Flzinga Prentice hall of India pvt ltd, (1978)
23. Entomology & death- A procedural guide, Catts E.P & Haskell NH; Joyce's print shop (1990)
24. A manual of Forensic Entomology Smith DGV; Ithaca NY Camstock Univ. Press, USA (1986)
25. General text book of Entomology, O.W. Richards & R.G. Davis; Chapman & hall ltd, (1973)

Paper No.	Code	Title	Marks	Credits
XXXIII	**MFSBS4T2**	**Forensic microbiology & Quality Management in laboratories**	**100**	**4**

Unit I: Diagnosing and tracking microbial diseases, Cholera, Influenza, Botulism, TB, hepatitis, SARS. Characteristics, epidemiology, pathology, diagnosis and chemotherapy, Principles of epidemiology, epidemiology and public health: Public health measures for the control of disease, Global health consideration, emerging and reemerging infectious diseases**.** Role of microorganisms in body putrefaction process, Microbial profiles as identification tools, Microbial infections and human behavior (Rabies, polio, Syphilis, AIDS, filariasis), Microbial infections that can be mistaken for signs of criminal activity.

Unit II: Biological agents in warfare: Collection and preservation of microbial forensic samples, sampling for microbial forensic investigations, Categories of biological weapons, study of potential bacteria, fungi, viruses, and their toxins, mode of action, identification, sampling, transport, preventive measures during handling, laboratory setup, epidemiologic investigation for public health, investigation of suspicious disease outbreak, Biosafety and biosecurity, Bio surveillance, documentation, and case studies

Unit III: Toxin analysis using mass spectrometry, Non-DNA methods for Biological signatures, electron beam-based methods for bio-forensic investigations, proteomics development and application for bio-forensic, design of genomic signature for pathogen identification and characterization.

Unit IV: Introduction to QA/QC, Laboratory quality management, Laboratory Accreditation, Validation of laboratory tests, Key Elements of a QA/QC Program, proficiency testing, quality control testing, quality assurance monitoring, procedure manual, laboratory reports, laboratory records, laboratory security, Personnel and Training, Validation of Analytical Procedures, Equipment, Standard Operating Procedures, Study protocols, The Final report, Archiving, Storage and Retrieval, Inspection and Compliance. Regulatory aspects of quality control, Quality

assurance and quality management ISO, WHO and US certification. Quality Assurance Standards for Forensic DNA Testing Laboratories :References, Scope, Definitions, Quality Assurance Program, Organization and Management Personnel, Facilities, Evidence Control ,Validation, Analytical Procedures, Equipment Calibration and Maintenance, Reports.

***

Suggested reading:

1. Microbial Forensics : Roger G Breeze, Bruce Budowle, Steven E Schutzer
2. Microbial Forensics : Bruce Budowle, Steven E Schutzer, Roger G Breeze, Paul S Keim, Stephen A Morse
3. Chemical and Physical Signatures for Microbial Forensics: Cliff, J.B, Kreuzer, H.W, Ehrhardt C.J, Wunschel,D.S
4. Practical Approaches to Method Validation and Essential Instrument Qualification: Chung Chow Chan , Herman Lam , Xue-Ming Zhang.
5. Guidelines for Forensic Science Laboratories International Laboratory Accreditation Cooperation(ILAC)
6. DNA Technology in Forensic Science By Committee on DNA Technology in Forensic Science, National Research Council
7. The laboratory Quality Assurance system: A manual of Quality Procedures and forms. Thomas
8. A Ratliff. 2003 3rd ed. John Wiley & Sons ISBN. 0-471 26918-2Systematic Quality Management Gary B Clark. 1995 Practical Laboratory Management Series.
9. Quality assessment of chemical Measurements John K. Taylor. CRC Press 1987. 087371-097-5.
10. Quality in the analytical chemistry laboratory E. Prichard. 1995 JohnWiley ISBN 0471 955418
11. IS/ISO/IEC 17025 : 2005 General Requirements for the competence of testing and calibration laboratories
12. Juran's Quality Control Handbook, Fourth Edition, J.M. Juran, Frank M. Gryna, McGraw-Hill
13. International Editions, Industrial Engineering Series (1988)
14. Total Quality Control Essentials - Key Elements Methodologies and Managing for Success,
15. Quality Control & Application, Bertrand L. Hansen, Prabhakar M. Ghare, Prentice-Hall of India Pvt. Ltd., New Delhi-110001 (1993)

***

Paper No.	Code	Title	Marks	Credits
XXXIV	MFSBS4T3	DNA Profiling and Interpretation	100	4

Unit I: **Sample collection**: DNA sample sources, biological evidence at crime scenes, evidence collection and preservation, collection of reference DNA samples, storage and sample characterization, sample storage and transport of DNA evidence, sample characterization: blood stain, saliva stains, semen stains, body fluid identification by RNA testing, contamination concerns

Unit II: **DNA extraction and Quantification methods**: organic (Phenol-chloroform) extraction, chelex extraction, FTA paper, Solid phase DNA extraction methods: Qiagen extraction Chemistry and kits, DNA IQ (Identification & quantification), PrefFiler, Differential extraction, Direct PCR. **DNA quantification**: Slot blot, Pico-green micro-titer plate assay, AluQuant human DNA quantification system, endpoint PCR, real time quantitative PCR (QPCR).

Unit III: **Structure of STR loci**, Development of STR multiplexes, Detection of STR polymorphisms, Interpretation of STR profiles, Assessment of STR profiles, Stutter peaks, split peaks, pull up, template DNA, overloaded profiles, low template DNA typing, peak balance, mixtures, degraded DNA, PCR inhibition,

Unit IV: DNA profiling applications & **case studies in disputed paternity cases**, child swapping, missing person's identity, civil immigration, veterinary, wild life and agriculture cases ;Legal perspectives – legal standards for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad; Limitations of DNA profiling; Population databases of DNA markers –STRs, Mini STRs, SNPs. New &future technologies: Analysis of SNP, DNA chip technology- Microarrays cell free DNA , Synthetic DNA, Degraded DNA, Principles and components of capillary electrophoresis, new technologies and automation: Mass spectrometry, pyro-sequencing

***

Suggested reading:

1. An Introduction to Forensic DNA Analysis, Rudin, Norah CRC Leviw Publishers, (2002)
2. An Introduction to Forensic DNA Analysis, Inman, Keith CRC Press, (1997)
3. Ancient DNA, Herrmann, Bernd Springer Publishing Co., (1994)
4. Basics of DNA and Evidentiary Issues, Vij, Krishan Jaypee Brothers, (2004)
5. DNA, forensic and legal applications Kobilnsky, Lawrence John Wiley & Sons, (2005)
6. DNA Cloning 4: Mammalian systems, Glover, D.M.; IRL Press,(1995)
7. DNA Damage and repair, Nickoloff, Jac A Humana Press,(1998)

8. DNA Evidence and Forensic Science, Newton, David E. Viva books private limited, (2010)
9. DNA fingerprinting, Kirby, Lorne W H Freeman and Co, (1992)
10. DNA Fingerprinting: Approaches and applications. T. Burke, Terry Birkhauser Verlage, (1991)
11. DNA in forensic science, Robertson, J Ellis Horwood Ltd., (1990)
12. DNA profiling Easteal, Simon, Harwood academic Publishers,(1993)
13. DNA profiling and DNA fingerprinting, Epplen, Jorg T Birkhauser Verlage,(1999)
14. DNA technology, Alcamo, I Edward Harcourt Academic Press,(1999)
15. DNA tests in Criminal Investigation Trial & Paternity Disputes Singh, Yashpal, Alia Law Agency,(2006)
16. Forensic DNA typing, J.M. Butler Elsevier Academic press,(2005)
17. Forensic DNA technology, Mark A. Farley & James J. Harrington CRC Press,(1991)
18. Forensic DNA analysis, J. Thomas McClintock Lewis Publications, (2008)
19. Forensic DNA typing protocol: Carracedo

Paper No.	Code	Title	Marks	Credits
XXXV	**MFSBS4T4**	**Biological evidences, Forensic Medicine and anthropology**	**100**	**4**

UNIT I: Biological evidences collection and preservation: Types of biological evidences, retaining biological evidences (Identification, category), Safety and handling of biological evidences (Universal precautions, personal protection, and exposure control plan). Disposal of biological evidences: Regulations, Decontamination processes. Packaging and Storage of biological evidences (Wet and dry evidences) Blood, DNA, Urine samples, Tissue samples, etc.Physical storage considerations, Storage equipments.

UNIT II: Forensic Medicine and pathology: Definition of Forensic Medicine, State Medicine, Legal Medicine and Medical Jurisprudence. History of Forensic Medicine, Definition of death, Types of death, Description of signs of death. Post-mortem changes after death (cooling of dead body, postmortem lividity, rigor mortis, cadaveric spasm, heat and cold stiffening, putrefaction, mummification, adipocere formation maceration and preservation of dead bodies).

Post mortem examination: Definition of postmortem examination, Different types of autopsies, aims and objectives of postmortem examination, Legal requirements to conduct postmortem examination, Procedure to conduct medicolegal postmortem examination, obscure autopsy, examination of clothing, preservation of viscera on postmortem examination for chemical analysis and other medicolegal purposes, postmortem artefacts.

Unit III: Forensic Osteology : Definition, Bone formation, Morphology of bones, ossification centers, Branches of forensic anthropology (socio-cultural anthropology, linguistic anthropology, paleoanthropology, etc.), Field recovery methods, scene documentation, Laboratory processing,

curation, Identification of race, sex (metric & non-metric analysis), age (juvenile & adult), histological aging methods, stature from skeletal remains, Report writing,

Unit IV: Forensic anthropology Identification of skeletal remains from other evidences, Identification of fragmented remains, Identification of human and non-human remains, Somatometry, Craniometry, Skull photo superimposition, facial reconstruction, Post mortem interval and post burial interval determination.

Forensic Dentistry - History of forensic Dentistry, Morphology of tooth, identification of the type of tooth, chronological development, Forensic dental photography (alternate light imaging, fluoroscene imagining technique, UV, IR)

Suggested Reading:

1. Dr.K.S.N.Reddy- The essential of Forensic Medicine & Toxicology 21st Edition 2002. Published byK.Saguna Devi, H,No. 16-11-15/2/2, Saleem nagar Colony, No.1, malapet, Hyderabad-500036.
2. Modi‘s Textbook of Medical Jurisprundence and toxicology- Edited by BV Subramanyam,
3. Butterworths India, New Delhi.22nd edition, 2001.
4. Dr. C.K.Parikh- A text book of Medical Jurisprundence, Forensic Medicine & Toxicology, CBS Publishers, Delhi, Sixth Edition 1999.
5. Dr. Apurba Nandy- Principles of Forensic Medicine, 3rd Edition 2000, New Central Book Agency (P) ltd. Calcutta.
6. Dr. Krishan Vij- Text book of Forensic Medicine & Toxicology- Principles and Practice, BI Churchill Livingston, New Delhi, 2nd edition, 2002.
7. Forensic recovery of human remains: Dopras, Schultz, Whirler, Williams
8. Forensic Anthropology : contemporary theory and practice, Debra A. Komar, Jane E. Buikstra
9. Forensic Antrhopology, MariaTeresa A. Tersigni-Tarrant, Natalie R. Shirley
10. A manual of biological Anthropology, Indra P. Singh& M.K. Bhasin Kamla Raj Enterprises,
11. Anthropology, Fred Plog, Clifford J. Jolly & Danial G. Bates Alfred A. KNOPF NewYork,
12. Anthropology, Kroeber Oxford & IBH Publishing Co.,
13. Dental Anthropology, V.Rami Reddy Inter-India Publication,
14. Forensic Anthropology : Current methods & practices, Angi M. Christensen, Nicholas V
15. Passalacqua, Eric J. Bartelink
13. Introduction to Forensic Anthropology, Steven N. Byers.
14. Forensic Medicine & Toxicology, KSN Reddy.

Paper No.	Code	Title	Marks	Credits

XXXVI	**MFSBS4P1**	**Practical Based on MFSBS4T1 and MFSBS4T2**	**50**	**2**

List of Experiments:

(Minimum 12 experiments)

1. Identification of wood using physical and anatomical features.
2. Identification and classification of diatoms.
3. Examination of hair of different animals as cat, dog, cow, horse and goat.
4. Identification of pollen grains to genus level
5. Identification of starch granules.
6. Staining techniques and laboratory exercises for identification of different plant cell types.
7. Microscopy of various plants fibers.
8. Differentiation of fibers including sisal, manila, jute and cotton based on ashing.
9. Microscopic examination of man-made fibers.
10. Section and cutting of plant material and their examination.
11. Step wise method for collection of botanical evidence
12. Collection and processing of algal evidence in forensic investigation
13. Collection, identification and preservation of entomological evidence
14. Laboratory rearing of forensically significant insects.
15. Impact of drugs and toxin on insect development
16. Identification of human bones and determination of their sides.
17. Determination of age from skull, teeth, sex from skull and pelvis
18. Alignment of the bones according to their anatomical positions
19. Stature estimation from long bones
20. Histological staining methods for different tissues
21. Study of micro flora of cadaver
22. Isolation of microorganisms from decomposing tissues
23. Determination of ethnicity from skull

***

Paper No.	Code	Title	Marks	Credits
XXXVII	**MFSBS4P2**	**Practical Based on MFSBS4T3 and MFSBS4T4**	**50**	**2**

List of Experiments:

(Minimum 12 experiments)

1. Environmental microbiology: Isolation of coliforms
2. Enumeration of Soil microorganisms
3. Bacterial morphology and staining: Negative staining, monochrome and Gram staining Acid fast staining -ZNCF, Endospore - Schaeffer–Fulton
4. Environmental factors affecting growth of microorganisms, temperature, pH
5. Effect of disinfectants and antimicrobial agents
6. Environmental microbiology: Confirmation of coliforms on Endoagar or EMB agar
7. Isolation of micro biota from human/animal cadaver
8. Isolation and identification of *Bacillus* species
9. Detection of Afla toxin –**from specimen**
10. Isolation and characterization of microbial Plasmids for identification
11. DNA– Isolation from bones/teeth/tissues/saliva/hair root/ seminal stains/nails
12. PCR– amplifications and polyacrylamide gel electrophoresis and silver staining.
13. Differential centrifugation for separation of epithelial cell from sperm
14. Representation of Statistical data by a)Histograms b) Ogive Curves c) Pie diagrams
15. Determination of Statistical averages/ central tendencies. a) Arithmetic mean b) Median c) Mode
16. Determination of measures of Dispersion a) Mean deviation b) Standard deviation and coefficient of variation c) Quartile deviation
17. Tests of Significance-Application of following a) Chi- Square test b) t- test c) Standard error.
18. Use of computer software's for the statistical analysis (Past-3, Graph-Pad prism, etc)

Paper No.	Code	Title	Marks	Credits
XXXVIII	**MFSBS4P3**	**Dissertation**	**100**	**4**

Dissertation will be compulsory to all students. The format for dissertation report will be similar to the research thesis style; incorporating chapters on: Introduction, Materials and Methods, Results and Discussion and References / Bibliography. The dissertation will be submitted in a typewritten and bound form. Copy of each dissertation will be submitted to the respective department and the centre will store it permanently. Dissertation on forensically significant and need based problems in the area of Forensic Biology/Serology/DNA Profiling.

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

Specialization in Digital and Cyber Forensics

Paper No.	Code	Title	Marks	Credits
XXXII	**MFSDC4T1**	**Data Communication Network And**	**100**	**4**

		Network Security		

Unit I

Multi channel Data Communication Channels and Concept of multi channeling, Baseband and Broadband,

Multiplexing: FDM and TDM (Synchronous and asynchronous TDM), 2 Data Networks and Protocols Switching, Circuit Switching, Packet Switching and Message Switching.

Network Protocol: syntax, semantics and timings, The OSI model, 7-layers of n/w model, Functions of each layer

Unit II

Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link protocols, Sliding Window Protocols, Protocol Performance, Protocol Specification and verification

Network Layer : Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Internetworking.

Transport layer: Transport layer design issues, Connection management, A Simple transport on Top of X.25. Session Layer: Session layer design issues, Remote procedure call .

Unit III

Presentation layer: Presentation layer design issues, Abstract syntax notation1(ASN.1), Data compression techniques, Cryptography.

Application Layer: Application layer design issues, File Transfer, access and management, Electronic mail, Virtual Terminals.

Networks Architecture & Security: Network Scanning, Eavesdropping techniques and countermeasures. Network security including firewalls. Internet and E-commerce security issues.

Networks and vulnerabilities, networking software - Client side and server side, secure network infrastructure, security protocol layers, create usage policy, conduct risk analysis, security violation, restoration. Network security zone , encapsulation of network services, allocation of traffic control functions. Internal boundary systems.

Unit IV

Hardening a network - Basic services, extended services, Perimeter defense tools, Cryptographic tools, Systems penetration testing, Studying computer forensics issues associated with computer networks, telecommunications and distributed systems. Wireless Network

Security –Introduction and Standards, Vulnerabilities, Countermeasures, Management Issues of Wireless and Mobile Devices.

Reference Books:

1. Computer Networks by A.S Tannenbaum.
2. Data Communication and Networking :: Behrouz A. Forouzan; Mc-Graw Hill Pub.
3. Introduction to Digital and Data Communications, Michal A Miller, JAICO, publishing.
4. Data Communication and Networking: C.S.V. Murthy, Himalaya Publishing House

Paper No.	Code	Title	Marks	Credits
XXXIII	**MFSDC4T2**	**Pattern Recognition and Biometrics**	**100**	**4**

Unit-I

Introduction to pattern recognition, features and feaure vectors, concepts of learning: supervised, unsupervised and reinforced. Basic concepts of clustering and classification, classifiers: based on Bayseian decision theory, perceptron model, artificial neural networks, support vector machine, nearest neighbors. Principal component analysis and Linear Descriminant analysis.

Unit-II

Introduction and scope of biometrics, physiological and behavioral biometrics, characteristics of a biometric trait/system.Modules of a biometric system: verification and identification, Design and working of a generic biometric system. Criteria for performance evaluation, Advantages and limitations of a biometric system.

Fingerprint Biometric system: Acquisition process and sensors for fingerprint image capturing, features and feature extraction process for fingerprints, fingerprint matching and indexing.

Unit-III

Face Biometric system: Detection algorithm for facial images, Acquisition process for face biometric, features and feature extraction process for facial images, models for face recognition.
Iris Biometric system: structure and anatomy of iris, acquisition of iris images, segmentation of iris images, feature extraction process for iris biometric,Iris encoding and matching

Unit-IV

Speaker Recognition:Introduction to speaker identification, human vocal tract and production of speech sound, articulation and articulators, phonetics and accoustic basis of speaker identification, Text dependent and text independent approach, models for speaker recognition.

Multimodal biometrics: introduction and scope of multimodal biometrics, acquisition process and fusion algorithms.

Secuity issues: security issues for biometric systems.

Suggested Readings:

1. Pattern Recognition by Theodoridus
2. Biometrics by Anil jain and salil prabhakar

Paper No.	Code	Title	Marks	Credits
XXXIV	MFSDC4T3	Digital Forensics and Incident Response	100	4

Unit I

Introduction to Incident handling: Computer Security Incident, Types of incidents, Why necessary, Goals, Purpose, Organizational Roles. Incident Response Methodology

Preparing for incident Response- Identifying Risk, Preparing Individual Hosts, Preparing Network ,Establishing Appropriate Policies & Procedures, Creating Response Toolkit, Establishing an Incident Response Team.

Unit II

After detection of Incident- Overview of IR phases, documenting steps, Establisng an incident notification procedure, Recording Details After Initial Detection, Conducting Interviews, Formulating a Response Strategy.

Initial Response: Initial Response & Volatile Data Collection from Windows system - Initial Response & Volatile Data Collection from Unix system.
Forensic Duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic Duplicate/Qualified Forensic Duplicate of a Hard Drive.

Unit III

Storage And Evidence Handling : File Systems-FAT,NTFS - Forensic Analysis of File Systems - Storage Fundamentals-Storage Layer, Hard Drives.
Evidence Handling: Types of Evidence, Challenges in evidence handling, Overview of vidence handling procedure.

Unit IV

Network Forensics: Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing - Internet Fraud. Systems Investigation And Ethical Issues.
Data Analysis Techniques - Investigating Live Systems (Windows &Unix) - Investigating Hacker Tools - Ethical Issues – Cybercrime. Report Writing Guidelines, A Template for Digital and Cyber Forensics report.

Reference Books:

1. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”,Tata McGrawHill, 2006.
2. Peter Stephenson, “Investigating Computer Crime: A Handbook for Corporate Investigations”, Sept 1999.
3. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition, 2001.
4. Skoudis. E., Perlman. R. Counter Hack: “A Step-by-Step Guide to Computer Attacks and Effective Defenses”, .Prentice Hall Professional Technical Reference. 2001.
5. Norbert Zaenglein, “Disk Detective: Secret You Must Know to Recover Information From a Computer”, Paladin Press, 2000.
6. Bill Nelson,Amelia Philips and Christopher Steuart, “Guide to computer forensics and investigations”, course technology, Cengage Learning; 4thedition, ISBN: 1-435-49883-6, 2009.

Paper No.	Code	Title	Marks	Credits
XXXV	MFSDC4T4	Mobile and Digital Forensics	100	4

UNIT – I

Introduction To Wireless Technologies

Overview of wireless technologies and security: Personal Area Networks, Wireless Local Area Networks, Metropolitan Area Networks, Wide Area Networks.

Wireless threats, vulnerabilities and security: Wireless LANs, War Driving, War Chalking, War Flying, Common Wi-fi security recommendations, PDA Security, Cell Phones and Security, Wireless DoS attacks, GPS Jamming, Identity theft.

Security Framework For Mobile Systems - CIA triad in mobile phones-Voice, SMS and Identification data interception in GSM: Introduction, practical setup and tools, implementation- Software and Hardware

Mobile phone tricks: Netmonitor , GSM network service codes, mobile phone codes, catalog tricks and AT command set- SMS security issues.

UNIT - II

Mobile Phone Forensics: Crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card,

Operators systems- Android forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques.

UNIT - III

Introduction To Digital Forensics

Digital forensics: Introduction – Evidential potential of digital devices: closed vs. open

systems

Evaluating digital evidence potential- Device handling: seizure issues, device identification, networked devices and contamination.

UNIT - V

Analysis Of Digital Forensic Techniques

Digital forensics examination principles: Previewing, imaging, continuity, hashing and evidence locations- Seven element security model- developmental model of digital systems- audit and logs- Evidence interpretation: Data content and context.

Reference Books:

1.Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 2007.

2.Iosif I. Androulidakis, " Mobile phone security and forensics: A practical approach", Springer publications, 2012.

3.Andrew Hoog, " Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 2011.

4.Angus M.Marshall, " Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008.

Paper No.	Code	Title	Marks	Credits
XXXVI	**MFSDC4P1**	**Practical Based on MFSDC4T1 and MFSDC4T2**	**50**	**2**

List if Experiments:

Section A

1. Working with advance network diagnostic and connectivity commands
2. To study networking commands for foot print
3. To configure DSL and Router for Internet Connection
4. To study network cable crimping and configure LAN in a office
5. To study working of TCP/IP and DHCP
6. To shear printer, Local drive in network
7. Performing VLAN and routing configuration
8. Wireless networking and VPN configuration
9. Network administration services and security measure application
10. Detail MAC Analysis
11. Email header and URL analysis
12. Network filtering audit
13. Lan Scanner using look@LAN, wireshark.

14. Auditing with and without network traffic
15. Live Network evidence Capture process
16. To Install and configure windows server and Linux server

Section B

1. Write a MATLAB code for K nearest neighbor classifier.
2. Write a MATLAB code for Mahalanobis classifier.
3. Classify the given data using SVM classifier.
4. Enhance a fingerprint image using various filters.
5. Perform clustering over given data using k-mean clustering.
6. Segment a given iris image.
7. Implement voila-jones algorithm for face detection.
8. Write a MATLAB code for reading and writing an audio data.

Paper No.	Code	Title	Marks	Credits
XXXVII	**MFSDC4P2**	**Practical Based on MFSDC4T3 and MFSDC4T4**	**50**	**2**

List if Experiments:

1. Live system evidence Capture process
2. Advance Mobile device forensic analysis
3. Working on Cell phone tower site and Cell phone Hub
4. Recovery and backup data from Mobile Phone.
5. Recover WhatsApp Database
6. Recover data from SIM card
7. Recover Data From Memory Card
8. To study Mobile network
9. Drive and partition carving process
10. Advance firewall auditing
11. Auditing Authentication, Authorization, accounting and logging configuration
12. Intrusion detection and prevention configuration
13. Password encryption techniques
14. Performing Physical port audit
15. Password strength assessment
16. Software vulnerability analysis
17. Working with Winhex
19. Demonstrate Winhex software for recovering digital evidence, cloning disk with Winhex.
20. NetBIOS Enumeration Using NetView Tool, Nbtstat Enumeration Tool (Open Source).

21 How to Detect Trojans by using – Netstat, fPort, TCPView, CurrPorts Tool, Process Viewer.

22. Understanding DoS Attack Tools- Jolt2, Bubonic, Land and LaTierra, Targa, Nemesy Blast, Panther2, Crazy Pinger, Sometrouble, UDP Flood, FSMax.

Paper No.	Code	Title	Marks	Credits
XXXVIII	**MFSDC4P3**	**Dissertation**	**100**	**4**

Dissertation will be compulsory to all students. The format for dissertation report will be similar to the research thesis style; incorporating chapters on: Introduction, Materials and Methods, Results and Discussion and References / Bibliography. The dissertation will be submitted in a typewritten and bound form. Copy of each dissertation will be submitted to the respective department and the centre will store it permanently. Dissertation on forensically significant and need based problems in the area of Digital and Cyber Forensics.