

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, Digital and Cyber 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 Examination, Forensic Chemistry and Toxicology, Forensic Biology, Serology and DNA Finger Printing, Digital and Cyber Forensics and IT Security 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. XXXVIII of each specialization, in semester IV, this record/work of student shall be taken into account along with other parameters like, performance of the student in experimental work, field work required to carry out project etc. Institution(s) offering this course shall arrange study visit / field visit / on-site training etc. during the course.

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

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

I) Eighty (80%) seats shall be reserved for the eligible candidates those have obtained the B.Sc. Forensic Science degree from Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

II) Ten (10%) seats shall be reserved for the eligible candidate who has obtained the B.Sc. Forensic Science degree from the other University within the State of Maharashtra. One seat will be for open and the other seat will go for student having higher percentage from any reserved category.

III) Ten (10%) seats shall be reserved for the eligible candidate who has obtained the B.Sc. Forensic Science degree from the other State Universities and will be filled on the basis of merit.

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

<u>Minimum intake capacity for each specialization (M.Sc.-II):-</u> There shall be minimum 20% of the intake capacity of the students for each specialization.

<u>Allotment of specialization:-</u> 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 4th 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

Marks	Grade Point	Letter	Description
Obtained (%)		Grade	
90-100	9.00-10	0	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	В	Fair
45-49	4.50-4.90	C ⁺⁺	Average (Above)
41-44	4.1-4.49	С	Average
40	4.0	Р	Pass
< 40	0.0	F	Fail (Unsatisfactory
	0.0	AB	Absent

range of marks are shown in the following Table. **Table: Ten point grade and grade description**

- 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.

<u>Computation of SGPA (Semester Grade Point Average) and CGPA (Cumulative</u> <u>Grade Point Average)</u>

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

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.

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 4^{th} 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	f papers Total Marks		Total Credits				
		Theory	Practical	Theory	Practical	Total	Theory	Practical	Total
M.Sc. – I	SemI	06	06	450	150	600	18	09	27
(Common)	SemII	06	06	450	150	600	18	09	27
M.Sc. – II	SemIII	05	02	500	100	600	20	04	24
(Specialization)	SemIV	04	03	400	200	600	16	08	24
TOTAL		21	17	1800	600	2400	72	30	102

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

	SEMESTER – I Marks								
Paner	Paner	SEMIESTER – I Title	No. of	Hrs	Internal	External	Total		
No	Code	The	Credits	/week	(CIA)	(SEE)	Totai		
I I	MFS1T1	Advance Criminalistics	3	3	15	60	75		
II	MFS1T2	Toxicology & Forensic Chemistry	3	3	15	60	75		
ш	MFS1T3	Trajectory Physics and Forensic Ballistics 3 3				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		
		36	90	510	600				
		SEMESTER – II			Marks				
Paper	Paper	Title	No. of	Hrs.	Internal	External	Total		
No.	Code		Credit s	/week	(CIA)	(SEE)			
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)

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
1		TOTAL	4	4	25	75	100

Common papers to all specializations – Semester III

Specialization-I: Fingerprint and Questioned Document Examination

		SEMESTER – III			Marks			
Paper	Paper Code	Title	No. of	Hrs.	Internal	External	Total	
No.			Credits	/week	(CIA)	(SEE)		
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&	2	4		50	50	
		MFSQD3T2						
XXXI	MFSQD3P2	Practical based on MFSQD3T3&	2	4		50	50	
		MFSQD3T4						
	TOTAL 20 24					400	500	
SEMESTER – IV								
		SEMESTER – IV				Marks		
Paper No.	Paper Code	SEMESTER – IV Title	No. of	Hrs.	Internal	Marks External	Total	
Paper No.	Paper Code	SEMESTER – IV Title	No. of Credits	Hrs. /week	Internal (CIA)	Marks External (SEE)	Total	
Paper No. XXXII	Paper Code MFSQD4T1	SEMESTER – IV Title Advanced Document Examination	No. of Credits 4	Hrs. /week 4	Internal (CIA) 25	Marks External (SEE) 75	Total 100	
Paper No. XXXII XXXIII	MFSQD4T1 MFSQD4T2	SEMESTER – IV Title Advanced Document Examination Microscopy and Photography	No. of Credits 4 4	Hrs. /week 4 4	Internal (CIA) 25 25	Marks External (SEE) 75 75	Total 100 100	
Paper No. XXXII XXXIII XXXIII XXXIV	 Paper Code MFSQD4T1 MFSQD4T2 MFSQD4T3 	SEMESTER – IV Title Advanced Document Examination Microscopy and Photography Advanced Instrumentation	No. of Credits 4 4	Hrs. /week 4 4	Internal (CIA) 25 25 25 25	Marks External (SEE) 75 75 75 75	Total 100 100 100	
Paper No. XXXII XXXIII XXXIV XXXV	Paper Code MFSQD4T1 MFSQD4T2 MFSQD4T3 MFSQD4T4	SEMESTER – IV Title Advanced Document Examination Microscopy and Photography Advanced Instrumentation Forensic Pattern Recognition	No. of Credits 4 4 4 4	Hrs. /week 4 4 4 4	Internal (CIA) 25 25 25 25 25 25	Marks External (SEE) 75 75 75 75 75 75	Total 100 100 100 100	
Paper No. XXXII XXXIII XXXIV XXXV XXXV	 Paper Code MFSQD4T1 MFSQD4T2 MFSQD4T3 MFSQD4T4 MFSQD4P1 	SEMESTER – IV Title Advanced Document Examination Microscopy and Photography Advanced Instrumentation Forensic Pattern Recognition Practical based on MFSQD4T1&	No. of Credits 4 4 4 4 2	Hrs. /week 4 4 4 4 4 4	Internal (CIA) 25 25 25 25 25 -	Marks External (SEE) 75 75 75 75 75 50	Total 100 100 100 100 50	
Paper No. XXXII XXXIII XXXIV XXXV XXXVI	 Paper Code MFSQD4T1 MFSQD4T2 MFSQD4T3 MFSQD4T4 MFSQD4P1 	SEMESTER – IVTitleAdvanced Document ExaminationMicroscopy and PhotographyAdvanced InstrumentationForensic Pattern RecognitionPractical based on MFSQD4T1&MFSQD4T2	No. of Credits 4 4 4 2	Hrs. /week 4 4 4 4 4 4	Internal (CIA) 25 25 25 25 25 -	Marks External (SEE) 75 75 75 75 50	Total 100 100 100 100 50	
Paper No. XXXII XXXIII XXXIV XXXV XXXVI XXXVI	 Paper Code MFSQD4T1 MFSQD4T2 MFSQD4T3 MFSQD4T4 MFSQD4P1 MFSQD4P2 	SEMESTER – IVTitleAdvanced Document ExaminationMicroscopy and PhotographyAdvanced InstrumentationForensic Pattern RecognitionPractical based on MFSQD4T1&MFSQD4T2Practical based on MFSQD4T3&	No. of Credits 4 4 4 2 2	Hrs. /week 4 4 4 4 4 4 4	Internal (CIA) 25 25 25 25 - -	Marks External (SEE) 75 75 75 75 50 50	Total 100 100 100 100 50 50	
Paper No. XXXII XXXIII XXXIV XXXV XXXVI XXXVI	 Paper Code MFSQD4T1 MFSQD4T2 MFSQD4T3 MFSQD4T4 MFSQD4P1 MFSQD4P2 	SEMESTER – IVTitleAdvanced Document ExaminationMicroscopy and PhotographyAdvanced InstrumentationForensic Pattern RecognitionPractical based on MFSQD4T1&MFSQD4T2Practical based on MFSQD4T3&MFSQD4T4	No. of Credits 4 4 4 2 2	Hrs. /week 4 4 4 4 4 4 4	Internal (CIA) 25 25 25 25 - -	Marks External (SEE) 75 75 75 75 50 50	Total 100 100 100 50 50	
Paper No. XXXII XXXIII XXXIV XXXV XXXVI XXXVII XXXVIII	 Paper Code MFSQD4T1 MFSQD4T2 MFSQD4T3 MFSQD4T3 MFSQD4T4 MFSQD4P1 MFSQD4P2 MFSQD4P3 	SEMESTER – IVTitleAdvanced Document ExaminationMicroscopy and PhotographyAdvanced InstrumentationForensic Pattern RecognitionPractical based on MFSQD4T1&MFSQD4T2Practical based on MFSQD4T3&MFSQD4T4Research Project / Dissertation	No. of Credits 4 4 4 2 2 4	Hrs. /week 4 4 4 4 4 4 4 8	Internal (CIA) 25 25 25 25 - - 25 25 25	Marks External (SEE) 75 75 75 50 50 50 75	Total 100 100 100 50 50 100 100	

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

Specialization-II: Forensic	Chemistry and Toxicology
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SEMESTER – III					Marks		
Paper	Paper Code	Title	No. of	Hrs.	Internal	External	Total
No.			Credits	/week	(CIA)	(SEE)	
XXVI	MFSCT3T1	Forensic Toxicology	4	4	25	75	100
XXVII	MFSCT3T2	Advanced Chemistry-I	4	4	25	75	100
XXVIII	MFSCTT3	Spectroscopy	4	4	25	75	100
XXIX	MFSCT3T4	Analytical Chemistry and Chromatography	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				24	100	400	500
		SEMESTER – IV				Marks	
Paper	Paper Code	e Title	No. of	Hrs.	Internal	External	Total
No.			Credits	/week	(CIA)	(SEE)	
XXXII	MFSCT4T1	Forensic Drug Analysis	4	4	25	75	100
XXXIII	MFSCT4T2	Forensic Chemistry	4	4	25	75	100
XXXIV	MFSCT4T3	Advanced Chemistry-II	4	4	25	75	100
XXXV	MFSCT4T4	Methods of Chemical Analysis	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	XXXI MFSBS3P2 Practical based on MFSBS3T3& MFSBS3T4		2	4		50	50
TOTAL				24	100	400	500
	I	SEMESTER – IV	1			Marks	
Paper	Paper Code	e Title	No. of	Hrs.	Internal	External (SFF)	Total
No.			Credits	/week	(CIA)	(SEE)	100
	MFSBS4T1	Forensics in Botany, Entomology, Wildlife and Environment	4	4	25	75	100
XXXIII	MFSBS4T2	2 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, ForensicMedicine 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

		SEMESTER – III				Marks	
Paper	Paper Code	Title	No. of	Hrs.	Internal	External	Total
No.			Credits	/week			
XXVI	MFSCF3T1	OOPs using java	4	4	25	75	100
XXVII	MFSCF3T2	Forensic Image Processing	4	4	25	75	100
XXVIII	MFSCF3T3	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	Paper Code	e Title	No. of	Hrs.	Internal	External	Total
No.			Credits	/week			
XXXII	MFSCF4T1	Data Communication, Network and Network Security	4	4	25	75	100
XXXIII	MFSCF4T2	Pattern Recognition and Biometrics	4	4	25	75	100
XXXIV	MFSCF4T3	Digital Forensics and Incident Response	4	4	25	75	100
XXXV	MFSCF4T4	Mobile Computing	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
XXXVII	MFSCF4P3	Research Project / Dissertation	4	8	25	75	100
		TOTAL	24	36	125	475	600

M.Sc. - II (Semester III & IV) Specialization-IV: Digital and Cyber Forensics and IT Security

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

Introduction to research methodology, definition and basic concepts of research, objectives of research, motivation behind a research, types of research, research process: defining research problem, review the literature, formulation of hypothesis, research design, collection and analysis of data, interpretation and writing a report. Criteria for a good research, measuring research impact and quality: JCR report, impact factor and citation index, ethics and scientific conduct, Ethics in human and animal studies.

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, publication processes; presentation of research: oral and poster presentations, presentation in conferences and symposia; presentation and submission of research proposals to the funding agencies.

A brief idea about government research agencies including DBT, DFSS, DST, ICMR, CSIR, UGC, BPR&D, and DRDO.

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 coefficient 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, chisquare test, F-test and ANOVA.

Software related to statistical analysis: MS-Excel, SPSS etc.

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.

SPECIALIZATION IN FINGERPRINT AND QUESTIONED DOCUMENTS EXAMINATION SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER –III

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.

Secretory glands: Eccrine (Inorganic, Organic etc.), Sebaceous (Fatty acids, Phospholipids, Wax esters, Sterols, Squalene etc.) and Apocrine. Variation of secretion with age, Composition of Latent Print residue by different agencies (UK Home Office, Oak Ridge National Library, Pacific Northwest National Library, Savannah River Technical Center research, Forensic Science Services, etc).

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 and reflected UV imaging.

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

Unit III: Chemical techniques

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

Development of prints on challenging surfaces (thermal paper, gloves, guns, cartridges, wet surfaces, adhesive tape, and skin), Enhancement of bloody prints. Effect of fingerprint detection techniques on subsequent DNA profiling. Age estimation of latent prints.

Unit IV: Comparison and Examination

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

Palm prints: Cumins and Midlo classification systems and its significance.

Edgeoscopy : Chatterjee classification

Poroscopy : Significance in personal identification.

Fundamentals of comparison: print-to-print, trace-to-record, trace-to-print, trace-to-trace comparison. ACE-V examination method, documentation (Primary, secondary & tertiary custody documentation).

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, plant tissue: vascular and ground, types of wood: hard and soft wood, cellulose: alpha and beta, hemicelluloses, lignin, polysaccharides etc.

Paper making process: history of paper making, raw materials, pulping: introduction, methods of pulping, mechanical pulping, chemical pulping, pulp bleaching, pressing, drawing and sheet formation process, chemical treatment.

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, microscopic examination: color reaction to different fibers, Herzberg staining and Graff-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: nigrosine ink, logwood ink, iron nut gall ink, fountain pen ink, ball pen ink, gel pen ink, printing inks. Chemical ingredients of ink: vehicle, binder, colorant and additives (humctant, surfactant, anti-foaming agent, anti-bacterial, pH modifier, and others). Ink formulation.

Ink analysis: introduction, preliminary examination, ink color assessment, pen line microscopy, microscopic specular reflectance, video spectral analysis, identification and comparison of ink by spectroscopic (UV Visible, FTIR, Raman spectroscopy, Mass spectroscopy and laser induce fluorescence methods) and chromatographic (TLC, HPTLC and HPLC) methods.

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: Printing technologies

History and Introduction of Industrial Printing. Principle and Mechanism of: Offset Lithography, Letterpress, Flexography, Gravure Printing, Screen Printing, Engraving, Thermography, Reprography.

Security Printing Techniques: Holograms, UV Visible Printing, Rainbow Printing, Microprinting, Gullioche, Line Printing, Embossing, UV Thread, Bar Coding.

Analysis of Printed Matters: Visual and Microscopic Examination, Thermal Methods: DSC, TGA, DTA, Instrumental: HPLC, XRD, SEM, TEM, STEM, AFM, etc.

Unit-IV: Typewriters, Digital Printers and Photocopiers

Typewriters: History and Introduction of Typewriters, Mechanism of typewriting, Types of crimes including typewriters, Forensic Examination of Typewritten matter: Visual, Microscopic and Examination of Ink.

Digital Printers: Introduction and history of digital printer, types of printer, Impact and Nonimpact printing technologies: dot matrix printer, daisy wheel, ink jet continuous and drop on demand (DOD), thermal, laser printer etc.,

Components and working mechanism of: Dot matrix Printer, Ink jet printer, Laser printer and Variable Data Printers.

Forensic examination of dot matrix, ink jet, laser.

Photocopier: History of xerography, Components and working process of photocopier. Kinds of forgery by photocopy, inquiry related to photocopy, forensic examination 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:

Human Nervous System, Broadmann's area, 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.

Unit-II Neural Abnormality and motor control:

Neurological disease and motor control: Parkinson's disease, Palsy and Corticobasal degeneration, Essential tremors, Multiple System atrophy, Multiple Sclerosis, Huntington's disease, Lower Moto neuron Disease, Alzheimer's disease.

Psychotropic Medication and motor control.

Ageing and motor control.

Unit-III Handwriting systems and factor affecting Handwriting:

History of Questioned Document Examination, Origin of Alphabet, Writing Systems (Indian, American, English, French, etc.), Development of Handwriting, Factors Affecting the Development of Handwriting, Basis of Handwriting Identification, Handwriting Characteristics.

Factors influencing handwriting: Different writing system, Physical Impedance, Neurological disease and handwriting, Effect of psychotropic medication on handwriting, Substance abuse and handwriting, Aging and Handwriting, Genetic Factors, Accidental, Circumstantial, Deliberate.

Unit-IV Handwriting/Signature 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. Kinematics of signature authentication: Isochrony in genuine, simulated and forged signatures, stroke direction, etc.

Suggested Readings:

- 1. Caliguri M P and Mohammed LA, Neuroscience of Handwriting, CRC Press.
- 2. Huber, A. R. and Headrick, A.M. (1999) : Handwriting identification : facts and fundamental CRC LLC
- 3. Ellen, D (1997) : The scientific examination of Documents, Methods and techniques. 2nd ed., Taylor & Francis Ltd.
- 4. Morris (2000) : Forensic Handwriting Identification (fundamental concepts and Principals)
- 5. Harrison, W.R. : Suspect Documents & their Scientific Examination, 1966, Sweet & Maxwell Ltd., London.
- 6. Hilton, O : The Scientific Examination of Questioned Document, 1982, Elsaevier North Holland Inc., New York.
- 7. Sulner, H.F. : Dispated Document, 1966 Oceana Publications Inc., New York.
- 8. Saxena's : Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery, Central Law Agency, Allahabd (Ed. A.K. Singla).
- 9. Quirke, A.J. : Forged, Anonymous & Suspet Documents, 1930, Reorge Rontledge & Sons Ltd., London.
- 10. Osborn, A. S. : Questioned Documents 1929, Boyd Printing Co., Chicago.
- 11. Levinson, J: Questioned Documents, 2000, Academic Press, Tokyo.
- 12. Kelly, J.S and Lindblom, B.S: Scientific Examination of Questioned Documents, 2006, Taylor & Francis, New York.
- 13. Brunelle, R.L. and Reed, R.W: Forensic Examination of Ink and Paper, 1984, Charles C Thomas Publisher, U.S.A.
- 14. 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 coordinate 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 MATLAB Programming

Introduction to MATLAB programming, The MATLAB environment, data type and its representation, variables and arrays, initializing variables in MATLAB, multidimensional array, displaying output data, data files, scalar and array operations, hierarchy of operations, MATLAB scripts and functions (m-files), built-in MATLAB functions, introduction to Plotting, 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
- 5. A Guide to MATLAB for Beginners to Experienced Users: Brian R. Hunt, Ronald L. Lipsman Jonathan and M. Rosenberg.

- 6. MATLAB Primer: Timothy A. Davis and Kermit Sigmon
- 7. MATLAB Programming for Engineers: Stephen J. Chapman

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

List of Experiments

(Minimum 12 experiments)

- 1. To develop Latent prints by Cyanoacrylate fuming
- 2. To develop latent prints by SPR method
- 3. To develop fingerprints on challenging surfaces
- 4. To study the effect of environment on fingerprint development
- 5. To classify fingerprint cards by FBI Henry's classification system
- 6. To classify fingerprint cards by Indian Henry's classification system
- 7. To classify fingerprint card by NCIC classification system
- 8. To classify fingerprint cards by Argentine classification system
- 9. To compare chance prints with a known prints
- 10. To make pulp for paper sheet formation through Kraft method.
- 11. Preparation of paper sheet through recycled paper.
- 12. Identification and detection of different types of ink through instrumental techniques.
- 13. Microscopic examination of different types of ink.
- 14. Identification of source of photocopier machine by examination photocopied documents.
- 15. Identification of different types of printing technology on documents.
- 16. Identification and detection of type written matter on documents.

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

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 study 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

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SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER –IV (Specialization in Fingerprint and Questioned Documents Examination)

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, Types of Auditing.

Unit II: Forensic Linguistics and stylistics

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 forgeryalteration, 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. <u>Tommie W. Singleton</u>, <u>Aaron J. Singleton</u> 2010 <u>Fraud</u> Auditing <u>and</u> 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. <u>Mary-Jo Kranacher, Richard Riley, Joseph T. Wells</u> 2010 Forensic Accounting <u>and Fraud</u> <u>Examination</u>.
- 5. <u>Steven L. Skalak, Thomas W. Golden, Mona M. Clayton</u> 2011 <u>A Guide to Forensic Accounting Investigation</u>
- 6. <u>Larry E. Rittenberg</u>, <u>Karla M. Johnstone</u>, <u>Audrey A. Gramling</u> 2011 Auditing: <u>A Business</u> <u>Risk Approach</u>
- 7. <u>George A. Manning, Ph.D, CFE, EA</u> 2010 <u>Financial Investigation and Forensic</u> Accounting, <u>Second Edition</u>
- 8. <u>Saurav K. Dutta</u> 2013 Statistical <u>Techniques for</u> 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: Basic Optics:

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

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

Unit-II: Optical Microscopy

Basic Principle, Instrumentation, Working and Applications of: 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

Basic principle, Instrumentation, Working and Applications of: Scanning Electron microscope, Cryo-SEM, Scanning Probe Microscope, Scanning Tunneling Microscope, Transmission electron microscope, Scanning transmission electron microscope, Electron tomography, 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, Color theory, image formats.

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

Suggested Readings:

- 1. Concept of Quantum Optics, P L Knight, L Allen, Pregamon Press.
- 2. Basic Optics: Principle and Concepts, Avijit Lahiri, Elsevier 2006.
- 3. Optics and optical instruments, B K Johnson, Dover Publication inc.

- 4. Optics and optical instruments, Dionysius Lardner, LULU Press 2010.
- 5. The Microscope Book, Shar Levine, Sterling Publishing Company.
- 6. An Introduction to the theory and use of microscope, C R Mashall, Read Books 2007.
- 7. Light and Electron Microscopy, Elizabeth M Slayter, Henry S Slayter, Cambridge University Press.
- 8. Scanning Tunelling Microscope and its applications(Second revised edition), C Bai, Springer.
- 9. Scanning electron Microscope(Second edition), L Reimer, Springer.
- 10. Practical Electron Microscopy, Elaine Hunter, Cambridge university press.
- 11. The principle and practice of electron microscopy(Second edition), Ian M Watt, Cambridge university press.
- 12. Optical imaging and Microscopy, Peter Torok and Fu Jen Kao, Springer.
- 13. Fundamental of Light Microscopy, Michael Spencer, Cambridge University Press.
- 14. Physical Principles of Electron Microscopy, Ray F Egerton, Springer.
- 15. Analytical and quantitative methods in microscopy, G A Meek, H Y Elder, Cambridge University press.
- 16. Photography, John Freeman, Collins and Brown.
- 17. A concise history of photography, Helmut Gernsheim, Dove publications.
- 18. Optics in Photography, Rodolf Kingslake, Spie optical engineering press.
- 19. Digital Photography, Ken Milburn, OReillly press.
- 20. Basic Photography, Michael Langford, Focal Press.
- 21. Magic: Stage illusions, special effects and trick photography, Albert A Hopkins, Diver
- 22. Color Theory, Patti Mollica, Walter Foster Publishing.

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

Mass Spectroscopy: principle, theory and instrumentations and 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;

Introduction to hyphenated techniques: GC-MS, LC-MS and other hyphenated techniques

Unit-IV Instruments related to Elemental Analysis

Atomic Absorption/Emission Spectroscopy: Introduction, Basic principles, Instrumentation and Techniques, Interference in AAS-Background correction methods, 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.

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.

Suggested readings:

- 1. Introduction to Molecular Spectroscopy By Gordon M. Barrow
- Instrumental Methods of Analysis By Willard, H.H., Merritt, L.L. Jr., Dean, J.A., Settle, F.A. Jr.
- 3. Principles of Instrumental Analysis By D.A. Skoog, F.J. Holler, T.A. Nieman.
- 4. Advances in Forensic Science, (Vol. 2) Instrumental Analysis By Lee & Gaensslen
- 5. Spectroscopy of Organic compounds By P. S. Kalsi.
- 6. Handbook of Instrumental Techniques for Analytical Chemistry By Settle, F.A.
- 7. Advances in chromatography By Brown, P.R.
- 8. The use of X-ray Techniques in Forensic Investigation By Grahm D.
- 9. Quantitative Chemical Analysis By D.C. Harris.

- 10. Instrumental Methods of Chemical Analysis By G.W. Ewing.
- 11. Instrumental Analysis By G.D. Christian and J.E. O'Reilley.
- 12. Spectrochemical Methods of Analysis By J.D. Ingle and S.R. Crouch.

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 feature vectors, concepts of learning: supervised, unsupervised and reinforced. Basic concepts of clustering and classification, classifiers: based on Bayesian 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 and scope of automated document examination; modules for automated document examination.

Automated analysis of ink and paper: acquisition of data, extraction of features, comparison and identification.

Automated analysis of torn documents: extraction of data, feature extraction, comparison and matching.

Automated analysis of charred documents: acquisition of data and enhancement of charred document.

Unit-III: Automated Handwriting Examination

Introduction to automated handwriting examination, acquisition of handwriting data, preprocessing 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	50	2
		MFSQD4T2		

List of Experiments:

(Minimum 12 experiments)

- 1. To study the different camera controls.
- 2. Document photographic techniques Close up photography, UV, IR, Transmitted and oblique light photography
- 3. Contact and trick photography.
- 4. Preparation of Juxtapose charts.
- 5. Photography of Watermarks and wire marks..
- 6. Analysis of samples using optical microscope.
- 7. Analysis of samples using Comparison microscope.
- 8. Photography of secret writings.
- 9. Application of Forensic Stylistics in personal identification.
- 10. To Study the stylistics features.
- 11. To study the linguistic features.
- 12. To identify account fraud.
- 13. To identify anomalies in entry registers.

Paper No.	Code	Title	Marks	Credits
XXXVII	MFSQD4P2	Practical Based on MFSQD4T3 and	50	2
		MFSQD4T4		

List of Experiments:

(Minimum 12 experiments)

- 14. To perform TLC analysis of ink of various pens (2).
- 15. To perform TLC analysis of toners (2).
- 16. To perform FT-IR analysis of handwriting strokes/printed documents (3).
- 17. To perform FT-IR analysis of currency and other security documents (2).
- 18. To perform UV-Vis analysis of various ink dyes.
- 19. To extract features from handwritten documents/signature (2).
- 20. To classify data using various classifiers (3).
- 21. To enhance charred document images.
- 22. To study a pattern recognition framework for ink analysis
- 23. To study a pattern recognition framework for paper analysis
- 24. To study a pattern recognition framework for signature verification.
- 25. To study a pattern recognition framework for Handwriting Examination.
- 26. To study a pattern recognition framework for fingerprint examination
- 27. To study a pattern recognition framework for matching of torn documents.
- 28. To enhance various fingerprint images.
- 29. To apply various pattern recognition operators.

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.

SPECIALIZATION IN FORENSIC CHEMISTRY AND TOXICOLOGY SYLLABUS FOR M.Sc.-II FORENSIC SCIENCE - SEMESTER –III

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

Unit-I Introduction to Forensic Toxicology

Introduction and scope of Forensic Toxicology, classification of poisons: based on their origin, mode of action, chemical nature; classification of poisoning: accidental, homicidal, suicidal and miscellaneous, nature of poisons and poisoning in view of Indian scenario, sign and symptoms of various poisons and their antidotes, factors affecting poisoning, medico-legal aspects in poisoning.

Collection, handling and preservation of viscera, blood, urine and other biological samples in poisoning cases, submission of samples into the laboratory, interpretation of toxicological findings and preparation of reports, limitation of methods and trouble shooting in toxicological analysis, disposal of unused samples pertaining to toxicological analysis.

Unit II: Plant and animal poisons

Plant poisons: Nature, active constituents, mode of action, extraction, isolation and identification of the following:

- Abrusprecatorius, Calotropisgigantea, Croton tiglium, Argemone Mexicana.
- Atropa belladonna, Cerberathevetia, Daturafastuosa, Ricinuscommunis.
- Semicarpusanacardium, Digitalis purpurea, Aconitum napellus, Plumbagorosea.

Animal Poisons: classification of snakes, snake venom: composition, mode of action and tests for identification.

Food Poisoning: classification: bacterial and non-bacterial, bacterial: infection type, toxin type and botulism, nonbacterial: viruses, fungus and poisonous foods.

UnitIII: Extraction and Identification Methods-I

Extraction: Introduction and fundamental principles of extraction, pre-conditions of extraction, types of extraction methods: liquid-liquid extraction, solid-phase extraction and micro-extraction; Isolation and clean-up procedure.

Extraction and isolation of metallic poisons from various biological matrices by dry ashing, wet digestion and microwave digestion methods and their subsequent identification by Reinsch's test, Gutzeit Test and instrumental techniques.

Extraction of toxic anions from biological matrices by dialysis method and their identification using color tests and other methods.

UnitIV: Extraction and Identification Methods-II

Extraction of alkaloids from various matrices using stass-otto, modified stass-otto and ammonium sulphate methods.

Basic concepts of insecticides and pesticides and their classification, Extraction of organophosphorus, carbamates and organochlorine compounds from various biological matrices including viscera, blood and urine and their subsequent identification using color tests and instrumental techniques.

Extraction of volatile poisons including alcohol from various matrices and their subsequent identification.

Extraction of gaseous poisons including ammonia, phosphine, sulfur dioxide, hydrogen sulphide, chlorine from various Biological matrices and their subsequent identification.

Carbon monoxide poisoning: sample collection, extraction of sample and tests for identification.

Suggested Readings:

- 1. Drugs, Poisons, And Chemistry- Suzanne Bell
- 2. Clarke's Analytical Forensic Toxicology- Adam Negrusz and Gail AA Cooper
- 3. Casarett and Doull's Toxicology: The Basic Science of Poisons- Curtis D. Klaassen
- 4. Fundamentals of Analytical Toxicology- Robert J Flanagan, Andrew Taylor, Ian D Watson and Robin Whelpton.
- 5. Analysis of Plant Poisons- M. P. Goutam and Shubhra Goutam.
- 6. Clarke's Analysis of Drugs and Poisons: In Pharmaceuticals, Body Fluids and Postmortem Material, Volume 1 and 2- Anthony C. Moffat, M. David Osselton, B. Widdop.

	Code	Title	Marks	Credits
XXVII	MFSCT3T2	Advanced Chemistry	100	4

UNIT I: Stereochemistry and Bonding in Main Group Compound

VSEPER

Shape of simple inorganic molecules and ions containing lone pairs, Various stereochemical rules and resultant geometry of the compounds of non-transitional elements, Short coming of VSEPR model. Bent rule and energetic of hybridization.

Molecular Orbital Theory

Introduction , Molecular orbital representation of polyatomic molecules with special reference to C_2H_4, C_2H_6 and CO and delocalised molecular orbital of ozone, Carbon dioxide, Nitrite, Nitrate and Benzene.

Coordination chemistry

Introduction, important terms involved in coordination compounds, EAN Rule IUPAC nomenclature (Complex cation, anion, naming ligands).

UNITII: Stereochemistry

Stereo chemical Principle – Enantiometric relationships, diastereomeric relationships, R and S, Optical activity in absence of chiral carbon (biphenyl, allenes and spiranes). Stereochemistry of the compounds containing N, P and Sulphur. E and Z nomenclature, prochiral relationship, stereo-specific and stereo selective reactions.

Conformational analysis of cycloalkanes (5–8 membered rings), decalines, effect of conformation on reactivity, steric strain due to unavoidable crowding. Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, method of resolution, optical purity, enantiotopic and distereotopic atoms, groups and faces, stereo specific and steroselective synthesis.

UNIT III: Reaction mechanism: Structure and Reactivity

Types of mechanism, Types of reaction, Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects.

Reactive Intermediates

Classical and non-classical carbocations, Carbanions, radical anions and radical cations, Carbenes, nitrenes and arynes. General methods of generation, detection and reactivity of these intermediates. Singlet oxygen, it's generation and reactions with organic substrates. **Effect of Structure on reactivity**

Resonance and field effects, Steric effect, Conjugation, cross conjugation, hyper conjugation, tautomerism, inductive effect quantitative treatment.

Aliphatic nucleophilic substitution

The SN_1 , SN_2 , mixed SN_1 , SN_2 and SET and SNi mechanisms. Nucleophilicty, effect of leaving group, ambient nucleophiles and ambient substrates regiospecificity. The neighbouring group. Participation mechanisum, substitution at allylic and vinylic carbon atoms.

UNIT: IV Solid State Chemistry

Introduction, definition of space lattice unit cell, laws of crystallography Symmetry elements in crystal, Crystalline and amorphous solids, crystal structures simple cubic, body centred cubic and face centred cubic, Properties of ionic solids, packing arrangements of anions in an ionic solids, Voids in crystal structure- tetrahedral and octahedral, Ionic radius, univalent and crystal radii, Conversion of univalent radii to crystal radii, problems based on conversion of radii, Radius ratio effect, Lattice energy, Born-Lande equation, Born Haber cycle and its applications, Schottky and Frenkel defect. X-ray diffraction in crystals derivation of brag equation, determination of crystal structure of NaCl And CsCl.

Colloidal State

Introduction definition of colloids Classification of collides, Sols Properties of sols kinetic optical electrical stability of colloids Hardy-Schulze law and gold no. Emulsion types of emulsion emulsifier, gel classification, preparation and Properties, applications of colloids.

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 : Scientific 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.
- 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
XXVIII	MFSCT3T3	Spectroscopy	100	4

Unit I:

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-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 Spectrometry: Introduction, Review of Mass spectrometry, Basic Principles and Theory, Instrumentations and technique, Ionization methods, Fragmentations in Mass spectrometry, selected ion monitoring

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 : Scientific 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.
- 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	Analytical Chemistry and Chromatography	100	4

Unit I: Basic concepts

Basic concepts in analytical, qualitative and quantitative methods; Classification of analytical methods, an overview of analytical methods, types of instrumental methods, instruments for analysis, data domains, electrical and non-electrical domains, detectors, transducers and sensors, selection of an analytical method, accuracy, precision, selectivity, sensitivity, detection limit and dynamic range, classification of techniques: calibration curve, standard addition and internal standard methods.

Unit II:

Concentration of a solution based on volume and mass units. Calculations of ppm, ppb and dilution of the solutions, concept of mmol. Stoichiometry of chemical reactions, concept of kgmol, limiting reactant, theoretical and practical yield. Solubility and solubility equilibria, effect of presence of common ion. Calculations of pH of acids, bases and acidic and basic buffers. Concept of formation constants, stability and instability constants, step wise formation constants.

Unit III: Chromatographic Technique

Chromatography: Introduction, Review of basic principles and types of chromatography. column efficiency, plate and rate theories, resolution, selectivity and separation capability, Van Deemter equation

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.

TLC: Principle, Theory and instrumentation, visualization, Qualitative and Quantitative concepts and 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 : Scientific 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.
- 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	50	2
		MFSCT3T2		

List of Experiments

(Minimum 12 practical)

- 1. Analysis of phenolphthalein in trap cases by TLC and color tests (2).
- 2. Analysis of Phenolphthalein in trap cases by UV and FTIR (2)
- 3. Analysis of Phenolphthalein in trap cases by HPLC.
- 4. To study the thermal behavior of calcium carbonate by TGA.
- 5. To study the thermal behavior of fibre thread by TGA.
- 6. Detection of explosive content from given sample by HPLC
- 7. Extraction and identification of Benzodiazepine (alprazolam) from stimulated copy sample.
- 8. Detection of Benzodiazepine (alprazolam) by UV, FTIR, HPLC (3).
- 9. Detection of cholesterol by UV, FTIR, HPLC (3).

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

List of Experiments

(Minimum 12 practical)

- 1. Separation of organic binary mixture. (minimum 5 and maximum 6)
- 2. To prepare Aspirin from salicylic acid and identification by TLC and M. P. (2)
- 3. Preparation of Benzanilide from Benzophenone.
- 4. Preparation of p- nitroaniline from Acetanilide.
- 5. Estimation of Vitamin "C" Iodometrically in biological fluids.
- 6. To determine the dissociation constant of Cu (II) and Fe (III) solution photometrically .
- 7. Determination of percentage of number of hydroxyl group in an organic compound by acetylation method.
- 8. Determination of Fe^{3+} spectrophotometrically with thiocynate using isobutanol as extracting agent.
- 9. To determine sulphate ions by turbidometry.
SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER –IV Specialization in Forensic Chemistry and Toxicology

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

Unit-I Drugs of abuse

Introduction to drug of abuse; drug dependence, drug addiction and its problems; classification of drug of abuse: depressant, stimulant and hallucinogen. Depressants: opium and opioids, barbiturates and benzodiazepines. Stimulants: cocaine, nicotine and amphetamines. Hallucinogens: Cannabis and its derivatives, Phencyclidine and LSD.

Unit-II: Drugs of abuse in sports

Introduction of drugs of abuse in sports, 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

Unit-II Forensic Pharmacology

Introduction to Forensic Pharmacology, routes of drug administration, Pharmacokinetics: membrane transport, absorption and distribution, metabolism and excretion of drugs. Pharmacokinetics parameters: clearance, volume of distribution, bioavailability and half-life. Therapeutic drug monitoring. Pharmacodynamics: mechanism of drug action. Adverse drug effect.

Unit-III Extraction and analysis of drug from various matrices

Methods of extraction of drugs (from all the three major classes) from various matrices including viscera, stomach wash, vomit, urine, blood, suspected drinks/foods; subsequent detection and quantification of extracted drugs from spot test and instrumental methods.

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).
- 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	Forensic Chemistry	100	4

Unit I: Forensic Analysis of Explosive

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: Investigation of Arson and Fire

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, labeling and forwarding of exhibits, methods of extraction from exhibit-direct extraction, distillation and micro diffusion methods, analysis of arson exhibits by color test, TLC, Head-space GC and GC-MS.

Unit III: Forensic Examination of Dyes, Fertilizers and Trap cases

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

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.

Trap cases: Introduction and forensic significance, trap chemicals: phenolphthalein and anthracene, 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.

Unit-IV Analysis of petroleum products and beverages

Petroleum: Origin, Composition, Refining, Reforming, Fractionation, Cracking, Knocking, Octane number, Cetane number; Introduction to Petroleum Products, Properties and Testing of Petroleum Products; Analysis of Petrol, Kerosene and Diesel as per BIS/ASTM Specifications. **Analysis of Beverages:** Alcoholic and non-alcoholic beverages and their composition, Analysis of alcoholic beverages as per BIS specifications.

Suggested Readings:

- 1. Systematic Quality Management Gary B Clark. (1995) Practical Laboratory Management Series.
- 2. Froede, R. C.: The Laboratory Management of the Medico-Legal, Specimen Analytical Chemical Laboratory Sciences.
- 3. DFS Working Procedure Manual- Chemistry, Explosives and Narcot ics.
- 4. Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi (2005)
- 5. Jehuda Yinon; Forensic and Environmental Detection of Explosives
- Yinon Jitrin; Modern Methods & Application in Analysis of Explosives, John Wiley & Sons England (1993)
- Houck, M. M. & Siegel, JA; Fundamentals of Forensic Science, Acadamic Press, London, 2006.
- 8. Asthana N.C and Nirmal Anjali; The Ultimate Book Of Explosives, Bombs and I E Ds ,Pointer Publishers (2008).
- 9. Suceska, T; Test Methods for Explosives, Springer (1995).

Paper No.	Code	Title	Marks	Credits
XXXIV	MFSCT4T4	Advance chemistry II	100	4

UNIT I Metal ligand Bonding

CFT

Crystal Field Theory Splitting of d-orbital in low symmetry environments, Structural effects of orbital splitting. Jahn Teller effects, tetragonally distorted octahedral complexes. Thermodynamic effects, crystal field stabilization energies (CFSE's) for octahedral and tetrahedral complexes, correlation of crystal field stabilization energy with the related thermodynamic properties such as lattice energies, enthalpies of hydration, formation constants, stabilization of unusual oxidation states and ionization energies, Limitations of crystal field theory.

Metal pi-Complexes:

Metal carbonyls: Structure and bonding, vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls, Metal nitrosyl, structure and bonding. Dinitrogen and dioxygen complexes; Wilkinson's catalyst and Vaska's compound

UNIT II Reaction Mechanism

Aromatic Nucleophilic Substitution

A general introduction to different mechanisms of aromatic nucleophilic substitution SNAr, SN1, Benzyne and SRN1 mechanisms. Reactivity effect of substrate structure leaving group and attacking nucleophile. The Von Richter, Sommlet-Hauser and Smiles rearrangements.

Elimination Reactions

The E1,E2 and E1CB mechanisms orientation of the double bond. Saytzeff and Hoffman's rule. Effect of substrate structure, attacking base, leaving group and medium. Pyrolytic elimination mechanism and orientation. Cleavage of quaternary ammonium salts. Conversion of vicinal dihalides and nitro compounds to alkenes.

AROMATIC ELECTROPHILLIC SUBSTITUTION

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The o/p ratio, ipso attack, orientation in benzene ring with more than one substituents, orientation in other ring system. Diazonium coupling, Gatterman-koch reaction, Pechman reaction, Houben –hoesch reaction.

UNIT III : Oxidation-Reduction and Electrontrasfer reactions

Oxidation: Principle, aromatisation, dehydration yielding C=C ,oxidation aldehyde, ketone, cleavage of C-C single bond in glycols, ozonolysis, epoxidation, oppenauer oxidation, sommelet reduction.

Reduction: Selectivity in reduction, reduction of nitro and nitroso compounds, metal hydride reduction, dissolving metal reduction, reduction of aldehydes, ketones to alcohols, reduction of carbonyl group to methylene.

Electron transfer reaction: Selective oxidation of alkyl side chain in aromatic compounds, alcohols and acid using Co(III), Reduction with LiAlH4 ,NaBH4.

UNI- IV Electrochemistry

Types of reversible electrode: Gas-Metal Ion, Metal-metal Ion, Metal-Insoluble Salt Anion and Redox Electrodes, Nernst Equation, Definition of pH and pKa, Determination of pH using standard hydrogen electrode(SHE) and glass electrode by potentiometric method Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action, conductometric titrations. EMF of cells, reversible cells, single electrode potential, reference electrodes, cell reaction and e.m.f. thermodynamic relationship, Calculation of cell EMF from single electrode potentials. Definition and applications of electromotive series. Electrochemical theory of corrosion, corrosion due to dissimilar metals.

Nano Chemistry: Introduction to nano material, Synthesis of methods (high emergency ball milling, physical vapour deposition, chemical vapour deposition, micro emulation), Synthesis using micro organism and plant extract, Characterisation using SEM (Scanning electron microscope) and TEM (Transmission electron microscope), properties (elastic, hardness, thermal stability), Application (Energy source, Automobile, Textile, Cosmetics, Medicines)

Suggested Readings:

1) Introduction to Instrumental Analysis by R. D. Broun, Mc Graw Hill (1987)

2) Instrumental methods of chemical analysis by H. willard, L.Merrit, J.A. Dean and F.A. settle. Sixth edition CBS (1986)

3) Fundamentals of Analytical Chemistry, 6th edition, D.A. Skoog, D.M. West and F.J. Holler, Saunders college publishing.

4) Principles of Instrumental Analysis, Skkog, Holler, Nieman, (Sixth Ed.)

5) Vogel's Textbook of Quantitative analysis 6th Ed. 7

6) Modern analytical techniques in the pharmaceutical and bio analysis By Dr. Istvan Bak (Book Available Online).

7) Preparative chromatography Chrome Ed. book series, Raymond P. W. Scott (free e book available on internet)

8) Extraction technique in analytical science, John R. Dean, Wiley (2009)

9) Practical HPLC method Development, Snyder, Kirkiand, Glajch, Wiley India Pvt.

10) Standard methods of chemical analysis, Sixth Edition, F.J. Welcher.

11) Quantitative Inorganic Analysis including Elementary Instrumnetal analysis, By A. I. Vogel, 3ed, ELB

12) Introduction to instrumental analysis by R. D. Braun, MC. Graw Hill- International edition.13) Analytical spectroscopy by Kamalesh Bansal- First edition.

3) Instrumental methods of chemical analysis by Willard, Dean and Merittee- Sixth edition.

14) Analytical chemistry principles by John H. Kenedey- Second edition, Saunders college publishing.

15) Spectroscopic identification of organic compounds Fifth Ed., Silvestrine, Bassler, Morrill, John Wiley and son

Paper No.	Code	Title	Marks	Credits
XXVI	MFSCT3T1	Methods of Chemical Analysis	100	4

UNIT: I

Classical approach for aqueous extraction: Introduction, Liquid-Liquid extraction (LLE) (Theory of LLE, selection of solvents, solvent extraction, problems with LLE process), purge and trap for volatile organics in aqueous samples

Solid Phase extraction (SPE): Introduction, Types of SPE media, SPE formats and apparatus, method for SPE operation, solvent selection, factors affecting SPE, selected methods of analysis for SPE, Automation and On-Line SPE

Solid phase micro-extraction:

Introduction, theoretical considerations, experimental, Methods of analysis: SPMEGC, Methods of analysis: SPME-HPLC-MS, Automation of SPME, New development in micro extraction (liquid micro extraction, membrane micro extraction).

Microwave assisted extraction: Introduction, instrumentation, Forensic Applications **Supercritical Fluid Extraction**: Introduction, instrumentation, Forensic Applications

UNIT: II

Radio analytical Methods of Analysis

Activation analysis: Neutron activation analysis, principle, technique, steps involved in neutron activation analysis. Radiochemical and instrumental methods of analysis, important forensic application of NAA.

Isotope dilution analysis: Principle, types of isotope dilution analysis, typical applications of isotope dilution analysis.

Radiometric titration: Principle, techniques based on complex formation and precipitation, radiometric titration curves for estimation of ions from their mixture.

UNIT: III

X- Ray Methods of Analysis:

Principle, Theory- X-ray spectral lines, X-ray tube, X-ray emission, Absorptive apparatus: Sources, Collimation, sample handling, wavelength dispersive devices, Energy dispersive devices, detectors, readout device, Chemical analysis using X-ray absorption, X-ray Fluorescence- instrumentation and chemical analysis, X-ray Diffraction, Chemical analysis with X-ray diffraction, numerical problems. Forensic application.

UNIT: IV

Electrophoretic Technique: General principles, Factors affecting electrophoresis, Law voltage thin sheet electrophoresis, High voltage electrophoresis, Sodium dodecylsulphate (SDS) polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Isoelectrophoresis, Preparative electrophoresis, Horizontal and Vertical electrophoresis. Forensic application.

Nephelometry and Turbidometry: Light Scattering, Comparison between Nephelometry and turbidometry, Concentration and Scattering, Instrumentation of Nephelometry and turbidometry, general procedure for operation of Nephelometry, Turbidometric titration, Forensic application.

Suggested Readings:

1) Introduction to Instrumental Analysis by R. D. Broun, Mc Graw Hill (1987)

2) Instrumental methods of chemical analysis by H. willard, L.Merrit, J.A. Dean and F.A. settle. Sixth edition CBS (1986)

3) Fundamentals of Analytical Chemistry, 6th edition, D.A. Skoog, D.M. West and F.J. Holler, Saunders college publishing.

4) Principles of Instrumental Analysis, Skkog, Holler, Nieman, (Sixth Ed.)

5) Vogel's Textbook of Quantitative analysis 6th Ed. 7

6) Modern analytical techniques in the pharmaceutical and bio analysis By Dr. Istvan Bak (Book Available Online).

7) Preparative chromatography Chrome Ed. book series, Raymond P. W. Scott (free e book available on internet)

8) Extraction technique in analytical science, John R. Dean, Wiley (2009)

9) Practical HPLC method Development, Snyder, Kirkiand, Glajch, Wiley India Pvt.

10) Standard methods of chemical analysis, Sixth Edition, F.J. Welcher.

11) Quantitative Inorganic Analysis including Elementary Instrumnetal analysis, By A. I. Vogel, 3ed, ELB

12) Introduction to instrumental analysis by R. D. Braun, MC. Graw Hill- International edition.

13) Analytical spectroscopy by Kamalesh Bansal- First edition.

3) Instrumental methods of chemical analysis by Willard, Dean and Merittee- Sixth edition.

14) Analytical chemistry principles by John H. Kenedey- Second edition, Saunders college publishing.

15) Spectroscopic identification of organic compounds Fifth Ed., Silvestrine, Bassler, Morrill, John Wiley and son

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

List of Experiments:

(Minimum 12 Practical)

- 1. Analysis of given fertilizers.
- 2. Estimation of sugar in jaggery sample by Fehling's solution.
- 3. Analysis of unknown tablet.
- 4. Selective detection of dichlorvos by TLC.
- 5. Confirmation of dichlorvos by preparative TLC.
- 6. Determination of active pharmaceuticals ingredients in paracetamol tablet by titrimetric method.
- 7. Estimation of Paracetamol from Paracetomal tablet by U V visible spectrometer.
- 8. TLC detection of Dimethoate (Rogor) using mercurous nitrate as spray reagent.
- 9. Extraction and detection of codeine an opium alkaloid.
- 10. Confirmation of codeine by preparative TLC and FTIR spectroscopy.
- 11. TLC detection of thimate (phorate) in visceral material.
- 12. Determination of sodium carbonate in washing soda sample.
- 13. TLC detection of Baygon-A carbamate insecticide.
- 14. To determine active an available chlorine in bleaching powder.

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

List of Experiments:

- 1. Analysis of ink by UV and HPLC (2)
- 2. Extraction of alkaloid from the Dhatura seeds and identification by color test and TLC.
- 3. Identification and confirmation of Atropine alkaloids extracred from by UV-VIS and FTIR(2)
- 4. Identification of active ingredient from cannabis sativa extracted by colour test and TLC.
- 5. To find the concentration of ethyl alcohol(mg/100 ml) in given sample by oxidation method.

- 6. To find out the percent (v/v) of ethyl alcohol by specific gravity method and detection by colour test.
- 7. Estimation of lime (calcium oxide) in given sample of cement ascertain its purity.
- 8. Detection of concentration of potassium in given unknown liquid by using flame photometry.
- 9. To determine the moisture (LOD) coal sample.
- 10. To determine the normality and strength of HCl using 0.1N NaOH solution pH metrically.
- 11. Detection of kerosene residues in homicidal cases.
- 12. Instrumental analysis of given organic compound by UV and HPLC (2)

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.

SPECIALIZATION IN FORENSIC BIOLOGY, SEROLOGY AND DNA FINGERPRINTING SYLLABUS FOR M.Sc.-I FORENSIC SCIENCE - SEMESTER –III

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, inducedmutagenesis (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
- 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
		Anthropology		

Unit I: Forensic Osteology

Definition, Bone formation, ossification centers, Branches of forensic anthropology (sociocultural anthropology, linguistic anthropology, paleoanthropology, etc.), Field recovery methods, scene documentation, Laboratory processing, curation, Identification of race, sex (metric & nonmetric analysis), age (juvenile & adult), histological aging methods, stature from skeletal remains, Report writing,

Unit II: 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.

UNIT III Forensic Dentistry

History of forensic Dentistry, Morphology of tooth, identification of the type of tooth, 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 (alternate light imaging, fluoroscene imagining technique, UV, IR) & invasive techniques, differential diagnosis of bite-

marks including carnivore bite-marks, bite-mark as biological evidence, factors affecting bitemark in perishables, histological 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. Advance 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
- 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,
- 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

(Minimum 12 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 Absorptioninhibition, 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 –IV (Specialization in Forensic Biology, Serology and DNA Fingerprinting)

Paper No.	Code	Title	Marks	Credits
XXXII	MFSBS4T1	Forensics in Botany, Entomology,	100	4
		Wildlife and Environment		

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	100	4
		Management in laboratories		

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.
- 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	100	4
		and Anthropology		

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 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 IV 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.

Suggested Reading:

 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

Paper No.	Code	Title	Marks	Credits
XXXVI	MFSBS4P1	Practical Based on MFSBS4T1 and	50	2
		MFSBS4T2		

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	50	2
		MFSBS4T4		

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) Medianc) 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.

SPECIALIZATION IN DIGITAL AND CYBER FORENSICS

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

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 quantization, 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 II

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	50	2
		MFSDC3T2		

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	50	2
		MFSDC3T4		

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)

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 ISO-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 feature 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 for window, linux and Mac OS, --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 Computing	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.

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 - II

Introduction to Android: Overview and evolution of Android , Features of Android , Android architecture , Application Framework, Application Components.

Android's Development Environment setups: Setup java Development kit, setup Android SDK, setup Eclipse IDE, Setup Android Development tools(ADT) Plugin, create android virtual device, Create Android Application,

UNIT - III

Android Application Fundamentals: Android application building blocks, Activating components, Shutting down components,Life Cycle of Application, Development tools, The Manifest File, The Strings File, The R File, The Layout File, Life Cycle of Activity,Anatomy of Android Application.

User Interface : View Hierarchy and Layouts ,UI Events,Building Menus,Notifying users,Creating dialogs, Graphics & Animations

Main Building Blocks: Activity, Services, Content Providers, Broadcast Receivers

UNIT - V

Resources: Overview of Android Resources, Creating Resources, Using Resources, Drawable Resources, Animation Resources

Data Storage : Shared Preferences, Internal Storage (Files), External Storage(SD Card), SQLite Databases

Android Media API: Playing audio/video,Media recording,Blue tooth,WiFi,Camera,TelephonyManager,Location Services,Google Maps,Deploying Android Application on Device.

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.

5.Bipin Sureshbhai Rupadiya,"Mobile Computing", 2014 ISBN-9789351631934

6.Jerome(J.F.)DiMarzio, "Android a programmers guide ".

7. Ryan Tao Wang,"Android application development for the Intel Paltform".

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

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	50	2
		MFSDC4T4		

List if Experiments: (Minimum 12 experiments) Section A

. As per MFSDC4T3 syllabus (minimum 6 practical's)

Section **B**

- 1. Live system evidence Capture process
- 2. Advance Mobile device forensic analysis
- 3. Working on Cell phone tower site and Cell phone Hub
- 4. Create "Hello World" application. That will display "Hello World" in the middle of the screen in the red color with white background.

5. To understand Activity, Intent

Create sample application with login module.(Check username and password) On successful login, go to next screen. And on failing login, alert user using Toast. Also pass username to next screen.

- 6. Create login application where you will have to validate EmailID (UserName). Till the username andpassword is not validated , login button should remain disabled.
- 7. Create and Login application as above . On successful login , open browser with any URL.
- 8. Create an application that will pass some number to the next screen , and on the next screen that number of items should be display in the list. Understand resource folders :
- Create spinner with strings taken from resource folder(res >> value folder). On changing spinner value, change image.
- Understand Menu option.
 Create an application that will change color of the screen, based on selected options from the menu.
- 11. Create an application that will display toast(Message) on specific interval of time.
- 12. Create an background application that will open activity on specific time.
- 13. Create an application that will have spinner with list of animation names. On selecting animation name, that animation should affect on the images displayed below.
- 14. Understanding of UI : Create an UI such that , one screen have list of all the types of cars. On selecting of any car name, next screen should show Car details like : name , launched date ,company name, images(using gallery) if available, show different colors in which it is available.
- 15. Understanding content providers and permissions:
- 16. Read phonebook contacts using content providers and display in list.
- 17. Read messages from the mobile and display it on the screen.
- 18. Create an application to call specific entered number by user in the EditText

- 19. Create an application that will create database with table of User credential.
- 20. Create an application to read file from asset folder and copy it in memory card.
- 21. Create an application that will play a media file from the memory card.
- 22. Create an application to make Insert, update, Delete and retrieve operation on the database.
- 23. Create an application to read file from the sdcard and display that file content to the screen.
- 24. Create an application to draw line on the screen as user drag his finger.

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.