AC – 07/07/2023

Item no.- 6.34 (N)

As Per NEP 2020

University of Mumbai

Title of the program

A - P.G. Diploma in Forensic Science

B - M.Sc. (Forensic Science) (Two Years) } 2023-24

C - M.Sc. (Forensic Science) (One Year)-2027-28

Syllabus for
Semester – Sem I & II

Ref: GR dated 16th May, 2023 for Credit Structure of PG

Preamble

1) Introduction

This program is designed to provide a comprehensive and in-depth understanding of the fascinating world of Forensic Science. Through a rigorous academic curriculum and hands-on research experience, the aim is to nurture the intellectual curiosity and scientific acumen of the students, preparing them for successful careers in various sectors of forensic sciences. The M.Sc. in Forensic Science course is structured to equip students with a strong theoretical foundation, practical skills, and critical thinking abilities necessary to address the challenges and opportunities in the diverse fields of forensics. M.Sc. in Forensic Science postgraduates will act as catalysts for positive change, equipped to drive innovation, shape industries, and address societal challenges through their expertise in the field of Forensics. Whether the passion lies in research, industry, education, or beyond, this program aims to provide the knowledge and skills necessary to excel in the chosen path of the learners.

2) Aims and Objectives

The programme objectives for M.Sc. degree includes:

- To gain knowledge in various disciplines of Forensic Science, evaluate and devise solutions to problems encountered in the field of research and analysis.
- Identifying various types of crimes and their investigation.
- Understanding the working and operation of various scientific instruments and statistical interpretation of various evidences in Forensic Science.
- Developing and creating new strategies to combat and solving crimes more efficiently and effectively.
- Developing critical thinking, communication skills and analytical skills through case studies, field visits and presentations.
- Conducting independent research in various disciplines and thesis writing.
- To inculcate professional, scientific and moral ethics in the field of forensic science.
- Proposing new ideas and practices for more efficient and effective crime solving.
- To imbibe an attitude of lifelong learning so as to thrive in knowledge and skills.

3) Learning Outcomes:

The learners will be able to:

- Demonstrate advanced knowledge and understanding of the fundamental concepts and theories of forensic science, including crime scene science, forensic medicine and digital and cybercrimes.
- Apply scientific principles and methods to the analysis and interpretation of forensic evidence, using specialized techniques and equipment related to questioned documents, fingerprints, forensic physics, forensic chemistry and toxicology, forensic biology, serology and DNA profiling, digital and cyber forensics, and IT security along with the substantive and procedural law.
- Express expert opinion about complex forensic science concepts, techniques and findings to the law enforcement agencies.
- Think critically and solve complex problems related to forensic science, using analytical and logical reasoning skills to identify and evaluate evidence, generate hypothesis and make informed conclusions.

4) Any other point(if any):

5) Credit Structure of M.Sc. (Forensic Science) Semester I, II, III & IV

R_____

Post Graduate Program in University Parishishta-1

Year	Level	Sem.	Major		Minor	OJT/ FP	RP	Cum. Cr.	Degree/Cum. Cr.
			Mandatory	**Elective (anyone)**					
1	**6.0**	**I**	**DSC1-1:** MSFSDC101T Crime Scene Forensics & Quality Assurance **(4)** **DSC1-1:** MSFSDC101P Lab Course-1 **(2)** **DSC1-2:** MSFSDC102T Motor Vehicle Crimes & Accident Analysis **(4)** **DSC1-2**: MSFSDC102P Lab Course**(2)** **DSC1-3:** MSFSDC103T Forensic Psychology **(2)**	**DSE1-1:** MSFSDE101T Forensic Chemical Evidences **(2)** **DSE1-1**: MSFSDE101P Lab Course-3 **(2)** **OR** **DSE1-1:** MSFSDE102T Biological Evidence Analysis **(2)** **DSE1-1:** MSFSDE102P Lab Course-3 **(2)** **OR** **DSE1-1:** MSFSDE103T Digital and Cyber Forensics **(2)** **DSE1-1**: MSFSDE103P Lab Course-3 **(2)**	**MSFSMN101T (4)**	-	-		PG Diploma
			14	**4**	**4**			**22**	
		II	**DSC2-1:** MSFSDC201T Instrumental Analysis **(4)** **DSC2-1**: MSFSDC201P Lab Course -4**(2)** **DSC2-2:** MSFSDC202T Forensic Serology & DNA Profiling **(4)** **DSC2-2**: MSFSDC202P Lab Course-5 **(2)** **DSC2-3:** MSFSDC203T Fundamentals of Jurisprudence & Constitution (2)	**DSE2-1:** MSFSDE201T Biometric in Identification **(2)** **DSE2-1:** MSFSDE201P Lab Course-6 **(2)** **OR** **DSE2-1:** MSFSDE202T Pattern & Impression Evidence **(2)** **DSE2-1**: MSFSDE202P Lab Course-6 **(2)** **OR** **DSE2-1:** MSFSDE203T Python Forensics **(2)** **DSE2-1**: MSFSDE203P Lab Course-6 **(2)**		**MSFSOJT201P (4)**	-		
			14	**4**		**4**		**22**	
Cum. Credits for 1 Year			**28**	**8**	**4**	**4**		**44**	
Exit Option: Award of PG Diploma (Forensic Science) with 44 credits OR Continue with M.Sc. Forensic Science (Title of Specialization)									

Year	Level	Sem.	Major		Minor	OJT/ FP	RP	Cum. Cr.	Degree/Cum. Cr.
			Mandatory	**Elective (anyone)**					
2	**6.5**	**III**	**DSC3-1: SP1/SP2/SP3/SP4/SP5 : T (4) DSC3-1: SP1/SP2/SP3/SP4/SP5 : P (2)** **DSC3-2: SP1/SP2/SP3/SP4/SP5 : T (4) DSC3-2: SP1/SP2/SP3/SP4/SP5 : P (2)** **DSC3-3: SP1/SP2/SP3/SP4/SP5 : Specific Laws T (2)**	**Elective 1 (4)** **OR** **Elective 2 (4)**		-	**MSFS RP301 T** RP **(4)**		PG Degree
			14	**4**			**4**	**22**	
		IV	**DSC4-1: SP1/SP2/SP3/SP4/SP5 : T (4) DSC4-1: SP1/SP2/SP3/SP4/SP5 : P (2)** **DSC4-2: SP1/SP2/SP3/SP4/SP5 : T (4) DSC4-2: SP1/SP2/SP3/SP4/SP5 : P (2)**	**Elective 1 (4)** **OR** **Elective 2 (4)**		-	**MSFS RP401 T** RP **(6)**		
			12	**4**			**6**	**22**	
Cum. Cr. for 2 Yr PG Degree			**54**	**16**	**4**	**4**	**10**	**88**	
2 Years (4 Semester) PG Degree (88 credits) after Three Year UG Degrees or 1 Year (2 Semesters) PG Degree (44 credits) after Four Year UG Degrees									

*Abbreviations: T: Theory Course; P: Lab Course; OJT: On-Job Training; Internship/ Apprenticeship; FP: Field projects; RM: Research Methodology; RP: Research Project; SP1: Questioned Documents, Fingerprints and Biometrics; SP2: Digital and Cyber Forensic and IT Security; SP3: Forensic Physics & Ballistics; SP4: Forensic Chemistry & Toxicology; SP5: Forensic Biology, Serology & DNA Fingerprinting.

** OJT/FP: Student has to earn the requisite 04 credits of on-the-job training (OJT) / Field Project (FP) during vacations

Dr. Pratima Jadhav
Director,
Institute of Forensic Science,
Mumbai

Dr. S.S. Garje
Dean,
Faculty of Science,
University of Mumbai

6) Course Structure & Distribution of Credits:

The M.Sc. in Forensic Science program is divided into four semesters with a total **88** credits. The program consists of **16** theory papers, a total of **15** practical lab courses, **1** On-job training, and **2** projects spread over four semesters. Each theory paper shall consist of four units. Lab course (practical paper) shall consist of a minimum of ten experiments based on respective theory papers.

M.Sc. Part 1 Semester-I there are Five theory papers which includes 03 Mandatory & 01 Elective, 01 Minor Research Methodology paper and 02 lab course (practical papers) of the core subjects, whereas one elective Major theory paper to be selected by the students from amongst the three papers given in the list along with its lab course. Similarly, in M.Sc. Part 1 Semester-II there are Major Four theory papers includes 03 Mandatory, 01 Elective theory papers and 02 lab course (practical papers) of the core subjects, whereas one elective major theory paper to be selected by the students from amongst the three papers given in the list along with its lab course and the student has to earn 04 credits of on-the-job training (OJT) / Field Project (FP) during vacations. On-job Training (OJT)/ Field Project (FP) which is to be completed during the vacation period and the report of the same needs to be submitted to the Institute at the end of the Sem.-II.

After completing M.Sc. First year (Semester I & Semester II) with 44 credits the students can exercise the option to Exit leading to the award of PG Diploma in Forensic Science. Those students who will continue for M.Sc. Second year (Semester III & Semester IV) with specialization 88 Credits shall be awarded PG degree, M.Sc. Forensic Science (Title of Specialization).

During the Second year of M.Sc. Semester-III there are 03 Mandatory Major theory papers and 02 lab courses (practical paper), which is common and one elective Major theory paper that has to be selected by the students from amongst the papers given in the list along with its lab course and the student has to earn 04 credits by doing a Research Project in any topic related to the discipline under the guide.

Similarly, in Semester-IV, there are 02 Mandatory Major Theory papers and one elective Major theory paper with their respective lab course to be selected by the students from amongst the papers given in the list and the student has to earn 06 credits by completing a Research Project in any topic related to the discipline under the guide.

A student earns 22 (twenty-two) credits per semester and a total of 88 (eighty-eight) credits in four semesters. The course structure is as follows:

7) **Distribution of Marks and Credits:** The number of theory/practical papers and marks/credits allotted for M. Sc. Forensic Science program shall be as under:

Year	Semester	No. of papers		Total Marks			Total Credits		
		Theory	Practical	Theory	Practical	Total	Theory	Practical	Total
M.Sc. – I	Sem.-I	05	03	400	150	550	16	06	22
	Sem.-II	04	03	300	150	550	12	06	22
			01 OJT		100			04	
M.Sc. – II	Sem.-III	04	03	300	150	550	12	06	22
			01 Project		100			04	
	Sem.-IV	03	03	250	150	550	10	06	22
			01 Project		150			06	
Total		16	15	1250	950	2200	50	38	88

Work load calculation:
Theory course of 4 credits = 4 Hrs. per week
Practical course/ Lab course of 2 credit = 4 Hrs. per week per batch

SEMESTER –I MANDATORY			
Paper Code	**Paper Title**	**Lectures (Hrs.)**	**Credits**
DSC1-1			
MSFSDC101T	Crime Scene Forensics & Quality Assurance	60	4
MSFSDC101P	Lab Course-1	60	2
DSC1-2			
MSFSDC102T	Motor Vehicle Crimes & Accident Analysis	60	4
MSFSDC102P	Lab Course-2	60	2
DSC1-1			
MSFSDC103T	Forensic Psychology	30	2
	Total	**270**	**14**
ELECTIVE (ANYONE)			
DSE1-1			
MSFSDE101T	Forensic Chemical evidence	30	2
MSFSDE101P	Lab Course-3	60	2
DSE1-1			
MSFSDE102T	Biological Evidence Analysis	30	2
MSFSDE102P	Lab Course-3	60	2
DSE1-1			
MSFSDE103T	Digital & Cyber Forensics	30	2
MSFSDE103P	Lab Course-3	60	2
	Total	**90**	**4**
MINOR			
MSFSMN101T	Research Methodology	60	4
	Total	**60**	**4**
Total Credits:22			

SEMESTER –II MANDATORY			
Paper Code	**Paper Title**	**Lectures (Hrs.)**	**Credits**
DSC2-1			
MSFSDC201T	Instrumentation Techniques	60	4
MSFSDC201P	Lab Course-4	60	2
DSC2-2			
MSFSDC202T	Forensic Serology & DNA profiling	60	4
MSFSDC202P	Lab Course-5	60	2
DSC2-1			
MSFSDC203T	Fundamentals of Jurisprudence & Constitution	30	2
	Total	**270**	**14**
ELECTIVE (ANY ONE)			
DSE2-1			
MSFSDE201T	Biometric in Identification	30	2
MSFSDE201P	Lab Course-6	60	2
DSE2-1			
MSFSDE202T	Pattern & Impression Evidence	30	2
MSFSDE202P	Lab Course-6	60	2
DSE2-1			
MSFSDE203T	Python Forensics	30	2
MSFSDE203P	Lab Course-6	60	2
	Total	**90**	**4**
MSFSOJT201P	On-Job Training	120	4
	Total	**210**	**8**
Total Credits: 22			
Total Credits after Sem –I and Sem-II : 44			
Exit Option: Award of PG Diploma (Forensic Science) with 44 credits OR Continue with M.Sc. Forensic Science (Title of Specialization)			

8. Award of Degree:

The candidates have the option to exit after one year by getting 44 credits and **PG Diploma** will be awarded to them OR the candidates can continue with the second year to get 88 credits and be awarded a PG degree.

The candidate shall be awarded the degree of Master of Science in Forensic Science **(M. Sc. in Forensic Science)** after completing the course and meeting all the evaluation criteria.

9. Scheme of Examination and Passing:

Evaluation Structure and Marking Scheme of Assessment Scheme of Examination and Passing for Faculty of Science:

- ✓ For mandatory theory paper of weightage 100 marks, there shall be separate passing of 40% for internal assessment, external assessment each. There shall be semester end theory examination for 50 marks of 2 hours duration and internal assessment for 50 marks.
- ✓ There shall be separate passing of 40% for practical course. The practical examination shall be

conducted externally by the university at the end of each semester and shall be of 3 hours duration. The student must be present with the duly certified journal, failing which they will not be allowed for the practical examination. In case of loss of a journal, a report must be obtained from the head/coordinator failing which the student will not be allowed to appear for the practical examination.

- ✓ There shall be external theory examination for elective course of 50 marks of 2 hours duration at the end of each semester. There shall be no internal assessment for elective course.
- ✓ There shall be external examination for OJT/FP/RP courses. OJT/FP/RP shall be evaluated at the end of respective semesters. For evaluation of these courses, there shall be minimum two examiners, one preferably external.

10. Internal Assessment:

- ✓ Continuous assessment shall be adopted for internal assessment by the concerned teachers.
- ✓ For mandatory course of weightage 100 marks, the distribution of 50 marks for evaluation of internal assessment shall be as follows:

  -20 marks – Minimum one written test.

  -30 marks – On the basis of minimum two activities viz. Seminar, Home Assignment, Presentation, Quiz, Team work, etc.
- ✓ Concerned teacher should maintain proper documentation of internal assessment.

11. **Standard of Passing for University Examinations:**

As per ordinances and regulations prescribed by the University for semester-based credit and grading systems.

12. Intake Capacity:

The intake capacity for M.Sc. (Forensic Science) Sem.-I is twenty (20) and in multiple of ten thereafter. The seats shall be filled strictly on the basis of merit and prevailing reservation policies. The distribution of sanctioned intake seats shall be as follows:

I) 80% seats shall be reserved for the eligible candidates those have obtained the B.Sc. Forensic Science degree from Mumbai University.

II) 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 students having higher percentage from any reserved category.

III) 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 candidates 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 the seats will be filled up by candidate pertaining to criteria I.

2. If any seat remains vacant then it will be allotted to candidates pertaining to criteria I) above further vacant seat/s if any will be allocated to waitlist candidates belonging to criteria II or then to criteria III

3. Prevailing reservation policies of Maharashtra state and University of Mumbai will be applicable.

4. Admissions will be strictly on the basis of merit and reservation policies.

5. Vacant seats, if any due to exit option in second year (Sem.-III) shall be filled on the basis of merit from respective category.

13. Choice of Electives:

The student has to select any one of the elective in each semester. The student is not allowed to change the selected elective after fifteen days from the commencement of respective semester. For each elective, there shall be minimum 25% of the intake/ on roll students. If inadequate students have opted for any specific elective in such circumstances whether to run or not such electives shall be sole discretion of the Director/Principal of the Institute/College.

14. Allotment of Specialization:

The multidisciplinary nature of forensic science and the set-up of forensic laboratories, investigation agencies in the country and the expertise required therein, most of the Indian Universities have identified and offering various specializations such as, Questioned Documents, Fingerprints, and Biometrics, Forensic Chemistry and Toxicology, Forensic Biology, Serology and DNA profiling, Forensic Physics & Engineering, Forensic Ballistics, Digital & Cyber Forensics and IT security, Crime Scene Management & Investigation, Behavioral Science &Forensic Psychology, Criminology, Forensic Journalism, Artificial Intelligence & Data Science, Forensic Biotechnology, Forensic Nursing, Forensic Odontology, Forensic Accounting & Fraud Investigation, etc.

Out of these specializations, five specializations have been proposed keeping in view their importance. However, the number of specializations offered by an affiliated Institute/College will be their sole right based on available infrastructure and choice of the students of that Institute/College.

The specialization will be offered from the second year (third semester) onwards based on the choice and merit of the student, calculated as per the aggregate marks of semester I and semester II; however, if the result of semester II is awaited, then only the aggregate marks of semester-I shall be considered for allotment of specialization . The specific specialization shall be run by the institution for that semester/year if, the number of students opting for the specialization are not less than 20% of the intake capacity/ on roll students.

However, based on the choice of student the Institute/College can run the specialization even with less than 20% honoring the spirit of NEP 2020. The decision of the Director/Principal of the Institute/College in this regard will be final.

15. 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.

Letter Grades and Grade Points

Semester GPA/ Program CGPA/Semester	% Marks	Letter Grade Result
9.00-10.00	90.0-100.0	O (Outstanding)
8.00<9.00	80.0<90.0	A+ (Excellent)
7.00<8.00	70.0<80.0	A (Very Good)
6.00<7.00	60.0<70.0	B+ (Good)
5.50<6.00	55.0<60.0	B (Above Average)
5.00<5.50	50.0<55.0	C (Average)
4.00<5.00	40.0<50.0	P (Pass)
Below 4.00		F (Fail)
AB (Absent)		Absent

Dr. Pratima Jadhav
Director,
Institute of Forensic Science,
Mumbai

SEM-I

Mandatory

DSC1-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC101T	Crime Scene Forensics & Quality Assurance	4	4	100

Course Outcome:

- Understand the various aspects of crime scene and crime scene reconstruction
- Examine various crime scene
- Analyze evidence recovered from a specific crime scene
- Apply the various concepts in crime scene reconstruction
- Recreate the events which might have occurred at the crime scene

Course Contents:

Unit-I: Science of Reconstruction-

History and Development of Crime Science Reconstitution, Introduction to CSR, Understanding the concept of CSR, Importance and Significance of CSR, Scientific approach to reconstruction, CSR: Ethos and Ethics, Concepts and techniques of logical reasoning and systematic methodology of CSR.

Various models of CSR: The Ryerson Method, The Bevel Model, Integrated Bevel method, The Henry Lee Model, The Robert Ogle Model, The Consilient Method, Case studies.

Unit-II: Field Crime Scene Reconstruction-

Fundamental Principles of Reconstruction, Locard's principle of transfer in reconstruction, four point base method for reconstruction, Evidence from the scene of crime. Stages in reconstruction, Classification of reconstruction, Scene profiling- Primary, secondary or multiple scenes.

Unit-III: Reconstruction of various scene of crime-

Reconstruction of events reconstruction and involvement reconstruction, Specific type of physical evidence reconstruction, Special areas or determinations in reconstruction, Case studies.

Unit-IV: Quality Assurance-

ISO/IEC: 17025- Need and Scope, Managements requirements: General requirements, Document Control, Internal Audit, and Technical Requirements: General, Personnel, Standardization and calibration of instruments, Method Validation, Estimation of uncertainty of measurement, Reports, Proficiency testing: Definition, scope and procedure. QA and QC: Definition, Scope, Difference and importance in Forensic Science Laboratories, Accreditation: Definition, Scope, Benefits, Preparation and eligibility, Process, Modifications, Complaints and Appeals.

DSC1-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC101P	Lab Course -1	2	4	50

List of Experiments (Minimum ten):

1. Understanding and performing the general protocols of CSI, CSM & CSR.
2. Perform CSR using the Ryerson Method.
3. Perform CSR using the Bevel Model,
4. Perform CSR using the Integrated Bevel method.
5. Perform CSR using the Henry Lee Model.
6. Perform CSR using the Robert Ogle Model.

7. Perform CSR using the Consilient Method.
8. Simulation & reconstruction of Shooting Scene
9. Simulation & reconstruction of Homicide.
10. Simulation & reconstruction of House breaks.
11. Simulation & reconstruction of Suicide
12. Simulation & reconstruction of Explosion.
13. Simulation & reconstruction of arson.
14. Calibration of instruments.
15. Standardization of protocols.

Suggested Readings:

1. Bevel, T., Gardner, M. R., Practical Crime Scene Analysis and Reconstruction
2. Lee, C. H., Palmbach, T., Miller, T. M., Henry Lee's Crime Scene Handbook
3. Brian J Heard, Firearms and Ballistics
4. John J Lentini, Scientific Protocols for Fire Investigation.

DSC1-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC102T	**Motor Vehicle Crimes & Accident Analysis**	**4**	**4**	**100**

Course Outcome:

- The learner will understand the Crime Scene investigation and management in motor vehicle cases such as Road accidents, Theft of Vehicle, Abandoned Vehicles Vehicle involved in terrorism.
- The learner will understand the collection, packing, preservation and analysis of physical evidences involving motor vehicle crimes.
- The learner will understand the different Analytical Techniques for the analysis of evidence involved in Hit and Run cases.
- The learner will understand the different aspects of motor vehicular accident reconstruction.

Course Contents:

Unit-I: Understanding the vehicle-

Overview of exterior and interior body parts of various vehicles; Introduction to: Steering system, suspension system, braking system, chassis and chassis numbers, wheels and tires; Automotive engines: Types and general technical specifications (manufacturer, type, bore, stroke, capacity, compression ratio, valve gear, engine control, maximum power, maximum torque, fuel tank capacity etc.) of various vehicles and their relevance; Vehicle Identification Number (VIN) locations, engine number and RTO registration number, tachometric data, relevant vehicle documents.

Unit-II: Motor vehicle crimes-

Crimes and vehicles, theft of vehicles, abandoned vehicles, vehicles involved in terrorism/ explosion, road accidents and main contributing factors (equipment failure, roadway design, poor roadway maintenance, driver behavior), motor vehicle fire (exterior and interior examination, fuel tank/capacity examination, electrical systems, collection of fire evidence, evidence containers). Evidentiary clues: Vehicle, scene, culprit/victim, eye witnesses. Procurement/collection and evaluation of: Tire marks/skid marks, tire residue, tire burst, scratch marks, head/tail light and other fragments, bulbs and filaments, glass fragments, blood, hairs, fabric, finger prints/foot marks,

paint samples, vehicle registration and insurance related documents, engine number, VIN (constitution, decoding and interpretation), scene photographs and plans. Tire evidence: Original equipment tires, replacement tires and tire construction, tread nomenclature and sidewall information, noise treatment, tread wear indicators, retread tires. Tire track evidence: Stance, wheelbase, turning diameter, tire position in turn.

Unit-III: Vehicle examination-

Vehicle identification, examination of vehicle licence plate, examination of vehicle documents, Restoration of VIN/serial numbers, anti-theft systems, examination of steering columns and ignition locks, examination of vehicle keys, examination of burnt vehicles, examination of vehicles recovered underwater.

Unit-IV: Vehicular accident reconstruction-

Inspection techniques, types of vehicle collision (head-on collisions, front-to-back collisions and eccentric collisions). Application of Impulse-Momentum theory to Linear Central Impact, Oblique Central Impact and Eccentric Impact and Rotations. Application of Poisson impact theory to vehicular collisions. Simple falls of vehicles. Breaking efficiency (motorcycle and four-wheeler). Types of skid marks and evidential value, Estimation of speed from skid marks on plane, up/down-graded roads. Occupants' kinematics, biomechanics of injuries.

DSC1-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC102P	Lab Course -2	2	4	50

List of Experiments (Minimum ten):

1. VIN collection from various vehicles interpretation and authentication using check digit calculations.
2. Examination of the registration number plate and finding the owner, type and other information of the various vehicles.
3. Photography and documentation of the vehicular accident.
4. Tire examination: Determination of the age and pitch sequence of the various tires, sidewall information and its interpretation and class characteristics and wear and tear of various tires.
5. Examination and understanding of various road signs, signal and constructional features of the highways.
6. Examination of steering columns, braking system and ignition locks.
7. Determining the positions and severities of injuries to the occupants from the accidental velocity vector calculation in collision accidents.
8. Collection and decoding of Chassis numbers of various vehicles.
9. Comparative study of keys of various vehicles.
10. Examination of broken head/tail lights and bulb filament.
11. Examination of driving license/vehicle RTO registration/vehicle insurance documents.
12. Measurement of stance, wheelbase and turning diameter/radius of vehicle
13. Casting and evaluation of tire impressions.
14. Sample calculations of accident reconstructions.
15. Estimation of vehicle speed from skid lengths considering braking efficiency.
16. Analysis of simple fall of vehicles-sample calculations.
17. Physical examination of accidental vehicle-Visit to authorized auto garage.
18. Case study of vehicular accidents.

Suggested Readings:

1. Automobile Engineering, R.B. Gupta, Satya Prakash, New Delhi.
2. Basic automobile engineering, C.P. Nakra, Dhanpat Rai Publication Company.
3. Automotive Mechanics, N. K. Giri, 8th Edition, Khanna Publishers, New Delhi.
4. Automobile Engineering, Kripal Singh.
5. Forensic Examination of Stolen-Recovered and other crime related vehicles, Eric Staufer.
6. Forensic Science, An Introduction to Scientific and Investigative Techniques, 2nd Edition, Stuart H. James and Jan J. Nordby.
7. Forensic Engineering Fundamentals, Harold Franck and Darren Frank, CRC Press.
8. Encyclopaedia of Forensic Science Vol.1 & 3, J A Siegel, Pekka J Saukko et al, Academic Press.
9. Highway Engineering,S K Khanna C E G Justo. Nem Chand and Bros, Roorkee, 2001.
10. Investigating automobile fire causes, Glen A. Shifflett, Journal of criminal law and criminology, 1958, volume 49, issue 3, article 14.
11. Automobile arson investigations, William J. Davis, Journal of criminal law and criminology, 1946, volume 37,issue 1, article 8. Fire investigator: principles and practice, 4th edition, Jones and Bartlett
12. Application of Impulse Momentum Theory to Vehicle Collisions, A. G¨uven ¨OZTAS, Tr. J. of Engineering and Environmental Science, 23 (1999) , 455 - 464.
13. Milan Batista. On the mutual coefficient of restitution in two car collinear collisions, 2006.
14. Website www.crashforensics.com, John C Glennon, Chartered.
15. Gardner, Ross M.; Practical Crime Scene Processing and Investigation, Boca Raton CRC Press (2005).
16. J.Walls; Forensic Science-An Introduction to Scientific Crime Detection 2nd Ed.,Universal, 1st Indian Reprint (2002).
17. Jay A.Siegel, Pekka J Saukko and Geoffrey C. Kooupfer; Encyclopedia of Forensic Science, Academic Press (2000). Laboratory procedure manual, Forensic Physics, Director of Forensic Science (2005).
18. Nabar B. S.; Forensic science, Hyderabad Ashoka Law House (2005).
19. Richard Saferstein; Criminalistics-An Introduction to Forensic Science 5th Ed., Prentice Hall (1995).
20. Sharma, B R.; Forensic science in criminal investigation and trials, Allahabad Central Law Agency (1983).
21. Working Procedure Manual: Physics BPR&D Publication (2000).

DSC1-3	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC103T	**Forensic Psychology**	**2**	**2**	**50**

Course Outcome:

- Learner will be oriented with clinical, scientific, ethical and legal constraints associated with techniques of deception.
- To elucidate about criminal profiling and prevention.
- Importance of psychological assessment in gauging criminal behaviour.
- Orienting with different Personality and projective techniques of assessment.

Course Contents:

Unit- I: Psychological investigation of crime-

Polygraph, Brain electrical oscillation signature profiling (BEOS), Narcoanalysis, Psychological autopsy, Psychological testing and assessment, Personality and Projective tests

Unit-II: Profiling and Victimology-
Profiling- Definition, stages and types of profiling, Development and components of profiling, Victimology- Definition & meaning, victims of crime, victims of abuse, impact of victimization, Victims role in criminal proceedings, Restorative justice, therapeutic jurisprudence

Unit-III: Recidivism-
Recidivist and causes of recidivism and psychological perspective, Recidivist offenders, Combating recidivism, Recidivism in India, Supreme Court on Recidivism, Prevention of Recidivism

Unit-IV: Learning from the consequences of behavior & Theories of Punishment-
Positive reinforcement- primary & secondary reinforcement, Negative reinforcement- escape & avoidance conditioning, Dangers of punishment and its guidelines for usage, Concept of Punishment, Justification for punishment, Theories of punishment – Any two

Suggested Readings:
1.'Criminology' by Larry Siegel
2. 'Introduction to Forensic Psychology ' by Bruce Arrigo
3.'Forensic & Criminal Psychology ' by Dennis Howitt.

Minor

DMN1-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSMN101 T	**Research Methodology**	**4**	**4**	**100**

Course Outcomes:
- Familiarization and building competence with the Concept of Research, its importance and its role in advancing society.
- Ability to select an appropriate research method, experimental design.
- Ability to collect, analyze and interpret the data, prepare the research project report, and make Conclusions.
- Effective dissemination of scientific information through scientific writing in different field, such as scholarly articles, reviews, and technical reports.
- Understand the importance of ethical writing.

Course Contents:
Unit-I:
Research-Definition, Characteristics, Objectives, Research and Scientific method, Types of Research , Descriptive vs. Analytical Research, Applied vs. Fundamental Research, Quantitative vs. Qualitative Research, Conceptual vs. Empirical Research, Deductive and Inductive method.
Research Methodology: An Introduction. Research Process: Basic Overview, Formulating the Research Problem. Defining the Research Problem, Research Questions
Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Criteria of Good Research, Problems Encountered by Researchers in India Defining the Research Problem, What is a Research Problem?, Selecting the Problem, The Necessity of Defining the Problem, Technique Involved in Defining a Problem,
Research Design, Meaning of Research Design, Need for Research Design,
Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs.

Unit-II:

Research Design, Formulation of Hypothesis, Sources of Hypothesis, Characteristics of Hypothesis, Role of Hypothesis, Tests of Hypothesis

Sampling Design, Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design,

Different Types of Sample Designs, How to Select a Random Sample, Random Sample from an Infinite Universe, Complex Random, Sampling Designs

Methods of Data Collection, Collection of Primary Data, Observation Method , Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data.

Unit-III:

Descriptive Data Analysis: Measures of central tendency, Variability. Measures of Divergence from Normality, Skewness, Kurtosis, Estimation of Population Parameters of Mean and SD, Graphical Presentation of Data. Regression analysis. Parametric Techniques: Conditions to be satisfied for using parametric techniques, Pearson's Coefficient of Correlation, t-test for comparison of Mean Scores, z-test for comparison of r's, ANOVA, Hotelling's t-test, Biserial and Point-Biserial r.

Interpretation and Report Writing. Meaning of Interpretation, Why Interpretation?, The technique of Interpretation: Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation ,Mechanics of Writing a Research Report

Unit-IV:

Concept of information organization and dissemination (IOD), Need For IOD, Role Of IOD, Definition Of Documentation, IOD Activities, and Information Sources.

Discovering scientific information, Chemical Abstracts Service (CAS), Introduction to Chemical Abstracts and Beilstein, Subject Index, Author Index, Formula Index, citation indices Indices with Examples.

Web sources, E-journals, E-books, open access, Internet Search engines, Scirus, Google Scholar, ChemIndustry, Wiki-databases, SciFinder, Scopus, Plagiarism UGC Infonet, Shodhganga.

Publications of scientific work- Scholarly article, Research Paper, Research Project, Legislation Drafting, Judgment Writing, Thesis, Dissertation, Book, Citation Methods- Foot Note, Text Note, End Note, Bibliography, Citation Rules, Blue Book, OSCOLA, MLA, APA, Chicago writing ethics, plagiarism.

Suggested Readings:

1. Research Methodology, Methods and Techniques, By C. R. Kothari, New Age International (P) Limited
2. Elements of Information Organization and Dissemination. Amitabha Chatterjee, Chandos Publishing.
3. Managing Scientific Information and Research Data, Svetla Baykoucheva, Elsevier Publisher
4. Driving Science Information Discovery in the Digital Age, Svetla Baykoucheva, Elsevier publisher
5. Scientists Must Write, A Guide to better writing for Scientists, engineers and Students
6. Second edition, Robert Barrass, Routledge-Taylor & Francis Group
7. Guide to Publishing a Scientific Paper, Ann M. Körner, Routledge- Taylor & Francis Group
8. McGraw Hill's concise guide to Writing Research Papers, Carol Ellison McGraw Hill Publisher

Elective (any one)

DSE1-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE101T	Forensic Chemical Evidences	2	2	50

Course Outcomes:

- The learner should be able to understand the basic concept of the Forensic Chemistry
- To examine different types of forensic exhibits related to forensic Chemistry found at crime scene sites.
- To demonstrate experimental protocol to analyzed the forensic chemistry-related exhibits
- To evaluate the final result obtained after analysis of forensic chemistry related exhibits.
- To design new material and methodology for the examination of forensic samples.

Course Contents:

Unit-I: Dyes, Paints and Pigments-

Dyes: Different types of dyes, role of dyes in crime investigation, food colors (edible and non-edible dyes); dyes used in cosmetic and pharmaceutical products. Chemical and instrumental methods of analysis of dyes. Forensic Significance, Related Case studies.

Paint: Types of paint and their composition, physical examination of paint, instrumental analysis of pigment, interpretation of paint evidence, Chemical and physical properties of paint. Analysis of paint, Raman and IR spectroscopic analysis of Paints. Forensic Significance, Related Case studies

Pigments: Introductions, properties of blue pigment, white pigments, red pigment, green pigment, yellow pigment, Forensic Significance.

Unit-II: Food chemistry-

Analysis of lipids, fats and oils: Physical and Chemical examination of lipids, Acid value, Saponification value, Ester value, Acetyl value, Iodine value, Test for hydrogenated oils and fats, Detection and Determination of rancidity, Analysis of butter and butter fats, Analysis of adulterated and non-adulterated oils

Analysis of dairy products: Physical examination, nutrition value, chemical examination, and adulteration of milk and its products

Forensic Significance, Related Case studies.

Unit-III: Fibers and Fertilizers-

Fibers: Introduction to fibers, Classification of fibers, Analysis by microscopy, melting point and solubility testing of fibers, Analysis of fiber FT-IR, forensic chemical analysis. Analysis of fibers by thermal methods such as DSC, TGA.

Fertilizers: Introduction, Types of fertilizers and classification, Adulterated fertilizers, common adulterants in fertilizer; Estimation of the nitrogen, phosphorous and potassium content in fertilizer, Chemical and physical methods analysis of fertilizers; forensic analysis of organic and inorganic fertilizers

Unit-IV: Analysis of alcoholic beverages-

Alcohols and alcoholic beverages, Analysis of alcohols, country made liquor, illicit liquor and medicinal preparations, Analysis of various denaturants of alcohol, detection and determination of ethanol, methanol, aldehyde, ester by color test and instrumental technique.

DSE1-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE101P	**Lab Course-3**	**2**	**4**	**50**

List of Experiments (Minimum ten):

1. Preliminary and chemical analysis of paint, dyes and pigments. (3)
2. Analysis of alcoholic liquor as per BIS specifications (3)
3. Analysis of dyes in petrol by UV-Visible spectroscopy.
4. Examination of various types of fibers. (2)
5. Study the composition of various fertilizers.(4)
6. Saponification of different oils (2)
7. Analysis of alcohols- Chemical & Analytical (4)
8. Detection of metallic poisons in foodstuff.
9. Separation of amino acids by thin-layer chromatography
10. Identification of acidic and basic drug by UV-VIS spectroscopy and TLC
11. Examinations of petroleum products as per BIS/ASTM specifications.
12. Identification and Estimation of Volatile Substances by Gas chromatography-Head Space technique (GC-HS).

Suggested Readings:

1. Pearson D; "Chemical Analysis of Food", Chemical Publ. Co. New York, 1971.
2. JaVed I. Khan, Thomas J. Kennedy, Donnell R. Christian Jr.; Basic Principles of Forensic Chemistry; Springer Science, Humana Press, ISBN 978-1-59745-437-7; 2012
3. Jay Siegel, Geoffrey Knupfer, Pekka Saukko; Encyclopedia of Forensic Sciences, Three Volume Set; Elsevier Publications; ISBN 0122272153
4. Manuals of Food Quality Control, Food analysis: quality, adulteration and tests of identity; FAO of United Nations, ISSN 0254-4725, 1996
5. Jay A. Siegel, Forensic Chemistry : Fundamentals and Applications; John Wiley & Sons, Ltd, ISBN 978-1-118-89772-0, 2016
6. Bogen, E. (1932). The human toxicology of alcohol. In H. Emerson (Ed.), Alcohol and Man (pp. 126–152). New York, NY: The Macmillan Company
7. Emerson, V. (2004). Alcohol analysis. In P. C. White (Ed.), Crime scene to court - The essentials of forensic science (2nd ed., pp. 350–376). Cambridge, England: Royal Society of Chemistry.

DSE1-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE102T	Biological Evidence Analysis	2	2	50

Course Outcomes:

- Designing kits and protocols for the collection of biological evidences.
- Acquiring the skill set for body fluid analysis through various biochemical and microscopic assays, as well for determination of the species of origin.

Course Contents:

Unit-I: Biological evidence-

Collection and preservation, Types of biological evidence, Retaining biological evidence (Identification, category), Safety and handling of biological evidence (Universal precautions, personal protection, and exposure control plan). Disposal of biological evidence: Regulations, Decontamination processes, Packaging and Storage and Transportation of biological evidence (Wet and dry evidence) Blood, DNA, Urine samples, Tissue samples, etc. Physical storage considerations, Storage equipment.

Unit-II: Forensic Palynology -

Pollens: Structure, function, methods of collection and processing of samples from different environments, analysis, identification and comparison, forensic significance

Diatoms types and morphology, methods of identification and comparison, forensic importance; methods of collection, processing, analysis.

Seeds and spores: structure and formation in fungi, gymnosperm and angiosperm, forensic significance.

Unit-III: Hair and Fibre Examination -

General characteristics of human hair, morphological characteristics of hair for racial determination. Characteristics of hair from different sites. Animal and human hair-general differences. Sampling, hair examination-temporary mount, scale casting, nail polish /cellulose acetate method, permanent mount, cross-sectioning, micrometry, Sex determination from hair root sheath.

Fibre examination-microscopic, temporary mount, maceration of plant fibres, cross-sectioning, physical methods (twist on drying, floatation method, burning test). Cotton, Akmund, coir, wool, silk, jute, sisal, abaca rayon silk, wool, asbestos, nylon. Fabrics & cordage- sample handling, analysis, fabric examination, cordage examination.

Unit-IV: Blood and other body fluids –

Composition, antigen markers of blood, saliva, semen, urine, sweat, vitreous humor, vomitus, vaginal fluid, menstrual blood, amniotic fluid, tears, fecal matter.

Biochemical and microscopic assays for identification of blood, saliva, semen, urine, sweat, vitreous humor, vomitus, vaginal fluid, menstrual blood, amniotic fluid, tears, fecal matter.

DSE1-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE102P	Lab Course-3	2	4	50

List of Experiments (Minimum ten):

1. Collection and processing of biological evidences
2. Analysis of pollen from soil
3. Analysis of diatoms from water bodies
4. Microscopic observation of spores and seeds
5. Examination of human and animal hair
6. Preparation of temporary mounts for hair samples
7. Physical tests for examination of fibre
8. Microscopic examination of fibre
9. Examination of bloodstains: collection, analysis by chemical tests, microscopic observation
10. Examination of seminal stains: collection, crystal tests, chemical tests, microscopic observation.
11. Examination of saliva and its stains: microscopical and chemical tests.
12. Examination of urine, sweat, vitreous humor, vomitus, menstrual blood, amniotic fluid, fecal matter.

Suggested Readings:

1. Blood biochemistry : Nicholas J Russell
2. Human blood groups-Chemical and biochemical basis of antigen specificity (Second edition): Helmut Schenkel –Brunner, Springer Wein New York
3. Blood: Principles and practice of hematology (2003): Robert L Handin, Samuel Lux, Thomas Stossel.
4. Medical laboratory techniques: Godkar and Godkar
5. Typing of blood stains: Callifird, Bryan
6. Forensic examination of hair, Robertson, James Taylor & Francis, (1999)
7. Pollen morphology & Plant taxonomy: angiosperms (an introduction to palynology)
8. Forensic Biology: Alan Gunn.
9. Introduction to Forensic Science: James, Nordby

DSE1-3	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE103T	Digital & Cyber Forensics	2	2	50

Course Outcomes:

After completion of this course students will be able to

- Understand Investigation procedure of Windows and Linux Systems.
- Practice open-source tools for digital forensics and Registry Forensic
- Understand structure of Windows Registry.
- Investigate various windows operating system artefacts

Course Contents:

Unit-I: Investigating Windows Systems -

Where Evidence Resides on Windows Systems,

Conducting a Windows Investigation: Reviewing**,** Performing Keyword Searches**,** Reviewing Relevant Files**,** Identifying Unauthorized User Accounts or Groups**,** Identifying Rogue Processes**,** Looking for Unusual or Hidden Files**,** Checking for Unauthorized Access Points, Examining Jobs Run by the Scheduler Service**,** Analyzing Trust Relationships**,** Reviewing Security Identifiers (SIDs)**,** File Auditing and Theft of Information

Handling the Departing Employee: Reviewing Searches and Files Used**,** Conducting String Searches on Hard Drives

Unit-II: Investigating Linux Systems -

An Overview of the Steps in a Linux Investigation**,**

Reviewing Pertinent Logs: Network Logging**,** Host Logging**,** User Activity Logging

Performing Keyword Searches: String Searches with grep**,** File Searches with find**,**

Reviewing Relevant Files: Incident Time and Time/Date Stamps**,** Special Files**,**

Identifying Unauthorized User Accounts or Groups: User Account Investigation**,** Group Account Investigation

Identifying Rogue Processes: Checking for Unauthorized Access Points**,** Analyzing Trust Relationships**,**

Detecting Trojan Loadable Kernel Modules: LKMs on Live Systems**,** LKM Elements**,** LKM Detection Utilities

Unit-III: Open-source tools for digital forensics and Registry Forensic-

Open source, Open source examination platform, preparing the examination system, using LINUX and Windows as host, Study of Sleuth Kit: Installing Sleuth Kit, Sleuth Kit tools (Volume layer tools, File system Layer tools, Data unit Layer tools, Metadata Layer Tools) Registry Analysis, Understanding Windows Registry and Registry Structure.

Unit-IV: Virtualization -

Introduction: How Virtualization Works, Hypervisors, Main Categories of Virtualization, Benefits of Virtualization, Cost of Virtualization

Server Virtualization: What Is Server Virtualization? Differences between Desktop and Server Virtualization, Common Virtual Servers

Desktop Virtualization: What Is Desktop Virtualization, Common Virtual Desktops, Virtual Appliances and Forensics, Virtual Desktops as a Forensic Platform?

Investigating Dead Virtual Environments: Install Files of Virtual Systems, Remnants of Virtual Systems, and Registry of Virtual System.

Investigating Live Virtual Environments: Artifacts, Virtual Environment File Ports and Processes. Log Files. VM Memory Usage, Memory Analysis

DSE1-3	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE103P	**Lab Course-3**	**2**	**4**	**50**

List of Experiments (Minimum ten):

1. Setting up a Virtual Lab Environment: Set up a virtual lab environment using tools like Virtual Box or VMware to simulate various computer forensic scenarios.
2. Incident Triage and Initial Response: Simulate a real-world incident and practice incident triage and initial response techniques. Analyze and prioritize incidents based on severity and impact.
3. Acquiring and Imaging Digital Evidence: Learn how to properly acquire and create forensic images of digital storage devices, such as hard drives and USB drives. Practice using tools like FTK Imager or dd to create forensic images.
4. Evidence Handling and Chain of Custody: Understand the importance of evidence handling and maintaining the chain of custody. Practice proper evidence handling procedures, documentation, and maintaining the integrity of evidence.
5. Study of Windows Registry
6. File System Analysis: Conduct file system analysis on a given forensic image to identify and extract relevant files, including deleted files and file metadata. Use tools like Autopsy or The Sleuth Kit to perform file system analysis.
7. Memory Forensics: Analyze volatile memory (RAM) to extract valuable information, such as running processes, open network connections, and artifacts left by malware or attackers. Use tools like Volatility Framework or Redline for memory forensics analysis.
8. Network Forensics: Analyze network traffic captures to identify potential security incidents or suspicious activities. Use tools like Wireshark to analyze packet captures and identify patterns or indicators of compromise.
9. Malware Analysis: Analyze a sample of malware to understand its behavior, extract indicators of compromise (IOCs), and determine its impact on a system. Use tools like Cuckoo Sandbox or REMnux for dynamic and static malware analysis.
10. Log Analysis and Event Correlation: Analyze system logs and event logs to identify potential security events or anomalous activities. Practice log analysis techniques using tools like ELK Stack (Elasticsearch, Logstash, and Kibana).
11. Timeline Analysis: Create a timeline of events based on digital artifacts extracted from a forensic image or log files. Use timeline analysis tools like Plaso or Log2Timeline to build a chronological view of system activities.
12. Forensic Reporting: Develop skills in writing clear and concise forensic reports. Practice documenting the findings, analysis, and conclusions of a forensic investigation in a professional report format.
13. Incident Response Tabletop Exercise: Conduct a tabletop exercise simulating an incident response scenario. Work through the incident response process, including detection, containment, eradication, and recovery, while collaborating with a team.
14. Legal and Ethical Considerations: Discuss and analyze legal and ethical considerations in incident response and computer forensics. Explore the legal framework, privacy regulations, and best practices for handling digital evidence.
15. Case Studies: Analyze real-world case studies involving incident response and computer forensics. Review and discuss the forensic methodologies, techniques, and lessons learned from these cases.
16. Mock Forensic Investigation: Conduct a comprehensive forensic investigation on a provided

scenario. Apply the skills and techniques learned throughout the course to analyze digital evidence, document findings, and present a comprehensive forensic report.

17. Creating virtual network
18. Configuration of windows web server
19. Configuration on Linux server
20. Analysis of traces of Virtual Machine using – Registry Analysis
21. Analysis of VMWare traces on the system
22. Analysis of external device
23. Analysis of prefetch file
24. Data Carving
25. Investigating Dead Virtual Environments
26. Recovering cached and internet artifacts

Suggested Readings:

1. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGraw Hill, 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; 4th edition, ISBN: 1-435- 49883-6, 2009.
7. Practical Cyber Forensics by Niranjan Reddy, Après publication
8. Digital Forensics Basics by NihadA. Hassan
9. Practical Windows Forensic Packt publisher
10. Computer Forensics, Computer Crime Investigation by John R,Vacca, Firewall Media, New Delhi.
11. File System Forensic analysis by Brian carrier, publisher Addison Wesley professional
12. Incident Response & Computer Forensics, By Jason Luttgens and Matthew Pepe and Kevin Mandia
13. Digital Forensics and Incident Response by Johansen Gerard
14. Hands-on Incident Response and Digital Forensics by Mike Sheward
15. Computer Forensics: Incident Response Essentials, by Warren Kruse and Jay G. Heiser
16. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning.
17. Real Digital Forensics by Keith J Jones, Richard Bejitlich,Curtis W.Rose ,Addison Wesley Pearson Education
18. Forensic Compiling, Partitioners Guide by Tony Sammes and Brain Jenkinson ,Springer International edition.
19. Virtualization and Forensics By Diane Barrett, Greg Kipper
20. Virtualization Security Protecting virtualized environment By Dave Shackleford
21. Dr. Keval Ukey: Cyber Forensics, A Legal Perspective of Data Protection and E-Commerce, A-22/1, Akash Vihar, Shahid Chandrashekhar Azad Marg, Nangloi- Najafgarh Road, New Delhi, 2018

SEM - II

Mandatory

DSC2-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC201T	**Instrumental Analysis**	**4**	**4**	**100**

Course Outcomes:

- Understand various instrumental techniques.
- Principles & Applications of Chromatographic techniques
- Principles & Applications of various Spectroscopic techniques

Course Contents:

Unit-I: Chromatography Techniques-

Principle, theory, instrumentation and forensic applications of following techniques; HP-TLC, Gas Chromatography, Head-Space, Supercritical fluid chromatography, HPLC, Types of HPLC techniques, (Normal phase chromatography, Reverse phase chromatography, Size- exclusion chromatography, Ion exchange chromatography, Qualitative and quantitative analyses in chromatography

Unit-II: Atomic spectroscopy-

Atomic Absorption Spectroscopy: Principle, theory, instrumentation, sample introduction, nebulizers and burners system, Non-flame methods of atomization, radiation sources, monochromators, detectors, interferences encountered, qualitative and quantitative analysis; Forensic significance of AAS.

Inductively Coupled Plasma – Optical Emission Spectroscopy Principle, theory, instrumentation, inductively coupled and other methods of generating plasma, sample introduction, the axial and radial configuration of plasma source, monochromators, detectors, interferences encountered, qualitative and quantitative analysis using ICP-OES. The interface of ICP with MS and applications of ICP-MS in forensic science.

Unit-III: Mass Spectrometry-

Introduction, Theory of Mass spectrometry, Instrumentation, various hard and soft ionization methods, mass analyzers (magnetic sector, quadrupole filter, ion trap, time of flight, FT-ICR, etc.), mass detectors, Basic mechanism of fragmentation and related rules, McLafferty Rearrangement, Nitrogen rule, Retro Diels Alder Reaction, fragmentation pathways for organic functional groups, Base Peak, Molecular Ions Peak.,Interpretation of mass spectra of organic compounds, Forensic applications and Numerical problems based on mass spectrometry.

Unit-IV: Spectroscopy-

Infrared Spectroscopy -Principle, theory, the concept of dipole moment, types of IR active vibrations. Instrumentation, IR sources, dispersive and Fourier Transform IR spectroscopy sampling techniques, IR detectors, working, Attenuated Total Reflectance FT-IR. Group frequencies for common organic functional groups, Systematic interpretation of IR spectrum, Applications and Limitations of IR Spectroscopy. X-ray Spectroscopy: X-ray absorption method, X-ray Fluorescence (XRF) and Energy Dispersive-X-ray fluorescence (EDXRF) method, X-ray diffraction, forensic applications.

DSC2-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC201P	**Lab Course -4**	**2**	**4**	**50**

List of Experiments (Minimum ten):

1. Analysis of cholesterol (steroids) by HPLC.
2. Detection and analysis of petrol, diesel and kerosene by GC.(3)
3. Extraction and Analysis of petrol, diesel and kerosene residues from the collected samples of fire and arson cases by TLC and UV-Visible spectroscopy.(3)
4. Comparison of fibers by chemical analysis FT-IR techniques. (2)
5. Quantitative analysis of metal poison in various samples by spectrophotometric techniques. (3)
6. Analysis of Na+ and K+ contents in a soil sample by Flame Photometry.
7. Analysis of Ink samples by chromatographic techniques.
8. Examination of explosive residues by TLC and Color test, GC-MS, HPLC, HPTLC analysis.(4)
9. Determination of poisonous metals in biological materials by AAS.
10. Analysis of Plant poisons using FT-IR and UV-VIS techniques.

Suggested Readings:

1. D.A. Skoog, F.J. Holler and T.A. Neman, Harcoust; Principles of Instrumental Analysis; College publishers, Singapore
2. G.D. Christian and J.E. O'Reilly, Instrumental Analysis, Allyn and Bacon, Inc., Boston
3. F.W. Fifield and D. Kealey, Principles and practice of Analytical Chemistry, International Textbook Company, London.
4. R.P. Bauman, Absorption Spectroscopy, John Wiley, New York.
5. M. Donhrow, Instrumental Methods in Analytical Chemistry; Their Principles and practice; Vol.2, optical method, Pitaman, New York.
6. W.J. Price, Spectrochemical Analysis by Atomic Absorption, Hyden, London.
7. Analytical Chemistry by open Learning, John Wiley & Sons, New York.
8. J.C.Giddings, Dynamics of Chromatography, Marcel Dekker, New York.
9. R.C.Grob, Modern Techniques of Gas Chromatography, Marcel Dekker, New York.
10. J.A.Dean, Chemical Separation Methods, Ban Nostrand Reinhold Co., New York.
11. Safferstein: Forensic Science Handbook Vol. I, II, III.
12. Lee Honry: An Introduction to Forensic Science
13. Egon Stahl: Thin Layer Chromatography
14. Donald L. Pavia, Gary M. Lampman, George A. Kriz and James
15. R. Vyvyan; Introduction to Spectroscopy, 5th Ed.; Cengage Learning India Private Limited, ISBN 978-9381466476, 2015
16. C.N. Banwell, E.M. McCash; Fundamentals of Molecular Spectroscopy, 5th Ed., Tata Mcgraw Hill Publishing, ISBN 9781259062599, 2016
17. Willard H. H. et. al : Instrumental Methods of Analysis, 7th Ed.; CBS Publishers & Distributors, ISBN 9788123909431; 1986.
18. H. Kaur; Instrumental Methods of Chemical Analysis, Pragati Prakashan, ISBN: 9788183989015, 2010
19. J.W. Robinson, et.al.; Undergraduate Instrumental Analysis, 7th Ed.;CRC Press, ISBN 978-1-4822-3374-2, 2014

DSC2-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC202T	Forensic Serology & DNA Profiling	4	4	100

Course Outcomes:

- Familiarization with the concepts of immune system and application of the knowledge in immunological assays.
- Evaluation of blood for the purpose of identification and differentiation between individuals.
- Understanding of the concepts of replication, gene expression and regulation.
- Thorough conceptual and practical knowledge of current DNA profiling techniques.

Course Contents:

Unit-I: Immunology-

Innate immunity vs Adaptive immunity, Antigen-antibody interactions, B-cell receptor and T-cell receptor, generation of diversity, Major Histocompatibility Complex structure and functions, Complement system, Cytokines, Hybridoma technology and monoclonal antibodies, Vaccine: development of different types of vaccines, Immuno deficiencies and autoimmune diseases.

Unit-II: Serological markers and their analysis-

Biochemistry, genetics and clinical significance of ABO antigen system, Lewis antigen, Rh antigen system, Bombay blood group, MNS antigen system. Protein markers and abnormalities of blood. Determination of origin of species: Precipitation assays, Agglutination assays, Immuno-electrophoresis, RIA, ELISA, Immuno-chromatography, Western blot, Complement fixation tests.

Unit-III: Molecular Biology-

Structure of DNA, organization of chromosomes, DNA replication in prokaryotes and eukaryotes, Genetic code, Transcription of genes in prokaryotes and eukaryotes, post-transcriptional modifications, Protein Synthesis: Initiation, elongation & termination of protein synthesis in prokaryotes and eukaryotes

Unit-IV: Advanced Techniques in DNA Profiling-

Genetic markers and their forensic significance, Types of STR markers, STRs used in forensic DNA typing, core and common STR markers. Development of STR multiplexes, DNA chips, Factors affecting STR interpretation (Degraded DNA, Low level DNA), VNTR, SNP, mt DNA, Y-STR, X-chromosome analysis and forensic significance. Kinship analysis, New technologies and automation, Non-human DNA testing.

DSC2-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC202P	Lab Course-5	2	4	50

List of Experiments (Minimum ten):

1. Immunoassays: ELISA, Immuno-chromatography, Western blot
2. Precipitation techniques: Ouchterlony Double diffusion, Radial Immuno-diffusion
3. Immuno-electrophoresis techniques: Crossover electrophoresis, Rocket electrophoresis
4. Determination of Secretor/ non-Secretor status

5. To determine blood group from stains of blood and various body fluids with Absorption inhibition, mixed agglutination, and absorption-elution techniques
6. PAGE for analysis of blood protein markers
7. Chromosome staining by Giemsa.
8. Isolation of Human Genomic DNA from blood, semen, hair, nails
9. Determination of purity and quantity of DNA.
10. Extraction of mitochondrial DNA from forensic sample
11. Restriction digestion of DNA
12. PCR– amplification of DNA
13. RAPD.
14. STR analysis with commercial kits

Suggested Readings:

1. Immunology: An Introduction by I.R. Tizard.
2. Kuby Immunology: Kindt, Goldsey, Osborne.
3. Immunology: Roitt, Brostoff, male.
4. The elements of Immunology: FahimHalim Khan
5. Fundamental immunology William E. Paul
6. Microbial Forensics: Roger G Breeze, Bruce Budowle, Steven E Schutzer
7. Handbook of computational molecular biology: Edt by Srinivas Aluru
8. S.C. Rastogi, N. Mendiratta& P. Rastogi; Bio-informatics- Methods & Applications, PHI learning pvt. Ltd., (2009)
9. Dr. Westhead, J.H. Parish & R.M. Twyman, Bio-informatics, Viva Books Pvt Ltd., (2003)
10. Introduction to bioinformatics: Lesk
11. Blood biochemistry: Nicholas J Russell
12. Human blood groups-Chemical and biochemical basis of antigen specificity (Second edition): Helmut Schenkel –Brunner, Springer Wein New York
13. Blood: Principles and practice of hematology (2003): Robert L Handin, Samuel Lux, Thomas Stossel
14. Medical laboratory techniques: Godkar and Godkar
15. Blood group typing: Danford and bowly.
16. Blood grouping on man: R.R. Race and Sanger.
17. Blood grouping techniques: Boorman, Dodd. B, Lincoln. PB
18. Typing of blood stains: Callifird, Bryan
19. Genetics- Russell
20. An Introduction to Forensic DNA Analysis, Rudin, Norah CRC Leviw Publishers, (2002)
21. An Introduction to Forensic DNA Analysis, Inman, Keith CRC Press, (1997)
22. Ancient DNA, Herrmann, Bernd Springer Publishing Co., (1994)
23. Basics of DNA and Evidentiary Issues, Vij, Krishan Jaypee Brothers, (2004)
24. DNA, forensic and legal applications Kobilnsky, Lawrence John Wiley & Sons, (2005)
25. DNA in forensic science, Robertson, J Ellis Horwood Ltd., (1990)
26. DNA profiling Easteal, Simon, Harwood academic Publishers,(1993)
27. DNA profiling and DNA fingerprinting, Epplen, Jorg T BirkhauserVerlage,(1999)
28. Forensic DNA typing, J.M. Butler Elsevier Academic press,(2005)
29. Forensic DNA technology, Mark A. Farley & James J. Harrington CRC Press,(1991)
30. Forensic DNA analysis, J. Thomas McClintock Lewis Publications, (2008)
31. Forensic DNA typing protocol: Carracedo
32. Advanced Topics in DNA typing: John M. Butler

DSC2-3	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDC203T	Fundamentals of Jurisprudence & Constitution	2	2	50

Course Outcomes: After completion of this course student will be able to:

- Fathom the jurisprudential aspect of legal concepts, legal statutes, legal interpretations.
- The importance of Fundamental Rights, Directive Principles of State Policy and Fundamental Duties and their justifiability and non–justifiability.
- Have in depth knowledge of various statutory safeguards for protection of human rights in India and role of judiciary.
- Comprehend the fundamental aspects of intellectual property rights law in the special statutes and judicial interpretations.

Course Contents:

Unit-I:

Introduction, Meaning, nature, scope and importance of jurisprudence, Sources of law: Formal and material sources of law, like custom, precedent, legislation etc., Schools of Jurisprudence: Natural Law, Legal positivism, Historical school of law, Sociological school of law, Realist school of law.

Unit-II:

Rights and Duties: Meaning of Rights, Characteristics of legal Rights, Rights and duties co-relatives and classification of Rights. Legal concepts: Person, Property, possession, ownership and Obligations

Unit-III

Philosophy of the Constitution, Constitution as a basic norm, Concept of Rule of Law and Constitutionalism, Preamble as a tool to interpret the constitution, judicial pronouncements on preamble, Fundamental rights from article 12 to 19.

Unit-IV:

Fundamental rights from article 20 to 32, Directive Principles of State Policy under Indian Constitution, Fundamental duties under the Constitution.

Suggested Readings:

1. W. Friedmann, "Legal Theory" (1999) Universal Publication, Delhi.
2. Roscoe Pond, "Introduction to the Philosophy of Law (1998-Re-print)
3. Fizerald (ed.) Salmond on Jurisprudence (1999) Tripathi, Bombay.
4. V.D. Mahajan, "Jurisprudence and Legal Theory" 1996 Re-print, Eastern Book, Lucknow
5. H.L.A Hart, "The Concept of Law", Oxford University Press, ELBS, 1970
6. Dr. M. P. Tandon, "Jurisprudence –Legal Theory", 19th Edition- (2016), Allahabad Law Agency, Faridabad, Haryana.
7. Dr. Nomita Agarwal, "Jurisprudence", 2019, Central Law Agency, Faridabad.
8. Rohinton Mehta, "50 Lectures on Jurisprudence", Edi. 2000, Network Publications, Mumbai
9. Dr. B.N. Mani Tripathi, "Jurisprudence (Legal Theory), 2012 (Reprint- 16-17) Allahabad Law Agency, (Faridabad)
10. Dr. S.R. Myneni- "Jurisprudence", 2004 (Reprint-2010) Asia Law House, Hyderabad.
11. Dr. Avtar Singh & Dr. Harpeet Kaur, "Introduction to Jurisprudence" 2009, Lexis Nexis (Nagpur).

12. Jurisprudence and Legal Theory by G W Paton
13. Jurisprudence Indian Legal Theory Prof. S.N. Dhyani, Central Law Agency.
14. Bodenheimer Jurisprudence- "The Philosophy and Method of Law" (1996), Universal Publication, Delhi.
15. H.M. Seervai, Constitutional Law of India, Law and Justice Publishing Company
16. M.P. Jain, Indian Constitutional Law, Lexis Nexis
17. Narendra Kumar, Constitutional Law of India, Allahabad Law Agency
18. J.N. Pandey, Constitutional Law of India, Central Law Agency
19. P.M. Bakshi, The Constitution of India, Butterworth Lexis Nexis
20. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis
21. Subhash Kashyap, Constitution of India, National Book Trust
22. Dr. Suresh Mane, Indian Constitutional Law, Dynamics and Challenges, Aarti & Co.
23. Mahendra Pal Singh, V. N. Shukla's Constitution of India, Eastern Book Company
24. Writings and speeches of Dr. Baba Saheb Ambedkar by the Government of Maharashtra
25. Arvind Datar, Commentary on Constitutional Law

MSFSOJT201P	**On-Job Training/Field Project**	**During Vacations**
Course Credit: 4	**Total**	**120 Hrs.**

Elective (any one)

DSE2-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE201T	Biometric in Identification	2	2	50

Course Outcomes:

- Understand the various biometrics and their features
- Understand the strengths and weaknesses of various biometrics
- Classify and apply various biometrics in identification
- Devise and propose new biometrics

Course Contents:

Unit-I: Introduction to Biometrics-

Definition, development & features, Verification systems, SWOT analysis of biometrics, Biometric applications

Unit-II: Automated Fingerprint Identification System (AFIS)

Introduction and history of AFIS, components and working mechanism of AFIS, Steps involved in automated fingerprint identification, Types of AFIS searches: Ten print to Ten print search, Latent to ten print searches, Latent to latent search. Enhancement of digitally captured fingerprints. ANSI-NIST standards for fingerprint transmission and compression. Indian fingerprint identification system: FACTS, AMBIS, NAFIS.

Unit-III: Other Biometric traits-

Iris pattern, Retinal pattern, facial recognition, Hand geometry, DNA biometrics, vein pattern, Ear Biometrics, skin reflection.

Unit-IV: Behavioral biometrics-

Typing/keystroke dynamics, voice & speech pattern, Odor recognition, lip motion, brain wave pattern, footprint & foot dynamics, Gait pattern, Thermography recognition.

DSE2-1	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE201P	Lab Course-6	2	4	50

List of Experiments (Minimum ten):

1. Practical on fingerprint biometric (FACTS): Algorithms and working
2. Practical on fingerprint biometric (AMBIS and NAFIS): Algorithms and working
3. Practical on facial recognition: Algorithms and working
4. Practical on voice and speech analysis: Algorithms and working (3)
5. Practical on iris recognition: Algorithms and working
6. Practical on retina identification: Algorithms and working (3)
7. Practical on typing/keystroke biometric (2)
8. Practical on footprint and foot dynamics (3)
9. Practical on gait analysis (2)
10. Practical on DNA biometrics: Working.

Suggested Readings:

1. Biometrics for Network Security by P.Reid New Delhi (2004).
2. Biometrics by S. Nanavati, M. Thieme and R. Nanavati, Wiley India Pvt. Ltd. (2002)
3. Biometrics by Anil Jain and Salil Prabhakar
4. Biometric Technologies and Verification Systems By J.R. Vacca, Butterworth-Heinemann Oxford (2007)
5. Handbook of Biometrics by A. K. Jain, P Flynn & A.A. Ross, Springer, New York (2008).
6. Automated Fingerprint Identification System by Peter Komarinski.

DSE2-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE202T	Pattern & Impression Evidence	2	2	50

Course Outcomes:

- The learner will understand the recovery and enhancement of footwear/tire impressions.
- The learner will understand the recovery and examination of various tire and tire track marks.
- The learner will understand the examination methodology and procedure for comparison of tire impressions source identification.
- The learner will understand the manufacturing, composition and forensic examination of plastic bags for source identification.

Course Contents:

Unit-I: Footwear marks-

Footwear sizing, manufacturing process of synthetic soled shoes, known shoes of suspects and the preparation of known impressions, wear characteristics, class and identifying characteristics, comparison of the questioned impression with known shoes, the footwear impression examiner in court, impression of the foot, some case applications.

Unit-II: Vehicle tire marks and tire track-

Introduction, sidewall information, tire construction, designs and databases, original equipment tires versus replacement tires, tire size designations, aspect ratio, noise treatment, tread wear indicators, known standards of tires, examination of tires, known standards of tires, examination of tire impressions, vehicle dimensions and turning, recovery methods specific to tires.

Unit-III: Retreaded tires

Retreaded tires tread design and dimension, tire wear, individual characteristics, examination methodology and procedure for comparison of tire impressions, presenting tire evidence in court, resources and databases, case studies.

Unit-IV: Plastic bag striations

Introduction, background, plastic bag and film manufacture, Physical features, methods for visualization of physical features, chemical methods, protocol for forensic examination of plastic bags and films, value of plastic bag evidence.

DSE2-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE202P	Lab Course-6	2	4	50

List of Experiments (Minimum ten):

1. Casting of 3D footwear/tire impressions using zip lock bag and bucket method method.
2. Casting of 3D footwear/tire impressions (Partially underwater and completely undewater).
3. Casting footwear impression in snow using snow print wax/sulfar/paraffins/autopaint primer spray and dental stone.
4. Photographic documentation of casted 3D and lifted 2D footwear impression.
5. Treatment and recovery of the 2D footwear/tire impression using adhesive lifting tape, gelatine lifting tape and carbon paper.
6. Treatment and recovery of the 2D footwear/tire impression using ESDA/ vacuum box.

7. Treatment and recovery of the 2D footwear/tire impression (dental stone, microsil and liquid Silicone).
8. Enhancement of 2D footwear/tire impression by specialized lightning forensic photographic methods (using oblique light, cross polarization, UV light and IR light).
9. Enhancement of 2D wet muddy footwear footwear/tire impression by chemical methods (Potassium thiocynate/ammonium thiocynate method and 1,8-Diazafluoren-9-One (DFO)).
10. Recovering and enhancing 2D footwear/tire impressions on pieces of glass and plastic by using Safranin-O.
11. Recovering and enhancing 2D footwear/tire impressions containing CaCO3 residue using Bromphenol Blue
12. Recovering and enhancing 2D footwear/tire impressions using chemical methods (8-hydroxyquinoline, cyanoacrylate fuming, Iodine).
13. Recovering and enhancing 2D footwear/tire impressions on raw metal surfaces that have a wet origin using antimony trichloride.
14. Enhancement of 2D footwear/tire impression by Physical developer method.
15. Chemical methods for enhancement of footwear impressions in blood (leuco crystal violet, Diaminobenzidine and amido black)
16. Chemical methods for enhancement of bloody footwear impressions using water soluble protein dyes (Patent Blue, Fuchsin Acid, Tartrazine, Ninhydrin, Luminol etc.)
17. Enhancement of 2D footwear/tire impression by using computer softwares and scanners.
18. Examination of comparison of tire marks impressions and their class and individual/accidental characteristics.
19. Examination of comparison of tire marks impressions on the basis of wear characteristics.
20. Physical examination of tires on the basis of sidewall information.
21. Chemical examination of tire residue from the skid marks for source identification.
22. Physical examination of plastic bags and films for source identification.
23. Examination of plastic packaging material by UV-Visible spectroscopic method.
24. Examination of plastic packaging material by FTIR spectroscopic method.
25. Examination of plastic packaging material by TLC method.
26. Microscopic examinations of plastic packaging materials for source identifications.
27. Examination of plastic bags on the basis of birefringence using cross polarization.

Suggested Readings:

1. Encyclopedia of forensic sciences, volume 3, edited by Jay Siegel, G. Knupter, PekkaSaukko, Elsevier.
2. Tire tread and tire track evidence recovery and forensic examination, William J. Bodziak, CRC series in practical aspects of criminal and forensic investigations, CRC press taylor and Francis group.
3. Footwear impression evidence detection, recovery and examination, second edition, William J. Bodziak, CRC press.
4. Forensic pattern recognition, 1st edition, Robert D. Keppel, Katherine M. Brown, Kristen M. Welch, ISBN-13: 978-0132329484.
5. Forensic footwear evidence, William J. Bodziak, Practical aspects of criminal and forensic investigations series, CRC press.
6. Criminalistics: an introduction to forensic science, textbook by Richard Saferstein, Pearson publication, twelfth edition.
7. Tire Imprint Evidence, Peter McDonald, CRC Press.
8. Tire Tread and Tire Track Evidence: Recovery and Forensic Examination,Author: William J. Bodziak, Apr-2008, CRC Press.
9. Physical Evidence in Forensic Science Paperback – Import, 31 Jul 2006, by Henry C. Lee (Author), Howard A. Harris (Author), Publisher: Lawyers & Judges Pub Co; 2 edition (31 July

2006).
10. Plastics in Life and Environment, Dr. J.R. Bhat, http://envfor.nic.in/sites/default/files/press-releases/Lo_Book01.pdf.
11. Personnel Selection in the Pattern Evidence Domain of Forensic Science: Proceedings of a Workshop, by Engineering, and Medicine National Academies of Sciences (Author), Division of Behavioral and Social Sciences and Education (Author), Board on HumanSystems Integration (Author), Committee on Workforce Planning Models for Forensic Science: A Workshop (Author), Julie Anne Schuck (Editor), Publisher: National Academies Press.

DSE2-3	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE203T	Python Forensics	2	2	50

Course Outcomes:

After completion of this course students will be able to design a program to

- Solve and debug simple logical problems.
- Demonstrate various control statements in Python.
- Implement Functions Strings, List and Dictionaries.
- Perform various file operations.
- Enhance Object Oriented Skills in Python
- Practice applications of python in digital forensics

Course Contents:

Unit-I: Introduction-

Python Features, History, Installation Procedure, variable, Keywords, Comments, Literals Data types, Operators, Math Functions

Conditional Statements: If Statements, If-else Statements, Nested if-else Statements

Looping: For Loop, While, Nested loops, Control Statement, Break, Continue, Pass Exercises

Unit-II: Strings, Lists and Dictionaries-

Strings: Accessing strings, Basic operations, String slices, Functions and methods.

Lists: Basics, List indexing and splitting, Updating List values, List Operations, iterating a List, adding elements to the list, removing elements from the list, Built-in functions, and List methods.

Tuple: Creating a tuple, Tuple indexing and slicing, Negative Indexing, Deleting Tuple, Basic Tuple operations, Tuple inbuilt functions, List vs. Tuple

Set: Creating a set, adding items to the set, removing items from the set

Dictionaries: Basics, working with dictionaries, accessing values in dictionaries, counting words.

Function: Writing functions in Python, Introduction, defining a function, calling function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

Unit-III: File Handling, Object Oriented Programming-

File Handling: File Objects, File Built-in Functions, File Built-in Methods, File Built-in Attributes, Standard Files, Command-Line Arguments, File System, File Execution, opening a file, Writing the file, Read Lines of the file, creating a new file, File Pointer positions, modifying file pointer positions module, Creating the new directory, The directory, The () method, Changing the current working directory, Deleting directory,

Object-oriented programming: Introduction, Class and object, Attributes, Inheritance, Overloading, Overriding, Abstraction, Data hiding, Processing files

Unit-IV: Python Forensic-

Why Python Forensics, Introduction, Cybercrime Investigation Challenges, setting up a Python Forensics Environment, Forensic Searching and Indexing Using Python, Forensic Evidence Extraction (JPEG and TIFF), Forensic Time, Using Natural Language Tools in Forensics.

DSE1-2	Course Code	Course Title	Course Credits	Hours/week	Marks
	MSFSDE203P	Lab Course-6	2	4	50

List of Experiments (Minimum ten):

1. Installing Python
2. Basic python programs(Variables, Operators)
3. Demonstration of Branching in python
4. Demonstration of Looping in python
5. Working with File Handling in python (2 No's)
6. Working with Strings in python
7. Working with Lists in python
8. Working with Tuples in python
9. Working with Dictionary in python
10. To study Functions in pythons
11. Use of Regular Expressions in python (2 No's)
12. Python Programming using Object Oriented Concepts
13. File hashing with python
14. File system hashing with python
15. Evidence Searching with python-I
16. Evidence Searching with python-II
17. Meta data extraction using python-I
18. Meta data extraction using python-II
19. NTP client setup and applications
20. Accessing webpage with python
21. Assessing webpage in python (downloading media from webpage)
22. Assessing webpage in python (data extraction and processing)
23. Accessing webpage in python (accessing tags and finding potential useful information)
24. IP communication with python (TCP and UDP)
25. Network forensic with python-I Scanning
26. Network Forensic with python-II Packet analysis
27. Analyzing virtual environment in python
28. Analyzing mobile in python (2 No's)
29. Memory forensic with python(2 No's)

Suggested Readings:

1. Python Forensics A Workbench for Inventing and Sharing Digital Forensic Technology, Gary C. Kessler
2. Beginning Python Using Python 2.6 and Python 3.1,James Payne.
3. Beginning Python from Novice to Professional. 2nd.Edition.Magnus.Lie.Hetland
4. Core Python Programming (2nd Edition)
5. Dr. Michael Spreitzen barth and Dr. Johann Uhrmann,- Mastering Python Forensics, Packt Publication
6. Preston Miller, Chapin Bryce, ―Python Digital Forensics Cookbook-Effective Python recipes for digital investigations‖, Packt Publication
7. Charles Severance- Python for Informatics
8. Chet Hosmer- Integrating Python with Leading Computer Forensics Platforms Syngres.

Team of Contributors for the Compilation of Contents:

Department of Higher & Technical Education, Government of Maharashtra had constituted the committee to prepare syllabus for the subject Forensic Science to be implemented in the institutions imparting education in the field of Forensic Science in the state under the Chairmanship of Director, Directorate of Forensic Science Laboratories, Mumbai vide GR No. 2021/ Pr. Kr.-96 / Mashi-1 dated 01/12/2021. While preparing this syllabus, the syllabus prepared by the said committee is referred.

Team for Creation of Syllabus

Name	College Name	Sign
Prof. Vandana Kamble	IFS, Mumbai	
Prof. Pravin More	IFS, Mumbai	
Prof. Shrinaag Panchbhai	IFS, Mumbai	
Mr. N.M. Fatangre	IFS, Mumbai	
Dr. Deepika Bhandari	IFS, Mumbai	
Mr. Abhijeet Sarkar	IFS, Mumbai	
Ms. Neeta Khobragade	IFS, Mumbai	
Mr. Swaroop Manerikar	IFS, Mumbai	
Mr. Milind Meshram	IFS, Mumbai	
Ms. Fayth D'silva	IFS, Mumbai	
Dr. Shrihari Sanap	IFS, Mumbai	
Mr. Santosh Lohakare	IFS, Mumbai	
Ms. Bhagyashree Kulkarni	IFS, Mumbai	
Ms. Ashwini Pol	IFS, Mumbai	
Ms. Romila Lemos	IFS, Mumbai	
Mr. Nitin Deshmukh	IFS, Mumbai	

DIRECTOR
Institute of Forensic Science, Mumbai

Director
Government Institute of Forensic Science
Mumbai

Institute of Forensic Science Mumbai-32

Sign of Dean _____
Name of the Dean _____
Name of the Faculty _____

Appendix B

Justification for M.Sc. (Forensic Science)

1.	Necessity for starting the course:	This programme of Mater's in Forensic science has infusion of latest technologies in forensics and skill upgradation of manpower is imperative in the contemporary times to keep pace with exponential increase in the crime rate and the changing paradigms of crime and its investigations. The Master's programme of the Institute is well structured and designed by seeking guidance and inputs from various experts in the field of Forensic Science. The subjects incorporated in the degree are chosen from the major domains of Forensic Science.
2.	Whether the UGC has recommended the course:	**Yes**
3.	Whether all the courses have commenced from the academic year 2023-24	The P. G. Degree course has already commenced from the academic year 2012 and in the academic year 2022-23 it is restructured as per NEP 2020.
4.	The courses started by the University are self-financed, whether adequate number of eligible permanent faculties are available?	At present this course is started in only one institution affiliated to this university which is managed and financed by the Government of Maharashtra. Currently fourteen permanent and four contractual faculty members are working.
5.	To give details regarding the duration of the Course and is it possible to compress the course?	The duration of the program is two years (4 semesters). It is not possible to compress the course. Under NEP 2020 students have option of exit at the end of first year with PG Diploma in Forensic Science.
6.	The intake capacity of each course and no. of admissions given in the current academic year:	The intake capacity of the program is 20. Number of admissions for the academic year 2022-23 were 20.
7.	Opportunities of Employability / Employment available after undertaking these courses:	The M.Sc. in Forensic Science students have a wide range of employment opportunities across various sectors. The skills and the knowledge acquired during their Masters programme make them well equipped for diverse roles. Some of the common areas are the various central and state forensic science laboratories, GEQDs, BPRD, NCRB, CID, FPB, etc. Students also find opportunities in other laboratories such as environmental and analytical chemistry, Quality Assurance and Control in addition to research and academia. The students can also work in the Insurance sector, banking and private investigative agencies. Also, they can work as entrepreneurs along with providing consultancy and Expert Witness in the court of law. Additionally, staying updated with the latest advancements in the field and continuously improving their skills can enhance their competitiveness in the job market.

Chairperson
Ad-hoc Board of Studies (Forensic Science)
University of Mumbai

Director
Government Institute of
Forensic Science
Mumbai

Sign of Dean _____
Name of the Dean _____
Name of the Faculty _____