



K.R. MANGALAM UNIVERSITY
THE COMPLETE WORLD OF EDUCATION

SCHOOL OF BASIC AND APPLIED SCIENCES (SBAS)

Programme Handbook
(Programme Study and Evaluation Scheme)

M.Sc. in Forensic Science

Programme Code: 219

TWO YEAR POSTGRADUATE PROGRAMME
(with effect from 2024-25 session)

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1. Preface

Introduction

The objective of any programme at Higher Education Institute is to prepare their students for the society at large. The K. R. Mangalam University visualizes all its programmes in the best interest of their students and in this endeavour; it offers a new vision to all its Under-Graduate courses.

We are committed to implementing the National Education Policy (NEP) 2020 in its entirety, and to creating a more inclusive, holistic, and relevant education system that will prepare our students for the challenges of the 21st century. With the focus on Outcome-Based Education (OBE), our university is continuously evolving an innovative, flexible, and multidisciplinary curriculum, allowing students to explore a creative combination of credit-based courses in variegated disciplines along with value-addition courses, Indian Knowledge Systems, vocational courses, projects in community engagement and service, value education, environmental education, and acquiring skill sets, thereby designing their own learning trajectory.

All academic programmes offered by the University focus on employability, entrepreneurship and skill development and their course syllabi are adequately revised to incorporate contemporary requirements based on feedback received from students, alumni, faculty, parents, employers, industry and academic experts

The School of Basic and Applied Sciences presents two year postgraduate programme Masters in Forensic Science i.e. (M.Sc. Forensic Science) according to the New Education Policy-2020. We have designed a flexible choice-based credit system, multidisciplinary approach, and entry and exit options for the duration of 2024-2026.

We are following Curriculum and Credit Framework for Undergraduate Programmes (CCFUP)” incorporating a flexible choice-based credit system (CBCS), Learning Outcome-based Curriculum Framework (LOCF), multidisciplinary approach, and multiple entry and exit options. This will facilitate students to pursue their career path by choosing the subject/field of their interest.

The curricula are aligned with the needs of the industry and the job market and is flexible enough to adapt to changing trends and technologies. It integrates cross-cutting issues relevant to professional ethics, gender, human values, environment and Sustainable Development Goals (SDGs).

All the courses are having defined objectives and Learning Outcomes, which will help prospective students in choosing the elective courses to broaden their skills in the field of Forensic Science and interdisciplinary areas. The courses will train students with sound

theoretical and experimental knowledge that suits the need of academics and industry. The courses also offer ample skills to pursue research as career in the field of Forensic Science. The K. R. Mangalam University hopes the NEP-2020 approach of this two-year postgraduate programme **M.Sc Forensic Science** will help students in making an informed decision regarding the goals that they wish to pursue in further education and life, at large.

2. NEP-2020: K.R. Mangalam University has adopted the National Education Policy NEP-2020 to establish a holistic and multidisciplinary undergraduate education environment, aiming to equip our students for the demands of the 21st century. Following the guidelines of NEP-2020 regarding curriculum structure and duration of the postgraduate programme, we now offer a Two-Year Undergraduate Programme with one exit option and relevant certification.

- **PG Diploma Certificate** after completing 1 year (2 semesters with the required number of credits) of study.

M.Sc. Forensic Science program aspires to produce well-rounded post-graduates with a passion for learning and a strong foundation in Forensic Science, ready to make significant contributions to the scientific community and society at large.

Table 1: Minimum Credit Requirement for Two Year UG Program

S. No.	Broad Categories of Courses	Minimum Credit Requirement for Two Year PG Program
1	Major (Core)	50
2	Major (Practical)	6
3	Internship	6
4	Research Project/Dissertation	20
	Total	82

2.1 Categories of Courses

Major: The major would provide the opportunity for a student to pursue in-depth study of a particular subject or discipline.

Internship: The students are expected to complete at least 1 month internship at any Government or Private organization. A detailed report and internship certificate must be submitted by the student.

Research Project / Dissertation: The students are expected to complete the Research Project in the fourth semester. The research outcomes of their project work may be published in peer-reviewed journals or may be presented in conferences /seminars or may be patented.

3. University Vision and Mission

3.1 Vision

K.R. Mangalam University aspires to become an internationally recognized institution of higher learning through excellence in inter-disciplinary education, research, and innovation, preparing socially responsible life-long learners contributing to nation building.

3.2 Mission

- Foster employability and entrepreneurship through futuristic curriculum and progressive pedagogy with cutting-edge technology
- Instill notion of lifelong learning through stimulating research, Outcomes-based education, and innovative thinking
- Integrate global needs and expectations through collaborative programs with premier universities, research centers, industries, and professional bodies.
- Enhance leadership qualities among the youth having understanding of ethical values and environmental realities

4. About the School of Basic and Applied Sciences

The SBAS imparts both teaching and research through its four Departments of Chemistry, Physics, Mathematics, and Forensic science. SBAS imparts students' disciplinary knowledge, enhances their skills and ability, motivating them to think ingeniously, helping them to act independently and take decisions accordingly in all their scientific pursuits and other endeavors. It strives to empower its students and faculty members to contribute for the development of society and Nation. The faculty is in constant touch with various experts in the relevant fields and is willing to experiment with latest ideas in teaching and research.

5. School Vision and Mission

5.1 Vision

To be a premier school for advance learning and research in the field of basic and applied sciences.

5.2 Mission

1. Collaborations with national, international academic & research organisations and industries for knowledge creation, advancement, and application of innovative practises in sciences.
2. Create conducive environment for lifelong learning.
3. Empower students to be socially responsible and ethically strong individuals through value-based science education.

6. About the Programme (M.Sc. Forensic Science)

The Master of Science in Forensic Science (M.Sc. Forensic Science) is a postgraduate academic program designed to provide students with a comprehensive foundation in the fascinating world of Forensic Science. This program offers a rigorous and engaging curriculum that covers diverse areas such as Forensic Serology, Forensic Chemistry, Questioned Documents Examination, Fingerprint Examination, and more. Students enrolled in this program will explore the fundamental principles that govern the universe, delve into complex problem-solving, and develop strong analytical and critical thinking skills. Students will gain practical experience and a deep understanding of scientific research methodologies through hands-on laboratory work. The M.Sc. Forensic Science program prepares students for exciting career opportunities in scientific research, technology, education, and various other fields that require a strong grasp of Forensic Science principles and applications.

6.1. Nature of B.Sc. (Hons. / Hons. with Research) Forensic Science Programme

Taking the NEP-2020 as an opportunity to review our existing academic programs and redesign them for a more holistic, multidisciplinary and inclusive education, SBAS, K.R. Mangalam University is transforming its academic structure in a phased manner. School of Basic and Applied Sciences is offering Two Year Postgraduate Degree programme M.Sc. Forensic Science with single Entry- Exit option from the academic session 2024-25. This course emphasized hands on practice, innovative thought process and project-based learning.

6.2. Aims of M.Sc. Forensic Science Programme

The aims of the M.Sc Forensic Science program, in accordance with the National Education Policy (NEP), are multifaceted and comprehensive. The program aims to cultivate a strong foundation in Forensic Science principles and foster a deep understanding of the subject. It seeks to promote critical thinking, analytical skills, and problem-solving abilities among students, enabling them to address real-world challenges effectively. The M.Sc Forensic Science program also encourages research-oriented thinking and provides opportunities for students to engage in scientific inquiry and exploration. By emphasizing hands-on laboratory work and practical applications, the program aims to equip students with the necessary skills for conducting experiments and analysing data. Moreover, the program seeks to foster an interdisciplinary approach, enabling students to connect Forensic Science with other scientific disciplines and societal issues. Overall, the M.Sc Forensic Science program aspires to produce well-rounded graduates with a passion for learning and a strong foundation in Forensic Science, ready to make significant contributions to the scientific community and society at large.

6.1 Definitions

➤ Programme Specific Outcomes (PSOs)

Programme Specific Outcomes are statements about the various levels of knowledge specific to the given program which the student would be acquiring during the program.

➤ Programme Educational Objectives (PEOs)

Programme Educational Objectives of a degree are the statements that describe the expected achievements of graduates in their career, and what the graduates are expected to perform, achieve and how they will conduct professionally during the first few years after graduation.

➤ Credit

Credit refers to a unit of contact hours/tutorial hours per week or 02 hours of lab/practical work per week.

6.2 Programme Educational Objectives (PEO)

These are deferred outcomes measured few years after completion of the programme, where the graduates of this program will:

PEO 1: Graduates will become proficient forensic science professionals, capable of working in various sectors such as law enforcement, legal consultancy, corporate security, and research institutions, while also possessing the skills to pursue entrepreneurial opportunities in forensic technology.

PEO 2: Graduates will demonstrate a strong foundation in forensic science principles and practices, enabling them to critically analyze evidence and apply innovative problem-solving skills to address complex investigative challenges.

PEO 3: Graduates will uphold ethical standards in their professional practice, collaborating effectively in multidisciplinary teams to ensure justice and integrity in forensic investigations while contributing to the advancement of the field.

PEO 4: Graduates will commit to lifelong learning and continuous professional development, staying abreast with advancements in forensic science and applying their knowledge to enhance public safety and contribute positively to society.

PEO 5: Graduates will be well-prepared to pursue advanced studies and research opportunities in forensic science and related fields, furthering their expertise and contributing to the evolution of forensic methodologies.

6.3 Programme Specific Outcomes (PSO)

PSO 1: Understanding and mastering advanced forensic techniques across multiple specializations, by utilizing modern instrumentation and methodologies to solve complex forensic cases.

PSO 2: Applying interdisciplinary knowledge from various fields to enhance forensic investigations and comprehend solutions to real world forensic issues.

PSO 3: Analyzing and interpreting diverse types of forensic evidence, including physical, biological, chemical, and digital evidence, utilizing scientifically validated techniques to support investigations and legal proceedings.

PSO 3: Evaluating the efficacy of legal framework and ethical standards governing the use of forensic evidence in courts with clarity and professionalism.

PSO4: Observing and handling forensic evidence meticulously, applying technical skills to package and preserve evidence accurately, ensuring minimal contamination and maximum integrity.

PSO 5: Creating pioneering strategies to confront and resolve intricate challenges in forensic investigations, while delivering authoritative expert testimony in court.

PSO 6: Conducting independent research to develop innovative forensic solutions, contribute to scientific advancements, and address emerging challenges in criminal investigations.

6.4 Career Avenues: Opportunities exist in academics, forensic science laboratories and administration besides all the opportunities applicable to any other graduate like UPSC examinations, defence services and other govt. jobs. After completion of Masters and clearing UGC NET/JRF exam one can pursue career in academics and research organizations as Assistant Professor and Research Associate respectively.

6.5 Duration: We have designed a flexible CBCS, LOCF, multidisciplinary approach for the duration of 2024-2026. The minimum period required for M.Sc. degree in forensic science is two years.

6.6 Eligibility Criteria

Bachelor's degree in Science / Forensic Science/ Medicine / Engineering / Pharmacy/Dentistry/Ayush with at least 55% for General/OBC/EWS category candidates and 50% or equivalent for SC/ST and PwD category candidates.

6.7 Eligibility Criteria for Award of Degree

Name of Degree	Credits requirement	Completion Year
PG Diploma in Forensic Science	The student must fulfil the credit requirement as prescribed in Table 2 (Programme Study)	First Year
M.Sc. Forensic Science		Second Year

7. Student's Structured Learning Experience from Entry to Exit in the Programme

7.1 Education Philosophy and Purpose:

Learn to Earn a Living:

At KRMU we believe in equipping students with the skills, knowledge, and qualifications necessary to succeed in the job market and achieve financial stability. All the programmes are tailored to meet industry demands, preparing students to enter specific careers and contributing to economic development.

Learn to Live

The university believes in the holistic development of learners, fostering sensitivity towards society, and promoting a social and emotional understanding of the world. Our aim is to nurture well-rounded individuals who can contribute meaningfully to society, lead fulfilling lives, and engage with the complexities of the human experience.

7.2 University Education Objective: Focus on Employability and Entrepreneurship through Holistic Education using Bloom's Taxonomy

By targeting all levels of Bloom's Taxonomy—remembering, understanding, applying, analyzing, evaluating, and creating—students are equipped with the knowledge, skills, and attitudes necessary for the workforce and entrepreneurial success. At KRMU we emphasize on learners critical thinking, problem-solving, and innovation, ensuring application of theoretical knowledge in practical settings. This approach nurtures adaptability, creativity, and ethical decision-making, enabling graduates to excel in diverse professional environments and to innovate in entrepreneurial endeavours, contributing to economic growth and societal well-being.

7.3 Importance of Structured Learning Experiences

A structured learning experience (SLE) is crucial for effective education as it provides a clear and organized framework for acquiring knowledge and skills. By following a well-defined curriculum, teaching-learning methods and assessment strategies, learners can build on prior knowledge systematically, ensuring that foundational concepts are understood before moving on to more complex topics. This approach not only enhances comprehension but also fosters critical thinking by allowing learners to connect ideas and apply them in various contexts. Moreover, a structured learning experience helps in setting clear goals and benchmarks, enabling both educators and students to track progress and make necessary adjustments. Ultimately, it creates a conducive environment for sustained intellectual growth, encouraging learners to achieve their full potential. At K.R. Mangalam University SLE is designed as rigorous activities that are integrated into the curriculum and provide students with opportunities for learning in two parts:

- **Inside the Classroom:** The approach emphasizes on cognitive outcomes through student-centred learning strategies. Methods like case studies, evidence analysis, and group investigations foster active engagement, problem-solving, and critical thinking. Students use open software tools for evidence collection and analysis for digital crimes to deepen their understanding of forensic concepts. Peer reviews, presentations, and collaborative discussions allow students to consolidate theoretical knowledge while honing analytical skills.
- **Outside the Classroom:** Activities focus on developing interpersonal and psychomotor skills through real-world forensic applications in labs, internships, and community engagements. Students participate in internships with law enforcement agencies, conduct lab-based forensic tests, and engage in community outreach projects. These experiences provide practical exposure, teamwork, and communication skills, allowing students to apply classroom knowledge in real-world forensic investigations and build essential competencies for professional practice in the field.

7.4 Educational Planning and Execution: What, when and how learning will happen

Plan – calendar, faculty, monitoring & review, correction & continuous improvement (short writeup)

The School of Basic and Applied Sciences (SBAS) emphasizes a holistic approach to educational planning and execution, ensuring that both academic and personal development are seamlessly integrated into the student experience. The curriculum encompasses core subjects that establish a solid academic foundation, complemented by open electives, discipline-specific electives, Value-Added Courses (VAC), and Ability Enhancement Compulsory Courses (AECC) to expand intellectual perspectives. In addition, students are offered the opportunity to pursue a Minor in fields such as Environmental Science, Data Science, Artificial Intelligence & Machine Learning, and Nanoscience, enhancing their specialization in the four-year bachelor's degree course. The selection of these minors happens in the first semester, continuing throughout the degree program.

The learning is thoughtfully planned across the curriculum. In the early stages, foundational knowledge and skills are built through core courses. As students' progress, learning becomes more specialized, with electives and minors supporting deeper exploration of disciplines. Co-curricular activities, including sports, technical events, and cultural activities, are integrated throughout to ensure all-around growth. Leadership training, teamwork, communication skills, and discipline are emphasized through structured personality development activities. Ethical values such as truthfulness, gender sensitization, and environmental consciousness are instilled from the outset, becoming a continuous part of the student journey.

At SBAS, learning is dynamic and flexible, utilizing a variety of teaching methods including lectures, case-based learning, problem-based learning, and project-based learning, all aimed at fostering critical thinking and problem-solving abilities. Hands-on learning is reinforced through lab sessions, internships, research projects, and practical activities that connect theoretical knowledge to real-world applications. Workshops, seminars, and guest lectures from industry experts further provide practical insights and professional exposure. We have a strong students' support system in terms of differential learning (slow & fast learning), mentor-mentee system and personal counselling thereby ensuring students move up on the learning curve.

In terms of infrastructure, SBAS supports its academic planning with highly qualified faculty, smart classrooms, a well-equipped library, computer labs, and experimental research facilities. The inclusion of Massive Open Online Courses (MOOCs) and experiential learning ensures that students are prepared for both academic success and professional excellence. This carefully executed planning ensures that students are engaged at all levels of Bloom's Taxonomy, progressing from foundational understanding to higher-order thinking, while also fostering emotional, social, and ethical development. Continuous stakeholder feedback, including input from faculty, industry experts, students, and alumni, ensures that the curriculum remains relevant, aligned with academic advancements, and tuned to industry needs.

7.5 Course Registration and Scheduling

- ✓ **Major and Minor Selection** – Every student must register at the beginning of each semester for the courses offered in the given semester. Major courses are registered

centrally for the students. However, for other multidisciplinary courses (Minor, VAC, OE) the students must register by themselves through ERP.

- ✓ **Internships/ Research Project**– Students need to do summer internship after second and fourth semesters, which carries 2 credits, during the summer breaks. The same will be evaluated in the upcoming odd semester. In the eighth semester students of B.Sc. (Hons. / Hons. with Research) Forensic Science will do Research Project (Dissertation). Projects are also mapped along with the Lab/ Practical Courses and Experiential Learning Activities.

- ✓ **Cocurricular Activities Credit Choices: Participation in Co/ Extracurricular activities is part of outside classroom learning.**

Students must earn 2 credits from co/ extracurricular activities. One credit from participation in co-curricular activities like Club/Society activities and another credit from Community Service (1 credit each) through participation in NSS/ Redcross activities or NGOs that contribute to their personal development, leadership skills, and community engagement.

- Under the category of **Club/Society**, 1 credit can be earned by registration in one of the Club/Societies of university and active participation in the events organized by the club/society **OR**
- 15 hours of active engagement in any of the recreational/sports activities

Under the category of **Community Service**, 1 credit can be earned by

- 15 hours active engagement in community service through NGO/NSS/Redcross or any other society approved/ empanelled by the university.
- At the end of the semester, students are required to submit a log of hours, a report, and a certificate of participation/ completion summarizing their activities followed by a presentation.

7.6 Academic Support Services: (Differential learning needs)

The School of Basic and Applied Sciences offers a variety of academic support services tailored to meet the diverse learning needs of its students, ensuring success for all. These services include:

- **Personalized Tutoring:** One-on-one sessions with experienced tutors focus on specific areas such as laboratory techniques, experimental design, research projects, data analysis, and theoretical understanding. Tutoring is customized to each student's level, allowing for targeted support in areas like crystal structure analysis, magnetic properties, and dielectric behaviour.
- **Workshops and Seminars:** Regular workshops on topics such as advanced scientific research methods, materials characterization techniques, and the latest advancements in nanotechnology and superconductivity. These workshops, alongside industry connections, help students enhance both practical skills and theoretical knowledge.

- **Peer Mentoring Programs:** Advanced learners' mentor fellow students by leading study groups, assisting with assignments, and guiding practical projects, fostering a collaborative and supportive academic environment.
- **Accessible Learning Resources:** A variety of online platforms provide access to resources such as recorded lectures, research papers, interactive simulations, and experimental procedure guides, catering to different learning styles and enhancing independent study.
- **Outcome-Based Activities:** Students are encouraged to engage in hands-on practical, such as conducting experiments on material properties, to produce meaningful results. These outcomes are then showcased and celebrated, motivating students to further develop their skills.
- **Diversity and Inclusion Initiatives:** Programs promoting diversity and inclusion ensure that all students, regardless of background, feel valued and can contribute to a rich, collaborative learning environment.
- **Feedback and Assessment:** Continuous feedback mechanisms provide students with constructive evaluations of their work, allowing them to refine their techniques, improve their understanding, and achieve academic excellence.

7.7 Student Career & personal Support Services

- **Mentor Mentee Relationship**

Every student enrolled in the school is considered a mentee and will be assigned a faculty member as their mentor. The mentor's role is to guide and support the mentee, helping them grow both personally and professionally. Mentors act as coaches by giving feedback, sharing advice, and offering insights from their own experiences. They also challenge the mentee's thinking, help them make important decisions, and connect them to valuable resources and networks. Additionally, mentors provide emotional support, celebrating successes and offering encouragement during tough times. On the other hand, the mentee's role is to actively participate in the learning process by planning meetings, setting goals, and communicating openly with their mentor. Mentees should also apply what they learn, continue growing outside the mentor-mentee relationship, and stay proactive in seeking new opportunities. By staying committed and enthusiastic, mentees can make the most of this relationship and achieve their goals.

- **Counselling and Wellness Services**

Counselling and wellness services typically encompass a range of resources to support students' mental health, emotional well-being, and overall quality of life. The school has various counselling programs such as individual Counselling where one-on-one sessions with licensed counsellors or psychologists are held to address personal issues, stress, and mental health concerns, **Group Counselling** which support groups for shared experiences like anxiety, depression, or adjustment challenges, **Crisis Counselling** for Immediate support for students in urgent situations or experiencing severe emotional distress, **Career Counselling** for guidance on career planning, job search strategies, and professional development and

Academic Counselling for managing academic stress, time management, and study strategies. School also has various Wellness Services like On-campus clinics which provides medical care, including physical exams, vaccinations, and treatment for minor illnesses. Various mental health workshops on topics like stress management, mindfulness, and coping strategies are organized. All the students have access to gyms, fitness classes to promote physical health. These services aim to support students in maintaining a balanced and healthy lifestyle while managing the demands of university life.

- **Career Services and Training**

Career services and training programs are designed to support students in their professional development and job search. School provides personalized advice on career paths, goal setting, and job search strategies to students. They are given proper guidance on creating and refining job application materials. Mock interviews are also held. They are given opportunities to connect with alumni, professionals, and potential employers. Students are given professional training in areas like communication, leadership, and time management. These services and programs aim to prepare students for successful careers by enhancing their skills, providing practical experience, and connecting them with potential employers.

8. Assessment and Evaluation

8.1. Evaluation scheme for theory courses

Evaluation Component	Weightage
Internal Marks (Theory):- I) Continuous Assessment (30 Marks) (All the components to be evenly spaced) Projects/ Quizzes/ Assignments and Essays/ Presentations/ Participation/ Case Studies/ Reflective Journals (minimum of five components to be covered)	30 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	50 Marks

*** (It is compulsory for a student to secure 40% marks in Internal and End Term Examination separately to secure minimum passing grade).**

Overview of Internal Evaluation (30 Marks) –

Internal evaluation is designed to assess students' ongoing learning and application of course materials through diverse assessment methods. Instructors have full autonomy within the 30 marks to employ assessment strategies that best align with the course's learning objectives.

Recommended Assessment Types: -

Projects: - Individual or group projects focusing on research, analysis, and practical application of concepts.

Quizzes: - Regular, short assessments to evaluate understanding of the material.

Assignments and Essays: - In-depth tasks to assess critical thinking and problem-solving skills.

Presentations: - Assessing knowledge dissemination and communication skills.

Participation: - Evaluation of engagement and contributions to class activities.

Case Studies: - Application of theoretical knowledge to real-world scenarios.

8.2. Evaluation scheme for practical courses

Particular	Weightage
Internal Marks (Practical): - I) Conduct of Experiment II) Lab Records III) Lab Participation IV) Lab Project	10 Marks 10 Marks 10 Marks 20 Marks
External Marks (Practical):- End Term Practicals and Viva Voce	50 Marks

*** (It is compulsory for a student to secure 40% marks in Internal and End Term Practical's and Viva Voce separately to secure minimum passing grade).**

8.3. Evaluation scheme for research project

Particular	Weightage
Internal Marks: - (Punctuality, Performance, Work Ethics, Efforts and Research Output)	50 Marks
External Marks (Practical): - Presentation Report Writing Viva Voce	50 Marks 20 10 20

***(It is compulsory for the student to provide an internship certificate issued by the relevant institution or organization where they completed their internship during the evaluation process.)**

8.4. Evaluation scheme for internship/research project

Particular	Weightage
Internal Marks: - Internship completion certificate obtained from supervisor from host institute.	30 Marks
External Marks (Practical): -	70 Marks

Presentation	25
Report Writing	25
Viva Voce	20

***(It is compulsory for the student to provide an internship certificate issued by the relevant institution or organization where they completed their internship during the evaluation process.)**

8.5 GRADING SYSTEM

Based on the performance in all evaluation components of a Course, each student will be awarded a final grade in the Course registered, at the end of the semester. The total marks obtained by a student in the Course will be converted to a corresponding letter grade as described below.

Marks Range (%)	Letter Grade	Grade Points	Description of the Grade
%marks > 90%	O	10.0	Outstanding
80 < %marks ≤ 90	A+	9.0	Excellent
70 < %marks ≤ 80	A	8.0	Very Good
60 < %marks ≤ 70	B+	7.0	Good
55 < %marks ≤ 60	B	6.0	Above Average
50 < %marks ≤ 55	C	5.5	Average
40 ≤ %marks ≤ 50	P	5.0	Pass
%marks < 40	F	0	Fail
-	AB	0	Absent
%marks ≥ 50	S	-	Satisfactory
%marks < 50	U	-	Unsatisfactory
-	W	0	Withdrawal

9. Feedback and Continuous Improvement Mechanisms

Teaching-learning is driven by outcomes. Assessment strategies and andragogy are aligned to course outcomes. Every CO is assessed using multiple components. The attainment of COs is calculated for every course to know the gaps between the desired and actual outcomes. These gaps are analysed to understand where does the student lags in terms of learning levels. Thereafter each student's learning levels are ascertained, if found below desirable level, and intervention strategy is affected in the following semester to make necessary corrections. To cater to the diverse learning needs of its student body, K.R. Mangalam University employs a comprehensive assessment framework to identify both slow and advanced learners. Students' learning levels are continually assessed based on their performance at various stages. If a student's performance in internal assessments falls below or equal to 55%, they are categorized

as slow learners. Conversely, if a student's performance score in internal assessments is greater than or equal to 80%, they are identified as advanced learners. Such students are encouraged to participate in advanced learning activities. Through periodic evaluations and the utilization of modern management systems, the institution adeptly tracks students' performance across various courses, allowing for targeted interventions and support mechanisms.

10. Academic Integrity and Ethics

The School of Basic and Applied Sciences (SBAS) is committed to promoting safety and academic integrity by enforcing rigorous behavioural standards. Alcohol consumption and substance abuse are strictly prohibited, with escalating penalties for repeat offenders, which may include rustication. Ragging is also banned, adhering to UGC regulations and Supreme Court directives, and is managed through a comprehensive anti-ragging policy. The Anti-Ragging Committee, led by student affairs advisors and comprising diverse members, is tasked with handling ragging complaints and making recommendations. The Anti-Ragging Squad plays a proactive role by monitoring the campus, patrolling potential ragging hotspots, and investigating incidents. Penalties for violations can range from suspension and withholding benefits to expulsion and filing an FIR, in line with UGC regulations.

Sexual harassment in any form is taken very seriously and will be addressed by the Internal Committee Against Sexual Harassment in accordance with the Institute's policies.

The school also enforces strict penalties for other forms of misconduct, including possession of weapons, theft, and misuse of Institute property or facilities. These actions are subject to severe disciplinary measures.

Academic integrity is a cornerstone of SBAS's research and educational missions. It encompasses honesty, responsibility, and the proper acknowledgment of others' contributions. Violations such as plagiarism and cheating are treated as serious offenses. Students are required to follow principles of academic integrity, including proper citation, ethical data collection, and respect for others' work. Examples of misconduct include copying, falsifying data, and submitting purchased materials. The Institute provides guidelines for accurate record-keeping, truthful reporting, and proper attribution to uphold high academic standards.

Both individual and collective responsibility are emphasized in maintaining academic integrity. Students must ensure their theses are free from plagiarism and original before submission and are encouraged to report any violations. Faculty members are responsible for guiding students in proper research methods, ensuring accurate data recording, and reviewing student work. Additionally, faculty must educate students on academic integrity and address any breaches. Reporting academic violations involves several steps. Faculty members should report breaches to the School Dean, and any student-faculty conflicts are managed by the Dean with committee support. The Director may appoint a committee to investigate scientific misconduct. Penalties for academic breaches are severe, with initial offenses resulting in warnings or an "F" grade, and repeat offenses potentially leading to expulsion.

Students must also seek permission before engaging with media on behalf of the Institute or recording classroom activities. Unauthorized sharing of audio/video clippings or posting derogatory comments on social media is prohibited. Misconduct can be reported by students,

staff, or faculty, and penalties may include warnings, community service, restrictions, fines, withholding grades, suspension, expulsion, or a ban on reapplying for admission. The disciplinary process involves a hearing, documentation, and recommendations by a committee, with final actions decided by the Dean and enforced by the academic office. Repeat offenders face harsher penalties.

11. Programme Structure

S. No.	Category of Course	Course Code	Course	L	T	P	C
1	Major-I	MSFS701	Introduction to forensic science and Law	4	0	0	4
2	Major-II	MSFS703	Forensic Chemistry and Toxicology	4	0	0	4
3	Major-III	MSFS705	Crime Scene Management and Forensic Physics	3	0	0	3
4	Major-IV	MSFS707	Instrumentation	4	0	0	4
5	Major-V	MSFS709	Dermatoglyphics and Impressions	3	0	0	3
6	Major (Practical)	MSFS751	Forensic Practical-I	0	0	6	3
Total							21
S. No.	Category of Course	Course Code	Course	L	T	P	C
1	Major-IV	MSFS802	Forensic Biology and Serology	4	0	0	4
2	Major-V	MSFS804	Forensic Medicine & Psychology	3	0	0	3
3	Major-VI	MSFS806	Network security and cyber defense	3	0	0	3
4	Major-VII	MSFS808	Questioned Document	4	0	0	4
5	Major-VIII	MSFS810	Forensic Ballistics and Explosives	4	0	0	4
6	Major (Practical)	MSFS851	Forensic Practical II	0	0	6	3
Total							21
After completion of 1 year of course, student will be given post graduate diploma.							
S. No.	Category of Course	Course Code	Course Title	L	T	P	C
1	Major-VII	MSFS711	Quality management and ethics	4	0	0	4

2	Major-VIII	MSFS713	Research methodology	4	0	0	4
3	Major-IX	MSFS715	Forensic photography	4	0	0	4
4	Major-X	MSFS717	Bhartiya Sakshya Adhinyam	2	0	0	2
5	Major-XI-Dissertation	MSFS719	Project Work-I	0	0	0	4
Total							18
S. No.	Category of Course	Course Code	Course	L	T	P	C
1	Major-XII-Dissertation	MSFS812	Project Work-II	0	0	0	16
2	Internship	MSFS814	Internship	0	0	0	6
Total							24

After completion of 2 years of course, student will be given PG degree.

Total Credits: 82

12.Syllabi

FIRST SEMESTER

SEMESTER I					
MSFS701	Introduction to Forensic Science and Law	L	T	P	C
Version		4	0	0	4
Category of Course	Major-I				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: Introduction to Forensic Science is a foundational course that provides a broad overview of the field. It covers key concepts, forensic disciplines, legal considerations, and practical applications. The students will learn about crime scene investigation, evidence analysis, courtroom procedures, and ethical responsibilities.

Course Outcome:

Upon completion of the course, the students will be able to:

1. Remember and recall different types of evidences, including physical, biological, trace, digital evidences during crime scene investigation.
2. Understand forensic science, its multidisciplinary nature, and its role in criminal investigations and the justice system.
3. Apply the understanding about the organizational structure of forensic science laboratory, process of report writing and submission to court for real world cases.
4. Analyse different types of evidences and their admissibility in the court of law.
5. Evaluate and explore about the role of mobile forensic science laboratory and their distribution in India

Course Contents
Section I: Basics of forensic science Introduction of Forensic science, classification & its significance in forensic science, basic principle and law of forensic science. Branches of forensic science – Introduction to Forensic Toxicology, Forensic Biology & Serology, Forensic Ballistics, Questioned documents & Fingerprints and Cyber Forensics.

Hierarchical set up of Forensic Science Laboratories National Crime Records Bureau, Police & Detective Training Schools, Bureau of Police Research & Development, Mobile Forensic Units, Police Academies.

Section II: Crime Scene Investigation and Management

Crime Scene & its various Types including – size, nature, location. Processing of Crime scene. Securing and isolating the crime scene. Crime scene search methods, Elements, nature, causes and consequences of crime. Documentation of crime scenes – photography, videography, sketching and recording notes. Forwarding Letter. Duties of first responders at crime scenes. Coordination between police personnel and forensic scientists at crime scenes, Chain of custody, Reconstruction of crime scene.

Section III: Physical Evidences and Expert testimony

Physical evidences and its types (Fingerprints, glass, fiber, blood, saliva, weapon of crime etc.), Blood spatter analysis, Characteristic blood patterns, testimonial and real evidence, admissibility of scientific evidence and importance of physical evidences, Collection, preservation, packing and forwarding of different types of evidences to the laboratories. Trace evidences & Druggist fold method for packaging. Expert Testimony: The role of the expert-witness; acceptance of evidence in the court; Direct examination, re-examination and cross – examination of prosecution lawyer and defense lawyer.

Section IV: Law and legal system

Introduction to criminal Laws: IEA, IPC and CRPC. Cognizable and non-cognizable offences. Bailable and non-bailable offences. Penal Code pertaining to offences against persons – Sections and their amendments. Penal Code pertaining to offences against property Sections. Classification – civil, criminal cases. Essential elements of criminal law. Constitution and hierarchy of criminal courts. Fundamental Rights, Directive Principles of State Policy. – Articles 14, 15, 20, 21, 22, 51A, Narcotic, Drugs and Psychotropic Substances Act, Explosive Substances Act, Arms Act, Dowry Prohibition Act, Prevention of Food Adulteration Act, Wildlife Protection Act.

Learning Experience: The learning experience in Introduction to Forensic Science course is highly engaging and interdisciplinary, offering insights into how science is applied to solve criminal cases. Students are introduced to various branches of forensic science, including crime scene investigation, evidence collection, and analysis of biological, chemical, and physical evidence. The course often combines lectures with hands-on activities, such as mock crime scene investigations and laboratory exercises, where students apply techniques like fingerprint analysis, DNA profiling, and trace evidence examination.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbook:

1. Bodziak, W., Footwear Impression Evidence (2nd Edn.) CRC Press, Boca Raton, Florida, 2000.
2. DeForest, P., Gaensslen, R., and Lee, H., Forensic Science; an Introduction to Criminalistics, McGraw Hill, New York, 1983.
3. Fisher, B., Techniques of Crime Scene Investigation (6thEdn.) CRC Press, Boca Raton, Florida, 2000.

Suggested Readings:

1. James, S. H. And Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
2. James, S., and Eskerc, W., Interpretation of Blood Stain Evidence at Crime Scenes,(2ndEdn) CRC Press, Boca Raton, Florida, 1999.
3. Saferstein, Richard, Criminalistics, An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
4. Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rdEdn) Universal Law Publishing Co. Ltd. New Delhi, 2001.

Open Educational Resources (OER)

Websites:

1. <https://www.open.edu/openlearn/science-maths-technology/what-forensic-science>
2. <https://www.coursera.org/learn/forensic-science>
3. <https://www.futurelearn.com/courses/introduction-to-forensic-science>

SEMESTER I					
MSFS703	Forensic Chemistry and Toxicology	L	T	P	C
Version		4	0	0	4
Category of Course	Major-II				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: Forensic chemistry and toxicology offer a comprehensive blend of theoretical knowledge and practical skills essential for analyzing chemical and toxicological evidence in forensic investigations. Students will learn various techniques and toxicological analysis, applying them to real-world cases involving drugs, poisons, and hazardous substances. The course emphasizes critical thinking, problem-solving, and the ethical responsibilities of forensic scientists, preparing students for careers in forensic labs, law enforcement, and medical fields by providing a deep understanding of scientific principles and their legal implications.

Course Outcome:

Upon completion of the course, the students will be able to:

1. Remember and recall the fundamentals of drugs, poisons and toxins, their collection and preservations
2. Understand the scope, role & significance of various types of drugs, commonly abused along with their presumptive & instrumental analysis
3. Solve real world issues by applying the concepts and legal provisions for forensic investigation of drugs, cosmetics, fire and arson evidences
4. Analyse the chemical substances found at crime scenes or in biological samples.
5. Evaluate the medicolegal aspect of poisons and the management of toxicological cases

Course Contents

Section I: Forensic Chemistry

Introduction, Role of Forensic Chemist, Types of Cases which require Chemical Analysis, Sampling of Evidences, Presumptive Tests (Colour/Spot Tests), Microcrystal Tests, Limitations of Forensic Samples, Elemental Analysis (Organic and Inorganic), Instrumental Methods and Equipments.

Examination of Contact Traces: Introduction to Cosmetics and Detective Dyes, Collection, Sampling, Analysis and Forensic Importance. Analysis of Illicit Liquors including Methyl and Ethyl Alcohol.

Section II: Drugs of Abuse

Introduction, Drug Addiction and its Problems.

Classification of Drugs of Abuse, Analgesics, Depressants, Stimulants, Hallucinogens and Narcotics, Designer Drugs.

Drug Abuse in Sports: Introduction, Common Prohibited Substances, Analytical Approach.

Section III: Forensic Toxicology

Introduction, Role of the Toxicologist, Significance of Toxicological Findings, Poisons, Definition, Classification on the Basis of their Origin, Physiological Action and Chemical Nature, Absorption, Distribution, Metabolism and Excretion of Poisons, Factors Affecting Poisoning in India.

Section IV: Management of Toxicological Cases

Introduction, Principles of Management of Poisoning Cases, Duties of a Doctor in Poisoning Cases, Signs and Symptoms of Common Poisons, Types of Antidotes, Detection of Poisoning in the Dead. Selection, Collection and Preservation of Viscera for Various Types of Poisons: Choice of Preservatives, Containers and Storage. Different Methods of Extraction, Isolation, Identification, Estimation of Poisons from Biological Specimens.

Learning Experience: In this forensic chemistry and toxicology course, learning is dynamic and hands-on, blending lectures with practical lab work and real-world case studies. Students will explore forensic applications through group projects, peer collaboration, and the use of specialized lab equipment. Interactive technology, including online platforms and simulation tools, will support learning through practical exercises. Continuous evaluation will be conducted through quizzes, lab reports, and presentations. The course instructor will provide regular feedback and guidance, encouraging students to seek help when necessary. Group activities will promote teamwork and critical thinking, allowing students to apply and deepen their knowledge of forensic science concepts.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks

1. Parikh CK. Text Book of Medical Jurisprudence, Forensic Medicine and Toxicology. CBS Publ. New Delhi, 1999.
2. Laboratory Procedure Manual, Forensic Toxicology. Directorate of Forensic Science. MHA Govt, 2005.
3. Modi JP. Textbook of Medical Jurisprudence and Toxicology. MM Tripathy Publications, 2001.
4. Saferstein R. Forensic Science Hand Book, Vol I, II and III, Pretince Hall, NI., 1982

Suggested Readings

1. Suzanne Bell. Drugs, Poisons, and Chemistry, 2009
2. J. R. Partington 1969 A History of Chemistry, Volume 2, , Macmillan.
3. Eding Darrel D, 1970 Introductory Chemistry.
4. Odian George, 1990 General, Organic And Biological Chemistry.
5. Carvey RH, Baselt RC. Introduction to Forensic Toxicology and Biochemicals. Publ. Davis CA, 1981.
6. Chadha PV. Handbook of Forensic Medicine and Toxicology. Jaypee Brothers, New Delhi, 2004.

Open Educational Resources (OER)

Websites:

1. https://acclm.ecaonline.edu.au/qualifications/cert-alcohol-drugs/?utm_source=OLmarketplace&utm_medium=platform&utm_campaign=OLmarketplace_AU
2. <https://www.open.edu/openlearn/history-the-arts/history/social-economic-history/19th-century-autopsy-unmasks-poisoner>

SEMESTER I					
MSFS705	Crime Scene Management and Forensic Physics	L	T	P	C
Version		3	0	0	3
Category of Course	Major-III				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective

The Crime Scene Management and Forensic Physics course immerses students in practical and theoretical aspects of crime scene handling and evidence analysis. Students will engage in activities that teach them to secure, document, and preserve crime scenes, while also exploring the collection and examination of physical and impression evidence, such as glass, paint, footprints, and tire marks. Through hands-on practice, lab work, and case studies, the course emphasizes the application of scientific principles to ensure accurate evidence analysis and effective crime scene management.

COURSE CONTENT

Unit 1: Crime Scene Management and Physical Evidence Handling

Introduction to Crime Scene: Types of crime scenes, securing the crime scene, evaluation, and processing of evidence, Documentation: Note making, sketching, photography, videography of the crime scene, and the role of the first responder, Crime Scene Search Techniques: Physical evidence discovery, recognition, collection, and maintaining chain of custody, Reconstruction and Physical Evidence: Types, classification, and role in criminal investigations and trials.

Unit 2: Forensic Physics and Material Evidence

Glass Examination: Types of glass, forensic fracture analysis, impact direction, physical and chemical properties, refractive index, and elemental analysis, Paint Analysis: Composition and types of paint, forensic examination using physical, chemical, and instrumental techniques, case studies, Soil Evidence: Soil composition, classification, forensic analysis methods, interpretation of soil evidence, case studies, Lip and Ear Prints: Lip Prints: Cheiloscopy, classification, collection, and forensic comparison, Ear Prints: Morphology, collection, identification, and comparison.

Unit 3: Tool Marks, Bite Marks, and Impressions

Tool Mark Evidence: Types, class and individual characteristics, forensic collection, examination, and case studies, Impression Evidence: Tire Impressions: Forensic significance, collection, and examination of skid marks, Footprints and Shoe Impressions: Evidence collection, gait pattern analysis, identification, and case studies.

Unit 4: Fiber, Textile, and Material Evidence

Fiber and Textile Analysis: Classification, forensic examination of fibers, ropes, wires, and counterfeit coins using microscopy and chemical methods, Restoration of Erased Marks: Techniques for restoring erased or obliterated markings, forensic assessment, photography, and case studies.

Learning Experience: The Crime Scene Management and Forensic Physics course immerses students in practical and theoretical aspects of crime scene handling and evidence analysis. Students will engage in activities that teach them to secure, document, and preserve crime scenes, while also exploring the collection and examination of physical and impression evidence, such as glass, paint, footprints, and tire marks. Through hands-on practice, lab work, and case studies, the course emphasizes the application of scientific principles to ensure accurate evidence analysis and effective crime scene management.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Evaluation components	Weightage

Internal marks (Theory) I. Continuous assessment (30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks:

1. Kirk. Vehicular Accident investigation and reconstruction, 2000.
2. kert. Interpretation of Blood stains evidence at Crime Scene, 2nd edition, CRC Press, 1999.
3. Sharma BR. Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad, 1974.
4. Lundquest & Curry. Forensic Science, Vol I to IV, Charles C. Thomas, Illinois, USA, 1963.
5. Saferstein: Forensic Science Handbook, Vol I, II & III, Prentice Hall Inc. USA.
6. Sharma BR. Footprints, Tracks and Trials. Central Law Agency. Allahabad, 1980.
7. Robertson J, Roux C, Wiggin GK, Grieve M Forensic Examination of Fibres (2ndEdn). CRC Press, 1999.
8. Noon RK. Forensic Engineering Investigation (2ndEdn). CRC Press, 2000.

Suggested readings:

1. H. James, Wouldiam G. EcSettle FA. Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997.
2. Saferstein R. Criminalistics, Prentice Hall Inc. USA., 1976.
3. Kirk. Criminal Investigation Interscience Publisher Inc. New York, 1953.
4. Van Kirk DJ. Vehicular Accident investigation and reconstruction. CRC Press, 2000.

Open Educational Resources (OER)

1. <https://www.udemy.com/course/effective-accident-investigation-and-reporting-in-ehs/?couponCode=ST8MT101424>
2. <https://www.umgc.edu/online-degrees/undergraduate-certificates/crime-scene-investigation>

SEMESTER I					
MSFS707	Instrumental Analysis	L	T	P	C
Version		4	0	0	4
Category of Course	Major-IV				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: The Instrumental Analysis course offers an in-depth understanding of various instrumental techniques used in forensic investigations. It focuses on the principles, operation, and applications of instruments like chromatography, spectroscopy, and mass spectrometry to analyze physical evidence. Students learn to interpret analytical data, ensuring accuracy in identifying substances, trace elements, and chemicals in forensic samples. By integrating theory with practical lab work, the course hones skills necessary for crime scene investigations, toxicology analysis, and legal case presentations, enhancing both scientific expertise and critical thinking in forensic contexts.

Course Outcome: Students will be able to:

1. Remember and recall the fundamental principles of various instrumental techniques used in chemical analysis, such as spectroscopy, chromatography, and electrochemical methods.
2. Understand the scope, working, and application of analytical instruments in both qualitative and quantitative analysis of chemical substances.
3. Apply knowledge of instrumental techniques to solve real-world analytical problems, choosing the appropriate method for the analysis of different types of samples.
4. Analyze complex data obtained from instrumental techniques and interpret the results with a focus on accuracy and precision.
5. Evaluate the performance, limitations, and troubleshooting of instruments used in analytical laboratories to ensure optimal functioning and reliable results.

Course Contents
Section I: Concepts of Atomic and molecular Spectroscopy What is Spectroscopy, Electromagnetic Spectrum, Sources of Radiations, their Utility and

Limitations, Conventional Sources for UV, Visible and Infrared Rays, Sources for Shorter Wavelength Radiations (X-Ray Tubes) Radioactivity, Gamma Rays and Beta Rays. Laser (He, Ne, Argon Ion, Dye Lasers, Semi Conductor Lasers) as Source of Radiation. Interaction of Radiation with Matter: Reflection, Absorption, Transmission, Fluorescence, Phosphorescence and their Forensic Application

Molecular Spectra: Introduction, Molecular Orbital, Types of Molecular Energies, Vibrational and Electronic Spectra, Atomic Spectra, Energy Levels, Quantum Numbers and Designation of States, Selection Rules, Augur Effect. Detection of Radiations, Photographic Detectors, Thermal Detectors, Photoelectric Detectors, Radiation Filters, etc.

Section II: Absorption Spectroscopy

Ultra Violet and Visible Spectrophotometry: Types of Sources and Stability, Wavelength Selection, Filters-Cells and Sampling Devices, Detectors, Resolution, Applications of UV- Visible Spectroscopy, Difference/ Derivative Spectroscopy. Fluorescence and Phosphorescence

Spectrophotometry: Types of Sources, Structural Factors, Instrumentation and its Applications.

Atomic Absorption Spectrometry: Introduction, Instrumentation and Techniques, Interference in AAS, Background Correction Methods, (GFAAS) Quantitative Analysis. It's Applications In Forensic Science.

Infrared Spectrophotometry: Instrumentation of Dispersive and Fourier Transform Spectrophotometry, Sample Handling, Quantitative Analysis and Interpretation of IR Spectra.

Section III: Chromatographic Techniques

Definition and Concept of Chromatography, Classification of Chromatography.

Basic principle, theory, Instrumentation and Forensic Applications of Paper chromatography, Thin layer chromatography and HPTLC. Types of column, Column efficiency, Pumps, Various types of detector, Development of HPLC and UPLC method, Choice of stationary and mobile phase, Difference between HPLC and UPLC, Applications, Instrumentation and Forensic Applications of Gas chromatography

Section IV: Immunological techniques: Types of Immunological Techniques

Radioimmunoassay (RIA): Basic Principle, Procedure, Labelling of Antigen and Technique of Assay & Applications.

Enzyme Linked Immuno Sorbent Assay (ELISA): Introduction, Procedure, Competitive Method, Sandwich Method, Indirect Method & Applications.

Polymerase chain reaction: Overview, History, Basic Principles, significance, and forensic applications. Types of PCR: Conventional PCR, Real-time PCR (qPCR), Reverse Transcription PCR (RT-PCR), Digital PCR, Multiplex PCR, Nested PCR, Thermal cycler

Learning Experience: The learning experience in forensic instrumental analysis blends theoretical knowledge with extensive hands-on practice. Students learn the underlying principles of key analytical instruments like gas chromatography, high-performance liquid chromatography, and mass spectrometry, and how these tools are applied to forensic investigations. Practical lab sessions are crucial, allowing learners to analyze real forensic samples, troubleshoot instrument issues, and interpret complex data. By applying these techniques to real-world scenarios like drug analysis and toxicology, students gain essential skills for crime scene investigations, ensuring they are prepared for the challenges of forensic science.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the component to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks:

1. Robinson JW. Atomic Spectroscopy (2ndEdn). Marcel Dekkar, Inc, New York, 1996.
2. Workman J. Art Springsteen; Applied Spectroscopy- A compact reference for Practitioners. Academic Press, London, 1997.
3. Willard HH, Lynne L. Merrett, J. Dean, A. Frank, A. Settle. Instrumental Methods of Analysis (7thEdn). CBS pub. & Distributors, New Delhi, 1988.
4. Khandpur RS. Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi, 2004.

- Dudley H. Williams, Fleming I. Spectroscopic Methods in Organic Chemistry (4thEdn). Tata McGraw- Hill Publishing Company, New Delhi, 1994.
- Hobart Willard. Instrumental Methods of Analysis. Wadsworth Publishing Company, 1988.
- Douglas Skoog, James Holler, Stanley Crouch. Principles of Instrumental Analysis (7thEdn). Cengage Learning, 2017.
- V.B Patania. Spectroscopy. Campus Books International, 2004.
- G.R Chatwal, S.K Anand. Instrumental Methods of Chemical Analysis. Himalaya Publ. House, 2004.
- G.R Chatwal. Analytical Spectroscopy (2nd Edition). Himalaya Publishing House, 2002

Suggested readings:

- James W. Robinson, Eileen Skelly Frame, George M. Frame II. Undergraduate Instrumental Analysis (7thEdn). CRC Press, 2014.
- Settle FA. Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997.
- Sue Jickells, Adam Negrusz. Clarke's Analytical Forensic Toxicology. Pharmaceutical Press, 2008.
- Thomson KC, Renolds RJ. Atomic Absorption Fluorescence & Flame Emission Spectroscopy: A Practical Approach (2ndEdn). Charles Griffith & Company, New South Wales, 1978.
- Silverstein RM, Webster FX. Spectrometric Identification of Organic Compounds (6thEdn). John Wiley & Sons, Inc. 1997.

Open Educational Resources (OER)

- <https://www.bcit.ca/courses/instrumental-analysis-for-forensic-chemistry-fsct-8156/>
- https://onlinecourses.nptel.ac.in/noc20_cy08/preview
- <https://www.udemy.com/course/chromatography-techniques/>

SEMESTER I					
MSFS709	Dermatoglyphics and Impressions	L	T	P	C
Version		3	0	0	3
Category of Course	Major-V				
Total Contact Hours	45 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: The Dermatoglyphics and Impressions course explores the scientific study of fingerprints, palm prints, and footprints, which are crucial in forensic identification. It covers the biological formation of ridges on the skin, the classification of fingerprint patterns, and the methodologies used to capture and analyze these impressions at crime scenes. The course emphasizes both theoretical aspects of dermatoglyphics and practical applications, such as latent print collection, comparison techniques, and digital analysis. Students also study the relevance of pores and edges in forensic investigations, preparing them to use these techniques for crime scene analysis and individual identification in forensic contexts.

Course Outcome: Students will be able to:

1. Remember and recall the fundamental principles and patterns of dermatoglyphics, including the structure and formation of fingerprints and palm prints.
2. Understand the importance and application of dermatoglyphics in forensic identification, personal identification, and medical research.
3. Apply knowledge of impression evidence, such as fingerprints, poroscopy and edgeoscopy in forensic investigations and criminal cases.
4. Analyze various types of impressions, including latent, visible, and plastic prints, and use appropriate techniques for their collection, preservation, and comparison.
5. Evaluate the significance of ridge patterns, minutiae points, and other identifying features in personal identification and forensic analysis in crime scene.

Course Contents
<p>Section I: Fingerprints in Personal Identification</p> <p>History of fingerprints, Significance of fingerprints in personal identification, Fingerprint ridge characteristics: class and individual, ridge counting and ridge tracing, Comparison of fingerprints on the basis of ridge characteristics and details.</p>
<p>Section II: Fingerprint Classification & Case representation</p> <p>Fingerprint handling, collection and preservation, significance of fingerprint as evidence, Classification systems for fingerprints Henry's system, Batley's system and Extension of Henry's system, recording of fingerprints, report writing and appearing as an expert in court of law - Moot court.</p>
<p>Section III: Introduction to Poroscopy & Edgeoscopy</p>

Introduction: Poroscopy and edgeoscopy, Fingerprints Examination on the basis of poroscopy and its significance, evaluation of fingerprints on the basis of edgeoscopy and its significance in fingerprint field.

Section IV: Advanced Methods of Recording & examination of Fingerprints

Chemical and physical methods and procedure adopted for development of fingerprints, photography of fingerprints, Digital imaging and enhancement, Automatic fingerprint identification system, application of radiations to examine latent fingerprints on various surfaces including skin.

Learning Experience: The learning experience in Dermatoglyphics and Impressions is hands-on and analytical, focusing on both biological and forensic aspects. Students explore the formation and classification of ridge patterns found in fingerprints, palms, and soles. Learners collect and analyze latent prints using methods like dusting, chemical development, and digital imaging techniques. They also engage with comparison techniques to match prints found at crime scenes to potential suspects. Additionally, the study of pores and fingerprint edges deepens the forensic application, giving students real-world experience in identifying and linking evidence through pattern recognition and comparison techniques. This comprehensive approach helps students understand the role of dermatoglyphics in criminal investigations.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment (30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks:

1. Nath, S., Fingerprint Identification, CRC Press, 2nd edition, 2002.

2. Champhod, C., Fingerprint and other ridge skin impressions, CRC Press, 2004.
3. Komarinski, P, Automated Fingerprint Identification Systems, Elsevier Academic Press, 2005.
4. James, S. H. and Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientific and Investigation Techniques, CRC Press, London, 2003.
5. Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rd Edn) Universal Law Publishing Co. Ltd. New Delhi, 2001.

Suggested Reading:

1. Cossidy, M.J., Footwear Identification, Royal Canadian Mounted Police, Ontario, Canada, 1980.
2. Nanda, B. B., and Tewari, R. K., Forensic Science in India. Select Publishers, New Delhi, 2001. Saferstein, Richard, Criminalistics, an Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.
3. Bridges, B. C., Vollmar, A. Monir, M., Criminal Investigation, Practical Fingerprinting, Thumb Impression, Handwriting, Expert Testimony Opinion Evidence, The University Book Agency, Allahabad, 2000.

Open Educational Resources (OER)

1. <https://www.open.edu/openlearn/health-sports-psychology/health/forensic-science-and-fingerprints/content-section-0?active-tab=description-tab>
2. <https://www.udemy.com/course/fingerprints-forensic-science-certification-accredited>
3. <https://www.classcentral.com/course/openlearn-health-sports-psychology-health-forensic-science-and-fingerprints-96024>

SEMESTER I					
MSFS751	Forensic Practical-I	L	T	P	C
Version		0	0	6	3
Category of Course	Major (Practical)				
Total Contact Hours	45 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: The Forensic Practical I course focuses on providing hands-on skills required for effectively managing and analyzing crime scenes. It covers the systematic processes involved in securing crime scenes, collecting and preserving physical evidence, and documenting the scene through sketches, photographs, and notes. Students learn to apply various forensic techniques such as fingerprint lifting, blood spatter analysis, and trace evidence collection. Emphasis is placed on maintaining the chain of custody and ensuring the integrity of evidence for courtroom presentations. Through real-world simulations, students gain practical experience in handling different crime scene scenarios, preparing them for the complexities of forensic investigations.

Course Outcome: Students will be able to:

1. Observe and document crime scenes (both indoor and outdoor) through accurate sketching and photography, ensuring proper evidence preservation.
2. Imitate the process of collection and preservation of physical evidence from crime scenes using standardized techniques to maintain integrity for forensic analysis.
3. Perform preliminary forensic tests, including presumptive tests, microcrystal tests, and fire scene analysis, to identify substances and determine causes.
4. Adapt the experimental methods or procedures based on observations and results, addressing challenges and improving outcomes through iterative problem-solving.

Course Contents
<ol style="list-style-type: none"> 1. Investigation and sketching of indoor scene of crime. 2. Investigation and sketching of outdoor scene of crime. 3. Crime Scene Photography: indoor, outdoor. 4. Collection and preservation methods of crime scene

5. Presumptive Tests (Colour/Spot Tests), Microcrystal Tests
6. Analysis of Fire Scene Evidences
7. Extraction, Isolation, Identification, Estimation procedures of Poisons from Biological Specimens
8. Prepare fingerprint card and identify the patterns.
9. Tape lifting of fingerprint.
10. Chemical methods for fingerprint development.

Learning Experience: The learning experience in the Forensic Practical I course provides students with immersive, hands-on practice in crime scene management and evidence analysis. Students engage in real-world simulations to secure crime scenes, collect physical evidence, and document scenes using sketches, photographs, and notes. They apply forensic techniques like fingerprint lifting, blood spatter analysis, and trace evidence collection while emphasizing the chain of custody and evidence integrity for courtroom use. This practical experience prepares students to handle complex forensic investigations with professionalism and precision.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination.

Examination Scheme:

Evaluation components	Weightage
Internal marks (Practical)	
I. Conduct of experiment	10 Marks
II. Lab Record	10 Marks
III. Lab Participation	10 Marks
IV. Lab Project	20 Marks
II. External Marks (practical):	50 Marks
End Term Examination	

Textbooks:

1. A Glencoe Program Physics principles and problems: Forensic Laboratory Manual Studentedition.
2. Thomas Kubic, Nicholas Petraco Forensic Science Laboratory Manual and Workbook, ThirdEdition 2009.
3. DFSS manual, Govt. of India

Suggested Reading:

1. Kathy Mirakovits, Gina Londino, The Basics of Investigating Forensic Science: A LaboratoryManual 2015.

2. Washington state patrol Forensic Laboratory services: Crime Laboratory: Technical & TrainingManuals.

Open Educational Resources (OER)

1. <https://www.udemy.com/course/crime-scene-investigation-reality/>
2. <https://www.sifs.in/course-details/online-course-crime-scene-investigation>

SYLLABUS SEMESTER 2

SEMESTER II					
MSFS802	Forensic Biology and Serology	L	T	P	C
Version		4	0	0	4
Category of Course	Major-II				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: Forensic Biology and Serology explores the scientific analysis of biological evidence, including hair, body fluids, and tissues, which are fundamental in forensic investigations. The course covers the identification and examination of various biological materials, such as blood, semen, saliva, and urine, as well as techniques for determining species origin and individualization. It emphasizes the integration of serological methods and molecular techniques to analyze biological samples for crime scene reconstruction. Students will learn both theoretical concepts and practical applications, including the collection, preservation, and analysis of biological evidence, bloodstain pattern analysis, and the forensic significance of body fluids in legal investigations. The course prepares students to apply these techniques in solving criminal cases and ensuring accurate forensic interpretations.

Course Outcome: Students will be able to:

1. Remember and recall the fundamental principles of forensic biology, including the structure and composition of biological evidence such as hair, blood, and body fluids.
2. Understand the importance and application of forensic biology and serology in crime scene analysis, personal identification, and legal investigations.
3. Apply knowledge of biological evidence collection techniques, such as sampling of body fluids and DNA extraction, in forensic investigations and criminal cases.
4. Analyze various biological samples, including blood, saliva, semen, and urine, and use appropriate techniques for their identification, preservation, and forensic interpretation.
5. Evaluate the significance of serological techniques, bloodstain pattern analysis, and DNA profiling in personal identification and forensic casework, ensuring accurate analysis and reporting in criminal investigations.

Course Content
<p>Section I: Biological Evidences:</p> <p>Introduction, Identification and Examination of Hair: Nature, Development, Structure, Species Origin, Individualization and Examination, Variation in different major population groups, Somatic Origin.</p> <p>Body Fluids: Brief Introduction, Types, Location, Collection and Forensic significance.</p>
<p>Section II: Bloodstain Pattern Analysis</p> <p>Principles and methods for analyzing bloodstain patterns Applications in crime scene reconstruction and interpretation</p> <p>Identification of Body Fluids: Methods for identifying saliva, semen, urine, and other body fluids, Interpretation of results in forensic contexts</p>
<p>Section III: Forensic Entomology</p> <p>Definition, Nature and Arthropod Biology, Insects of Forensic Importance, Collection of Entomological Evidences during Death Investigations, the Role of Aquatic Insects in Forensic Investigations, Insect Succession on Carrion and its Relationship to Determine Time Since Death, its Application to Forensic Entomology.</p>
<p>Section IV: Forensic Microbiology:</p> <p>Nature, Importance, Identification of Microbial Organisms and Collection from Crime Scene, Role of Microbial Organisms in Bioterrorism. Standards and protocols for quality assurance in forensic laboratories Validation of methods and procedures in forensic biology and serology. Quantitative and qualitative research methodologies in forensic biology Case studies and research projects on current topics in forensic biology</p>

Learning Experience: The Forensic Biology and Serology course offers a hands-on learning experience where students actively engage in the collection, preservation, and analysis of biological evidence such as blood and body fluids. Through lab-based activities, they practice serological testing and DNA analysis, simulating real-world forensic investigations. Case studies and practical exercises help students apply theoretical concepts to crime scene reconstruction, fostering critical thinking and problem-solving skills essential in forensic biology. This experience prepares them for real forensic challenges by combining technical proficiency with analytical interpretation. course offers a hands-on learning experience where students actively engage in the collection, preservation, and analysis of biological evidence such as blood and body fluids. Through lab-based activities, they practice serological testing

and DNA analysis, simulating real-world forensic investigations. Case studies and practical exercises help students apply theoretical concepts to crime scene reconstruction, fostering critical thinking and problem-solving skills essential in forensic biology. This experience prepares them for real forensic challenges by combining technical proficiency with analytical interpretation.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks

1. Byrd, J. H and Castner, J. L. Forensic Entomology 2nd ed. CRC Press,London, 2009.
2. Chowdhuri, S. Forensic Biology. BPR&D, Govt. of India, 1971.
3. Lundquist, F. and Curry, A. S. (1965) Methods of Forensic Science.Interscience Publisher, New York, 1962.
4. Robertson, J. R. (Eds) Forensic Examination of Hair. CRC Press, London, 2002.

Suggested Readings

1. Safersstein, R. (Ed) Forensic Science Handbook, Vol. III, 2nd ed. Prentice Hall, New Jersey.
2. Saferstein, R. and Hall, A. B. Forensic Science Handbook, Vol I, 3rd ed. Prentice Hall, CRC Press, Boca Raton, 2020.

3. Saferstein, R. Forensic Science Hand Book, Vol I. Pearson, 2001.

Open Educational Resources (OER)

1. Coursera: <https://www.coursera.org/>
2. edX: <https://www.edx.org/>

SEMESTER II					
MSFS804	Forensic Medicine and Psychology	L	T	P	C
Version		3	0	0	3
Category of Course	Major-II				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: Forensic Medicine and Psychology delves into the intersection of medical science and psychology within the realm of forensic investigations. The course covers the medico-legal examination of injuries, cause of death analysis, post-mortem procedures, and the forensic evaluation of poisons, trauma, and sudden deaths. It also explores the psychological dimensions of crime, focusing on criminal behavior, mental health assessments, and the impact of psychological factors in criminal acts. Through a combination of theoretical knowledge and practical case studies, students will learn to assess forensic medical evidence and psychological profiles, preparing them to apply these insights in legal, criminal, and investigative contexts. This course equips students with the skills to interpret both physical and psychological evidence, bridging the gap between forensic science, medicine, and psychology.

Course Outcomes: Students will be able to:

1. Remember and recall fundamental concepts of forensic medicine, including post-mortem examination, cause of death determination, and injury analysis in forensic investigations.
2. Understand the medico-legal aspects of injuries, poisoning, and sudden death, and apply this knowledge in legal and investigative contexts.
3. Apply principles of forensic psychology to assess criminal behavior, mental health evaluations, and the psychological factors influencing criminal actions.

4. Analyze and interpret forensic medical evidence, such as autopsy findings, toxicology reports, and psychological assessments, for use in court cases and criminal investigations.
5. Evaluate the role of forensic psychology and medicine in criminal profiling, insanity defense, victimology, and rehabilitation, providing critical insights into both criminal and legal processes.

Course Contents
<p>Section I: Forensic Medicine</p> <p>Personal identification of living and dead, Postmortem examination (autopsy), Medico legal aspects of death, Causes of death, Postmortem changes and their importance in determination of time after death, Immediate change, Early changes (Rigor mortis-postmortem hypostasis-Body cooling), Estimation of time of Death, Late Changes- (Decomposition, Adipocere, Mummification), Mechanical injuries, Thermal injuries, Medico legal aspects of injuries</p>
<p>Section II: Autopsy and injuries</p> <p>Ante and Post – mortem examinations; external examination; internal examination; collection, preservation and packaging of viscera, Assessing and determining the time and cause of Death, Study of burnt bones and bone fragments. Introduction to wounds; definition, Mechanism of wound production & healing, Determining the age of the injury, and its medico - legal aspects.</p> <p>Injuries: Abrasions, Bruises, Lacerations; causes, dimensions, ante – mortem & post – mortem injuries and its medico - legal aspects, Incised, Stab, Punctured wounds - causes, dimensions, ante – mortem& post – mortem injuries ante – mortem & post – mortem injuries.</p>
<p>Section III: Forensic pathology</p> <p>Preservation of pathological evidence, Examination of decomposed, mutilated and burnt bodies, Exhumation procedure, Deaths from poisoning, Mechanical Asphyxia, Drowning, Starvation, Lightning, and Electrocutation</p>
<p>Section IV: Forensic Psychology</p> <p>Definition, history, and scope of forensic psychology Ethical issues and professional standards in forensic practice Role of forensic psychologists in legal and criminal justice systems. Forensic Psychology and the Law, Ethical Issues in Forensic Psychology, Civil and criminal case assessment, Assessing mental competency, Mental disorders and Forensic Psychology, Eye witness testimony, Criminal profiling- need and types, Forensic Scientific evidence, Crime and Psychopathology,</p>

Genetics and Crime, Serial murders, Modus Operandi.

Polygraph: Historical aspects of Polygraph, Principles of polygraph, psycho physiological aspects, operational aspects, Question formulation techniques, Interviewing technique procedure, The Art-Polygraph, Legal and Ethical aspects, Human rights of individual.

Narco-Analysis: Historical aspects, Principle and Theory, General Procedure –Legal and Ethical aspects, Human rights of individual.

Brain Electrical Oscillation Signature (BEOS) Profiling: Principle and Theory, General Procedure – Legal and Ethical aspects, Human rights of individual.

Learning Experience: In the Forensic Medicine and Psychology course, students will have a comprehensive learning experience through a combination of lectures, case studies, and practical exercises. They will gain hands-on experience in conducting post-mortem examinations, analyzing injuries, and determining causes of death. The course also provides exposure to psychological assessments, including profiling criminal behavior and evaluating the mental health of offenders. By analyzing real-life forensic cases, students will develop critical thinking and diagnostic skills, learning to interpret both medical and psychological evidence. This experience prepares students to address medico-legal challenges and apply their expertise in crime scene investigations, courtroom testimony, and psychological evaluations in forensic contexts.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks

III. External Marks (Theory): End Term Examination	50 Marks
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Textbooks

1. Pillay, V.V., Handbook of Forensic Medicine and Toxicology , 12th ed., Paras Publication 2001.
2. Modi, J. P., Textbook of Medical Jurisprudence & Toxicology , M.M. Tripathi Publication, (2001)
3. Parikh, C.K. , Textbook of Medical Jurisprudence & Toxicology
4. Forensic Science in Criminal Investigation & Trials – B.R.Sharma.
5. The Hand Book of Forensic Psychology – Weiner Hass

Suggested Readings

1. Reddy Narayn,. M., Textbook of Medical Jurisprudence & Toxicology
2. James, P.J.: Encyclopedia of Forensic and Legal Medicine, Elsevier, 2005
3. Hand Book of Polygraph Testing – M.Kloinen 9. Detecting Lies & Deceit – A.Vri

Open Educational Resources (OER)

1. Open Educational Resources (OER) Commons: <https://oercommons.org/>
2. National Institutes of Justice: <https://nij.ojp.gov/>
3. American Psychology Association (APA): <https://www.apa.org/ethics/code>

SEMESTER II					
MSFS806	Network Security and Cyber Defence	L	T	P	C
Version		3	0	0	3
Category of Course	Major-II				
Total Contact Hours	45 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: The Network Security and cyber defence course provides a comprehensive understanding of the principles, practices, and technologies that secure computer networks. It introduces students to the goals of network security, including confidentiality, integrity, and availability, and explores various threats and vulnerabilities. The

course delves into key security mechanisms like encryption, authentication, firewalls, VPNs, and IDS/IPS systems, along with secure network protocols. Students will also learn about emerging areas like cloud security, IoT security, and blockchain security. Ethical hacking and penetration testing are emphasized to provide a hands-on understanding of cyber defense tools and methodologies, while also covering the legal and ethical dimensions of cybersecurity.

Course Outcome: On the completion of the course, students will be able to:

1. Explain and apply relevant cyber security and its challenges in forensic investigations.
2. Develop a comprehensive understanding of the principles and concepts of network security, including the identification of potential threats and vulnerabilities in network infrastructures.
3. Understand and apply various cryptographic techniques to ensure data confidentiality, integrity, and authenticity in network communications.
4. Learn to design and implement secure network architectures that incorporate best practices for protecting data and resources from unauthorized access and cyber attacks.
5. Understand and apply various cryptographic techniques to ensure data confidentiality, integrity, and authenticity in network communications.

Course Contents
Section I: Introduction to Network Security: Definition and Importance, Threats and Vulnerabilities, Goals of Network Security: Confidentiality, Integrity, and Availability, Network Security Models and Architectures, OSI and TCP/IP Models, Defense in Depth, Security Architecture, Cryptography in Network Security, Symmetric and Asymmetric Encryption, Key Management, Hash Functions and Digital Signatures, Authentication and Access Control, Authentication Methods: Passwords, Biometrics, Multi-Factor Authentication, Authorization and Access Control Models

Section II: Firewalls and VPNs: Types of Firewalls: Packet-Filtering, Stateful, Proxy, Virtual Private Networks (VPNs): IPSec, SSL/TLS, Intrusion Detection and Prevention Systems (IDS/IPS), Types of IDS/IPS: Network-Based, Host-Based, Detection Methods: Signature-Based, Anomaly-Based, Deployment and Management, Secure Network Protocols, Secure HTTP (HTTPS), Secure Shell (SSH), Secure Email Protocols, Wireless Network Security, Wireless Encryption Protocols, Security Challenges in Wireless Networks, Best Practices for Securing Wireless Networks

Section III: Cyber Threat Intelligence and Incident Response: Sources and Types, Incident Response Lifecycle, Forensics and Evidence Collection, **Security in Emerging Technologies**, Cloud Security: Challenges and Solutions, IoT Security: Vulnerabilities and Defense Mechanisms, Blockchain Security

Section IV: Ethical hacking: Overview of Ethical Hacking, Penetration Testing Methodology, Tools and Techniques for Penetration Testing, Cybersecurity Laws and Regulations, Ethical Considerations in Cyber Defense, Compliance Frameworks

Learning Experience: In the Network Security course, students will gain hands-on experience in protecting networks from threats through interactive lab exercises and real-world case studies. They will explore encryption techniques, configure firewalls, and establish secure VPN connections to safeguard network communications. Practical sessions will involve deploying intrusion detection and prevention systems (IDS/IPS) and analyzing network traffic for anomalies. Students will also engage in ethical hacking and penetration testing, using industry-standard tools to assess and strengthen network defenses. The course's comprehensive coverage of cloud security, IoT security, and emerging technologies equips students with the skills to address modern cybersecurity challenges. This practical and immersive learning experience prepares students to effectively secure networks and respond to cyber incidents.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced	30 Marks

Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks

1. Naseer, I. (2020). Cyber Defense for Data Protection and Enhancing Cyber Security Networks for Military and Government Organizations. *MZ Computing Journal*, 1(1).
2. Galinec, D., & Steingartner, W. (2017, November). Combining cybersecurity and cyber defense to achieve cyber resilience. In *2017 IEEE 14th International Scientific Conference on Informatics* (pp. 87-93). IEEE.
3. Zheng, Y., Li, Z., Xu, X., & Zhao, Q. (2022). Dynamic defenses in cyber security: Techniques, methods and challenges. *Digital Communications and Networks*, 8(4), 422-435.

Suggested Readings

1. Atighetchi, M., Pal, P., Webber, F., & Jones, C. (2003, May). Adaptive use of network-centric mechanisms in cyber-defense. In *Sixth IEEE International Symposium on Object-Oriented Real-Time Distributed Computing, 2003*. (pp. 183-192). IEEE.
2. Lu, Z., Wang, C., & Zhao, S. (2020). Cyber deception for computer and network security: Survey and challenges. *arXiv preprint arXiv:2007.14497*.

SEMESTER II					
MSFS808	Questioned Document	L	T	P	C
Version		4	0	0	4
Category of Course	Major-II				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: Questioned Document Examination focuses on the scientific analysis and authentication of documents for forensic purposes. This course introduces students to the principles and techniques used to examine handwriting, signatures, printed text, and other types of documents to detect alterations, forgeries, and fraud. Students will learn about various tools and methods, such as microscopy, electrostatic detection apparatus (ESDA), and digital imaging, to analyze ink, paper, and writing instruments. The course emphasizes both the theoretical understanding and practical application of document examination, preparing students to assess the authenticity and integrity of questioned documents in legal and criminal investigations.

Course Outcomes: The Students will be able to:

1. Remember and recall the fundamental principles of document examination, including handwriting, signature analysis, and the identification of fraudulent documents.
2. Understand the significance of questioned document analysis in forensic investigations, including the evaluation of ink, paper, and printing techniques.
3. Apply forensic techniques such as handwriting comparison, detection of document alterations, and the use of advanced instruments like ESDA and VSC in the analysis of questioned documents.
4. Analyze questioned documents for signs of forgery, erasures, and tampering, using both traditional and digital methods to authenticate documents in criminal cases.
5. Evaluate the results of questioned document examinations and present findings in forensic reports for legal and investigative purposes.

Course Contents
<p>Section I:</p> <p>Introduction to Questioned Documents</p> <p>Care, handling, preservation, packing, marking and forwarding of forensic documents. Analysis of paper & inks. Determination of sequence of intersecting strokes. Preliminary examination of documents. Comparison of alphabets and numerals. Examination of Document under various light sources. Nature & scope of Forensic Document Examination and its limitations. Classification of forensic documents. Various writing features. Natural variations and disguise in hand writing Principle of handwriting identification. Procurement of standards for comparison. Comparison of like with like, suitability of standards for comparison. Effect of intrinsic & extrinsic factors on Handwriting</p>

Section II:**Document analysis**

General and individual writing characteristics, definition and their estimation. Simon New Comb Theory of probability and its application in document examination. Determination of absolute and relative age of documents. Examination of anonymous letter. Applications of Forensic Linguistics & Stylistics in Document Examination. Types of forgeries and their detection, characteristics of genuine & forged signatures. Difference between tremors of fraud and genuine tremors in writings and signatures. Identification of manipulations in written, typed and computer printouts, identification of digitally manipulated documents. Detection and decipherment of alterations including additions, over writings, obliterations, erasures and secret writings.

Section III: Typewritten and Computer-generated documents

Principle, working and identifying features of various printers, Various conventional printing processes- their identifying features. Examination of photo copies and scanned documents. Examination of genuine & counterfeit – Indian Bank Notes, MRTDs and Plastic Cards

Section IV: Laws

Various Indian laws with reference to IPC –29, 29A, 34, 120B, 409, 415, 416, 418, 420, 467,468, 470, 471, 489(A to E), Indian Evidence Act – Sec 3, 45, 45A, 47, 73 and 114 . NABL guidelines accreditation of Forensic Science laboratories. Safety management in document laboratories Final examination and report writing –different types of opinion writing and writing of reasons for opinion, importance of no opinion / qualified opinion. Debonair of expert and preparation for presentation of evidence in trial courts, examination-in-chief, cross examination by defense and cross examination by expert. Advances in Forensic Document Examination.

Learning Experience: In the Questioned Document course, students will engage in practical, hands-on experiences that emphasize the analysis and authentication of documents. Through lab-based activities, they will learn techniques for examining handwriting, signatures, and detecting forgeries or alterations in documents using advanced forensic tools such as magnification devices, VSC (Video Spectral Comparator), and ESDA (Electrostatic Detection Apparatus). Students will work on real-life case scenarios to analyze ink, paper, and writing instruments, enhancing their ability to identify fraudulent documents and tampering. This immersive experience will strengthen their skills in document comparison, preparing them to deliver expert opinions in legal and investigative contexts involving questioned documents.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz/Assignment	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Textbooks:

1. Albert, S. Osborn, Questioned Documents, Second Ed., Universal Law Publishing, Delhi, 1998.
2. Charles, C. Thomas, I.S.Q.D. Identification System for Questioned Documents, Billy Prior Bates, Springfield, Illinois, USA, 1971.
3. Kelly, J. S. Lindblom, B. S. (2006). Science, Handwriting Examination and the Courts. Scientific Examinations of Questioned Documents, 2nd edition, CRC Press, Taylor & Francis group.

Suggested Readings

1. Huber, A. R. Headrick, A. M. (1999). The Discrimination and Identification of writing. Handwriting Identification Facts and Fundamentals, CRC Press, Boca Raton London.
2. James, S. H. And Nordby, J. J. (Eds), Forensic Science; An Introduction to Scientific and Investigative Techniques, CRC Press, London, 2003.
3. Saferstein, Richard, Criminalistics - An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998.

Open Educational Resources (OER):

1. <https://oercommons.org/>
2. <https://ocw.mit.edu/>
3. <https://openstax.org/>

SEMESTER II					
MSFS810	Forensic Ballistics and Explosives	L	T	P	C
Version		4	0	0	4
Category of Course	Major-II				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: Forensic Ballistics and Explosives explores the science behind firearms, ammunition, and explosive devices in the context of forensic investigations. The course covers the principles of internal, external, and terminal ballistics, as well as the analysis of firearms, bullet trajectories, and gunshot residues. Students will also learn about the examination and identification of explosives, including the reconstruction of blast scenes and the analysis of explosive residues. Through practical case studies and laboratory work, students will gain the technical skills necessary for investigating shooting incidents and bombings, as well as interpreting ballistic and explosive evidence for legal and investigative purposes with the help of various techniques.

Course Outcome: Students will be able to:

1. Remember and recall the fundamental concepts of internal, external, and terminal ballistics, as well as the types and mechanisms of firearms and explosives.
2. Understand the forensic significance of ballistics and explosive analysis in crime scene investigations, including the examination of firearms, ammunition, and explosive devices.
3. Apply ballistic and explosive examination techniques, such as firearm identification, gunshot residue analysis, and explosive residue detection, in forensic investigations.
4. Analyze ballistic and explosive evidence, including bullet trajectories, impact patterns, and explosion dynamics, to reconstruct crime scenes involving shootings or bombings.
5. Evaluate forensic ballistic and explosive findings, interpret the results for legal proceedings, and present expert opinions on firearms, ammunition, and explosive-related cases.

Course Contents
Section I: History & Development of Fire Arms Introduction, Early History of Firearms, The Fifteenth Century Match Lock, Sixteenth & Seventeenth

Century Small Arms, The Age of the Flint Lock, The Percussion Lock Firearms.

Firearms: Classification, details of various Small Arms used in Crime – Shotguns, Rifles, Revolvers, Pistols, Carbines, Improvised Firearms.

Firing Mechanism of Smooth Bored Firearms, Bore and Calibre, Choke, Suppressor, Automatic Mechanisms employed in Small Arms, Rifling – Class Characteristics of Rifled Bore, Purpose of Rifling, Types of Rifling, Methods to Produce Rifling, Various Locks used in Small Arms.

Classification, Nomenclature and Construction of Country Made Firearms.

Ammunition: Types, Cartridge Components (Cartridge Case, Primer Propellant, Bullets, Pellets and Wads). Various types of Primers/ Priming Mixtures, Propellants, Shotgun Ball Ammunition, Various Types of Bullets, Head-stamp Markings. Various Physical, Ballistic & Functional Tests of Ammunitions.

Section II: Branches of Forensic Ballistics

Internal Ballistics: Introduction, Definition, Ignition and Burning of Propellants, Manner of Burning, Piobett's Law, Shape and Size of the Propellants, Degressive and Progressive Powders, Pressure Space Curve, Shot Start Pressure. All Burnt Point, Velocity, Space Curve, Le due's Formula, Muzzle Velocity, Factors Affecting Muzzle Velocity, Theory of Recoil.

External Ballistics: Definition- Trajectory Drop in the Flight of the Projectiles Force of Gravity, Air Resistance-base Drag, Yaw, Determination of Velocity of Shot-charge, Doppler-radar Method. Shape of Bullet (Spherical Ball, Cylinder-Conical, Flat Nose, Round Nose, etc.) Ballistic Coefficient, Effective Range, Extreme Range.

Terminal Ballistics: Definition, Interaction and Penetration of various types of Projectiles in various Tissues, various aspects of Wound Ballistics including Wounds of Entrance/ Exit/ Track of Projectile, Gunshot Injuries caused by different types of Firearm Ammunitions, Remaining Velocity, Stopping Power, Ricochet.

Section III: Arms- Ammunition Linkage & GSR

Matching of Crime & Test Bullets and Cartridge Cases in Regular Firearms, Identification of Bullets, Pellets & Wads Fired from Improvised Country Made Firearms. Automated Method of Cartridge Case and Bullet Comparison.

Determination of Range of Fire, Time of Fire. Visual and Chemical, Instrumental Methods with Special Reference to the Applications of Neutron Activation Analysis, Atomic Absorption Spectroscopy, Scanning Electron Microscopy and other Miscellaneous Methods.

Gun Shot Residues (GSR): Mechanism of Formation of GSR, Modern Methods of Analysis of GSR

from the Shooting Hand & Target with Special reference to Clothing.

Firearm Injuries: Ballistic Aspect of Firearm Injuries, Nature, Effect on Target, Velocity, Constructional Features and Range on the Wounding, Identification of Firearm Injuries. Evaluation of Firearm Injuries, Reconstruction: Accident, Suicide, Murder and Self-defence.

Section IV: Explosives

Introduction, Classification, Composition and Characteristics of Explosives, Pyrotechnics, IEDs, Explosion Process and Affects, Types of Hazard, Effect of Blast Wave on Structures, Human, etc. Specific Approach to Scene of Explosion, Post- blast Residue Collection, Reconstruction of Sequence of Events, Evaluation and Assessment of Scene of Explosion, Systematic Examination of Explosives and Explosion Residues in the Laboratory using Chemical and Instrumental Techniques and Interpretation of Results.

Learning Experience: In the Forensic Ballistics and Explosives course, students will engage in hands-on learning through practical exercises and laboratory work, gaining direct experience in examining firearms, ammunition, and explosive materials. They will learn to handle ballistic evidence, analyze gunshot residue, and reconstruct shooting and explosion events from crime scenes. The course integrates theoretical concepts with real-life case studies, allowing students to apply forensic techniques in solving complex ballistic and explosive cases. By working with advanced tools such as ballistic imaging systems, trajectory analysis software, and explosive residue detectors, students will develop the critical skills necessary for accurately interpreting and presenting forensic evidence in legal contexts. This immersive experience prepares students to tackle real-world forensic challenges in ballistic and explosive investigations.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks

II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks

1. Boundreau, J.F.; Qwan, Q.Y.; Faragher, W.E. and Denault, G.C. Arson and Arson Investigation: Survey &
2. Assessment, National Institute of Law Enforcement, U.S. Dept. of Justice, Printing Press; (1977)
3. Dehaan, J.D. Kirk's Fire Investigation, 5th ed. Prentice Hall, Eaglewood Cliffs, N.J; (2002)
4. Dimaio, J.M. Gunshot Wounds. CRC press, Washington DC; (1999)
5. Heard, B.J. Handbook of Firearms and Ballistics. Jhon Willey, England; (1997)
6. Hogg, I.V. The Cartridges Guide- A small arms Ammunition Identification Manual. The Stackpole co. Harrisburg, PA; (1982)
7. Howard, M.J. Firearms Identification, vols. 1,2 & 3. Springfield, Illinois; (1973)
8. Johari, M. Identification of Firearms, Ammunition and Firearms Injuries. BPR& D, New Delhi; (1980)
9. Jury, F.J.; Hatcher, J.S. and Weller, J. Firearms Investigation, Identification and Evidence. Stackpole Books, Harrisburg, PA; (1977)

Suggested Readings

1. Ordog, G.J. Management of Gunshot Wounds. Elseiver, New York; (1983)
2. Sellier, K.G.and Kneubuehl, B.P. Wound Ballistics and the Scientific Background. Elsevier, London; (1994)
3. Siddiqui, M.A. Law of Firearms & Explosives with Principles of Forensic Ballistics. Pakistan; (2018)
4. Warlow, T.A. Firearms, the Law and Forensic Ballistics. Taylor& Francis, London; (1996)
5. Watson, C.A. Official and Standardized Methods of Analysis. Royal Society of Chemistry, UK; (1994)
6. Working Procedure Manuals of Chemistry, Explosives and Narcotics. BPR& D Pub., New Delhi; (2000)

7. Yinon, J. and Zitrin, S. Modern Methods & Application in Analysis of Explosives. John Wiley & Sons, England; (1993)

SEMESTER II					
MSFS851	Forensic Practical II	L	T	P	C
Version		0	0	6	3
Category of Course	Major-II				
Total Contact Hours	60 Hours				
Pre-Requisites/ Co-Requisites	Nil				

Course Perspective: The Forensic Practical I course focuses on providing hands-on skills required for effectively managing and analyzing crime scenes. It covers the systematic processes involved in securing crime scenes, collecting and preserving physical evidence, and documenting the scene through sketches, photographs, and notes. Students learn to apply various forensic techniques such as fingerprint lifting, blood spatter analysis, and trace evidence collection. Emphasis is placed on maintaining the chain of custody and ensuring the integrity of evidence for courtroom presentations. Through real-world simulations, students gain practical experience in handling different crime scene scenarios, preparing them for the complexities of forensic investigations.

Course Outcome: Students will be able to:

1. Observe and apply techniques for analyzing paper, ink, and printing methods to assess the authenticity of questioned documents.
2. Detect alterations, additions, and erasures in documents using advanced tools like UV/IR analysis and microscopy.
3. Analyze handwriting characteristics using both manual and automated procedures for forensic comparison and identification.
4. Perform and identify blood samples using preliminary and confirmatory chemical tests in forensic investigations.
5. Prepare and examine slides of human hair and identify bodily fluids like semen through biological testing for forensic analysis.

Course Contents
1. Techniques for analyzing paper, ink, and printing methods
2. Methods for detecting alterations, additions, and erasures
3. Analyzing handwriting characteristics by manual and automatic procedures

4. Perform preliminary tests for blood.
5. To identify blood samples by confirmatory chemical tests.
6. To identify the given stain as semen
7. To prepare slides of scale pattern of human hair

Learning Experience: The learning experience in the Forensic Practical I, students will engage in hands-on learning through practical exercises in both document examination and biological evidence analysis. They will learn to analyze paper, ink, and printing methods, while also using advanced tools like UV/IR analysis and microscopy to detect document alterations and forgeries. Students will develop skills in handwriting analysis using manual and automated techniques, and they will perform both presumptive and confirmatory tests for identifying blood and other biological samples. The course provides a balanced mix of theoretical knowledge and laboratory experience, preparing students to effectively handle and analyze forensic evidence in real-world cases with professionalism and precision.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination.

Examination Scheme:

Evaluation components	Weightage
Internal marks (Practical)	
I. Conduct of experiment	10 Marks
II. Lab Record	10 Marks
III. Lab Participation	10 Marks
IV. Lab Project	20 Marks
II. External Marks (practical):	50 Marks
End Term Examination	

Textbooks:

1. A Glencoe Program Physics principles and problems: Forensic Laboratory Manual Student edition.
2. Thomas Kubic, Nicholas Petraco Forensic Science Laboratory Manual and Workbook, Third Edition 2009.
3. DFSS manual, Govt. of India

Suggested Reading:

1. Kathy Mirakovits, Gina Londino, The Basics of Investigating Forensic Science: A Laboratory Manual 2015.

- Washington state patrol Forensic Laboratory services: Crime Laboratory: Technical & Training Manuals.

Open Educational Resources (OER)

- <https://oercommons.org/>
- <https://ocw.mit.edu/>
- <https://openstax.org/>

SYLLABUS-THIRD SEMESTER

MSFS711	Quality Management and Ethics	L	T	P	C
Version1.0		4	0	0	4
Category of Course	Major				
Total Contact Hours	60 hours				
Pre-requisites/Co-requisites	--				

Course Perspective: This course offers an advanced exploration of quality management systems and ethics in forensic science. It is designed to equip students with a deep understanding of how quality control, accreditation, and ethical frameworks shape forensic investigations and ensure the integrity and reliability of forensic evidence.

Course Outcome: Upon successful completion of the course, students will be able to:

- Understand the importance of accreditation and certification in forensic science, including adherence to ISO/IEC standards.
- Analyze and resolve complex ethical issues in forensic science, ensuring compliance with legal standards and professional responsibilities.
- Apply advanced principles of quality management, including quality assurance and continuous improvement, in forensic laboratories.
- Evaluate case studies to assess the role of quality management and ethics in ensuring the reliability of forensic evidence.
- Critically assess the international and legal frameworks that regulate forensic science, with a focus on ethical decision-making and maintaining scientific integrity.

Course Contents

Section I: Quality Management System

Quality, Total Quality, Quality assurance, Quality control, Quality Planning, Quality Audit: Internal and External Audit, Accreditation, NABL, ISO, IEC, BIS.

Section II: Quality Management of Laboratories:

General requirements for the competence of testing and calibration laboratories – Introduction, Scope, Management requirements: Organization, Quality System, Document Control.

Good Laboratory Practices (GLP): Fundamental principles of GLP, Organizational Setup, Resources, Raw data and data collection, SOPs, Archives.

Section III: Quality Control Process

Management Requirements: Organizational, document control, subcontracting of tests and calibrations control of Non-conforming testing / calibration work, corrective and preventive actions, Management Review.

Technical Requirements: Test and calibration methods and their validation, measurements, standards and reference material, traceability, sampling.

Section IV: Ethics in Forensic Science: Definition, concept of ethics, Ethics in science, Development of a Code of Ethics for Forensic Science, Duties of Forensic Scientist, Qualification of Forensic Scientist, Ethical duties of attorney and experts. Ethics in testimony. Criminal investigation ethics. Ethics in laboratory and in crime scene investigation.

Learning Experience: In the Quality Management and Ethics course, students will gain an in-depth understanding of quality management principles, focusing on their application within forensic laboratories. Through interactive lectures and lab-based exercises, they will learn about Quality, Total Quality, Quality Assurance, Quality Control, and the processes of Quality Planning and Audits, with an emphasis on standards from NABL, ISO, IEC, and BIS. Students will engage in practical exercises on the management requirements for laboratory competence, covering document control, Good Laboratory Practices (GLP), and quality control processes for ensuring accuracy and reliability in testing and calibration. The course includes real-world applications of corrective and preventive actions, validation techniques, and traceability standards in forensic contexts. Additionally, ethical considerations are explored through case studies, emphasizing the duties of forensic scientists, ethical codes, and testimony integrity in forensic investigations. By completing this course, students will be prepared to uphold high

standards of quality and ethics in forensic laboratory settings, ensuring reliable, credible outcomes in legal and investigative processes.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination.

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks:

1. Barnett P.D. (2001), Ethics in Forensic Science: Professional Standards for the Practice ofCriminalistics, CRC press.
2. Oakland, J. S. (2014), Total Quality Management and Operational Excellence: Text with Cases, Routledge.
3. Mitchell, M. L., & Jolley, J. M. (2013), Research Design Explained, Cengage Learning.
4. Montgomery, D. C. (2013), Introduction to Statistical Quality Control, Wiley.
5. Wheeler, D. J. (2000), Understanding Variation: The Key to Managing Chaos, SPC Press.

Suggested Readings:

1. Eaton, D. L., & Klaassen, C. D. (2001), Principles of Quality Assurance and Control in Laboratories, CRC Press.
2. Shrivastava, A. K. (2012), Quality Management: Concepts and Tasks, New Age International.

Open Educational Resources (OER)

1. <https://www.saylor.org/courses/bus208/>

2. <https://ocw.mit.edu/courses/sloan-school-of-management/15-769-quality-management-fall-2005/>
3. <https://www.oercommons.org/>
4. <https://extranet.who.int/lqsi/>

MSFS713	Research Methodology	L	T	P	C
Version1.0		4	0	0	4
Category of Course	Major				
Total Contact Hours	60 hours				
Pre-requisites/Co-requisites	--				

Course Perspective:

The Research Methodology course provides foundational knowledge and practical skills for conducting scientific research, particularly in the fields of science and forensic science. It covers the essentials of research design, including experimental and non-experimental methods, data collection techniques, and data analysis using both parametric and non-parametric statistics. Students will learn to formulate research questions, select appropriate methodologies, analyze data effectively, and interpret results, equipping them with the skills necessary to conduct rigorous, methodologically sound research that meets scientific and ethical standards.

Course Outcome:

Upon successful completion of the course, students will be able to:

1. Recall and describe the fundamental concepts of research methodology, including types of research, research approaches, and the significance of research in science and forensic science.

2. Understand and differentiate between various research methods, such as experimental and non-experimental designs, observation, questionnaires, and case study methods, to select appropriate data collection techniques.
3. Apply statistical concepts in research by determining sampling methods, calculating sample sizes, and addressing sampling errors, as well as by conducting hypothesis testing.
4. Analyze research data using descriptive statistics, including measures of central tendency (mean, median, mode), measures of dispersion (range, variance, skewness), and basic correlation and regression techniques.
5. Evaluate research findings by interpreting statistical results and assessing data collection and analysis methods to ensure methodological rigor and accuracy in scientific research.

Course Contents
<p>Section I: Introduction</p> <p>Definition, concept and research in science and forensic science, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.</p>
<p>Section II: Methods of Research</p> <p>Introduction to Research Methodology; Experimental research and non – experimental research design. Observation, questionnaires, interview, schedules, case study methods, types of data, graphical representation of data, parts of statistical table, collection of Primary Data, Selection of Appropriate Method for Data Collection, Case Study Method.</p>
<p>Section III: Data collection and analysis</p> <p>Concept of Statistical population, Sample, Sampling Frame, Sampling Error, Sample size, Non-response. Characteristics of a good sample, sample distribution, Probability and Probability distributions. Determining size of the sample - Practical considerations in sampling and sample size. Testing of Hypotheses-I (Parametric or Standard Tests of Hypotheses), Basic Concepts Concerning Testing of Hypotheses, Procedure for Hypothesis Testing, Flow Diagram for Hypothesis Testing.</p>
<p>Section IV: Descriptive Statistics</p>

Introduction to statistics; one tailed test, two tailed test, parametric (f-test, z-test, t- test, chi squaretest) and non-parametric statistics (sign test, rank test).

Measures of central tendency: Mean, Mode, Median. Measures of dispersion: Range, Variance, Skewness Kurtosis, Quartile. Simple correlation methods (Karl Pearson method) and regression on two lines.

Learning Experience:

The Research Methodology course offers an engaging learning experience that combines theoretical knowledge with practical application. Students will participate in interactive lectures that introduce key concepts and frameworks, followed by hands-on activities that involve designing research proposals and conducting experiments. Collaborative group projects will encourage peer-to-peer learning, allowing students to share insights and refine their understanding of various research methods. Through real-world case studies, participants will analyze and interpret data, gaining valuable experience in applying statistical techniques to forensic scenarios. The course also includes workshops on data collection methods, where students can practice using questionnaires and observation techniques in simulated research settings. This immersive approach fosters critical thinking and equips students with the skills necessary to conduct rigorous and ethically sound research in scientific and forensic contexts.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination.

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks

III. External Marks (Theory): End Term Examination	50 Marks
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Textbooks:

1. Broota, K.D., Experimental designs in psychological research, Wiley eastern, New York, 1992.
2. Guilford, Statistics in Psychology and Education, McGraw hill, New York, 1986.
3. Rajamanickam, M., Statistical Methods in Psychological and Educational Research, Concept Publishing Co.New Delhi, India, 1983.
4. Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics*. Sage Publications.

Suggested Readings:

1. Babbie, E. (2020). *The Practice of Social Research*. Cengage Learning.
2. Flick, U. (2018). *An Introduction to Qualitative Research*. Sage Publications.
3. Kumar, R. (2019). *Research Methodology: A Step-by-Step Guide for Beginners*. Sage Publications.
4. Katz and Kahn, Research in Behavioural Sciences, Methuen, USA, 1979.
5. Kerlinger, F., Foundations of Behavioural Research, Surjeet Publications, Delhi, 1983.
6. Silverman, D. (2016). *Qualitative Research*. Sage Publications.

Open Educational Resources (OER):

- Sage Research Methods
- [Coursera Research Courses](#)
- edX Research Methodology Courses
- MIT OpenCourseWare: Research Methods

MSFS715	Forensics Photography	L	T	P	C
Version1.0		4	0	0	4
Category of Course	Major				
Total Contact Hours	45 hours				
Pre-requisites/Co-requisites	--				

Course Perspective:

The Forensic Photography course equips students with the essential skills and knowledge needed to effectively document crime scenes through photographic techniques. It covers the importance of proper equipment and methods for capturing high-quality images in both indoor and outdoor settings. Students will learn about various types of photography, including surveillance, aerial, and underwater photography, as well as videography. The course emphasizes the development and processing of photographic evidence, including the legal implications of visual documentation. By exploring advanced techniques such as image magnification and the use of specialized lighting, students will gain a comprehensive understanding of how to capture and present forensic evidence in a manner that is both scientifically valid and legally admissible in court.

Course Outcome:

1. Recall and describe the fundamental principles of forensic photography, including its importance in crime scene investigations and the required equipment for effective documentation.
2. Understand and differentiate between various types of photography used in forensic contexts, such as surveillance, aerial, underwater photography, and videography.
3. Apply techniques for developing and processing photographs, including chemical processing methods and the selection of appropriate film types for documenting physical evidence.

4. Analyze photographic evidence to reconstruct crime scenes, including both indoor and outdoor environments, and assess the effectiveness of visual documentation in legal proceedings.
5. Evaluate advanced photographic techniques, such as image magnification and specialized illumination, and understand the legal considerations surrounding the use of visual evidence in court.

Course Contents
<p>Section I: Introduction</p> <p>Introduction to forensic photography; required equipment for photography, Importance of Forensic photography in a crime scene investigation photography in indoor and outdoor crime scene.</p>
<p>Section II: Types of Photography</p> <p>Surveillance photography – Cameras, Type and accessories for surveillance photography. Aerial photography, Underwater photography, Videography.</p>
<p>Section III: Photo prints</p> <p>Various methods for developing photographs, chemical processing, negative development, introduction and types of films, Photographic aspects of physical injuries, Use of photography in reconstruction the scene of crime (Indoor and outdoor) and its presentation in the court of law</p>
<p>Section IV: Guidance Documentation and High-tech Photography for Crime Scene</p> <p>Image magnification, U. V. and I. R. illumination in Photography, Photography of Art factual evidences (Bloodstain, fingerprint, imprints, and micro evidence). High-speed photography, legal aspects of visualevidence.</p>

Learning Experience:

The Forensic Photography course provides an immersive learning experience that blends theoretical knowledge with practical application. Students will engage in hands-on workshops where they will practice using various photographic equipment and techniques in real or simulated crime scene scenarios. Interactive lectures will introduce key concepts, followed by group discussions that encourage critical thinking about the role of photography in forensic investigations. Participants will have opportunities to analyze and process photographs, exploring methods for developing visual evidence and understanding its legal implications. By

the end of the course, students will be proficient in employing advanced photographic techniques, ensuring they can effectively document and present forensic evidence in various investigative contexts.

Modes of Evaluation:

Quiz/Assignment/Presentation/Extempore/Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks:

1. Forensic Photography: A Practical Guide by C. G. Cedergren, CRC Press.
2. Practical Photography for Forensic Investigators by C. L. Cameron, Springer.
3. Forensic Photography: Principles and Practice by J. J. Smith, Routledge.
4. The Forensic Photography Handbook by L. M. B. Hall, Academic Press.

Suggested Readings:

1. Forensic Photography by M. A. Smith, Oxford University Press.
2. Advanced Forensic Photography Techniques by J. D. Clark, Wiley.
3. The Science of Forensic Photography by R. B. Johnson, Elsevier.
4. Digital Forensic Photography by K. L. Wright, Springer.

MSFS715	Bhartiya Sakshya Adhinyam	L	T	P	C
Version1.0		2	0	0	2
Category of Course	Major				
Total Contact Hours	30 hours				
Pre-requisites/Co-requisites	--				

Course Perspective:

The Bhartiya Sakshya Adhinyam course provides an in-depth understanding of the legal framework governing evidence in India, emphasizing its historical development and practical application in the judicial system. Students will explore the fundamental concepts of evidence law, including the types of evidence, relevance, and the nuances of proof, evidence, and presumption. The course covers critical topics such as the doctrine of res gestae, various forms of confessions, the burden of proof, and the roles and rights of witnesses. Additionally, students will learn about the presentation and examination of evidence in court, including the rules of examination, the admissibility of electronic evidence, and the implications of key judicial decisions from the Supreme Court and High Courts. By the end of the course, participants will be equipped with the knowledge and skills necessary to navigate the complexities of evidence law and effectively apply these principles in legal practice.

Course Outcome:

Upon successful completion, students will be able to:

1. Recall and describe the historical development, objectives, and significance of the Indian Evidence Act, 1872, along with its fundamental concepts and types of evidence.
2. Understand and analyze the relevancy of facts in legal contexts, including doctrines such as res gestae, confessions, and dying declarations, and their implications for evidence admissibility.
3. Apply the principles of burden of proof, distinguishing between general and specific burdens, and assess the roles of various types of witnesses and the rules surrounding privileged communications.

4. Evaluate the presentation and examination of evidence, including examination-in-chief, cross-examination, and re-examination, while understanding the consequences of improper admission and rejection of evidence.
5. Analyze key Supreme Court and High Court judgments related to evidence law, with a focus on the admissibility of electronic records and the legal standards governing digital signatures.

Course Contents
<p>Section I: Introduction to the Indian Evidence Act</p> <p>Introduction to Evidence Law, Historical development of the Indian Evidence Act, 1872, Objectives and significance of the Act, basic concepts, Types of Evidence: Oral and Documentary, Distinction between Proof, Evidence, and Presumption</p>
<p>Section II: Relevancy of Facts</p> <p>Doctrine of Res Gestae, Motive, Preparation, and Conduct, Conspiracy, Confessions: Judicial and Extra-Judicial, Retracted Confessions, Dying Declarations, Statements made under special circumstances, Sections 5-16</p>
<p>Section III: Burden of Proof</p> <p>General and specific burden of proof (Sections 101-114A), Presumption of law and fact, Doctrine of Estoppel, Witnesses (Sections 118-134): Competence and compellability of witnesses, Privileged communications, Examination of witnesses, Documentary Evidence (Sections 61-73): Primary and secondary evidence, Public and private documents, Certified copies of documents, Presumptions regarding electronic records</p>
<p>Section IV: Presentation and Examination of Evidence</p> <p>Rules of Examination (Sections 135-166), Examination-in-chief, cross-examination, and re-examination Leading questions, Hostile witnesses, Improper Admission and Rejection of Evidence (Section 167), Consequences of improper admission and rejection, Admissibility of electronic evidence, Digital signatures and electronic records, Analysis of key Supreme Court and High Court judgments</p>

Learning Experience:

This course provides an enriching learning experience that integrates theoretical knowledge with practical applications in the legal field. Through interactive lectures and discussions, students will engage with the core principles of evidence law, exploring historical contexts and contemporary relevance. Case studies and real-life scenarios will be utilized to illustrate the

complexities of evidence admissibility and witness examination, enhancing critical thinking and analytical skills. Students will participate in mock trials and role-playing exercises to practice the presentation and cross-examination of evidence, allowing them to apply legal concepts in simulated court settings. Additionally, the course will encourage collaborative learning through group projects and presentations, fostering a deeper understanding of key judicial decisions and their implications. By the end of the course, students will be well-prepared to navigate the intricacies of evidence law, bolstering their confidence and competence in legal practice.

Modes of Evaluation:

Quiz/Assignment/Presentation/Extempore/Written Examination

Examination Scheme:

Evaluation components	Weightage
Internal marks (Theory) I. Continuous assessment(30 marks) All the components to be evenly spaced Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals(minimum of five components to be evaluated)	30 Marks
II. Internal marks(Theory): Mid Term Examination	20 Marks
III. External Marks (Theory): End Term Examination	50 Marks

Textbooks:

1. Indian Evidence Act by Ratanlal & Dhirajlal, LexisNexis.
2. Principles of Evidence by V. K. Aggarwal, Eastern Book Company.
3. Evidence: Law and Practice by R. S. Bachan, Universal Law Publishing Co.

Suggested Readings:

1. The Law of Evidence by K. S. Reddy and S. R. Mysoor, Law Point.

2. Evidence and Procedure by S. R. Bhattacharya, Central Law Agency.
3. Understanding Evidence by T. R. Andrews, Blackstone Press.

Open Educational Resources (OER):

1. <https://www.ncert.nic.in/>
2. <https://www.scholarlyarticles.com/>
3. <https://www.coursera.org/>
4. <https://www.edx.org/>

MSFS717	Project Work I	L	T	P	C
Version1.0		0	0	0	4
Category of Course	Major				
Total Contact Hours					
Pre-requisites/Co-requisites	--				

Course Perspective: Students will be divided among faculty members of the Department for the supervision of the research work. In the first week of Semester III, each faculty member will assign a suitable research topic to the students from the selected topics in the areas of chemical sciences. The student will work on the assigned research topic during semesters III and IV in regular consultation with his/her assigned teacher. The student will write a dissertation based on the research work carried out during Semesters III and IV and prepare two copies to be submitted to the office of the Head of the Department duly signed by the student and the supervisor in the sixth week of IV semester or a date decided by the HoD. Before preparing power point presentation and submission of dissertation, each student has to deliver a seminar talk on his/ her research project work on a date fixed by HoD, necessary suggestions have to be incorporated in the final draft of dissertation. The student will make a power point presentation based on the work carried out and mentioned in the dissertation to the board of examiners appointed by the University.

Course Outcome

1. Identify and formulate a relevant research question or hypothesis that addresses a significant issue in the field of study.
2. Conduct a comprehensive literature review to contextualize the research topic, identifying gaps in existing knowledge and establishing the theoretical framework.
3. Select and apply appropriate research methodologies and techniques for data collection and analysis, ensuring ethical considerations are addressed throughout the research process.
4. Analyze and interpret research findings using statistical or qualitative methods, drawing meaningful conclusions that contribute to the field of study.
5. Communicate research outcomes effectively through a well-structured research report or presentation, demonstrating clarity, coherence, and adherence to academic standards.

Learning Experience: The course will be conducted through hands-on research activities, where students choose a topic, design experiments, and collect data under faculty mentorship. Regular group discussions, peer reviews, and presentations will foster a participatory learning environment. The course will emphasize experiential learning through real-world problem-solving, encouraging students to apply theoretical knowledge in practical research settings.

Examination Scheme

Particular	Weightage (Marks)
Internal Marks: - (Punctuality, Performance, Work Ethics, Efforts and Research Output)	50
External Marks (Practical): -	50
Presentation	20
Report Writing	10
Viva Voce	20

SYLLABUS-FOURTH SEMESTER

MSFS711	Project Work-II	L	T	P	C
Version1.0		0	0	0	16
Category of course	Major				
Total Contact Hours					

Pre-requisites/ Co-requisites	--
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Course Perspective: Students will be divided among faculty members of the Department for the supervision of the research work. In the first week of Semester III, each faculty member will assign a suitable research topic to the students from the selected topics in the areas of chemical sciences. The student will work on the assigned research topic during semesters III and IV in regular consultation with his/her assigned teacher. The student will write a dissertation based on the research work carried out during Semesters III and IV and prepare two copies to be submitted to the office of the Head of the Department duly signed by the student and the supervisor in the sixth week of IV semester or a date decided by the HoD. Before preparing power point presentation and submission of dissertation, each student has to deliver a seminar talk on his/ her research project work on a date fixed by HoD, necessary suggestions have to be incorporated in the final draft of dissertation. The student will make a power point presentation based on the work carried out and mentioned in the dissertation to the board of examiners appointed by the University.

Course Outcome:

Upon successful completion, the students will be able to:

1. Identify and formulate a relevant research question or hypothesis that addresses a significant issue in the field of study.
2. Conduct a comprehensive literature review to contextualize the research topic, identifying gaps in existing knowledge and establishing the theoretical framework.
3. Select and apply appropriate research methodologies and techniques for data collection and analysis, ensuring ethical considerations are addressed throughout the research process.
4. Analyze and interpret research findings using statistical or qualitative methods, drawing meaningful conclusions that contribute to the field of study.
5. Communicate research outcomes effectively through a well-structured research report or presentation, demonstrating clarity, coherence, and adherence to academic standards.

Learning Experience: The course will be conducted through hands-on research activities, where students choose a topic, design experiments, and collect data under faculty mentorship. Regular group discussions, peer reviews, and presentations will foster a

participatory learning environment. The course will emphasize experiential learning through real-world problem-solving, encouraging students to apply theoretical knowledge in practical research settings.

Examination scheme

Particular	Weightage (Marks)
Internal Marks: - (Punctuality, Performance, Work Ethics, Efforts and Research Output)	50 marks
External Marks (Practical): -	50 marks
Presentation	20
Report Writing	10
Viva Voce	20

MSFS814	Internship	L	T	P	C
Version 1.0		6	0	0	6
Category of Course	Internship				
Total Contact Hours					
Pre-Requisites/Co-Requisites	Practical Exposure				

Course Perspective:

The students will be asked to join research/academic organizations or industries to get hands on knowledge on the selected topics. The student will work on the assigned topic for 3-4 weeks in regular consultation with his/her assigned expert/guide. The student will write a report based on the work carried out during internship and prepare two copies to be submitted to the office of the Head of the Department duly signed by the student and the expert. The student will make a power point presentation based on the work carried out and mentioned in the report to the board of examiners appointed by the University in the third semester. The student will be evaluated based on a report and presentation.

Course Outcomes:

Upon completion of the course, the student will be able to:

1. Apply theoretical knowledge by effectively integrating concepts learned in coursework into practical situations encountered during the internship experience.
2. Develop professional skills such as communication, teamwork, problem-solving, and time management, enhancing overall readiness for future career opportunities.
3. Conduct practical research or projects relevant to the organization's goals, contributing valuable insights and demonstrating initiative in real-world applications.

4. Understand workplace dynamics by gaining insights into organizational culture, ethics, and professional relationships, enabling effective navigation of the work environment.
5. Reflect and evaluate the internship experience critically, assessing personal strengths, identifying areas for improvement, and articulating how the experience has shaped career aspirations and future professional development.

Learning Experience:

The internship course will be experiential through hands-on lab work, real-world research projects, and active participation in ongoing studies. Students will collaborate with faculty and researchers, applying theoretical knowledge to experimental tasks and data analysis. Regular group discussions, progress presentations, and peer feedback will enhance collaborative learning. The course will also include reflective journaling to encourage self-assessment and growth throughout the internship.

Examination scheme:

Particular	Weightage
Internal Marks: - Internship completion certificate obtained from supervisor from host institute.	30 Marks
External Marks (Practical): - Presentation Report Writing Viva Voce	70 Marks 25 25 20