K.R. MANGALAM UNIVERSITY
THE COMPLETE WORLD OF EDUCATION

SCHOOL OF BASIC AND APPLIED SCIENCES (SBAS)

Programme Handbook
(Programme Structure & Evaluation Scheme)

Bachelor of Science (Honours) in

Forensic Science

Program Code- 212

THREE YEAR UNDERGRADUATE PROGRAMME

As per National Education Policy 2020
(with effect from 2025-26 session)

Approved in the 38th Meeting of Academic Council Held on 28th June 2025

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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 present three years undergraduate programme Bachelor of Science (Hons. with Research) Forensic Science i.e. (B.Sc. (Hons. with Research) Forensic Science) according to the New Education Policy-2020. We have designed a flexible choice-based credit system, multidisciplinary approach, and multiple entry and exit options for the duration of 2024-2028.

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.

2. NEP-2020: Important features integrated in the curriculum

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 undergraduate programme, we now offer a Four-Year Undergraduate Programme with multiple entry and exit points, along with re-entry options, and relevant certifications.

- **UG Certificate** after completing 1 year (2 semesters with the required number of credits) of study, and an additional vocational course/internship of 4 credits during the summer vacation of the first year.
- **UG Diploma** after completing 2 years (4 semesters with the required number of credits) of study, and an additional vocational course/internship of 4 credits during the summer vacation of the second year.
- **Bachelor's Degree** after completing 3-year (6 semesters with the required number of credits) programme of study.
- **4-year bachelor's degree (Honours)** with the required number of credits after eight semesters programme of study.
- Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. Upon completing a research project in their major area(s) of study in the 4th year, a student will be awarded **bachelor's degree (Honours with Research)**.

Advantage of pursuing 4-year bachelor's degree programme with Honours/Honours with Research is that the master's degree will be of one year duration. Also, a 4-year degree programme will facilitate admission to foreign universities.

Table 1: Minimum Credit Requirement for Three-year UG Program

S. No.	Broad Categories of Courses	Minimum Credit Requirement for Four year UG Program
1	Major (Core)	59
2	Minor (GEC)	24
3	Discipline selective	18
3	Multidisciplinary (Open electives)	9
4	Ability Enhancement Course (AEC)	08
5	Skill Enhancement Course (SEC)	12

6	Value-Added Course (VAC)	04
7	Summer Internship	04
8	Research Project/Dissertation	08
9	Co-curricular activity	02
10	Total	148

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.

Minor: Students will have the option to choose courses from disciplinary/interdisciplinary minors and skill-based courses. Students who take enough courses in a discipline or an interdisciplinary area of study other than the chosen major will qualify for a minor in that discipline or in the chosen interdisciplinary area of study.

Students have multiple minor streams to choose from. They can select one minor stream from the available options, which will be pursued for the entire duration of the programme.

Multidisciplinary (Open Elective): These courses are intended to broaden the intellectual experience and form part of liberal arts and science education. These introductory-level courses may be related to any of the broad disciplines given below:

- Natural and Physical Sciences
- Mathematics, Statistics, and Computer Applications
- Library, Information, and Media Sciences
- Commerce and Management
- Humanities and Social Sciences

A diverse array of Open Elective Courses, distributed across different semesters and aligned with the aforementioned categories, is offered to the students. These courses enable students to expand their perspectives and gain a holistic understanding of various disciplines. Students can choose courses based on their areas of interest.

Ability Enhancement Course (AEC): Students are required to achieve competency in a Modern Indian Language (MIL) and in the English language with special emphasis on language and communication skills. The courses aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and expository and academic writing skills, that help students articulate their

arguments and present their thinking clearly and coherently and recognize the importance of language as a mediator of knowledge and identity.

Skills Enhancement Courses (SEC): These courses are aimed at imparting practical skills, hands-on training, soft skills, etc., to enhance the employability of students.

Value-Added Course (VAC): The Value-Added Courses (VAC) are aimed at inculcating Humanistic, Ethical, Constitutional and Universal human values of truth, righteous conduct, peace, love, non-violence, scientific and technological advancements, global citizenship values and life-skills falling under below given categories:

- Understanding India
- Environmental Science/Education
- Digital and Technological Solutions
- Health & Wellness, Yoga education, Sports, and Fitness

Research Project / Dissertation: Students choosing a 4-Year Bachelor's degree (Honours with Research) are required to take up research projects under the guidance of a faculty member. The students are expected to complete the Research Project in the eighth 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 the 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 understanding ethical values and environmental realities

4. About the School of Basic and Applied Sciences

The School of Basic and Applied Science imparts both teaching and research through its four disciplines of Forensic Science, Chemistry, 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 endeavours. 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: Bachelor of Sciences (Honours) in Forensic Science

The B.Sc. (Hons.) Forensic Science is an undergraduate 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 of basic and applied sciences. Students in this program will study fundamental principles of forensic science, engage in complex problem-solving, and enhance their analytical and critical thinking skills. Students in this program will study fundamental principles of forensic science, engage in complex problem-solving, and enhance their analytical and critical thinking skills. Combining hands-on lab work with theoretical learning, they'll gain practical experience and a solid grasp of scientific research methods. The B.Sc. (Hons.) 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.) 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

three year Undergraduate Degree programme B.Sc. (Hons.) Forensic Science with Multiple Entry-Multiple Exit option from the academic session 2023-24. Through multiple entry/exit option, students will be able to enter and exit the program at various stages. This course emphasized hands on practice, innovative thought process and project-based learning.

6.2. Aims of B.Sc. (Hons) Forensic Science Programme

The aims of the B.Sc. (Hons.) 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 B.Sc. (Hons.) 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 B.Sc. (Hons.) 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.

6.3 Definitions

- **Programme Outcomes (POs)**

Programme Outcomes are statements that describe what the students are expected to know and would be able to do upon the graduation. These relate to the skills, knowledge, and behavior that students acquire through the programme.

- **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.

6.4 Programme Educational Objectives (PEO*)*

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

PEO1: Graduates will evolve into proficient professionals, well-suited for roles in government, corporate, and research arenas, while also possessing the acumen for entrepreneurial pursuits in various interdisciplinary areas of forensic science.

PEO2: Graduates will demonstrate robust technical expertise to think critically and conduct thorough and accurate forensic analyses, interpreting results, and presenting findings effectively.

PEO3: Graduates will adhere to the ethical guidelines and legal frameworks governing the field, ensuring the responsible and unbiased application of forensic methodologies.

PEO4: Graduates will pursue lifelong learning and engage in advanced research, staying updated with emerging technologies and methodologies in forensic science.

PEO5: Graduates will demonstrate acumen for pursuing higher education and taking on roles in forensic laboratories, academic institutions, research or related industries, contributing to advancements in forensic science and public safety.

6.5 Programme Outcomes (PO)

At the time of graduation, students of undergraduate degree program will be able to:

PO1- Critical Thinking: Develop high order critical thinking skills to address and resolve real world forensic issues.

PO2- Problem Solving: Develop problem solving skills and employ innovative approaches for effectively investigating and reconstructing crime scene, handling evidence, scientific instruments and legal reports.

PO3- Effective communication: Develop strong communication skills including reading, writing, listening, and speaking, to effectively express ideas and viewpoints.

PO4- Ethics: Apply ethical principles and commit to professional ethics, responsibilities, and norms in academic and industrial environment.

PO5- Interpersonal skills: Interact wisely and smartly within the society at personal and professional levels with a focus on achieving their target without affecting the societal harmony.

PO6- Environment and Sustainability: Practice and abide by processes required for a sustainable, healthy and safe environment and maintain contextual understanding of current environmental issues.

PO7- Team building and Leadership: Foster self-confidence, leadership and collaborative skills to navigate between multicultural and multidisciplinary environments.

6.6 Programme Specific Outcomes (PSO)

At the end of the program the students will be:

PSO 1: Understanding basic principles, concepts, techniques and theories in forensic science to build a strong foundational knowledge.

PSO 2: Applying appropriate forensic methodologies and techniques to analyze physical, biological, chemical and digital evidence in real-life crime scenarios and laboratory settings**.**

PSO 3: Analyzing complex civil and criminal cases to develop critical thinking and problem-solving skills, enabling the formation of well-informed conclusions while upholding ethical standards and legal compliance.

PSO 4: Evaluating the validity and efficacy of various forensic approaches and modify them to enhance the accuracy and reliability of forensic analyses.

PSO5: Observe and apply spatial awareness to reconstruct crime scenes, using technical skills to accurately position evidence and illustrate potential event sequences effectively.

PSO 6: Creating innovative strategies to address and tackle complex challenges during forensic investigations and provide expert testimony in court.

6.7 Career Avenues

Graduates can pursue careers in research and development (R&D) in industries, work as research scientists or assistants in forensic science laboratories, or continue with higher education (M.Sc., PhD) leading to academic or specialized roles in Forensic Science. Opportunities also exist in sectors like govt. jobs, defence services, data science, finance, and competitive examinations.

6.8 Duration

The duration of this programme is Three years with multiple entry/exit options.

6.9 Criteria for award of degree

Name of Degree	**Credits requirement**	**Completion Year**
B.Sc. Forensic Science (Hons.)	**148 Credits**	Third Year

The student must fulfil the credit requirement as prescribed in Table 2 (Programme Study)

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

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 (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

Overview of Internal Evaluation (40 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 40 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

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

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

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

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

1. 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.

Table 2. Programme Structure

Semester-I								
S. No.	**Category of Course**	**Course Code**	**Course**	**L**	**T**	**P**	**C**	**Hours/week**
1	Major 1	BSFSIF101	Introduction to Forensic Science	3	0	0	3	3
2	Major 2	BSFSFC102	Forensic Criminology	3	0	0	3	3
3	Major 3	BSFSCH103	Inorganic and Organic chemistry-I	2	0	0	2	2
4	Major Lab I	BSFSPC151	Practical-Chemistry I	0	0	2	1	2
5	Major 4	BSFSPH104	Forensic photography	3	0	0	3	3
6	SEC I	BSFSFP152	Forensic Practical I	0	0	4	2	4
7	VAC I		Environmental Studies	2	0	0	2	2
8	DSE I	BSFSCB105/BSFSEP106	Cell Biology /Elements of Physics	3	0	0	3	3
	Total Credit						**19**	**22**
Semester - II								
S. No.	**Category of Course**	**Course Code**	**Course**	**L**	**T**	**P**	**C**	**Hours/week**
9	Major 5	BSFSFD201	Forensics Dermatoglyphics	3	0	0	3	3
10	Core Course 6	BSFSQD202	Questioned Document	3	0	0	3	3
11	Core Course 7	BSFSCH203	Chemistry of elements	2	0	0	2	2
12	Core Course Lab II	BSFSPC251	Practical-Chemistry II	0	0	2	1	2
13	Minor I	UNMIDF206	Fundamentals of Digital Forensics & its legal implications	3	0	2	4	5
14	SEC II	BSFSFP252	Forensic Practical II	0	0	4	2	4
15	OE I*		Open elective I	3	0	0	3	3
16	DSE II	BSFSBC204/ BSFSME205	Biodiversity and Classification/Physics of Mechanics	3	0	0	3	3

17	Co-curricular activity I		Club and Society	0	0	0	1	0
	Total credits						**22**	**25**

*** Internship will be of 4-6 weeks duration at the end of Semester II during summer break and the evaluation will be done during Semester III**

Semester-III								
S. No.	**Category of Course**	**Course Code**	**Course**	**L**	**T**	**P**	**C**	**Hours/week**
18	Core Course 8	BSFSFB301	Forensic Ballistics and Explosives	3	0	0	3	3
19	Core Course 9	BSFSBS302	Forensic Biology and Serology	3	0	0	3	3
20	Core Course 10	BSFSCH303	Physical chemistry	2	0	0	2	2
21	Core Course Lab III	BSFSPC351	Practical-Chemistry III	0	0	2	1	2
22	Minor II	UNMIDF301	Mobile Device Forensics and Investigation	3	0	2	4	5
23	SEC III	BSFSFP352	Forensic Practical III	0	0	4	2	4
24	DSE III	BSFSDZ304/ BSFSPM305	Developmental zoology/Physics of Electricity and magnetism	3	0	0	3	3
25	SI	BSFSIN306	Evaluation of Summer internship-I	0	0	0	2	0
26	OE II*		Open elective II	3	0	0	3	3
27	AEC I		Self Awareness	2	0	0	2	2
28	Co-curricular activity II		Community services	0	0	0	1	0
	Total Credits						**26**	**27**
Semester IV								
S. No.	**Category of Course**	**Course Code**	**Course**	**L**	**T**	**P**	**C**	**Hours/week**
29	Core Course11	BSFSBS401	Forensic Physics and Biometric System	3	0	0	3	3
30	Core Course 12	BSFSFA402	Forensic Anthropology	3	0	0	3	3

31	Core Course 13	BSFSCH403	Analytical chemistry	2	0	0	2	2
32	Core Course Lab IV	BSFSPC451	Practical-Chemistry IV	0	0	2	1	2
33	Minor III	UNMIDF401	Operating Systems and Cloud Forensics	3	0	2	4	5
34	SEC IV	BSFSFP452	Forensic Practical IV	0	0	4	2	4
35	VAC II		Forensic Engineering	3	0	0	3	3
36	DSE IV	BSFSMZ404/ BSFSWA405	Molecular Zoology /Wave and optics	0	0	0	2	0
37	OE III*		Choose any one	3	0	0	3	3
38	AEC II		Communication and Personality Development	2	0	0	2	2
	Total Credits						**25**	**27**

*** Internship will be of 4-6 weeks duration at the end of Semester IV during summer break and the evaluation will be done during Semester V**

Semester-V									
S. N	**Category of Course**	**Course Code**	**Course**	**L**	**T**	**P**	**C**	**Hours/ week**	
39	Core Course 14	BSFSFM501	Forensic Medicine	3	0	0	3	3	**Award: Bachelo r's Degree** [after completing 3-year of study (6 semester s with
40	Core Course 15	BSFSCT502	Forensic Chemistry and Toxicology	3	0	0	3	3	
41	Core Course 16	BSFSCH503	Inorganic and Organic chemistry-II	2	0	0	2	2	
42	Core Course La	BSFSPC551	Practical-Chemistry V	0	0	2	1	2	
43	Minor IV	UNMIDF501	Social Media Forensics and Data Privacy	3	0	2	4	5	
44	SEC V	BSFSFP552	Forensic Practical V	0	0	4	2	4	

45	DSE V	BSFSEZ504 /BSFSTP 505	Evolutionary Zoology/Thermal Physics	3	0	0	3	3	credits as prescribed)] Entry: The student who took exit after completion of two years of study (UG Diploma) are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.
46	AEC III		Arithmetic Reasoning & Skills-III	2	0	0	2	2	
47	SI	BSFSIN506	Evaluation of Summer internship-II	0	0	0	2	0	
48	Minor V	UNMIDF502	Digital Forensic Project	0	0	0	4	0	
	Total Credits						**26**	**24**	
			Semester VI						
S. No.	**Category of Course**	**Course Code**	**Course**	**L**	**T**	**P**	**C**	**Hours/week**	
49	Core Course 17	BSFSPS601	Forensic Psychology	3	0	0	3	3	
50	Core Course 18	BSFSCH602	Inorganic and Organic Chemistry-III	2	0	0	2	2	
51	Core Course Lab VI	BSFSPC651	Practical-Chemistry VI	0	0	2	1	2	
52	GEC VI	UNMIDF601	Digital Forensics & Cyber Security	3	0	2	4	5	
53	SEC VI	BSFSFP652	Forensic Practical VI	0	0	4	2	4	
54	DSE VI	BSFSAZ603/BSFSSP604	Applied Zoology/Solid state physics	3	0	0	3	3	
55	AEC IV		Managing people and organisation	2	0	0	2	2	
	Core Course 19	BSFSQM605	Quality Management	2	0	0	2	2	
56	Core Course 20	BSCCRM606	Research methodology	3	0	0	3	3	
	Project	BSFSPR607	Research Project	0	0	8		0	

	Total Credits		**30**	**26**	

TOTAL CREDITS -148

DISCIPLINE SPECIFIC ELECTIVE -I						
Semester	**Course Code**	**Course**	**L**	**T**	**P**	**C**
1	**BSFSCB105**	Cell Biology	3	0	0	3
2	**BSFSBC205**	Biodiversity and classification	3	0	0	3
3	**BSFSDZ305**	Developmental zoology	3	0	0	3
4	**BSFSMZ405**	Molecular Zoology	3	0	0	3
5	**BSFSEZ505**	Evolutionary Zoology	3	0	0	3
6	**BSFSAZ605**	Applied Zoology	3	0	0	3

DISCIPLINE SPECIFIC ELECTIVE -II						
Semester	**Course Code**	**Course**	**L**	**T**	**P**	**C**
1	**BSFSEP105**	Elements of Physics	3	0	0	3
2	**BSFSME205**	Physics of Mechanics	3	0	0	3
3	**BSFSPM305**	Physics of Electricity and magnetism	3	0	0	3

4	**BSFSWA405**	Wave and optics	3	0	0	3
5	**BSFSTP505**	Thermal Physics	3	0	0	3
6	**BSFSSP605**	Solid state physics	3	0	0	3

Details of Digital Forensics as Minor						
Semester	**Course Code**	**Course**	**L**	**T**	**P**	**C**
2	**UNMIDF206**	Fundamentals of Digital Forensics & its legal implications	3	0	2	4
3	**UNMIDF301**	Mobile Device Forensics and Investigation	3	0	2	4
4	**UNMIDF401**	Operating Systems and Cloud Forensics	3	0	2	4
5	**UNMIDF501**	Social Media Forensics and Data Privacy	3	0	2	4
5	**UNMIDF502**	Minor Project (DFIS)	0	0	0	4
6	**UNMIDF601**	Digital Forensics & Cyber Security	3	0	2	4

11. Syllabi

FIRST SEMESTER

BSFSIF101	**Introduction to Forensic Science**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**0**	**0**	**3**
Category of Course	**Core Course 1**				

Total Contact Hours	**45 Hours**
Pre-requisites/ Co-requisites	**--**

Course Perspective: This course offers an in-depth understanding of forensic science's evolution, principles, and its application in criminal investigations. It covers the development of forensic labs, evidence types, and the role of expert testimony in court. Students will learn about crime scene investigation, documentation, and crime scene reconstruction, equipping them with practical skills in forensic analysis and legal applicability. The course blends theoretical knowledge with hands-on approaches, preparing students for real-world forensic challenges.

Course Outcome: Students will be:

CO1: Understanding the history and development of forensic science, including its definitions, principles, and the organizational structure of forensic laboratories, as well as the processes involved in report writing and chain of custody.

CO2: Applying knowledge of crime scene investigation techniques by defining crime scenes, identifying challenges associated with different types of crime scenes, and employing effective documentation and evidence handling practices.

CO3: Analysing modus operandi, crime scene reconstruction procedures by understanding the requirements for reconstruction along with analysis of applications of various types of evidence in court, exploring the laws of evidence and the significance of expert testimony in establishing the admissibility of scientific evidence within the legal framework.

CO4: Evaluating the importance of crime scene management roles and responsibilities of the investigating officer and expert teams along with analysis of various searching techniques used for locating physical evidence, as well as the impact of effective documentation on the overall investigation process.

Course contents	**:45 Hours**
Unit I: History and development of Forensic Science	**:10Hours**
Definition, Description, Principles, Concept, Needs and scope. History of Forensic Scienceand Forensic Science Labs; Progressive development and transformation of Forensic Science Labs; Hierarchical set up of Central Forensic Science Laboratories, State Forensic Science Laboratories; Basic services and optional services; Main Authority, Organizational structure of Forensic Science Laboratory – roles and responsibilities, Sections/ Divisions, Services provided, Process of report writing and submission to court, Chain of custody.	

Unit II: Evidence Applicability in Court	**:10Hours**
Definition, Various types of evidences, Laws of evidence, Expert's testimony and admissibility of scientific evidence in Court of Law.	
Unit III: Crime Scene investigation	**:15Hours**
Defining a crime and crime scene, Importance of crime scene, Problems associated with crime scenes (indoor and outdoor), Location and processing of Crime Scene; Introduction to Crime Scene Management, Handling clues and evidence; Types of crime scenes, Primary, Secondary crime scene, Mobile, Indoor and Outdoor crime scenes; Searching techniques used for locating physical evidences at scene of crime; Crime Scene documentation, Barrication of Crime Scene, Crime Scene Photography, Videography; Sketching; Notes making.	
Unit IV: Crime Scene Reconstruction	**:10Hours**
Procedure and requirement for Crime Scene Reconstruction, Modus operandi, Expert team constitution for different crime scenes, Roles of Investigating Officer.	

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of origin of forensic science, history of forensic science, evidences at crime scene and crime scene investigation.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbook:

1. Saferstein, Richard, Criminalistics, An Introduction to Forensic Science, 6th Ed. Prentice-Hall, New Jersey, 1998..
2. Sehgal, V.N., Forensic Science in Criminal Investigation and Court Evidence

Reference Books :

1. DeForest, P., Gaensslen, R., and Lee, H., Forensic Science; an Introduction toCriminalistics, McGraw Hill, New York, 1983

2. James, S. H. And Nordby, J. J. (Eds), Forensic Science - An Introduction to Scientificand Investigative Techniques, CRC Press, London, 2003.

3. Rao, M.S.; Maithil, B.P.Crime Scene Management: a Forensic Approach
4. Sharma, B. R., Forensic Science in Criminal Investigation and Trials (3rdEdn) UniversalLaw Publishing Co. Ltd. New Delhi, 2001.
5. Pratihari, H.K.,Forensic Evidence and Investigation Methods: case study and approach

Open Educational Resources (OER)

1. History and Development of Forensic Science – SIFS India Blog
   https://www.sifs.in/blog-details/history-of-forensic-science
2. Basics of Criminal Investigation (Alison Free Online Course)
   https://alison.com/course/basics-of-criminal-investigation
3. Crime Scene Reconstruction and Staging (EBSCO Research Starters)
   https://www.ebsco.com/research-starters/science/crime-scene-reconstruction-and-staging
4. Introduction to Criminal Investigation (University of Minnesota Open Textbook)
   https://open.umn.edu/opentextbooks/textbooks/introduction-to-criminal-investigation-processes-practices-and-thinking

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks

Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSFC102	**Forensic Criminology**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**0**	**0**	**3**
Category of Course	**Core Course 2**				
Total Contact Hours	**45 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: This course provides an interdisciplinary foundation in forensic criminology, combining criminological theories with scientific investigative methods. It covers classical, positivist, and sociological perspectives on criminal behavior, along with modern practices like offender profiling. Exploring various crime typologies, including cybercrime, hate crimes, and white-collar offenses, while examining the structure and functioning of the criminal justice system. The course also emphasizes understanding key legal frameworks such as the IPC, CrPC, IEA, and newly implemented BNS, BSA, and BNSS. Through critical engagement with crime data, including NCRB statistics and global trends, learners will develop analytical skills for evaluating criminal patterns and designing prevention strategies.

Course Outcome: Students will be:

CO1: Understanding the foundational concepts of forensic criminology, including definitions, aims, scope, and key theories of criminal behavior, demonstrating comprehension of interdisciplinary links with related fields.

CO2: Applying various forms and typologies of crime, including emerging crimes like cybercrime, and critically evaluate the causes, consequences, and behavioral patterns of offenders.

CO3: Analysing the structure and functioning of the criminal justice system, including policing, courts, corrections, and human rights considerations in forensic investigations.

CO4: Evaluate modern legal reforms such as Bharatiya Nyaya Sanhita (BNS), Bharatiya Sakshya Adhiniyam (BSA), and Bharatiya Nagarik Suraksha Sanhita (BNSS), and compare them with older criminal was to assess their impact on crime prevention and justice delivery.

Course contents	**:45 Hours**

Unit I: Foundations of Forensic Criminology	**:10 Hours**
Definition, aims and scope. Theories of criminal behavior – classical, positivist, sociological; Criminal profiling; Understanding modus operandi. Interdisciplinary Nature of criminology- Relation with Penology, Psychology, Sociology, Victimology, Criminal Law, Forensic Science.	
Unit II: Fundamentals of crime	**:10 Hours**
Elements, nature, causes and consequences of crime. Deviant behavior. Forms of Crime and Criminal Typologies - White Collar, Organized, and Environmental Crimes - Habitual, Professional, Violent, Aggressive, Sexual Offenders, Recidivists, Emerging crimes - Cybercrime (Economic and Social Media Offences), Corporate Crimes - Hate Crimes, Gender Violence, Situational Criminality	
Unit III: Criminal Justice System	**:10 Hours**
Structure and functioning of the criminal justice system including policing, courts, and corrections; policing styles and principles; police powers, investigation procedures, and filing charges; community policing in a diverse society; correctional measures and offender rehabilitation; human rights in forensic investigations.	
Unit IV: Modern Legal Reforms, Punishment, and Crime Prevention	**:15 Hours**
Introduction to Bharatiya Nyaya Sanhita (BNS), Bharatiya Sakshya Adhiniyam (BSA), and Bharatiya Nagarik Suraksha Sanhita (BNSS); comparative analysis of old and new criminal laws; key sections and punishments; crime prevention strategies and forensic interventions; role of the Law Commission of India and global agencies; and challenges of cybercrime and other emerging global crimes. Crime Statistics and Current Trends - Meaning and Importance, NCRB, SCRB, DCRB functions, Crime/Victim Surveys: International Crime Comparisons, Unreported Crimes	

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of key concepts of forensic criminology, from criminal profiling to emerging crime trends. Students will analyze criminal behavior through interdisciplinary perspectives, including psychology, sociology, and law, while gaining practical insights into the criminal justice system, policing, and legal procedures.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Ram Ahuja- Criminology Publisher: Rawat Publications ISBN-13: 9788170336105 01 Jan 2000

Reference Books:

1. 21st Century Criminology: A Reference Handbook by J. Mitchell Miller, Vol 12009

2. Forensic science in India: A vision for the twenty-first century Paperback – 1 January 2014 by B.B. Nanda

Open Educational Resources (OER)

1. https://www.open.edu/openlearn/society-politics-law/an-introduction-crime-and-criminology/content-section-0

2. Classical Sociological Theory | Coursera

https://www.coursera.org/learn/classical-sociological-theory

3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=eCJfy23Kjy3c0vICLa6VYg==

4. https://www.open.ac.uk/courses/criminology

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): –	

End Term Examination	40 Marks

BSFSCH103	Inorganic and Organic chemistry-I	L	T	P	C
Version1.0		2	0	0	2
Category of Course	Core Course 3				
Total Contact Hours	30				
Pre-requisites/ Co-requisites	--				

Course Perspective: This course introduces foundational principles in chemistry, integrating concepts from atomic structure, acid-base theories, organic chemistry, and stereochemistry. Students will explore atomic models, chemical bonding, and molecular behavior, building a solid understanding of chemical reactivity and molecular interactions. Through systematic learning of structure, nomenclature, and reaction mechanisms, the course strengthens analytical thinking and visualization in chemistry. It lays the groundwork for advanced studies by emphasizing conceptual clarity and practical relevance in real-world chemical phenomena.

Course Outcome: Students will be:

CO1: **Understanding** the fundamental principles of atomic structure, quantum mechanical models, acid-base concepts, and stereochemistry, including orbital shapes, quantum numbers, and chirality.

CO2: **Applying** the mole concept, empirical and molecular formulae, electronic configurations, and IUPAC rules to solve basic problems in general and organic chemistry.

CO3: Analysing chemical behavior through interpretation of acid-base strength, reactivity patterns of hydrocarbons, types of reagents and intermediates, and stereochemical conformations and representations.

CO4: **Evaluating** stability of intermediates, resonance effects, stereochemical outcomes, and molecular structure–property relationships to predict chemical reactivity and behavior.

Course contents :30 Hours
Unit I: Atomic Structure :7 Hours
Dalton's atomic theory: concept of elements, atoms and molecules. Atomic and molecular masses. Mole concept and molar mass: molarity, normality, molality, percentage composition, empirical and molecular formula. de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, quantum numbers, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's Multiplicity rule. Electronic configurations of the elements, effective nuclear charge, Slater's rules.
Unit II: Concept of Acids and Bases :5 Hours

Arrhenius, Bronsted – Lowry and Lewis concepts of acids & bases, relative strength of acids & bases, Concept of Hard and Soft Acids & Bases.
Unit III: Organic Chemistry :10 Hours
General introduction, Classification of hydrocarbons: Alkanes, Alkenes, Alkynes, Aromatic hydrocarbons. IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles.Types of organic reactions. Reactive intermediates carbocations, carbanions, free radicals. Localized and delocalizedchemical bond, resonance effect and its applications.
Unit IV: Stereochemistry :8 Hours
Conformations with respect to ethane, butane and cyclohexane. Interco version of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Racemic mixture and resolution.

Learning Experience:
This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of fundamental principles of atomic structure, mole concept, hydrocarbons, acids and bases.

Instruction Methods:
Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:
O**nline Platforms:** An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:
1.Formative: Quizzes and online discussions will provide continuous feedback.
2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes
Textbooks:

1. Advanced Inorganic Chemistry by Satya Prakash
2. Textbook of Organic Chemistry by Rakesh K. Parashar and V.K. Ahluwalia

Reference books:

1. Organic Chemistry by Wade
2. Organic Chemistry by Morrison and Boyd
3. Inorganic Chemistry by Atkins, P.

Open Educational Resources

1. https://chem.libretexts.org/Bookshelves/Organic_Chemistry
2. https://www.organic-chemistry.org/
3. https://www.masterorganicchemistry.com/
4. https://openstax.org/details/books/chemistry-2e/
5. https://chem.libretexts.org/Courses/Kutztown_University_of_Pennsylvania/CHM_320%3A_Advanced_Inorganic_Chemistry_**Textbook**/05%3A_Coordination_Chemistry_I_Structure_and_Isomers/5.06%3A_Hard_and_Soft_Acids_and_Bases

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSPC151	Practical-Chemistry I	L	T	P	C
Version1.0		0	0	2	1
Category of Course	Core Course Lab I				
Total Contact Hours	15				
Pre-requisites/ Co-requisites	--				

Course Perspective: The practical Chemistry 1 course offers a hands-on approach to fundamental techniques in pH determination, buffer preparation, and organic reaction mechanisms. Students will explore the application of pH meters, indicators, and pH papers to assess solution acidity or alkalinity. By conducting buffer preparation and identifying organic compounds based on functional groups, learners gain practical exposure to essential chemistry concepts. This course builds the skills necessary for advanced experimental chemistry, fostering a deeper understanding of both theoretical and applied chemistry.

Course Outcome: Students will be:

CO1: **Observing** and understand the principles and techniques for determining the pH of different solutions using pH paper, pH meter, and universal indicators, recognizing their importance in chemical analysis.

CO2: Imitating standard laboratory procedures to prepare buffer solutions, determine their pH, and understand their composition and function in maintaining pH balance.

CO3: Practice basic organic chemistry reactions such as substitution, addition, and elimination by performing experiments and writing accurate reaction mechanisms.

CO4: Creating a systematic approach for identifying organic compounds by detecting functional groups through qualitative analysis and confirming their presence using chemical tests.

List of experiments :
1. Determination of the pH of different solutions using pH paper, pH meter, and universal indicators.
2. Preparation of buffer solutions and determination of their pH.

3. Performing and observing simple organic reactions (e.g., substitution, addition, and elimination) and writing the corresponding reaction mechanisms.
4. Systematic identification of organic compounds containing functional groups like alcohols, aldehydes, ketones, carboxylic acids, esters, and amines.

Learning experience

This practical course will be giving hands-on learning to deepen the understanding of application of pH meters, indicators, and pH papers to assess solution acidity or alkalinity.

Instruction Methods:

Interactive sessions with role-plays, case studies, and hands-on practice of forensic assessment tools.

Technology Use:

Use of virtual simulations, and online platforms for tests and learning materials.

Assessments:

Evaluation through practical exams, case reports, scoring accuracy, and class participation.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Vogel's **Textbook** of Practical Organic Chemistry by B.S. Furniss, A.J. Hannaford, P.W.G. Smith, and A.R. Tatchell.
2. Laboratory Manual of Organic Chemistry by Raj K. Bansal

Reference books:

1. Practical Chemistry by Pandey O.P.

Open Educational Resources

1. https://www.khanacademy.org/science/organic-chemistry/substitution-elimination-reactions

Examination Scheme:

Evaluation components	Weightage
Internal marks (Practical)	
I. Conduct of experiment	10 Marks
II. Lab Record	10 Marks
III. Viva Voice	20 Marks
IV. Attendance	10 Marks

II. External Marks (practical): End Term Examination	50 Marks

BSFSPH104	**Forensic Photography**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**0**	**0**	**3**
Category of Course	**Core Course 4**				
Total Contact Hours	**45 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: This course provides a comprehensive understanding of photographic principles and techniques specifically tailored for forensic applications. It covers the essential tools, methods, and legal considerations required to accurately document crime scenes, evidence, and injuries, ensuring the integrity and admissibility of photographic evidence in legal proceedings. The course aims to develop both theoretical knowledge and practical skills necessary for forensic professionals.

Course Outcome: Students will be:

CO1 - Understanding the fundamental principles of photography and their specific application in forensic science.

CO2 - Applying appropriate photographic instrumentation and techniques for documenting various types of evidence at crime scenes.

CO3 - Analysing the quality, authenticity, and admissibility of forensic photographs for legal purposes.

CO4 – Evaluating the specialized photographic procedures for difficult-to-visualize evidence, such as latent prints and impression evidence. Evaluating the quality, authenticity, and admissibility of forensic photographic evidence, justifying its legal relevance and presentation.

Course contents

Unit I: Fundamentals of Forensic Photography :11 Hours
Introduction to Forensic Photography: History, importance, role in criminal justice, basic types of forensic photographs (overall, mid-range, close-up). Basic Photographic Principles: Light, color temperature, exposure (aperture, shutter speed, ISO), depth of field, white balance. Camera and Lens Systems: Digital Single Lens Reflex (DSLR) and Mirrorless cameras, types of lenses (normal, wide-angle, macro), filters (polarizing, UV). Lighting Techniques: Natural light, artificial light sources (electronic flash, continuous light), oblique lighting, transmitted light, bounce flash, fill flash.
Unit II: Crime Scene and Evidence Documentation :11 Hours
Crime Scene Photography Procedures: Initial photographs, general views, mid-range views, close-up views with and without scales, systematic approach. Documenting Specific Evidence: Fingerprint photography (latent and patent prints, dusting, chemical enhancements), bloodstain pattern photography, firearms and ballistics photography (firearms, cartridge cases, bullets). Impression Evidence Photography: Footwear impressions, tire track impressions, tool mark impressions, casting techniques and photographic documentation. Injuries and Victim Photography: Documentation of trauma, ethical considerations, use of color and grayscale scales.
Unit III : Specialized Photographic Techniques and Digital Imaging : 11 Hours
Alternate Light Source (ALS) Photography: Principles and applications of UV, Visible, and Infrared light for different types of evidence (fibers, fluids, questioned documents). Macro and Micro Photography: Principles, equipment, and applications for small-scale evidence (hairs, fibers, trace evidence), integration with microscopes. Digital Imaging Fundamentals: Pixels, resolution, file formats (JPEG, RAW, TIFF), digital image storage and management, metadata. Image Processing and Enhancement: Basic image processing software, ethical considerations in image enhancement, non-destructive editing.
Unit IV : Legal Aspects and Emerging Technologies : 12 Hours
Admissibility of Photographic Evidence: Legal requirements, chain of custody for photographic evidence, Daubert and Frye standards for scientific evidence. Digital Image Integrity and Authentication: Digital watermarking, hashing, preventing image manipulation, expert testimony regarding image authenticity. Courtroom Presentation: Preparing photographic exhibits for court, effective presentation of visual evidence, role of the forensic photographer as an expert witness. Emerging Technologies: Introduction to 3D crime scene scanning, photogrammetry, drone photography, and their applications in forensic investigations.

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of essential tools, methods, and legal considerations required to accurately document crime scenes, evidence, and injuries, ensuring the integrity and admissibility of photographic evidence in legal proceedings.

Instruction Methods:
Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:
O**nline Platforms:** An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:
1.Formative: Quizzes and online discussions will provide continuous feedback.
2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbook:

Textbook:

1. Jacobson, B.H.E., Ray, Sidney, Attridge G. G., The Manual of Photography; Focal Press, London, 1988. (T1)

Reference Books:

1. Robinson, Edward. Crime Scene Photography. Pearson Prentice Hall, 2011. (R1) (https://books.google.je/books?id=Zn_NCgAAQBAJ&printsec=copyright#v=onepage&q&f=false)

3. Marsh, N. (2014). Forensic photography: A practitioner's guide. Wiley. https://books.google.co.in/books?id=xrpYBQAAQBAJ

4. Gardner, Ross M., and Donna R. Krouskup. Practical Crime Scene Processing and Investigation. CRC Press, 2018. (R3)

Open Educational Resources (OER) · https://photographylife.com/ – General photography tutorials and guides.

https://www.forensicsciencesimplified.org/photo/Photography.pdf Resources on crime scene photography.

https://www.cameraforensics.com/blog/2020/03/06/a-quick-guide-to-digital-image-forensics-in-2020/ – Digital image forensics resources.

Examination Scheme:

Evaluation Component	Weightage
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSFP152	**Forensic practical I**	**L**	**T**	**P**	**C**
Version 1.0		**0**	**0**	**4**	**2**
Category of Course	**SEC I**				
Total Contact Hours	**60 Hours**				
Pre-requisites/ Co-requisites	--				

Course Perspective: It is a foundational exercise in forensic science, providing a hands-on opportunity to apply theoretical concepts. It focuses on crime scene investigation, sketching, photography, note-taking, searching, and camera basics. Students will learn to identify, document, and preserve evidence at crime scenes, create accurate sketches, capture relevant details through photography, record observations and evidence, employ various searching methods, and understand the parts and functions of a camera. This practical experience not only develops essential skills for forensic professionals but also fosters attention

to detail, problem-solving abilities, and teamwork. Additionally, students will be introduced to the ethical considerations involved in crime scene investigation.

Course Outcomes: - Students will be:

CO1- Observing the methodologies for investigating and sketching both indoor and outdoor crime scenes, emphasizing the importance of accuracy and detail in documentation.

CO2 - Imitating effective crime scene photography techniques for indoor and outdoor environments, ensuring that key evidence and contextual elements are captured accurately.

CO3- Practice proper note-taking procedures during crime scene investigations, ensuring that all observations and actions are thoroughly documented along with analysis of the components of a camera and their functions in relation to crime scene photography, enhancing the quality and utility of visual evidence collected during investigations.

CO5- Creating proficiency in the packaging and forwarding of evidence, including the construction of envelopes using the druggist fold method and adherence to sealing procedures.

List of Experiments
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. Notes making.
5. Searching of crime scene.
6. Parts and working of camera.
7. Packaging and forwarding.
8. Envelop making and Druggist fold method.
9. Sealing procedure.

Learning Experience:

This practical course will be giving hands-on learning to deepen the understanding of forensic science, providing a hands-on opportunity to apply theoretical concepts in a real-world setting. Students will develop meticulous observation and attention to detail as they identify, document, and preserve evidence at crime scenes. They will also enhance their problem-solving skills by navigating the challenges of crime scene investigation and making informed decisions.

Instruction Methods:

Interactive sessions with role-plays, case studies, and hands-on practice of forensic assessment tools.

Technology Use:
Use of virtual simulations, and online platforms for tests and learning materials.

Assessments:
Evaluation through practical exams, case reports, scoring accuracy, and class participation.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

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

Reference Books:

1.Scientific Criminal Investigation by B.R. Sharma.

Open Educational Resources (OER)

1. https://lsc.cornell.edu/how-to-study/taking-notes/cornell-note-taking-system/
2. https://www.nationalgeographic.com/photography/article/digital-photography-tips
3. https://www.nist.gov/itl/ssd/software-quality-group/computer-forensics-tool-testing-progracftt/digital-evidence

Examination Scheme:

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

	Environmental Studies	L	T	P	C
Version 2.0		**2**	**0**	**0**	**2**
Category of Course	**VAC I**				
Total Contact Hours	**30**				
Pre-Requisites/ Co-Requisites	**Basics of Environment**				

Course Perspective: This course on Environmental Sciences and Disaster Management provides a comprehensive understanding of environmental issues and disaster preparedness, crucial for students pursuing careers in environmental science, public policy, and emergency management. The curriculum covers critical topics such as land and water resources, pollution control, environmental policies, and disaster management strategies. Students will gain practical skills in assessing environmental impacts, managing resources sustainably, and preparing for and responding to various types of disasters. This knowledge is directly applicable in real-world scenarios, such as developing effective pollution control measures, implementing sustainable practices, and enhancing disaster response strategies. By integrating case studies and practical applications, the course equips students with the tools needed to address pressing environmental challenges and contribute to resilience and sustainability efforts globally.

Course Outcomes

Students will be:

CO1: Understanding the types, causes, and effects of environmental pollution, and the key environmental laws in India.

CO2: Applying knowledge of environmental laws and policies and utilize the concepts of disaster preparedness,

CO3: Analysing the effects of human activities on the environment

CO4: Evaluating the effectiveness of existing environmental laws, governance frameworks, and disaster management practices in India

CO5: Creating innovative solutions for sustainable development and disaster management plans.

Course Contents

Unit I: Environment and Natural Resources :8 Hours
Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness. Land resources; land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies. Carbon Footprints.

Unit II: Environmental Pollution and Environmental Policies :7 Hours
Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies. Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. Fundamentals and Application of ESG (Environment Social Governance).
Unit III: Introduction to Disasters :8 Hours
Concept and definitions- Disaster, Hazard, vulnerability, resilience, risks. Different Types of Disaster: Causes, effects and practical examples for all disasters. Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc. Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.
Unit IV: Disaster Management :7 Hours
Disaster Preparedness Plan, Prediction, Early Warnings and Safety Measures of Disaster, Role of Government, International and NGO Bodies in Disaster Preparedness. Reconstruction and Rehabilitation, Post Disaster effects and Remedial Measures Disaster Management Act, 2005: Disaster management framework in India before and after Disaster Management Act, 2005, Applications of AI and ML in Disaster Management and risk predictions.

Learning Experience
This comprehensive course integrates lectures, interactive discussions, hands-on activities, and field experiences to provide a deep understanding of environmental science, pollution, disaster types, and management strategies.

Instruction Methods:

Lectures: Core concepts will be presented through multimedia and problem-solving sessions.
Interactive Sessions: Includes Q&A segments, live quizzes, and discussions to enhance engagement and understanding.

Technology Use: The Learning Management System (LMS) will provide resources, recorded lectures, and discussion forums.

Activities:

Case Studies & Group Work: Students will analyse real-world problems related to environmental and disaster issues, working collaboratively on projects.

Field Visits: Real-world observation of environmental and disaster management practices.

Assessments:

1. **Formative:** Ongoing feedback through quizzes and online discussions.
2. **Summative:** Exams, presentations, and case study reports to evaluate overall understanding and application of course content.

Support:

Instructors will offer additional guidance and feedback, and peer collaboration will be encouraged to support student learning and achievement of course outcomes.

Textbooks

1. Content building programme (CBP) book on Disaster Management, Forum AS.
2. Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books:

1. A. K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.

2. S.E. Manahan, Environmental Chemistry, CRC Press.

3. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand & Company Ltd, New Delhi.

Open Educational Resources (OER)

1. NPTEL Environmental Studies Course
   https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. UN Environment Programme (UNEP) Student Resources
   https://www.un.org/sustainabledevelopment/student-resources/
3. "Introduction to Environmental Science" Open Textbook (OpenALG)
   https://alg.manifoldapp.org/projects/introduction-to-environmental-science
4. IGNOU Disaster Management Study Material
   https://www.ignouhelp.in/ignou-pgddm-study-material/
5. WHO Compendium on Health and Environment
   https://www.who.int/tools/compendium-on-health-and-environment

Evaluation Scheme:

Evaluation components	**Weightage**
I. End Term Examination	**100 Marks**

BSFSCB105	Cell Biology	L	T	P	C
Version1.0		3	0	0	3
Category of Course	DSE I				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: The interdisciplinary nature of cell biology also bridges the gap between basic sciences and applied fields like genetics, biotechnology, pharmacology, and bioinformatics. Through this course, students will develop critical observation and analytical skills, enabling them to visualize cells, perform basic laboratory experiments, and comprehend the intricate mechanisms that sustain life. By combining theoretical knowledge with hands-on practical sessions, this course aims to instill scientific curiosity and prepare students for more advanced studies and research in biological sciences.

Course Outcome: Students will be:

CO1: **Understanding** the structure and function of animal and plant cells.

CO2: Applying fundamental concepts of cell division, cell cycle regulation, and signal transduction to explain biological processes and experimental observations.

CO3: Analyzing the biochemical and ultrastructural organization of cellular components and interpret their roles in maintaining cell physiology and homeostasis.

CO4: Evaluating scientific data related to cell biology from laboratory and research studies to draw evidence-based conclusions on cell behavior and disease mechanisms.

Course contents	**:45 Hours**
Unit I: **Introduction to Cell Biology and Plasma Membrane**	**:10 Hours**
History and scope of cell biology, Cell theory, Overview: prokaryotic vs. eukaryotic cells, Comparison: animal vs. plant cells, Structure: Fluid Mosaic Model, Membrane proteins and carbohydrates, Transport mechanisms: Passive, Active, Endocytosis, Exocytosis	
Unit II: **Cytoplasm, Cytoskeleton and Cell Organelles**	**:12 Hours**
Cytosol and cytoplasmic streaming, Cytoskeleton: Microtubules, microfilaments, intermediate filaments, Cell motility and intracellular transport, Nucleus (Structure, nuclear pore, chromatin, nucleolus), Mitochondria (Structure, ATP synthesis), Chloroplasts: Structure and function (plant cells), Endoplasmic Reticulum (Rough and smooth), Golgi Apparatus (Protein packaging and transport), Lysosomes & Peroxisomes, Vacuoles and Tonoplast (Plant cells)	
Unit III: **Cell Wall, Extracellular Matrix, Cell Cycle and Cell Division**	**:12 Hours**
Phases of cell cycle (G1, S, G2, M), Mitosis and cytokinesis, Meiosis and gametogenesis, Checkpoints	

and cell cycle regulation, Types of signaling (autocrine, paracrine, endocrine), Receptors: Ion channel, G-protein coupled, enzyme-linked, Signal transduction pathways and second messengers
Unit IV: **Cell Death and Aging and Techniques in Cell Biology :11Hours**
Apoptosis vs. Necrosis, Role of caspases and Bcl-2 family, Telomeres and cellular senescence, Microscopy (Light, fluorescence, electron), Cell fractionation and centrifugation, Staining techniques, Immunocytochemistry and live cell imaging basics

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of both animal and plant cells through a variety of learning modes designed to foster critical thinking and conceptual clarity.

Instruction Methods:

Lectures: Theoretical lectures, enhanced with visual aids such as animations and micrographs, will provide students with a clear understanding of complex cellular structures and processes.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:
O**nline Platforms:** An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:
1.Formative: Quizzes and online discussions will provide continuous feedback.
2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:
1. **Karp, G. (2013).** Cell and Molecular Biology: Concepts and Experiments (7th ed.). Wiley.

Reference Books
1. **Cooper, G.M., & Hausman, R.E. (2013).** The Cell: A Molecular Approach (6th ed.). Sinauer Associates.
2. **Verma, P.S., & Agarwal, V.K. (Latest Ed.).** Cell Biology, Genetics, Molecular Biology, Evolution & Ecology. S. Chand Publishing.

Open Educational Resources (OER)

1) **OpenStax –** *Biology*
   https://openstax.org/books/biology/pages/1-introduction
2) **LibreTexts –** *Cell Biology*
   https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology
3) **NPTEL –** *Cell Biology* **(IIT Kanpur/IIT Delhi lectures)**
   https://nptel.ac.in/courses/102103044
4) **CK-12 –** *Biology FlexBook*
   https://www.ck12.org/biology/
5) **National Digital Library of India (NDLI)**
   https://ndl.iitkgp.ac.in/

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSEP106	Elements of Physics	L	T	P	C
Version1.0		3	0	0	3
Category of Course	DSE I				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: An Elements of Physics course provides a foundational understanding of the fundamental laws and principles governing the physical world. It explores concepts such as motion, forces, energy, matter, and waves, laying the groundwork for further studies in physics and related fields. Through lectures, laboratory experiments, and problem-solving exercises, students develop critical thinking skills and a deeper appreciation for the underlying structure of the universe.

Course Outcome: Students will be:

CO1: Understanding the fundamental nature of light, including Planck's quantum theory, the photoelectric effect, and the properties of photons and matter waves.

CO2: Applying kinetic energy and work, including the work-energy theorem and conservation of energy in mechanical systems.

CO3: Analyzing atomic physics concepts such as the Rutherford and Bohr models, quantum numbers, and the hydrogen spectrum to explain atomic structure.

CO4: Evaluating calculations involving radioactive decay, including mean life, half-life, and energy released during fission and fusion processes.

Course contents	**:45 Hours**
Unit I: Nature of Light	**:10Hours**
Light's nature: Planck's quantum, Planck's constant and light as a collection of photons; Photoelectric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment	
Unit II: Work and Energy	**:10 Hours**
Energy, kinetic energy, work, work done by gravitational force, work done by spring force,power, work and potential energy, conservation of energy, work energy theorem.	
Unit III: **Atomic Physics**	**:10 Hours**
Rutherford model, Bohr atomic model, quantum numbers, Pauli's exclusion principle, hydrogen spectrum, - series(Lyman, Balmer, Paschen, Bracket and fund), vector atom model	
Unit IV: **Radioactivity**	**:15 Hours**
Stability of nucleus; Law of radioactive decay; Mean life and half-life; decay; decayenergy released, spectrum and Pauli's prediction of neutrino; X-ray emission. Fission and fusion-mass decit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions	

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of the motion, forces, energy, matter, and waves.

Instruction Methods:

Lectures: Theoretical lectures, enhanced with visual aids such as animations and micrographs.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

O**nline Platforms:** An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1.Formative: Quizzes and online discussions will provide continuous feedback.

2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. 1.Concepts of Modern Physics by Arthur Beiser.

Reference Books:

1. Modern Physics, Murugeshan; Sivaprasath, Kiruthiga
2. OpenStax College Physics: https://openstax.org/details/books/college-physics-2e/
3. University Physics Volume 1, 2, and 3: https://openstax.org/details/books/university-physics-volume-1/.
4. College Physics for AP Courses: https://openstax.org/details/books/college-physics-ap-courses-2e/

Open Educational Resources (OER)

1. PhET Interactive Simulations: https://www.colorado.edu/csl/programs/phet-interactive-simulations
2. Khan Academy Physics: https://www.khanacademy.org/science/physics
3. MIT OpenCourseWare: https://ocw.mit.edu/courses/physics/

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

SECOND SEMESTER

BSFSFD201	Forensic Dermatoglyphics	L	T	P	C
Version1.0		3	0	0	3
Category of Course	Core Course 5				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: A Forensic Dermatoglyphics course provides a comprehensive understanding of the history, principles, and techniques involved in fingerprint analysis. You will delve into the biological significance of skin patterns, learn various fingerprint classification systems, and master the methods of lifting and developing latent fingerprints. This course equips you with the knowledge and skills necessary for identifying and analyzing fingerprints in criminal investigations, ensuring accurate and reliable forensic evidence.

Course Outcome: Students will be:

CO1: Understanding the historical development and significance of fingerprinting, including its origins, principles, and role in criminal investigations.

CO2: Applying the biological significance of skin patterns and the various types of fingerprints, including their class and individual characteristics, as well as methods for their collection, lifting, and preservation.

CO3: Analyzing classification systems for fingerprints, including Henry's system and Batley's Single Digit classification, to effectively categorize and organize fingerprint evidence using AFIS.

CO4: Evaluating present fingerprint evidence in a court setting, including the importance of photography and proper documentation in the judicial process.

Course contents	**:45 Hours**
Unit I: History and Development of Fingerprinting	**:10 Hours**
Origin & History of fingerprints, Principles of Fingerprint identification, Searching, location and significance of fingerprints in criminal ours.	
Unit II: Introduction of Fingerprint and its characteristics	**:11 Hours**
Biological significance of skin pattern, Types of fingerprints, Fingerprint characteristics: class and individual, Collection, lifting and preservation of fingerprints, Photography of latent fingerprints and presentation of fingerprint evidence in court.	
Unit III: Classification of Fingerprints	**:12 Hours**
Henry's system of classification, Batley's Single Digit classification, Extension of Henry's system of classification. Primary, secondary, sub-secondary, major, Second sub-secondary, key and final Classifications, AFIS	
Unit IV: Fingerprint Developmental techniques	**:12 Hours**
Methods of lifting and developing latent fingerprints – Physical methods - Powder method (Black, silver, florescent, red, yellow), Iodine fuming etc. Chemical methods - Ninhydrin, Silver nitrate method.	

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of Forensic Dermatoglyphics for legal and investigative purposes.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1.Formative: Quizzes and online discussions will provide continuous feedback.
2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Nayar, P. S., Fingerprint Identification and Procedural Manual
2. Kaushik, J. K.; Kaushik, Gaurav Guide to Fingerprint Investigation

Reference Books:

1. Nath, S. Fingerprint Identification

Open Educational Resources (OER)

1. International Association for Identification (IAI): https://www.theiai.org/
2. National Institute of Standards and Technology (NIST): https://www.nist.gov/
3. Forensic Science Digital Library: https://forensiclibrary.org/az/databases?v=137728

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSQD202	Questioned Document	L	T	P	C
Version1.0		3	0	0	3
Category of Course	Core Course 6				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: A Questioned Document Examination course provides a comprehensive understanding of the techniques used to analyze documents that may be disputed or questioned. It focuses on the scientific methods employed to determine the authenticity, origin, and authorship of documents.

Course Outcome: Students will be:

CO1: Understanding the definition and significance of questioned documents, including the types of cases encountered, and the procedures for their collection, handling, and presentation in forensic investigations.

CO2: Applying various types of documents such as charred, security, and counterfeit currency, utilizing appropriate examination equipment and techniques for accurate document analysis.

CO3: Analyzing principles of handwriting analysis to identify individual characteristics, distinguishing between authentic, forged, disguised, and traced signatures while considering external and internal factors affecting handwriting.

CO4: Evaluating findings from examinations of photocopies, printouts, and scanned documents to draw conclusions regarding their authenticity and integrity in forensic contexts.

Course contents :45 Hours
Unit I: Introduction to Questioned Documents :10Hours
Definition: Documents, questioned documents and the type of cases encountered; Importance, nature and problems of documents, Location, collection, handling and presentation of documents, adequacyof exemplars and standards.
Unit II: Document analysis :11Hours
Charred documents, security documents, torn documents, and Counterfeit currency. General Equipment for Examination: Hand lens, Camera, Compound Microscope, Stereo microscope, TLC, Transmitted light source, UV-IR radiation chamber and Oblique Light source, ESDA, VSC.
Unit III: Handwriting Characteristics :12Hours

Identification – principle individual handwriting characteristics, external, internal and physical factors affecting handwriting or signature of a person, Authentic Signatures, forged signatures, disguised signatures, traced signatures, and their characteristics
Unit IV: Typewritten and Computer-generated documents :12Hours
Comparison of typewritten documents, common types of styles, detection of altered typewritten documents, and ink analysis. Working of photocopiers and printers, scanners, examination of photocopies/ Xerox, printouts and scanned documents.

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of Questioned Documents for legal and investigative purposes.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. Formative: Quizzes and online discussions will provide continuous feedback.
2. Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Albert, S. Osborn, Questioned Documents, Second Ed., Universal Law Publishing, Delhi, 1998.
2. Sharma, B. R., Handwriting Forensics

Reference Books:

1. Gupta, Anil, Examination of Questioned Documents, Forgery Detection and Legal Aspects
2. Harralson, Heidi H. Development Handwriting and Signature Identification in the Digital Age.
3. Saini, Monika, Forensic Variability of Handwriting among Indian Population

Open Educational Resources (OER):

1. Questioned Documents - Osborn, Albert Sherman (Archive.org): https://archive.org/details/questioneddocume00osbo
2. Introduction to Forensic Science: Questioned Documents (Scribd Presentation): https://www.scribd.com/presentation/97039420/Introduction-to-Forensic-Science-Questioned-Documents
3. Forensic Document Examination - Research Starter from EBSCO: https://www.ebsco.com/research-starters/science/questioned-document-examination-qde
4. Forensic Handwriting and Signature Analysis (Dekalb Miller)albmiller.com/forensic-handwriting-analysis/
5. Instruments Used in Questioned Document Examination (Ultimate Forensic Consultants): https://ultimateforensicconsultants.com/instruments-used-in-questioned-document-examination/

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSCH203	Chemistry of elements	L	T	P	C
Version1.0		2	0	0	2
Category of Course	Core Course 7				
Total Contact Hours	30				
Pre-requisites/ Co-requisites	--				

Course Perspective: This course covers periodic properties, bonding theories, and the chemistry of s-, p-, d-, and f-block elements. It explores periodic trends, bonding models like VSEPR and MO theory, and coordination chemistry, with a focus on element groups and their key compounds. The course provides a comprehensive understanding of element behavior and bonding.

Course Outcome: Students will be:

CO1: Understanding the periodic law and the current structure of the periodic table, including trends in atomic and ionic radii, ionization energy, electron affinity, and electronegativity across different blocks of elements.

CO2: **Applying** the chemistry of s-block and p-block elements, focusing on bonding types (ionic, covalent, and coordinate bonds), VSEPR theory, hybridization, allotropy, and the structures and properties of key compounds within these groups.

CO3: Analyzing the principles of valence bond theory and molecular orbital theory to predict the shapes, bond strengths, and energy characteristics of various inorganic molecules and coordination compounds.

CO4: Evaluating the properties of transition elements by comparing their oxidation states, magnetic behavior, and spectral characteristics, and assessing the coordination chemistry of d-block elements to understand their complex formation and chemical behavior.

Course contents	**:30 Hours**
Unit I: Periodic Properties	**:9 Hours**
Periodic law and the present form of periodic table, Atomic and ionic radii, ionization energy, electron affinity and electronegativity – definition, trends in periodic table (in s, p, d & f block elements). Comparative study of the elements including, diagonal relationships.Chemistry of s-block elements, Ionic bond, Covalent bond, Coordinate bond. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3, ICI^- and H_2O. Valence bond theory and its limitations, directional characteristics ofcovalent bond, various types of hybridization and shapes of simple inorganic molecules	

and ions (BeF_2, BF_3,CH_4, PF_5, SF_6, IF_7 SO^{2-}, ClO^-). MO theory of heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.
Unit II: Chemistry of p-block elements :9 Hours
Boron family (13^{th} group): Diborane – properties and structure (as an example of electron – deficient compound and multicentre bonding), Borazene – chemical properties and structure. Carbon Family (14^{th} group): Allotropy of carbon, Catenation, pπ– d πbonding, carbides,fluorocarbons– general methods of preparations, properties and uses. Nitrogen Family (15^{th} group): Oxides – structures of oxides of N, P. oxyacids – structure and relative acid strengths of oxyacids of Nitrogen and phosphorus. Oxygen Family (16^{th} group): Oxyacids of sulphur – structures and acidic strength. Halogen Family (17^{th} group): Basic properties of halogen, hydro and oxyacids of chlorine – structure andcomparison of acid strength. Noble Gases (18^{th} group): Basic properties of noble gases, physical properties and structure of important compounds of Xenon.
Unit III: Chemistry of d-block elements :6 Hours
Definition of transition elements, position in the periodic table, General characteristics & properties of d- block elements, Comparison of properties of 3d elements with 4d & 5d elements with reference only to ionic, oxidation state, magnetic and spectral properties. Coordination Compounds Werner's coordination theory, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral and tetrahedral complexes, factors affecting the crystal-field parameters.
Unit IV: Chemistry of f-block elements :6 Hours
Lanthanides: General features and Electronic structure, oxidation states and ionic radii and lanthanide contraction. Actinides: General features and chemistry of actinides, actinide contraction. Comparison of properties of Lanthanides and Actinides and with transition elements. Elementary idea about the transuranic elements.

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of periodic trends, bonding models like VSEPR and MO theory, and coordination chemistry, with a focus on element groups and their key compounds.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Modern Inorganic Chemistry by Satya Prakash
2. Concise Inorganic Chemistry by J.D. Lee's

Reference books:

1. Madan, R.L, Chemistry for Degree Students.
2. Malik, Wahid U; Etal, Selected Topics in Inorganic Chemistry
3. Inorganic Chemistry by J. E. Huheey, E. A. Keiter, and R. L. Keiter.

Open Educational Resources

1. https://chem.libretexts.org/
2. https://openstax.org/details/books/chemistry-2e/
3. https://www.youtube.com/playlist?list=PLVaArxw9lrsl4oW6Nt9j5trOs9MWrJNbe

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): –	

End Term Examination	40 Marks

BSFSPC251	**Practical-Chemistry II**	**L**	**T**	**P**	**C**
Version1.0		**0**	**0**	**2**	**1**
Category of Course	**Core Course Lab II**				
Total Contact Hours	**15**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: Chemistry Practical II is designed to provide students with hands-on experience in the identification and analysis of elements across the periodic table, focusing on s, p, d, and f block elements.

Course Outcome: Students will be:

CO1: Observing and understand the fundamental properties of s-, p-, d-, and f-block elements, including their trends, electronic configurations, and characteristic behaviours.

CO2: Imitating standard experimental procedures and theoretical approaches to study the chemistry of alkali and alkaline earth metals, including their reactions and compound formation.

CO3: Practice analyzing the properties and reactivity of main group elements and their compounds, emphasizing their roles in various chemical processes and reactions.

CO4: Creating and executing basic synthetic reactions involving s-, p-, d-, and f-block elements, while integrating environmental considerations and evaluating the impact of these elements and their compounds on the ecosystem.

List of experiments :

1. Identification of s, p, d, f Block Elements
2. Flame test for alkali and alkaline earth metals.
3. Spot tests for transition metals (d-block) and lanthanides (f-block).
4. Detection and quantification of lead, cadmium, and mercury in water samples using colorimetric and spectroscopic methods.
5. Study of the effect of pH on the solubility of heavy metals.

Learning experience

This practical course will be giving hands-on learning to deepen the understanding of identification and analysis of elements across the periodic table, focusing on s, p, d, and f block elements

Instruction Methods:

Laboratory -Hands on learning on experiments such as flame tests, spot tests, and spectroscopic methods.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Vogel's **Textbook** of Practical Organic Chemistry by B.S. Furniss, A.J. Hannaford, P.W.G. Smith, and A.R. Tatchell.
2. Vogel's Qualitative Inorganic Analysis by G. Svehla

Reference books:

1. Advanced Inorganic Chemistry by F.A. Cotton, G. Wilkinson
2. Fundamentals of Analytical Chemistry by D.A. Skoog, D.M. West, F.J. Holler

Open Educational Resources

1. MIT OpenCourseWare - Principles of Inorganic Chemistry
2. Khan Academy - Chemistry
3. ChemCollective Virtual Labs
4. LibreTexts - Analytical Chemistry
5.
6. **Examination Scheme:**

Evaluation components	**Weightage**

Internal marks (Practical) I. Conduct of experiment II. Lab Record III. Viva Voice IV. Attendance	 10 Marks 10 Marks 20 Marks 10 Marks
II. External Marks (practical): End Term Examination	50 Marks

UNMIDF206	**Fundamentals of Digital Forensics and Its Legal Implications**	**L**	**T**	**P**	**C**
Version 2.0		**3**	**0**	**2**	**4**
Category of Course	**Minor I**				
Total Contact Hours	**45 Hours (Theory) + 30 Hours (Practical)**				
Pre-requisites/ Co-requisites	**Basic knowledge of Digital Forensics and Cyber Crime.**				

Course Perspective: This course provides foundational and applied knowledge of digital forensics, emphasising both theoretical concepts and hands-on training in cybercrime investigations. It covers the nature of digital evidence, forensic tools, legal frameworks, and challenges in evidence preservation. Students will engage with digital crime scenarios, perform forensic tasks, and learn legal and ethical principles relevant to India and international practices.

Course Outcome: Students will be:

CO1: Understanding the scope, evolution, and branches of digital forensics in crime investigation and cybersecurity.

CO2: Applying knowledge of digital crimes to identify evidence sources like file systems, metadata, memory, and logs using forensic tools.

CO3: Analysing evidence acquisition, imaging, and preservation using tools (FTK Imager, Volatility) and hash algorithms.

CO4: Evaluating legal frameworks and ethical issues in digital forensics through case studies and standards like the IT Act and ISO/IEC 27037.

CO5: Creating forensic reports and investigation strategies, integrating technical, legal, and ethical aspects.

Course Contents	**:45 Hours + 30 Hours**
Unit I: Introduction to Digital Forensics & Digital Evidence	**:10 Hours**

Definition, need, and scope, Evolution and role in modern crime investigation, Branches: Computer, mobile, network, cloud forensics, Key forensic principles and legal foundations, Role in incident response and cybersecurity
Unit II: Digital Crimes and Attacks :15 Hours
Types of digital crimes: Hacking, Phishing, Identity Theft, Cyberstalking, Ransomware Attacks, Online Frauds and Scams, Cyberbullying, Intellectual Property Theft, Child Pornography Distribution, Cyberterrorism, Email Spoofing, Website Defacement, Software Piracy. Credit Card Fraud, Online Drug Trafficking, Spamming, Social Media Hacking, ATM Skimming (Cyber-enabled fraud), Deepfake and AI-based Impersonation Type of Cyber Attack: malware (virus, trojan, ransomware), DoS/DDoS, APTs, spoofing, cyberstalking, data breaches, Sources of digital evidence: RAM, logs, file systems, network packets, Introduction to memory analysis and timeline analysis, Metadata and its forensic value, File system analysis: FAT, NTFS, ext.
Unit III: Evidence Acquisition and Preservation :10 Hours
Imaging and cloning tools and techniques, Write-blockers and hashing: MD5, SHA-512, SHA-256, Chain of custody and documentation, Live vs dead acquisition, Anti-forensics and countermeasures. Formatting & Wiping, Forensic Imager (TX1)
Unit IV: Legal and Ethical Considerations :10 Hours
Admissibility of digital evidence in court, Indian laws: IT Act 2000, IPC, Indian Evidence Act (relevant sections), International standards: ISO/IEC 27037, Ethics in forensic investigation, Case studies on use of digital evidence in court proceedings, Guidelines: ACPO, NIST standards
List of Practical : 30 Hours
1. Familiarisation with digital forensic tools such as Autopsy, FTK Imager. 2. Mounting and analysing FAT, NTFS, and ext. file systems. 3. Recovery of deleted files and extraction of metadata from file systems. 4. Investigation of system logs, application logs, and browser history. 5. Creation of forensic disk images using tools like FTK Imager and dd. 6. Preparation of chain-of-custody documentation for evidence handling. 7. Writing structured forensic investigation reports based on practical analysis.

Learning Experience (Theory + Practical)

This course combines theoretical understanding with practical skills in digital forensics. Students will learn about cybercrimes, digital evidence, memory analysis, and legal frameworks, alongside hands-on experience with forensic tools like Autopsy, FTK Imager, and Volatility.

Instruction Methods

Theory: Taught via multimedia lectures, case studies, and Q&A sessions.

Practical: Hands-on labs with simulations, tool-based tasks, and forensic report writing.

Technology Use

Tools: FTK Imager, Autopsy, X-Ways, Volatility, DumpIt, etc.
Platforms: LMS for resources, virtual labs, and interactive sessions.

Assessments

1. **Formative**: Quizzes, discussions, live demonstrations.
2. **Summative**: Practical exams, case reports, peer reviews, and presentations.

Support

Faculty guidance, peer collaboration, access to manuals, legal resources, and regular feedback to strengthen learning.

Textbooks

1. **Nelson, Bill, Phillips, Amelia, & Steuart, Christopher.** *Guide to Computer Forensics and Investigations*, 6th Edition, 2017, Cengage Learning.

Reference Book

1. **Holt, Thomas K.** *Cyber Crime and Digital Forensics*
2. **Tewari, R. K.,** Computer Crime and Computer Forensics
3. **Carrier, Brian.** *File System Forensic Analysis*, 2nd Edition (Volume 1), 2018, Addison-Wesley Professional.
4. **Kritika Singh.** Essentials of Digital Forensics: Fundamental, Procedure and Practical Application. 1st Edition 2025
5. **Sammons, John.** *The Basics of Digital Forensics*, 1st Edition (Volume 1), 2012, Elsevier.

Open Educational Resource

1. NPTEL – https://nptel.ac.in/
   - Courses: "Digital Forensics", "Cyber Security", "Information Security and Privacy"
2. MIT OpenCourseWare – https://ocw.mit.edu
   - Relevant topics in computer systems security and digital investigation
3. SANS Reading Room – https://www.sans.org/white-papers/
   - Authoritative papers on forensic tools, incident response, and legal analysis
4. DFIR Training Hub – https://digital-forensics.sans.org/
   - Free digital forensic and incident response labs
5. Coursera & edX
   - Coursera: *Digital Forensics Concepts* by University System of Georgia
   - edX: *Computer Forensics* by Rochester Institute of Technology

Examination Scheme:

Evaluation components	**Weightage**
Internal marks (Theory)	**40 Marks**

I. Continuous Assessment All the components are to be evenly spaced. (minimum of five elements to be evaluated)	
Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals	**20**
Practical Assessment I & II	**20**
Midterm Exam	**20 Marks**
External Marks (Theory): End Term Examination	**40 Marks**

BSFSFP252	**Forensic Practical II**	**L**	**T**	**P**	**C**
Version1.0		**0**	**0**	**4**	**2**
Category of Course	**SEC II**				
Total Contact Hours	**60 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: The course offers a comprehensive introduction to the field of forensic science, focusing on the analysis and interpretation of fingerprints and questioned documents. Students will gain practical skills in fingerprint identification, development, and comparison, as well as document examination techniques. This knowledge will be invaluable in various forensic investigations, including criminal cases and civil disputes.

Course Outcome: Students will be:
CO1: Observe and document fingerprint patterns and ridge characteristics using classification techniques and analysis tools for forensic identification.

CO2: Imitate the process of lifting, developing, and preserving latent fingerprints using powders, chemicals, and alternative light sources to maintain evidence integrity.

CO3: Practice practical exercises in fingerprint identification and comparison, including poroscopy and edgeoscopy, to match and individualize fingerprint evidence in forensic cases.

CO4: Creating and analysing fingerprints on fingerprint card.

List of Experiments
Fingerprints:
1. Prepare fingerprint card and identify the patterns.
2. Tape lifting of fingerprint.
3. Ninhydrin method for fingerprint development.

4. Iodine fuming method for fingerprint development.
5. Silver nitrate method for fingerprint development.

Questioned Documents:

1. Signature analysis based on class and individual characteristics.
2. Handwriting analysis based on class and individual characteristics.
3. Examination of Forged and Disguised Questioned Documents
4. Examination of Sequence of strokes
5. Examination of documents under different light sources- transmitted, oblique, UV.
6. Examination of Ink using Physical and Chemical procedures

Learning Experience:

This practical course will be giving hands-on activities that simulate real-world forensic scenarios.

Instruction Methods:

1. **Hands on Activity**: prepare fingerprint cards, identify different fingerprint patterns, and employ various techniques for fingerprint development, including tape lifting, casting, ninhydrin, iodine fuming, and silver nitrate methods. Examination of handwriting samples to determine class and individual characteristics, examine documents under different light sources, and identify genuine and fake currencies.
2. **Interactive Sessions**: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

Formative: Quizzes and online discussions will provide continuous feedback.

Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

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

Reference books:

1. "Criminalistics : An Introduction to Forensic Science" by Richard Saferstein

Open Educational Resources:

1. National Institute of Justice: https://nij.ojp.gov/
2. The Open University: https://www.open.edu/openlearn/
3. Forensic Science Education Resources: https://www.justice.gov/archives/dag/forensic-science

Open Educational Resource

1. Forensic science and fingerprints - OpenLearn, Open University https://www.open.edu/openlearn/health-sports-psychology/health/forensic-science-and-fingerprints/content-section-0
1. Best Practice Manual for Fingerprint Examination - ENFSI https://enfsi.eu/wp-content/uploads/2016/09/6._fingerprint_examination_0.pdf
2. Fingerprint Analysis, Distortion and Evaluation - Ontario Tech University https://ontariotechu.ca/programs/continuous-learning/science/fingerprint-analysis-distortion-evalution/index.php
3. Forensic Analysis for Questioned Document Examination - ZEISS https://www.zeiss.com/microscopy/en/applications/forensics/questioned-document-examination.html

Examination Scheme

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

BSFSBC205	**Biodiversity and Classification**	**L**	**T**	**P**	**C**
Version 2.0		**3**	**0**	**0**	**3**
Category of Course	**DSE II**				
Total Contact Hours	**45 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: This course provides an in-depth understanding of biological diversity—ranging from microscopic life forms to complex multicellular organisms. It introduces students to the principles and criteria used in biological classification, focusing on both historical and modern taxonomic systems,

including molecular phylogenetics. Students will explore the significance of biodiversity in ecosystems, conservation strategies, and its applications in ecological and evolutionary studies.

Course Outcome: Students will be:

CO1: Understanding the concept and levels of biodiversity (genetic, species, ecosystem).

CO2: **Applying** knowledge of classical and modern taxonomic principles.

CO3: Analysing the hierarchical classification of organisms across kingdoms.

CO4: Evaluating the evolutionary and ecological importance of biodiversity.

Course contents	**:45 Hours**
Unit I: Introduction to Biodiversity and Principles of Classification and Taxonomy	**:16 Hours**
Definitions and levels: Genetic, species, and ecosystem diversity, Values of biodiversity: Ecological, economic, ethical, Biodiversity hotspots in India and globally, Threats and conservation strategies, History and development of classification systems (Aristotle to Linnaeus to modern phylogenetics), Taxonomic hierarchy: Domain to species, Rules of nomenclature (ICZN, ICBN, ICNP)	
Unit II: Microbial and Protist Diversity	**:09 Hours**
Classification and characteristics of Bacteria, Archaea, Viruses, Protists: Algae and protozoa diversity and classification,	
Unit III: **Plant Diversity and Animal Diversity**	**:10 Hours**
Major groups: Bryophytes, Pteridophytes, Gymnosperms, Angiosperms, Diagnostic features and classification, Economic importance of plant groups. Non-chordates and chordates: Diagnostic characters and classification, Evolutionary trends in body plans, Ecological and economic importance	
Unit IV: **Tools for Taxonomy and Modern Approaches**	**:10Hours**
Use of morphological, anatomical, biochemical, and molecular characters, DNA barcoding, Cladistics and Phylogenetic trees, Introduction to biodiversity databases (e.g., GBIF, iNaturalist)	

Learning Experience: This course will be a mix of lectures, hands-on taxonomy practicals, field visits to local ecosystems, herbarium/museum studies, and group discussions.to deepen the understanding on identifying species, understanding hierarchical classification, and using dichotomous keys. Through virtual labs, students will also learn to apply digital biodiversity databases and bioinformatics tools to explore phylogenetic relationships.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

1.Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative**: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes.

Textbooks:

1. Raven, P. H., Johnson, G. B., Losos, J. B., Mason, K. A., & Singer, S. R. (2014). Biology (10th ed.). McGraw-Hill Education.– A general biology textbook with extensive chapters on biodiversity and taxonomy.
2. Campbell, N. A., & Reece, J. B. (2008). Biology (8th ed.). Pearson Education.
   – Widely used textbook for understanding the biological classification system and phylogenetics.

Reference Books:

1. Singh, G. (2009). Plant Systematics: Theory and Practice. Oxford & IBH.
2. Magurran, A. E. (2004). Measuring Biological Diversity. Blackwell.

Open Educational Resources (OER)

1. National Digital Library of India (NDLI)
2. Biodiversity Heritage Library (BHL)
3. iNaturalist
4. GBIF – Global Biodiversity Information Facility
5. Coursera - Biodiversity Courses

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks

Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSME205	Physics of Mechanics	L	T	P	C
Version1.0		3	0	0	3
Category of Course	DSE II				
Total Contact Hours	45 Hours				
Pre-requisites/Co-requisites	--				

Course Perspective: A Mechanics course in Physics provides a comprehensive understanding of the fundamental principles that govern the motion of objects. It serves as a cornerstone for many other physics disciplines and engineering fields.

Course Outcomes: Students will be:

CO1. Understanding the principles of motion, including Newton's laws, dynamics of particles, conservation of momentum and energy, as well as the concepts of torque, angular momentum, and gravitation.

CO2. Applying the implications of the Special Theory of Relativity, including the constancy of the speed of light, postulates of relativity, length contraction, time dilation, and the relativistic addition of velocities.

CO3. Analyzing the principles of sound, including velocity, intensity measurement, and acoustics, to evaluate the performance of sound in various environments, such as auditoriums, and understand the production and applications of ultrasonic waves.

CO4. Evaluating calculations involving light behavior, including refraction through different lens types, analysis of aberrations, and phenomena such as interference, diffraction, and polarization in optical systems.

Course contents	**:45 Hours**
Unit I: Classical Mechanics	**:10 Hours**
Newton's Laws of Motion, the dynamics of a system of particles, and concepts such as the centre of mass, momentum, energy, and the work-energy theorem, the conservation of momentum and energy, angular velocity and angular momentum, torque, and the conservation of angular momentum. These principles are essential for analysing crime scene dynamics, reconstructing accidents, and understanding the behaviour of objects under various forces.	
Unit II: Special Theory of Relativity	**:10 Hours**
Postulates of the Special Theory of Relativity, Galilean and Lorentz transformations, length contraction, time dilation, and the relativistic addition of velocities. These concepts are crucial for interpreting high-speed events and understanding relativistic effects in forensic investigations.	

Unit III: **Acoustics in Forensic Science** **:15 Hours**
The velocity of sound, noise and sound intensity measurement, echo, reverberation, Sabine's formula, absorption coefficient, and the acoustics of buildings, factors affecting acoustics, sound distribution in auditoriums, and the introduction to ultrasonics, including the production of ultrasonic waves and their applications in forensic science. Understanding these principles aids in analysing sound-related evidence and environmental factors at crime scenes.
Unit IV: Light in Forensic Investigation **:10Hours**
Refraction through thick and thin lens combinations, aberrations, interference in thin films, fringes in wedge-shaped films, Newton's rings, total internal reflection, diffraction, and polarization. These optical principles are applied in forensic investigations to analyse light behaviour, enhance imaging techniques, and interpret optical evidence effectively.

Learning Experience: This course offers rich and engaging content, covering a wide range of topics in classical mechanics, relativity, acoustics, and optics.

Instruction Methods:

.Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
3. **Summative**: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes.

Textbooks:

1. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).

Reference Books

1. Modern Physics – R. Murugesan S. Chand & Co. (2004)

Open Educational Resources (OER):

1. https://phet.colorado.edu/en/simulations/browse
2. https://academo.org/physics/
3. https://www.physicsclassroom.com/
4. https://www.coursera.org/specializations/introduction-to-mechanics

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

THIRD SEMESTER

BSFSFB301	Forensic Ballistics and Explosives	L	T	P	C
Version1.0		3	0	0	3
Category of Course	Core Course 8				
Total Contact Hours	45				
Pre-requisites/ Co-requisites	--				

Course Outcome: Students will be

CO1: **Understanding** the foundational knowledge of firearms, ammunition, and explosives.

CO2: **Applying** forensic techniques to identify firearm components and ammunition types.

CO3: Analysing rifling patterns, firing mechanisms, and explosive compositions.

CO4: **Evaluating** forensic evidence from firearms and explosives for legal and investigative purposes.

Course contents :45 Hours
Unit I: Fundamentals of Ballistics :10 Hours
Introduction to forensic ballistics, history and development of firearms, types of ballistics (internal, external, terminal, wound), Identification and classification of firearms, ammunition components, calibre and gauge, barrel and firearm firing mechanisms.
Unit II: Firearm Ammunition :11 Hours
Types of Ammunition, Classification and Constructional Features of Different Types of Cartridges, Types of Primers and Priming Composition, Propellants and their Compositions, Recent advances (IBIS, NIBIN, 3D imaging), and ethical/legal considerations.
Unit III: Ammunition :12Hours
Identification and classification of firearms, barrel characteristics, rifling, toolmarks, bullet and cartridge case comparison, use of comparison microscope, serial number restoration, and functionality testing. Various Types of Bullets and Compositional Aspects, Smooth Bore Firearm Projectile, Identification of Origin, Improvised Ammunition and Safety Aspects for Handling Firearms.
Unit IV: Explosives :12 Hours

Introduction to explosives, definition, High explosives and low explosives, difference and classification, Identifying the explosives, Black and smokeless powder identification, dynamite identification,identifying other explosives, reconstructing the destructive devices. Documentation and reporting, chain of custody, expert testimony, presentation of evidence in court, case studies,

Learning Experience:
This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen understanding of firearms, ammunition, and explosives for legal and investigative purposes.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. Formative: Quizzes and online discussions will provide continuous feedback.

2. Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes.

Textbook:

1. Chauhan, Ravinder. Identification of Firearms and Forensic Ballistics

Reference books:

1. Heard, B. J., Handbook of Firearm and Ballistics, Wiley & Sons, Chichester, England, 1997.
2. Forensic Science in India: A Vision for the Twenty First Century Nanda, B. B., and Tewari, R. K, 2001.

Open Educational Resource

1. Forensic Ballistics and Firearm Study | Online Course - sifs.in/course-details/forensic-ballistics-firearm-study-course

2. Forensic Ballistics | SlideShare Presentation - slideshare.net/slideshow/forensic-ballistics-91291961/91291961
3. Ballistics and Firearms Forensics 101 (ForensicsPedia) - forensicspedia.com/courses-page/ballistics-101
4. Curriculum and Virtual Lab Materials for Forensic Ballistics (University of Oklahoma) - nhn.ou.edu/assets/reu/Ballistics.pdf
5. Chemistry of Explosive Materials - Forensic Science Course (University of Florida) - forensicscience.ufl.edu/programs/courses/chemistry-of-explosive-materials

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSBS302	Forensic Biology and Serology	L	T	P	C
Version 2.0		3	0	0	3
Category of Course	Core Course 9				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: Forensic Biology and Serology is a specialized field that bridges the gap between biology and the legal system. This course delves into the application of biological principles in criminal investigations, focusing on the analysis of biological evidence such as blood, semen, saliva, and hair. Students will gain a deep understanding of the techniques used to identify and analyze these materials, as well as the legal implications of their findings. The course will cover topics such as DNA profiling, bloodstain pattern analysis, and serological testing, equipping students with the knowledge and skills necessary for a successful career in forensic science.

Course Outcome: Students will be:

CO1: Understanding the concept of Forensic biology and serology , its origin and scope along with characteristics and forensic significance of various body fluids, including semen, saliva, urine, and sweat.

CO2: Applying blood evidence collection, preservation, and packing methods, along with ABO and Rh blood group determination techniques along with semen evidence collection and examination.

CO3: Analysing species of origin analysis using spectrophotometric and immunological methods for blood identification.

CO4: Evaluating DNA fingerprinting techniques, including STR, VNTR, and SNP analysis, and explore the applications of PCR and CODIS in forensic science.

Course contents
Unit 1: Introduction to Forensic Biology and Serology -Body fluids composition and types :10Hours
Definition, History, Scope and Significance, Types of Biological Evidences encountered at Crime Scenes, Collection, Preservation, packaging, and transportation of Biological samples, Various types of body fluids, their nature and characteristics, Classification of Body fluids.
Unit II: Examination of Body fluids – Blood and Semen :15 Hours

Forensic analysis of Blood, Composition of blood, collection, preservation and packing of blood evidence, procedures and precautions. ABO system, Rh system; Techniques for the determination of blood groups; Identification of bloodstains by microscopic methods, Catalytic tests, crystal tests, bloodstain patterns. Forensic significance of semen. Composition, functions and morphology of spermatozoa. Collection, evaluation and tests for identification of semen. Individualization on the basis of semen examination.
Unit III: Species of Origin determination :5 Hours
Species of Origin analysis: Application of Spectrophotometric method and immunological methods (Ring, Precipitin, reverse agglutination, normal/mixed agglutination).
Unit IV: DNA fingerprinting :15 Hours
DNA structure, function and extraction from biological samples, DNA polymorphism, Short tandem repeats (STR), Variable number of tandem repeats (VNTR), single nucleotide polymorphism (SNP), Applications of PCR in forensics, DNA fingerprinting, CODIS, Mitochondrial DNA and its applications

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen understanding of Forensic Biology and Serology.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes.

Textbooks:

1. James, S.H. and Nordby, J.J. (Eds.), Forensic Science - An introduction to Scientific and investigative Techniques, CRC Press, London, 2003.
2. Tripathi, Archna; Dwivedi, A. K., Forensic Serology and Blood Examination

Reference Books:

1. Forensic Biology by Richard Li.
2. Forensic Serology by Richard Saferstein
3. Forensic Biology by Dr. Rukmani Krishnamurty

Open Educational Resources (OER):

1. OpenStax College Biology (https://openstax.org/books/biology/pages/1-introduction)
2. Khan Academy Biology (https://www.khanacademy.org/science/biology)
3. National Institutes of Health (NIH) Genetics Home Reference (https://ghr.nlm.nih.gov/)

Examination scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSCH303	Physical chemistry	L	T	P	C
Version1.0		2	0	0	2
Category of Course	Core Course 10				
Total Contact Hours	30				
Pre-requisites/ Co-requisites	--				

Course Perspective:Physical Chemistry delves into the fundamental principles governing the behavior of matter and energy. This course provides a solid foundation in thermodynamics, equilibrium, and the states of matter. By understanding these concepts, students can better analyze and predict the outcomes of chemical reactions and processes.

Course Outcome: Students will be:

CO1: Understanding the principles of chemical equilibrium, including the derivation of the equilibrium constant and free energy, as well as the application of Le Chatelier's principle in predicting the effects of changes in concentration, temperature, and pressure on chemical systems.

CO2: Applying the Nernst distribution law and its thermodynamic derivation, including modifications for solute dissociation and association, to evaluate its applications in determining hydrolysis constants and extraction processes.

CO3: Analyzing the concepts of states of matter, including the characteristics of solids, liquids, and gases, as well as the significance of crystal structures and defects, to explain the behavior of materials under different conditions.

CO4: Evaluating thermodynamic processes by applying the First, Second, and Third Laws to calculate absolute entropies and assess energy transformations in chemical reactions.

Course contents :30 Hours
Unit I: Chemical equilibrium :7 Hours
Equilibrium constant and free energy, concept of chemical potential, thermodynamic derivationof law of chemical equilibrium, temperature dependence of equilibrium constant, Vant'sHoff reaction isochoric, VantHoff reaction isotherm, Le- chatelier's principle and its application, Clapeyron equation and Clausius-clapeyron equation and its application.

Unit II: Distribution law	**:8 Hours**
Nernst distribution law- thermodynamics derivation, modification of distribution law when solute undergoes dissociation, association and chemical combination. Applications of distribution law: distribution of degree of hydrolysis and hydrolysis constant of aniline hydrochloride. determination of equilibrium constant of potassium tri-iodide complex and process of extraction	
Unit III: States of matter	**:9 Hours**
Solid state: crystal, types of crystals, crystal defects, Bragg's law. Metallic bond and its characteristics. Liquid state: properties of liquids- surface tension, viscosity and their determination. Gaseous state: derivation of real gases from ideal behavior. Derivation of vander wall's equation of state, explanation of behavior and real gas using vander wall's equation. Critical phenomenon: critical pressure, critical temperature, critical volume and the determination of PV isotherms of real gases, continuity of states, isotherms of vander wall's equation.	
Unit IV: Laws of Thermodynamics	**:6 Hours**
Introduction of thermodynamics; Statement of First, second, Third Law of thermodynamics and calculation of absolute entropies of substances.	

Learning Experience:
This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of thermodynamics, equilibrium, and the states of matter.

Instruction Methods:
Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:
Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative**: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Essentials of physical chemistry by Bahl Arun
2. Principles of Physical Chemistry by Puri, B.R. et al.
3. Textbook of Physical Chemistry by Negi, A.S; Anand S.C.

Reference books:

1. Thermodynamics by Callen.
2. Physical Chemistry by Daniels and Alberty

Open Educational Resources

1. Chemical Equilibrium: https://chem.libretexts.org/Courses/College_of_the_Canyons/CHEM_202:_General_Chemistry_II_OER/04:_Chemical_Equilibrium
2. Distribution Law: https://courseware.cutm.ac.in/wp-content/uploads/2020/06/11.-Distribution-Law-1.pdf
3. States of Matter: https://www.savemyexams.co.uk/igcse-chemistry-cie/23/revision-notes/1-states-of-matter/1-1-solids-liquids-and-gases
4. Laws of Thermodynamics: https://pressbooks-dev.oer.hawaii.edu/chemistry/chapter/the-second-and-third-laws-of-thermodynamics/
5. Comprehensive Chemistry Course (Principles of Chemical Science - MIT OCW): https://ocw.mit.edu/courses

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSPC351	Practical-Chemistry III	L	T	P	C
Version1.0		0	0	2	1
Category of Course	Core Course Lab III				
Total Contact Hours	15				
Pre-requisites/ Co-requisites	--				

Course Perspective:In Chemistry Practical III, students will explore the dynamics of chemical reactions and physical properties of liquids through hands-on experiments. This course emphasizes understanding key concepts like equilibrium constants, thin-layer chromatography, and the influence of temperature on viscosity and surface tension. By conducting these experiments, students will not only gain practical laboratory skills but also learn to interpret results using analytical techniques.

Course Outcome: Students will be:

CO1: **Observing** and understand the principles of chemical equilibrium through the determination of the equilibrium constant in the esterification reaction between acetic acid and ethanol.

CO2: **Imitating** laboratory procedures by performing thin-layer chromatography (TLC) to separate and analyze organic compounds using standard chromatographic techniques.

CO3: Practice calculating Rf values and interpreting chromatographic data to evaluate the distribution of components between stationary and mobile phases effectively.

CO4: **Creating** experimental setups to investigate the effect of temperature on the viscosity of liquids and analyze molecular interactions in relation to thermal changes.

List of experiments :

1. Determination of the equilibrium constant for the reaction between acetic acid and ethanol to form ethyl acetate.
2. Thin-layer chromatography (TLC) of a mixture of organic compounds.
3. Calculation of Rf values and interpretation based on the distribution of compounds between the stationary and mobile phases.
4. Study of the effect of temperature on the viscosity of liquids.
5. Study of the effect of temperature and concentration on surface tension.

Learning experience

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of equilibrium constants, thin-layer chromatography, and the influence of temperature on viscosity and surface tension.

Instruction Methods:

Hands on learning: will be given on experiments using virtual lab simulations.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Vogel's **Textbook** of Practical Organic Chemistry – B.S. Furniss, A.J. Hannaford, P.W.G. Smith
2. Organic Chemistry Laboratory Manual – Raj K. Bansal

Reference books:

3. Experimental Physical Chemistry – Arthur Halpern, George Mc Bane
4. Introduction to Chromatography – Bob Fried

Open Educational Resources

1. Khan Academy - Chromatography
2. MIT OpenCourseWare - Chemical Equilibrium
3. ChemCollective - Virtual Lab
4. LibreTexts - Surface Tension and Viscosity

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab	

work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

UNMIDF301	Mobile Device Forensics and Investigation	L	T	P	C
Version 2.0		3	0	2	4
Category of Course	Minor II				
Total Contact Hours	45 Hours (Theory) + 30 Hours (Practical)				
Pre-requisites/ Co-requisites	Basic knowledge of Digital Forensic and Cyber Crime.				

Course Perspective: This course introduces students to mobile device forensics, focusing on the acquisition, analysis, and legal handling of data from smartphones and mobile platforms. Mobile devices are key evidence sources in digital investigations, so the course addresses mobile OS challenges, data artefacts, forensic methodologies, and legal and ethical implications.

Course Outcome: Students will be:

CO1: Understand the evolution of mobile forensics, mobile OS structures, and observe various acquisition environments and tools.

CO2: Apply appropriate techniques to acquire mobile evidence (manual, logical, physical) and analyse SIM/cloud-based artefacts using forensic tools.

CO3: Analyse extracted data such as WhatsApp/SMS databases, GPS logs, and deleted files using forensic tools and hash functions for integrity verification.

CO4: Evaluate mobile forensic procedures and legal considerations including isolation techniques, hashing standards, and admissibility of evidence.

CO5: Create structured forensic reports, generate activity timelines, and maintain proper chain-of-custody documentation in compliance with legal standards.

Course Contents : 45 Hours + 30 Hours
Unit 1: Introduction to Mobile Forensics :08 Hours
Evolution and need for mobile device forensics, Challenges: encryption, OS fragmentation, anti-forensics, Overview of mobile OS: Android, iOS, Windows Mobile, Types of mobile data: user data, logs, app/system data, Type of Mobile OS, Mobile forensic process: Seizure → Preservation → Acquisition → Analysis → Reporting.
Unit II: Evidence Acquisition Techniques :10 Hours

Pre-investigation: identification, legal permission, isolation tools (Faraday bags, Faraday isolation Chamber), Acquisition methods: Manual, Logical, File System, Physical, Use of hash functions (MD5, SHA) for evidence integrity, Tools: Mobile Verification Toolkit (MVT), ADB, iTunes backups, Standard documentation & reporting practices, Case studies of mobile forensic procedures
Unit III: Mobile Network and Cloud Artifacts :12 Hours
SIM card analysis: ICCID, IMSI, SMS, contacts, Device identifiers: IMEI, MAC addresses, Cloud sync and remote storage (Google Drive, iCloud), Metadata, timestamps, timeline creation, Forensic examination of apps: WhatsApp, Telegram, Signal, social media.
Unit IV: Android and iOS Forensics :15 Hours
Android internals: partitions, file system, boot process, data storage, iOS internals: sandboxing, file system (APFS), keychain, plist files, Artifact extraction: calls, messages, contacts, GPS, browser data, SQLite database analysis and app-specific data, Rooting/Jailbreaking: methodology, risks, forensic pros & cons
List of Practical : 30 Hours
1. Data Extraction from Android Devices: Using ADB (Android Debug Bridge) and open-source tools. 2. Logical Acquisition of Mobile Data Tools: MOBILedit, Oxygen Forensic Suite. 3. Database Analysis: Examination of WhatsApp and SMS databases using SQLite Browser. 4. Web and Location History: Parsing and analysis of mobile browser history and GPS data. 5. Hashing and Integrity Verification: Generating and verifying cryptographic hash values of mobile dumps. 6. Documentation and Report Writing: Creating structured forensic case reports in line with legal standards. 7. Cloud-Based Mobile Data Examination: Analysis of cloud-synced data from Google Drive, iCloud, or WhatsApp backup archives.

Learning Experience: This course provides foundational and practical knowledge in mobile forensics, focusing on mobile operating systems, data types, and forensic processes. Students will learn evidence acquisition techniques, analyze mobile artifacts (e.g., SMS, app data, GPS), and handle cloud-synced content. Practical sessions using tools like ADB, MOBILedit, and SQLite Browser will enable students to extract, verify, and report mobile data in line with legal standards.

Instruction Methods

Lectures: Concept delivery through multimedia and real-case discussions.

Interactive Sessions: Tool demonstrations, Q&A, and case analysis.

Hands-on Labs: Practice with Android/iOS data acquisition and artifact analysis.

Case-Based Learning: Applying forensic methods to real-world scenarios.

Technology Use

Tools: ADB, MOBILedit, Oxygen Forensics, SQLite Browser, Elcomsoft, iMazing.
Platforms: LMS access for notes, assignments, and recorded sessions.

Assessments

1. **Formative**: Quizzes, discussions, and lab exercises.
2. **Summative**: Practical exams, case reports, and presentations.

Support

Faculty guidance, peer support, forensic toolkits, and report templates with regular feedback for continuous improvement.

Textbooks

1. *Mobile Forensics – Advanced Investigative Strategies* – Oleg Skulkin, Donnie Tindall, Rohit Tamma; 2016, 1st Edition
2. Kritika Singh. Essentials of Digital Forensics: Fundamental, Procedure and Practical Application. 1st Edition 2025

Reference Books

1. *iOS Forensics* – Mattia Epifani, Pasquale Stirparo; 2014, 1st Edition
2. *Android Forensics* – Andrew Hoog; 2011, 1st Edition
3. *Digital Forensics with Kali Linux* – Shiva V. N. Parasram; 2016, 1st Edition
4. *SQLite Forensics* – Paul Sanderson; 2015, 1st Edition

Open Educational Resource

1. DFIR Training Hub – https://digital-forensics.sans.org
2. NIST Mobile Forensics Guidelines – https://csrc.nist.gov/publications/detail/sp/800-101/rev-1/final
3. Mobile Verification Toolkit (MVT) – https://github.com/mvt-project/mvt
4. Coursera - Mobile Forensics courses – https://www.coursera.org
5. edX - Digital Forensics Series – https://www.edx.org
6. MIT OpenCourseWare (OCW) – Mobile security & forensics lectures: https://ocw.mit.edu

Examination Scheme:

Evaluation components	**Weightage**
Internal marks (Theory)	**40 Marks**
I. Continuous Assessment All the components are to be evenly spaced. (minimum of five elements to be evaluated)	
Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals	**20**
Practical Assessment I & II	**20**
Midterm Exam	**20 Marks**
External Marks (Theory): End Term Examination	**40 Marks**

BSFSFP352	Forensic Practical III	L	T	P	C
Version1.0		0	0	4	2
Category of Course	SEC III				
Total Contact Hours	4 hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: This integrated course aims to provide students with a comprehensive understanding of forensic biology, serology, and ballistics, equipping them with essential practical skills for analyzing biological and ballistic evidence encountered in criminal investigations. The curriculum combines theoretical knowledge with hands-on experience, allowing students to explore various aspects of forensic science critical for solving crimes and supporting the justice system.

Course Outcome: Students will be:

CO1: **Observe** different blood stain patterns and firearms found at crime scenes to infer the events leading to their formation.

CO2: **Imitating** preliminary tests for analysis of biological and ballistic evidence to establish the relationship between victim, suspect and the crime.

CO3: Practice on proper techniques for the collection, preservation, and packing of biological and ballistic evidence to ensure evidence integrity.

CO4: **Creating** relevance of various evidence using specific identification techniques the identification of gunshot residue (GSR) to link suspects to the discharge of firearms.

List of experiments
Forensic Biology and Serology
1. Analyse different blood stain pattern found at crime scene.
2. Perform preliminary tests for blood.
3. To identify blood samples by confirmatory chemical tests.
4. To identify the given stain as semen
5. To identify the given body fluid as urine.
6. To identify the given body fluid as saliva.
Forensic Ballistics and Explosives
1. To classify the firearms and their firing mechanisms
2. To know the characteristics of ammunition
3. Collection, preservation and packing of exhibits.

4. To perform chemical tests of powder residues (Walker's Test) around gunshot holes in fabrics.
5. Restoration of erased serial numbers on firearms.

Learning Experience: Through practical sessions, students will gain hands-on experience in collecting, preserving, and analyzing biological evidence.

Instruction Methods:
Hands-on demonstrations, guided lab experiments, and case-based learning to understand biological, serological, and ballistic evidence.

Technology Use:
Utilization of microscopes, forensic kits, ballistics software, and digital tools for analysis and documentation.

Assessments:
Practical exams, lab reports, viva voce, and continuous assessment based on lab performance and interpretation skills**.**

Support:
Faculty supervision during lab work, access to reference materials, peer discussions, and additional mentoring for skill enhancement**.**

Textbooks:
Saferstein, R., & Roy, T. (2020). *Criminalistics: An introduction to forensic science* (13th ed.). Pearson.

Reference Books

1. Lee, H., & Saferstein, R. (2001). *Bloodstain pattern analysis: A comprehensive guide for forensic crime scene investigation*. CRC Press.
2. Bhasin, M.K.; Chahal, S.M.S.,Laboratory Manual for Human Blood Analysis
3. O'Hara, J. E. (2003). *Forensic firearms examination*. CRC Press.

Open Educational Resources (OER)

1. Bloodstain Pattern Analysis Introduction (Forensic Science Simplified)
   Link: https://www.forensicsciencesimplified.org/blood/
2. Examination of Blood (Slideshare PPT)

Link: https://www.slideshare.net/slideshow/examination-of-blood-249424606/249424606

3. Forensic Semen Identification in Sexual Assault Investigations (Research Article)
   Link: https://theamericanjournals.com/index.php/tajmspr/article/view/6105
4. OSAC Standard for On-Scene Collection and Preservation of Physical Evidence
   Link: https://www.nist.gov/document/2021-n-0018standard-scene-collection-and-preservation-physical-evidencedraft-osac
5. Chemical Tests for Gunshot Residue (Slideshare PPT)
   Link: https://www.slideshare.net/slideshow/chemical-tests-for-gsr/112231635

Examination Scheme:

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

BSFSDZ305	Developmental zoology	L	T	P	C
Version1.0		3	0	0	3
Category of Course	DSE III				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: Developmental Zoology explores how a single cell (zygote) transforms into a complex, multicellular organism. It emphasizes the molecular, genetic, and cellular processes involved in embryogenesis, organogenesis, metamorphosis, and regeneration. This course aims to help students develop an integrative understanding of life processes across species, from fertilization to adult form, with examples from invertebrates and vertebrates.

Course Outcome: Students will be:

CO1: Understanding of fundamental concepts and stages in embryonic development, including fertilization, cleavage, gastrulation, and organogenesis in various animal models.

CO2: Applying the principles of developmental biology to explain morphogenetic movements, tissue differentiation, and the role of genes and hormones during development.

CO3: Analysing developmental processes across different phyla to identify similarities and variations in embryonic and post-embryonic development.

CO4: Evaluating the influence of genetic, environmental, and evolutionary factors on developmental abnormalities and metamorphosis in animals.

Course contents	:45 Hours
Unit I: Introduction to Developmental Biology	:10 Hours

History and scope of developmental biology, Basic concepts: potency, commitment, specification, induction, competence, morphogen
Unit II: **Gametogenesis and Fertilization :12 Hours**
Spermatogenesis and oogenesis, Egg membranes and egg types, Fertilization: mechanism, activation, prevention of polyspermy
Unit III: Cleavage, Gastrulation and Organogenesis and Morphogenesis :12 Hours
Types and patterns of cleavage, Fate maps, Gastrulation in amphibians and chick, Neurulation and development of notochord, Extraembryonic membranes in birds and mammals, Limb development and regeneration
Unit IV: **Experimental Embryology & Evolutionary developmental biology :11Hours**
Organizer concept and Spemann's experiment, Gradient theory and induction, Genetic regulation of development: Hox genes, Evolutionary developmental biology (Evo-Devo)

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of fascinating journey of life—from gametogenesis to organogenesis—through visual aids, model demonstrations, and laboratory experiments. The observation of developing embryos of frogs, chicks, and other model organisms under the microscope enhances their ability to connect textbook knowledge with real biological phenomena.

Instruction Methods:
Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:
Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative**: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Gilbert, S. F., & Barresi, M. J. F. (2016). Developmental Biology (11th ed.). Sinauer Associates.

2. Verma, P. S., & Agarwal, V. K. (2022). Chhatwal & Anand's Textbook of Developmental Biology. S. Chand.

Reference Books:

1. Zorn, A. M., Wells, J. M. (2009). Vertebrate endoderm development and organ formation. Annual Review of Cell and Developmental Biology, 25, 221–251. https://doi.org/10.1146/annurev.cellbio.042308.113344

2. Slack, J. M. W. (2006). Essential Developmental Biology: A practical approach to understanding animal form. Development, 133(13), 2471–2473. https://doi.org/10.1242/dev.02456

3. Martindale, M. Q., & Hejnol, A. (2009). A developmental perspective: changes in the position of the blastopore during bilaterian evolution. Developmental Cell, 17(2), 162–174. https://doi.org/10.1016/j.devcel.2009.07.014

4. St Johnston, D., & Nüsslein-Volhard, C. (1992). The origin of pattern and polarity in the Drosophila embryo. Cell, 68(2), 201–219. https://doi.org/10.1016/0092-8674(92)90464-N

5. Wolpert, L. (2011). Positional information and patterning revisited. Journal of Theoretical Biology, 269(2), 359–365. https://doi.org/10.1016/j.jtbi.2010.10.034

Open Educational Resources (OER)

1. LibreTexts Developmental Biology Collection
   Covers developmental biology principles, embryology, and experimental concepts.
   https://bio.libretexts.org/Bookshelves/Developmental_Biology
2. OpenStax Biology 2e
   A comprehensive, peer-reviewed biology textbook covering broad biology topics, including developmental biology fundamentals.
   https://openstax.org/details/books/biology-2e
3. MIT OpenCourseWare - Developmental Biology
   Free course materials including lectures, notes, and videos on developmental biology.
   https://ocw.mit.edu/courses/biology/7-28-developmental-biology-spring-2004/
4. Open Textbook Library - Biology Textbooks
   Collection of open-access textbooks in biology covering various subfields including developmental biology.
   https://open.umn.edu/opentextbooks/subjects/biology
5. ASCCC Open Educational Resources and Biology
   A curated list of OER biology textbooks and materials, suitable for developing courses on developmental biology topics.
   https://asccc-oeri.org/open-educational-resources-and-biology/

Examination Scheme:

Evaluation Component	Weightage
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSPM305	**Physics of Electricity and Magnetism**	**L**	**T**	**P**	**C**
Version1.0		**3**	**0**	**0**	**3**
Category of Course	**DSE III**				
Total Contact Hours	**45 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: Electricity and Magnetism is a fundamental branch of physics that explores the interactions between electric charges and magnetic fields. This course delves into the concepts of electric charge, electric fields, electric potential, electric current, magnetic fields, and Magnetic Properties of Matter. By understanding these concepts, students can grasp the underlying principles behind various electrical and magnetic phenomena, from the simple operation of a light bulb to complex technologies like electric motors and generators.

Course Outcome: Students will be:

CO1: Understanding the basic concepts of Electric field, Capacitors and magnetic field.

CO2: Applying the laws to Solve the electric and magnetic fields in symmetric systems

CO3: Analyzing electrical and magnetic properties of materials, and assess the effects of capacitors and dielectrics in various configurations.

CO4: Evaluating Gauss's Law, Magnetic Fields, and Energy Concepts in Complex Systems, B-H curves and related concepts.

Course contents	**:45 Hours**
Unit I: Electrostatics	**:10 Hours**
Coulomb's law, Electric Field, Electric Field lines and its properties, Electric Dipole and dipole moment. Electric field due to point charge, Electric field due to dipole, Electrical permittivity, Electric potentials, Electric Field due to a uniform charged sphere. Gauss' Law, Electric field due to solid charged sphere, charged spherical shell, line charge and thin sheet of charge using Gauss law.	
Unit II: Capacitors and Dielectrics	**:10 Hours**
Capacitor and Capacitance, Dielectric Constant, Parallel plate capacitor, Capacitor with a Dielectric. Capacitance of a system of charged conductors, Combinations of Capacitors: Series and Parallel, Energy stored in a capacitor.	
Unit III: Magnetostatics :	**:12 Hours**
Magnetic Field, Magnetic flux density, B. Biot- Savart's Law and its simple applications: straight wire and circular loop. Ampere's Law. Gauss's Law for magnetism.	
Unit IV: Magnetic Properties of Matter	**:10 Hours**
Magnetization vector (M). Magnetic Intensity (H), Magnetic Susceptibility and permeability. Relation between B, H, M, Classification of magnetic materials, B-H curve and hysteresis.	

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of real-world applications of electricity and magnetism, from power generation and transmission to medical imaging and electronics.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative**: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1.Electricity and Magnetism- Tewari, K.K.

2. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).

Reference Books:

Fundamentals of Physics by Halliday, Resnick, and Walker

Open Educational Resources (OER):

1. OpenStax College Physics - https://openstax.org/details/books/college-physics-2e/
2. MIT OpenCourseWare - 8.02 Electricity and Magnetism - https://ocw.mit.edu/courses/8-02-physics-ii-electricity-and-magnetism-spring-2007/
3. Khan Academy - Electricity and Magnetismhttps://www.khanacademy.org/science/hs-physics/x215e29cb31244fa1:types-of-interactions/x215e29cb31244fa1:electric-and-magnetic-fields/a/electric-and-magnetic-fields

Examination scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab	

work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSIN306	Evaluation of Summer Internship-I	**L**	**T**	**P**	**C**
Version 1.0		0	0	0	2
Category of Course	SI				
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:

CO1: Understand theoretical knowledge by effectively integrating concepts learned in coursework into practical situations encountered during the internship experience.

CO 2: Apply professional skills such as communication, teamwork, problem-solving, and time management, enhancing overall readiness for future career opportunities

CO 3: Analyze workplace dynamics by gaining insights into organizational culture, ethics, and professional relationships, enabling effective navigation of the work environment.

CO4 : 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.

CO 5: Writing and presenting technical reports/articles.

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.

Evaluation 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

	Self Awareness	L	T	P	C
Version 3.0		**2**	**0**	**0**	**2**
Category of Course	**AEC-I**				
Total Lectures	**30**				
Pre-Requisites/ Co-Requisites					

Course Perspective: The course aims to improve language proficiency in three key areas: grammar, vocabulary and identification of grammatical errors in writing. Language proficiency enables students to comprehend lectures, understand course materials and enhances students' ability to express themselves clearly and effectively. In many professions, strong language skills are a prerequisite. Whether in business, medicine, law, or science, being able to communicate fluently and accurately is essential for collaboration, negotiation, and advancement. A strong command of verbal abilities can significantly impact job interviews. It allows candidates to answer questions confidently, demonstrate their qualifications effectively and leave a positive impression on potential employers

Course Outcomes

Upon completion of the course the learner will be able:

CO 1: Understanding the grammar rules and word meaning (Vocabulary)

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CO 2: Applying grammar rules and vocabulary in different context & purpose

CO 3 Analyzing situations/ context of communication and selecting appropriate grammar and words.

CO 4: Developing sentences and paragraphs to describe and narrate a situation

Course contents	**:45 Hours**
Unit I: Vocabulary Development and Application	**:10 Hours**
Content Summary: Understanding the concept of root words, Prefix and suffix, Ways to enhance Vocabulary, Crosswords and word quizzes, Confusing words, One word substitution, Odd one out, Synonyms and Antonyms, Commonly misspelt words, Idioms and Phrase	
Unit II: Fundamentals of Grammar and Sentence Structure	**:08 Hours**
Content Summary: Introduction to Parts of Speech, Tenses and its ‘rules, Sentences (Simple, Compound and Complex), Subject Verb Agreement, Pronoun Antecedent agreement, Phrases and Clauses	

Unit III: Mastering Sentence Accuracy and Completion Skills	**:12 Hours**
Content Summary: Spot the error (grammatical errors in a sentence), Sentence Correction (Improvement of sentences based on Grammar rules), Sentence Completion, Cloze Tests	
Unit IV: Enhancing Sentence Structure and Reading Comprehension Skills	**:06 Hours**
Logical Arrangement of Sentences, Comprehending passages, Contextual questions, Anagrams, Analogies	

Learning Experience: This course will integrate lectures, interactive sessions, and hands-on activities to enhance skills in communication, personality development, mindset, and spoken skills.

Instruction Methods:
Lectures: Core topics such as effective communication, personality development, mindset, and spoken skills will be delivered through multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and group discussions will actively engage students and reinforce their learning.

Technology Use:
Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums to support extended learning.

Assessments:

1. **Formative:** Continuous feedback through quizzes and online discussions.
2. **Summative:** Evaluation through exams, peer reviews, and presentations to assess overall understanding.

Support: The instructor will offer additional guidance, and peer collaboration will be encouraged. Regular feedback will assist students in improving and achieving course outcomes.

Textbooks
Norman Lewis – Word Power Made Easy
Wren & Martin – High School English Grammar & Composition

Reference Books
R.S. Agarwal & Vikas Agarwal – Quick Learning Objective General English
S.P. Bakshi - Objective General English
Praxis Groups -Campus Recruitment Complete Reference

Open Educational Resources(OER)

1. **https://www.indiabix.com/online-test/aptitude-test/**
2. **https://www.geeksforgeeks.org/aptitude-questions-and-answers/**
3. **https://www.hitbullseye.com/**

Evaluation Scheme

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

FOURTH SEMESTER

BSFSBS401	Forensic Physics and Biometric System	L	T	P	C
Version1.0		3	0	0	3
Category of Course	Core Course 11				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: Forensic physics and biometric systems delve into the scientific analysis of physical evidence and biometric data used in criminal investigations. This course equips students with the knowledge and skills to examine various physical materials such as glass, paint, soil, and fibers, as well as biometric data like fingerprints, facial features, and iris patterns. By understanding the principles of forensic physics and biometrics, students can contribute to criminal investigations by providing valuable evidence and insights.

Course Outcome: Students will be:

CO1: Understand the fundamental principles of forensic physics and biometric systems, including the structure and function of biometric traits such as fingerprints, iris, voice, and gait.

CO2: Apply the techniques of physical evidence analysis (such as ballistics, glass, and tool marks) and biometric authentication in crime scene investigations and forensic identity verification.

CO3: Analyze various types of biometric modalities and forensic physics evidence to distinguish between individuals and determine the relevance and reliability of evidence in real-world forensic cases.

CO4: Evaluate the strengths, limitations, accuracy, and legal admissibility of biometric systems and physical evidence techniques used in forensic casework.

Course contents	**:45 Hours**
Unit I: Metric System & Biometric Systems	**:10 Hours**
Introduction to the metric system and units used in forensic science, **Biometric Personal Identification:** Concepts of biometric authentication, Physiological and behavioral traits, Technologies: **Fingerprint recognition, Facial recognition, Iris and retina scanning, Hand geometry and voice biometrics,** Applications in law enforcement, civil security, and surveillance, Introduction to common trace physical evidence: **soil, glass, fibre, hair, and liquids.**	
Unit II: Forensic Glass Examination	**:10 Hours**
Composition of glass: inorganic and organic elements, Types of glass and manufacturing methods, Analytical and chemical techniques used in glass examination, Fracture patterns: **radial vs concentric**, direction and sequence of impact, Density and refractive index comparison techniques, Case applications in hit-and-run and burglary cases.	
Unit III: Forensic Paint Analysis	**:10 Hours**
Chemistry of paint: components and layers (binder, pigment, solvent, additives), Types of paints: household, industrial, and automotive, Collection, preservation, and analysis of paint samples, Techniques: Microscopy, solubility, chromatography, spectrometry, Forensic significance of paint chips in criminal investigations.	
Unit IV: Soil and Construction Material Analysis	**:15 Hours**
Soil composition: organic vs inorganic content, Properties of forensic interest: color, particle size, density, moisture content, Methods of **collection, preservation, and comparison** of soil samples, Analytical techniques: **Density gradient column, pH and mineralogical analysis**, **Chemical profiling,** Introduction to concrete and cement: Composition and types, Physical and chemical characteristics, Forensic relevance in crime scene reconstruction	

Learning Experience: The course will adopt a **blended learning approach**, integrating lectures, visual case illustrations, and concept mapping for foundational topics such as the metric system, biometrics, and physical evidence types.

Instruction Methods:
Lectures: Core topics will be delivered through multimedia presentations and problem-solving sessions.
Interactive Sessions: Interactive discussions and **case-based learning** will be emphasized for forensic glass and paint analysis, engaging students in real-life applications and forensic problem-solving. Q&A segments, live quizzes, and group discussions will actively engage students and reinforce their learning.

Technology Use:
Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums to support extended learning.

Assessments:

1. **Formative:** Continuous feedback through quizzes and online discussions.
2. **Summative:** Evaluation through exams, peer reviews, and presentations to assess overall understanding.

Support: The instructor will offer additional guidance, and peer collaboration will be encouraged. Regular feedback will assist students in improving and achieving course outcomes.

Textbooks:

1. Indira Sudha, S. Biometrics and Fingerprint Analysis**.**

2. Jain, A. K., Ross, A., & Nandakumar, K. **(2011).** ***Introduction to Biometrics*****. Springer**.

Reference books:

1. Jackson, A. R. W., & Jackson, J. M. **(2011).** ***Forensic Science*****. Pearson Education.**
2. James, S. H., Nordby, J. J., & Bell, S. **(2014).** ***Forensic Science: An Introduction to Scientific and Investigative Techniques*** **(4th ed.). CRC Press.**
3. Sharma, B. R. **(2022).** ***Forensic Science in Criminal Investigation and Trials*** **(7th ed.). Universal Law Publishing**.

Open Educational Resource:

- **NPTEL forensic science course: https://nptel.ac.in/courses (search available courses)**
- **MIT OCW: https://ocw.mit.edu**
- **OpenLearn forensic science & fingerprint course: https://www.open.edu/openlearn/health-sports-psychology/health/forensic-science-and-fingerprints/content-section-0**

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks

External Marks (Theory): – End Term Examination	40 Marks

BSFSFA402	Forensic Anthropology	L	T	P	C
Version1.0		3	0	0	3
Category of Course	Core Course 12				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: Forensic anthropology is a specialized field that applies anthropological techniques to the identification of human remains in legal contexts. This course equips students with the knowledge and skills necessary to analyze skeletal remains, determine individual characteristics such as age, sex, and race, and assist in the identification of victims of crime, accidents, or disasters. By understanding the principles of forensic anthropology, students can contribute to criminal investigations and provide closure to families of the deceased.

Course Outcome: Students will be:

CO1: Understanding the definition, scope, and applications of Forensic Anthropology, including its significance in personal identification and its interplay with related sciences and contemporary issues.

CO2: Applying the methods used for identifying sex and estimating age from various bones, such as the humerus, radius, ulna, fibula, tibia, femur, pelvic bone, and foot and hand, and assess their reliability in forensic contexts.

CO 3: Analyzing morphology of the human skull to determine age, race, and sex, while analyzing techniques for race and height determination using long bones, exploring their medico-legal implications and the establishment of partial and complete identity from skeletal remains.

CO 4: Evaluating the medico-legal implications of skeletal material identification, considering the ethical issues and challenges faced in forensic anthropology practice.

Course contents
Unit I: Introduction to Forensic Anthropology : 15 Hours
Definition, scope and history of Forensic Anthropology; and related sciences., importance, application and issues related to personal identification Overview of human osteology and anatomical terminology.
Unit II: Age and Sex Determination from bones :10 Hours
Attribution of Sex, Estimation of Age (humerus, radius, ulna, fibula, tibia, femur, pelvic bone, footand hand).

Unit III: Height and race determination	**:10 Hours**
Race and height determination from long bones and their medico legal implication. Establishmentof Partial and Complete identity of skeletal material and dead bodies.	
Unit IV: Advanced Techniques in Forensic Anthropology	**:10 Hours**
Analytical tools- Osteometric board, sliding calipers, Radiological tools -X-ray, CT scan, MRI in skeletal analysis Facial 3D reconstruction – 3D Computerized facial reconstruction from skull, Applications of 3D imaging and modelling.	

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of bones, estimate age, sex, and race from skeletal features, and apply their knowledge to case scenarios. Through practical exercises, students will develop the skills and confidence needed to become proficient forensic anthropologists.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.
Practical: Hands on learning to identify bones on the basis of morpohological features.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Krogman, W. M. and M. Y.Iscan: Human Skeleton in Forensic Medicine.
2. Nath, S.: Forensic Anthropology
3. Stewart, T. D.: Essentials of Forensic Anthropology.

Reference Books:

1. Surender Nath; SehgaL,V.N.; Bhasin, M.K. - Forensic- Anthropology Science and Medicine

1. Forensic Anthropology: A Guide to the Identification of Human Remains by Clyde Snow and Larry A. Downs

Open Educational Resources:

1. National Museum of Natural History, Smithsonian Institution: https://humanorigins.si.edu/
2. American Academy of Forensic Sciences: https://www.aafs.org/

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSCH403	Analytical chemistry	L	T	P	C
Version1.0		2	0	0	2
Category of Course	Core Course 13				
Total Contact Hours	30				
Pre-requisites/ Co-requisites	--				

Course Perspective:Analytical chemistry is a fundamental branch of chemistry that focuses on the identification, separation, and quantification of matter. This course provides students with the theoretical knowledge and practical skills to analyze various substances using a wide range of analytical techniques. By understanding the principles of analytical chemistry, students can contribute to fields such as environmental science, forensic science, pharmaceutical research, and quality control.

Course Outcome: Students will be:

CO1: **Understanding** the principles of ultraviolet (UV) absorption spectroscopy, including Beer's Lambert law, molar absorptivity, and the significance of electronic transitions, chromophores, and auxochromes in the context of conjugated compounds.

CO2: **Applying** the principles and instrumentation of atomic absorption spectrometry (AAS) and mass spectrometry (MS), focusing on techniques, interference, background correction methods, and the quantitative analysis of samples.

CO3: Analyzing knowledge of infrared (IR) and nuclear magnetic resonance (NMR) spectroscopy, exploring their theoretical foundations, instrumentation, and practical applications in the analysis of forensic science samples.

CO4: **Evaluating** the accuracy and precision of chemical analysis by calibrating and utilizing various types of volumetric glassware, identifying potential sources of error, and assessing their impact on experimental results.

Course contents	**: 30 Hours**
Unit I: Ultraviolet (UV) absorption spectroscopy	**:10 Hours**
Absorption laws (Beer's Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. UV spectra of conjugated enes and enons. Wood fieser rules. Applications of UV spectroscopy in structure elucidation of simple organic compounds.	
Unit II: AAS & MS Spectroscopy	**:5 Hours**

Atomic absorption spectrometry: Principle, Instrumentation and techniques, interference in AAS, background correction methods, quantitative analysis. Introduction to Mass Spectroscopy- principles, instrumentation and applications.
Unit III: IR and NMR Spectroscopy :5 Hours
Introduction – Properties of light, interaction of matter and light - Electromagnetic spectrum – Infrared (IR) spectroscopy, theory, instrumentation and its application in forensic Science –Nuclear magnetic resonance (NMR) spectroscopy, theory, instrumentation and its application in forensic science.
Unit IV: :10 Hours
Volumetric glassware, their types, calibration and use of volumetric glassware in chemical analysis, source of error in volumetric glassware, Thermal Analysis- principles of thermal analysis, types and its application, Distillation Units Principle of distillation, types of distillation units (simple, fractional, steam, Vacuum, Zone), role of Raoult's law and Daltons Law, procedure involved in distillation, application in chemistry, Hot air oven and Incubators- Principle of hot air oven and incubators, their applications in chemistry, maintenance and calibrations of hot air oven and incubators. Hot Plates and Magnetic Stirrers- Principle and mechanics of hot plate and magnetic stirrer, types, their application in chemistry, , maintenance and calibrations.

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding on identification, separation, and quantification of matter.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.

2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Skoog, Douglas, A; Holler, F. James; Crouch, Stanley, R , Principles of Instrumental Analysis

2. Baker, D.R., Capillary – Electrophoresis, New York, 1995.

Reference books:

1. Dollisth, F.R., Fateley, W. G. & Bentley, F. F., Characteristic Roman frequencies of organic compounds, Wiley, New York, 1974.
2. Friebolin, H. Berik, One & Two Dimensional NMR spectroscopy; Weinheim Germany, VCH 1991.
3. Stout G.H., &Jensten, L.H., X-ray Structure Determination – A practical Guide, 2nd Ed., Wiley, New York, 1989.

Open Educational Resources

1. Khan Academy: https://www.khanacademy.org/science/chemistry
2. Chemistry LibreTexts: https://chem.libretexts.org/

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSPC451	Practical-Chemistry IV	L	T	P	C
Version1.0		0	0	2	1
Category of Course	Core Course Lab IV				
Total Contact Hours	15				
Pre-requisites/ Co-requisites	--				

Course Perspective: The Chemistry Practical IV course focuses on developing essential laboratory skills through hands-on experiments in spectroscopy, distillation, and titration techniques. Students will explore quantitative analysis methods, such as UV-Vis spectroscopy for concentration determination, and learn to record and interpret IR spectra for identifying organic compounds. Additionally, they will gain proficiency in separating liquid mixtures via simple and fractional distillation, alongside titration methods to analyze acid-base and redox systems. This course integrates theory with practical applications to enhance students' analytical skills and scientific reasoning.

Course Outcome: Students will be:

CO1: **Observing** and understand the principles of UV-Visible spectroscopy and its application in determining the concentration of various solutions through absorbance measurements.

CO2: **Imitate t**he interpretation of IR spectra to identify functional groups in organic compounds, gaining insights into molecular structure and bonding.

CO3: Practice separation techniques like simple and fractional distillation to effectively separate components of liquid mixtures, such as ethanol and water.

CO4: **Creating** accurate titration setups to determine the concentration of acids, bases, and redox-active species, while applying proper analytical techniques for quantitative analysis.

List of experiments :
1. Determination of Concentration Using UV-Vis Spectroscopy
2. Recording and interpretation of IR spectra for organic compounds
3. Separation of a mixture of two liquids (e.g., ethanol and water) using simple and fractional distillation.
4. Titration experiments to determine the concentration of acids, bases, and redox-active species.

Learning experience

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of analysis methods, such as UV-Vis spectroscopy for concentration determination, and learn to record and interpret IR spectra for identifying organic compounds.

Instruction Methods:

Practical Sessions: Experiments will be taught using practical demonstrations.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. Formative: Quizzes and online discussions will provide continuous feedback.

2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Vogel's **Textbook** of Quantitative Chemical Analysis by J. Mendham et al.

Reference books:

1. Spectrometric Identification of Organic Compounds by Robert M. Silverstein, Francis X. Webster
2. Physical Chemistry: A Molecular Approach by Donald A. McQuarrie and John D. Simon
3. Principles of Instrumental Analysis by Douglas A. Skoog, F. James Holler, Stanley R. Crouch

Open Educational Resources

1. UV-Vis Spectroscopy Concentration Determination
   https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Physical_Methods_in_Chemistry_and_Nano_Science_(Barron)/04:_Chemical_Speciation/4.04:_UV-Visible_Spectroscopy
2. IR Spectra Interpretation for Organic Compounds
   https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Organic_Chemistry_(Morsch_et_al.)/12:_Structure_Determination_-

_Mass_Spectrometry_and_Infrared_Spectroscopy/12.08:_Infrared_Spectra_of_Some_Common_Functional_Groups

3. Simple and Fractional Distillation
   https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Organic_Chemistry_Lab_Techniques_(Nichols)/05:_Distillation
4. Acid, Base, and Redox Titration Experiments
   https://chem.libretexts.org/Ancillary_Materials/Demos_Techniques_and_Experiments/General_Lab_Techniques/Titration/Redox_Titration
5. UV-Vis Spectroscopy Practical Guide
   https://www.slideshare.net/slideshow/uv-vis-spectroscopy-practical/35841435

Examination Scheme:

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

UNMIDF401	Operating Systems and Cloud Forensics	L	T	P	C
Version 2.0		3	0	2	4
Category of Course	Minor III				
Total Contact Hours	45 Hours + 30 Hours				
Pre-requisites/ Co-requisites	Knowledge of Windows Forensics, Operating Systems, and Networking.				

Course Perspective: This course provides a comprehensive understanding of forensic investigation techniques across Windows, Linux, macOS, and cloud environments (AWS, Azure, GCP). It emphasizes hands-on evidence acquisition, artifact analysis, and the handling of challenges like virtualization, multi-tenancy, and anti-forensics. Learners will also be introduced to legal and technical standards governing OS and cloud investigations.

Course Outcome: Students will be:

CO1: Understanding Windows, Linux, macOS, and cloud computing fundamentals relevant to forensic investigation.

CO2: Applying forensic techniques for acquiring and preserving digital evidence from operating systems and cloud storage.

CO3: Analysing system artefacts, logs, metadata, and cloud service logs to reconstruct user activities and detect anomalies.

CO4: Evaluating the effectiveness of forensic tools and legal frameworks in handling cloud forensics, virtual environments, and cross-border data issues.

CO5: Creating detailed forensic investigation strategies integrating OS artefacts and cloud-based data using industry-standard tools and protocols.

Course contents	:45 Hours + : 30 Hours

Unit I: Windows Forensics	**:12 Hours**
Introduction to Microsoft Windows architecture and file systems (FAT, NTFS), Windows Registry analysis (HKEY_LOCAL_MACHINE, HKEY_CURRENT_USER), Analysis of system artifacts: Event Logs, Prefetch files, Shortcut (LNK) files, Recycle Bin and file deletion forensics, Alternate Data Streams (ADS) and anti-forensics detection, Restore Points, Volume Shadow Copies, Memory acquisition and analysis (RAM dump basics), Tools: Autopsy, FTK Imager, RegRipper, Volatility Framework	
Unit II: Linux and macOS Forensics	**:10 Hours**
Linux file system structure (ext2/3/4) and key forensic paths: /var/log, /etc, /home, Linux commands for evidence collection and analysis. Shell artifacts: .bash_history, sudo logs, crontabs, macOS file system and system log locations. macOS-specific artifacts: plist files, Keychain analysis, Time Machine. Live data acquisition from Linux/macOS systems. Tools: Sleuth Kit, log2timeline, dd, Plaso	
Unit III: Cloud Computing Fundamentals	**:12 Hours**
Cloud models: IaaS, PaaS, SaaS, FaaS, Deployment types: Public/Private/Hybrid Cloud, Forensic challenges: Data sovereignty, multi-tenancy, encryption, Virtualization: Hypervisors, VMs, containers (Docker), Cloud logging: AWS CloudTrail, Azure Monitor	
Unit IV: Cloud Forensics Process	**:11 Hours**
Evidence acquisition: Google Drive, Dropbox, OneDrive, Virtual disk analysis: Snapshots, VM memory (Volatility), Tools: AWS CLI, Magnet AXIOM Cloud, OSFClone, Case studies: Cloud breaches, ransomware in cloud environments	
List of Practical	**: 30 Hours**
1. Windows Registry and Event Log Analysis 2. Linux Log and Shell Artifact Extraction 3. NTFS Timeline Analysis using Sleuth Kit/Autopsy 4. macOS plist File and User Artifact Analysis 5. AWS CLI for Log and Snapshot Retrieval 6. Memory Acquisition and Volatility Framework Analysis 7. Email Header and Attachment Analysis 8. Scripting with PowerShell/Bash for Automated Artifact Collection	

Learning Experience: Students will gain hands-on experience in OS-level and cloud-based forensic investigations using real tools and datasets. Through practicals and case-based simulations, learners will analyze logs, memory dumps, cloud snapshots, and correlate evidence from multiple sources. The legal and ethical aspects of handling forensic data in a virtualized and global cloud environment are also integrated.

Instruction Methods

- **Lectures**: Core concepts delivered via presentations, diagrams, and real-world examples.
- **Interactive Sessions**: Q&A, live tool walkthroughs, and group-based discussions.
- **Hands-on Labs**: Tasks on registry analysis, VM snapshots, cloud artifacts, log correlation, and timeline reconstruction.
- **Case-Based Learning**: Real-world case simulations related to ransomware, cloud breaches, and OS-level attacks.

Technology Use

- **Tools**: Autopsy, FTK Imager, RegRipper, Sleuth Kit, Plaso, Volatility, Magnet AXIOM Cloud, AWS CLI, OSFClone.
- **Platforms**: LMS with access to datasets, documentation, case templates, and recorded sessions.

Assessments

1. Formative: Quizzes, practical exercises, discussions, and scripting tasks.

2. Summative: Forensic case reports, cloud log analysis, memory dump interpretation, and simulation-based evaluations.

Support: Faculty mentoring, peer-to-peer learning, access to manuals, cloud datasets, and regular feedback for skill development.

Textbooks

1. Windows Forensics – Harlan Carvey; 2014, 1st Edition (Syngress)
2. Linux Forensics – Dr. Philip Polstra; 2011, 1st Edition (Elsevier)
3. Practical Forensic Imaging – Bruce Nikkel; 2014, 1st Edition (No Starch Press)

Reference Books

1. NIST Cloud Forensics Guidelines (SP 800-101) – NIST; 2014 (Special Publication)
2. AWS Security Best Practices (AWS Whitepapers*)* – Amazon Web Services; 2016 (Whitepaper)
3. Digital Forensics with Kali Linux – Shiva V.N. Parasram; 2016, 1st Edition (Packt Publishing)
4. Kritika Singh. Essentials of Digital Forensics: Fundamental, Procedure and Practical Application. 1st Edition 2025

Open Educational Resouce

1. OpenLearn - Digital Forensics
   Free introductory course covering digital forensics investigation, evidence analysis, and tools.
   https://www.open.edu/openlearn/science-maths-technology/digital-forensics/content-section-0
2. Swayam - Digital Forensics Course
   https://onlinecourses.swayam2.ac.in/nou22_cs05/preview
3. NCC 215 Digital Forensics I (National CyberWatch)
   https://www.nationalcyberwatch.org/programs-resources/curriculum/technical-course/ncc-215-digital-forensics-i-digital-forensics-fundamentals/
4. MIT OpenCourseWare - Related Computer Forensics & Cybersecurity
   https://ocw.mit.edu
5. Sample Digital Forensics Syllabus PDF (idCARE)
   https://idcareui.id/storage/files/1/Custom%20Syllabus%20FOR0040a%20Computer%20Forensic%20V1.1.pdf

Examination Scheme:

Evaluation components	**Weightage**
Internal marks (Theory)	**40 Marks**
I. Continuous Assessment All the components are to be evenly spaced. (minimum of five elements to be evaluated)	
Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals	**20**
Practical Assessment I & II	**20**
Midterm Exam	**20 Marks**
External Marks (Theory): End Term Examination	**40 Marks**

BSFSFP452	**Forensic Practical IV**	**L**	**T**	**P**	**C**
Version1.0		**0**	**0**	**4**	**2**
Category of Course	**SEC IV**				
Total Contact Hours	**60 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: The practical aspect of Forensic Anthropology and Forensic Physics aims to develop hands-on skills crucial for forensic investigations. Through direct interaction with human skeletal remains and trace evidence, students will gain essential knowledge in identification, examination, and interpretation of forensic materials. This will build their competency in real-world forensic casework, ensuring they can apply theoretical knowledge to practical scenarios in both anthropological and physical evidence contexts.

Course Outcome: Students will be:

CO1: **Observe** and identify the structure and forensic significance of human skeletal systems and understand the basic principles behind forensic instrumentation, including calibration procedures and safety protocols.

CO2: **Imitate** standard forensic laboratory techniques by following demonstrated procedures to estimate height from long bones, determine age and sex from skeletal features, and analyze trace physical evidence like paint, soil, and glass.

CO3: Practice the independent application of forensic methods—such as measuring specific gravity of glass, performing density gradient analysis of soil, and recording skeletal metrics—to draw preliminary forensic interpretations.

CO4: **Create** case-based forensic conclusions by integrating physical matching techniques, instrumental analysis, and skeletal evidence to evaluate their evidentiary value in identity establishment and crime reconstruction.

Course contents
Forensic Anthropology 1. Identification of human skeleton system. 2. Identification of various bones (Pelvic and skull bones). 3. Estimation of height using long bones. 4. Determination of sex from skull, pelvis and mandibular bone.Determination of age using skull
Forensic Physics 1. Safety, working manual and calibration of the instruments used for evidence examination and analysis. 2. Collection, preservation and labeling, chain of custody, covering letter, sample seal and taking control samples of trace evidence like glass, soil and paint samples. 3. Examination of different layers in a paint chip. 4. Determination of specific gravity of glass pieces and its interpretation. 5. Density gradient analysis of soil samples and its interpretation. 6. Physical matching of broken glass fragments.

Learning Experience

This practical course will be a mix of interactive sessions and hands-on learning to deepen the learning of identification techniques, sex determination, and age estimation from bones, providing them with the ability to handle forensic evidence for human identification. In Forensic Physics, students will focus on evidence collection, preservation, and examination of trace materials like glass, soil, and paint.

Instruction Methods:

Practical Sessions: Practical handling of the instrument to study bones and identification of bones using skeletal dummies will be taught.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Digital microscopes: For analyzing paint layers, soil particles, and physical matches in detail.

Forensic software or databases (if available): To simulate estimation of height, comparison of skeletal measurements, or physical matching of trace materials.

Multimedia resources: short videos, 3D skeletal models, and animations to visualize bone anatomy and forensic techniques.

Photographic documentation tools: Students will use digital tools for photographing, labeling, and comparing evidence fragments.

Assessments:

Daily lab performance: Continuous evaluation of student participation, procedural accuracy, and handling of materials.

Record book submissions: Students will maintain detailed, error-free records of all experiments, including observations, interpretations, and inferences.

Practical examination: Structured around key experiments (e.g., height estimation, density gradient method) to assess technical proficiency.

Viva voce: Oral questioning on principles, methodology, and forensic relevance of the performed experiments

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. *Surender Nath; SehgaL,V.N.; Bhasin, M.K.,* Forensic- Anthropology Science and Medicine.
2. *Muralikrishna, S. (2016).* Introduction to Forensic Physics*. Universities Press.*

Reference books:

1. Krogman, W. M., & İşcan, M. Y. (1986). *The Human Skeleton in Forensic Medicine* (2nd ed.). Charles C Thomas Publisher.

2. Petrescu, F. I. T., & Petrescu, R. V. (2016). *Forensic Physics*. CreateSpace Independent Publishing.

Open Educational Resources:

1. Introduction to Forensic Anthropology (human skeleton and bone identification) https://pressbooks.ccconline.org/ppscant2315introtoforensicanthropology/chapter/chapter-1-introduction-to-forensic-anthropology/
2. Estimating Sex in Human Skeletal Remains (skull, pelvis, mandible) https://pressbooks.ccconline.org/ppscant2315introtoforensicanthropology/chapter/chapter-9-estimating-sex-in-human-skeletal-remains/
3. Stature Estimation Using Long Bones https://ijcap.org/html-article/14216
4. Forensic Physics Overview and Study Materials (includes instrument calibration and evidence examination) https://gifsa.ac.in/forensic-physics/
5. Trace Evidence Collection and Preservation (chain of custody, labeling, sample sealing) https://www.sbsheriff.org/wp-content/uploads/2019/12/SOP-CSI-004-12-Trace-Evidence-Collection.pdf

Examination Scheme:

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

VAC II	Forensic Engineering	L	T	P	C
Version 1.0		3	0	0	3
Category of Course	VAC II				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: The Forensic Engineering course introduces students to the application of engineering principles and methodologies in the investigation of failures, accidents, and structural malfunctions. It explores how engineering knowledge is used to determine the causes behind failures in buildings, machinery, materials, and systems. The course emphasizes the systematic approach used in failure analysis, accident reconstruction, and materials evaluation. Students gain insights into how forensic engineering contributes to legal investigations, insurance claims, and safety improvements, bridging the gap between technical expertise and judicial processes.

Course Outcome: Students will be

CO1: Understanding the foundational concepts of forensic engineering, including its scope, significance, and role in the investigation of structural and mechanical failures across various engineering domains.

CO2: Applying the principles of engineering design and failure analysis, focusing on the evaluation of materials, structures, and systems to determine the causes and mechanisms of failure.

CO3: Analyzing the methods of accident reconstruction and forensic investigation, including the collection, preservation, and interpretation of physical evidence from failure or accident sites.

CO4: Evaluating engineering components through technical assessments (including stress-strain analysis, fracture surface examination, corrosion analysis, and mechanical testing) to identify failure modes, and interpreting these forensic engineering findings within a legal and ethical framework for effective communication in legal and investigative contexts.

Course contents
Unit I: Introduction to Forensic Engineering and Structural Failures
Introduction to forensic engineering: Scope, significance, and role in scientific investigation, Principles of structural engineering relevant to forensic applications, Common causes of structural failures: Material defects, design flaws, construction errors, natural forces, Investigation and observation of collapsed structures, Examination of key structural elements: Beams, columns, slabs, foundations, ties, reinforcement and cover, Reference to building codes and Indian Standards (IS) applicable at time of construction
Unit II: Analysis of Structural Design and Construction Materials
Examination of approved structural design vs. actual structure, Comparative analysis of structural parameters against standard specifications, Evaluation and testing of construction materials: a) Cement, sand, bricks, aggregates (grit), steel, and water b) Cube tests, curing procedures, and quality assessment, Sampling techniques and documentation for forensic investigation, Material evidence collection: Mortar, reinforcement steel, bricks, soil, concrete samples
UNIT III: Fire, Explosion, and Motor Vehicle Accident Investigations
Fire Investigation: Chemistry and behavior of fire, Classification of fires and fire patterns, Determining the origin and cause of fire, Investigation of motor vehicle fires, Explosion Investigation: Types and

characteristics of explosions, Scene reconstruction and report writing, Evidence collection and preservation from fire and explosion scenes, Case studies on fire and explosion incidents
UNIT IV: Motor Vehicle Accident Analysis and Forensic Reporting
Introduction to motor vehicle accident investigation, Primary causes of road accidents: Human, mechanical, environmental, Analytical tools and methods for accident reconstruction, Scene documentation: Photographs, skid marks, debris, measurements, Estimation of vehicle speed and impact force, Reconstruction of event sequences from physical evidence, Evidence preservation and chain of custody, Writing forensic engineering reports and presenting findings in legal contexts

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of forensic engineering, gaining insight into how engineering principles are applied in the investigation of structural failures, fires, explosions, and vehicular accidents. Through hands-on analysis, real-world case studies, and guided discussions, students will bridge the gap between theory and practical application.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Noon, R. (2000) – *Forensic Engineering Investigation*, CRC Press
2. Carper, K. L. (2000) – *Forensic Engineering*, CRC Press
3. Kirk, P.L. (2000) – *Vehicular Accident Investigation and Reconstruction*, Lawyers & Judges Publishing

Reference Books:

1. DeForest, P., Gaensslen, R., & Lee, H. (1983) – *Forensic Science: An Introduction to Criminalistics*, McGraw-Hill
2. Mannan, A. (2018) – *Forensic Structural Engineering Handbook*, CRC Press
3. Fisher, B. A. J. (2003) – *Techniques of Crime Scene Investigation*, CRC Press

Open Educational Resources (OER):

1. Forensic Engineering: Learning from Failures - TU Delft OpenCourseWare https://ocw.tudelft.nl/courses/forensic-engineering-learning-failures/
2. Curriculum for B.Voc in Forensic Science Techniques - University of Delhi PDF https://www.du.ac.in/uploads/RevisedSyllabi1/Annexure-134.%20(Bvoc%20Forensic%20Science%20Techniques).pdf
3. Fundamentals of Fire Investigation - International Association of Arson Investigators https://www.firearson.com/training/classes/fundamentals-of-fire-investigation/
4. Structural Failure Case Studies - Meegle https://www.meegle.com/en_us/topics/structural-engineering/structural-failure-case-studies
5. Accident Analysis & Prevention Journal - Elsevier https://www.sciencedirect.com/journal/accident-analysis-and-preventio

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSMZ405	Molecular Zoology	L	T	P	C
Version1.0		3	0	0	3
Category of Course	DSE IV				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: This course introduces students to the molecular foundations of zoological science, emphasizing the structure, function, and inheritance of genetic material across animal species. It covers fundamental concepts in DNA biology, gene expression, human genetics, molecular techniques, and their applications in modern biology and forensic science. Students will learn how molecular biology unifies the understanding of organismal development, evolution, and health.

Course Outcome: Students will be:

CO1: **Understanding** the molecular structure and functions of DNA, RNA, and proteins in animal systems.

CO2: **Applying** the basic principles of molecular genetics including gene expression and regulation.

CO3: **Analysing** knowledge of human genetics to analyze inheritance patterns and genetic disorders.

CO4: **Evaluating** and explain molecular biology techniques used in genetic and forensic research.

Course contents :45 Hours
Unit I: Introduction to Molecular Zoology and DNA Structure :10 Hours
Historical background and scope of molecular zoology, DNA: Structure, types, properties, and Packaging, RNA types and their roles, Nucleotides and their chemical nature, Central Dogma: DNA → RNA → Protein.
Unit II: Gene Expression and Regulation :12 Hours
DNA replication in eukaryotes, Transcription and translation mechanisms, Regulation of gene expression in animals, Epigenetics: DNA methylation, histone modification, Non-coding RNAs and gene silencing, DNA fingerprinting.
Unit III: Human Genetics and Patterns :12 Hours
Mendelian and non-Mendelian inheritance, Sex-linked traits and chromosomal abnormalities, Pedigree analysis and genetic counselling, Genetic basis of diseases: thalassemia, sickle cell anemia, haemophilia, Human genome project and its implications.
Unit IV: Molecular Techniques and Applications :12 Hours

DNA extraction, PCR, electrophoresis, blotting techniques, DNA sequencing and genetic markers ,Molecular diagnostics and gene therapy, CRISPR and genome editing basics, Applications in zoology, medicine, and forensic science

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the zoological science, emphasizing the structure, function, and inheritance of genetic material across animal species. The course fosters critical thinking through analysis of case studies and real-world genetic conditions, enhancing their understanding of molecular processes in animals and humans.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. **Molecular Biology of the Gene** by J.D. Watson, Tania A. Baker, Stephen P. Bell, et al., Pearson Education, 7th Edition, 2013, ISBN: 9780321762436.
2. **Human Molecular Genetics** by Tom Strachan & Andrew Read, Garland Science, 4th Edition, 2010, ISBN: 9780815341499.

Reference Books:

1. Introduction to Genetic Analysis by Anthony J.F. Griffiths, Susan R. Wessler, Richard C. Lewontin, et al., W.H. Freeman, 11th Edition, 2015, ISBN: 9781464109489.

2. Concepts of Genetics by William S. Klug, Michael R. Cummings, Charlotte Spencer, et al., Pearson Education, 11th Edition, 2015, ISBN: 9780321948915.

OPEN EDUCATIONAL RESOURCES:

1. Chapter 9 Molecular Biology – Concepts of Zoology (Pressbooks, Univ. Hawaii)
   Link: https://pressbooks-dev.oer.hawaii.edu/lccbiology/part/chapter-9-molecular-biology/
2. Basic Molecular Biology eLearning Series by CDC
   Link: https://www.cdc.gov/lab-training/php/courses/basic-molecular-biology-elearning-series.html
3. Open Genetics - LibreTexts
   Link:https://bio.libretexts.org/Bookshelves/Genetics/Online_Open_Genetics_(Nickle_and_Barrette-Ng)/08:_Techniques_of_Molecular_Genetics
4. Human Genetics - Wikipedia (with detailed genetics and inheritance topics)
   Link: https://en.wikipedia.org/wiki/Human_genetics
5. Molecular Approaches to Zoology and Evolution - Oxford Academic
   Link: https://academic.oup.com/icb/article-abstract/34/5/1/256903

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSWA405	**Wave and optics**	**L**	**T**	**P**	**C**
Version1.0		**3**	**0**	**0**	**3**
Category of Course	**DSE IV**				
Total Contact Hours	**45 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: This course provides a deep dive into the fundamental concepts of geometrical optics, oscillations, waves, and modern optics, including lasers and fiber optics. You'll learn about the laws of reflection and refraction, the properties of waves, the production and applications of lasers, and the principles of diffraction and holography. Through lectures, practical experiments, and problem-solving exercises, you'll gain a comprehensive understanding of the role of waves and optics in various fields of science and technology.

Course Outcome: Students will be:

CO 1: Understanding the fundamental principles of geometrical optics, including Fermat's principle, the laws of reflection and refraction at a plane interface, and their applications in thick lenses, Ramsden eyepieces, and Huygens eyepieces.

CO 2: Applying the characteristics and production of lasers, exploring the different types of lasers, their properties, and applications, as well as the principles of light propagation through optical fibers, including angle of acceptance, numerical aperture, and losses.

CO 3: Analyzing knowledge of wave phenomena by describing the types of waves, including transverse and longitudinal waves, electromagnetic waves, and the electromagnetic spectrum, as well as deriving the wave equation and explaining concepts such as sound waves, intensity, and the Doppler effect.

CO 4: Evaluating experiments related to Fraunhofer diffraction, including the analysis of single slit, double slit, and diffraction grating, as well as determining the resolving power of telescopes and gratings.

Course contents	**: 45 Hours**
Unit I: Geometrical optics: Fermat's principle, reflection and refraction at plane interface. :10 Hours	
Application to thick lenses, Ramsden and Huygens eyepiece Oscillations: Simple harmonic motion. Di erential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations	
Unit II: Laser & Fiber Optics	**:10 Hours**
Production of LASER, Types of LASER, Properties and applications of LASER, Optical fibres, Propagation of light through optical fibre, Angle of acceptance and numerical aperture, losses, Solar cells.	
Unit III: Waves	**:15 hours**
Types of waves, transverse and longitudinal waves, electromagnetic waves and electromagnetic spectrum, wavelength and frequency, speed of traveling wave, the wave equation, sound waves, speed of sound, intensity and sound level, the Doppler effect, shock waves, X Rays (continuous and characteristic), Spectra- Absorption and emission. Bragg's Law and X-ray diffraction.	
Unit IV: Diffraction and Holography	**:10 Hours**
Fraunhofer diffraction: Single slit, double slit & nth slits, Diffraction grating. Resolving Power of a telescope Resolving power of grating Holography: Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves	

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of wave phenomena and optical systems.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Demonstrations: performing of experiments with lenses, lasers, and optical fibers, analyze data, and solve problems related to wave propagation, diffraction, and interference.

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. Formative: Quizzes and online discussions will provide continuous feedback.

2. Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Allied Physics – R. Murugesan S. Chand & Co. First Edition (2005).
2. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
3. Allied Physics – Prof. Dhanalakshmi and others.
4. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).

Reference Books:

1. Modern Physics – R. Murugesan S. Chand & Co. (2004).
2. Electronic Principles and Applications – A.B. Bhattacharya, New Central Book Agency, Calcutta.
3. Introduction to Fiber optics by K. Thyagarajan and Ajay Ghatak, Cambridge, University Press (1999).

Open Educational Resources (OER)

1. Khan Academy: https://www.khanacademy.org/science/physics
2. Physics LibreTexts: https://phys.libretexts.org/

Examination Scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective	40 Marks

blogs/peer reviews (minimum of five components to be covered)	
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

	Communication and Personality Development	**L**	**T**	**P**	**C**
Version1.0		**2**	**0**	**0**	**2**
Category of Course	**AEC II**				
Total Contact Hours	**30 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective:

The course enhances public speaking and presentation skills, helps students confidently convey ideas, information & build self-reliance and competence needed for career advancement. Personality assessments like the Johari Window and Myers & Briggs Type Indicator (MBTI) provide frameworks to enhance self-understanding, helps people increase their self-awareness, understand and appreciate differences in others and apply personality insights to improve their personal and professional effectiveness. Interpersonal skills included in the course deal with important topics like communication, teamwork and leadership, vital for professional success.

Course Outcomes:

Upon completion of the course, the learner will be:

CO1: Improve public speaking and presentation abilities to confidently convey ideas and information.

CO 2: Understand the framework of Communication to augment oratory skills and written English

CO 3: Cultivate essential soft skills required at different workplaces.

Course contents	**: 30 Hours**
Unit I: Developing self and others	**:8 Hours**
Content Summary: Self Awareness, Personality Concepts (Personality Assessments -Johari Window, Myers & Brigg), Self-Management, Self-Esteem, Self-Efficacy, Interpersonal skills, mindset, grit and working in teams.	
Unit II: Enhancing Reading and Writing Skills	**:6 Hours**
Content Summary: Speed reading and its importance in competitive examinations, techniques for speed reading, note-taking, and critical analysis. Paragraph Writing, Essay and Summary writing, Business Letter, Email writing	
Unit III: Effective Communication and Public Speaking	**:7 Hours**
Content Summary: Communication Framework, barriers & overcoming these barriers, Group Discussions, Extempore & Public Speaking drills, to manage stage fright and anxiety. Structuring and organizing a presentation (Oral & PPT), Etiquettes, Grooming, Body Language and Conversation starters, TMAY.	
Unit IV: Career Guide and readiness	**:15 Hours**
Cover Letter, ATS friendly resume, Elevator Pitch, Video Resume (Visume), Networking, Group Discussion, Mock Interviews. Capstone Project	

Learning Experience:

The course will be conducted using experiential and participatory methods such as interactive workshops, group discussions, and practical exercises. Students will engage in self-assessment tools, collaborative writing, and public speaking drills to develop critical skills. Hands-on activities like mock interviews, resume writing, and capstone projects will provide real-world career preparation. Continuous peer feedback and role-playing will enhance communication, teamwork, and problem-solving abilities.

Textbooks:

1. Talking to Strangers – Malcom Gladwell
2. Fierce Conversation - Scot Susan
3. Public Speaking - William S. Pfeiffer, Pearson
4. Soft Skills for Everyone – Jeff Butterfield
5. Business Communication – Rajendra Pal, J S Korlahalli

6. The power of Positive Attitude -Roger Fritz
7. Believe in Yourself – Dr. Joseph Murphy

Reference Books:

1 Robbins, S. P., & Judge, T. A. (2019). *Organizational Behavior* (18th Edition). Pearson.
2 Guffey, M. E., & Loewy, D. (2021). *Business Communication: Process and Product* (10th Edition). Cengage Learning.
3 Carter, L., Bishop, J., & Kravits, S. L. (2018). *Keys to Career Success* (2nd Edition). Pearson

OPEN EDUCATIONAL RESOURCES:

1. Self-Awareness and Personal Development - https://www.usmcu.edu/Portals/218/Self-Awareness%20and%20Personal%20Development.docx
2. Open Educational Resources: Developmental Reading - https://irsc.libguides.com/openeducationalresources/devread
3. Open Educational Resources and Communication Studies (Public Speaking) - https://asccc-oeri.org/open-educational-resources-and-communication-studies/
4. Career Exploration and Readiness - https://www.training.nih.gov/career-services/readiness-exploration/
5. Free Personality Tests (Myers-Briggs and Johari Window) - https://www.16personalities.com/ and https://www.truity.com/test/type-finder-personality-test-new

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

FIFTH SEMESTER

BSFSFM501	**Forensic Medicine**	**L**	**T**	**P**	**C**
Version1.0		**3**	**0**	**0**	**3**
Category of Course	**Core Course 14**				
Total Contact Hours	**45 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: Forensic Medicine offers a deep understanding of the medical principles involved in legal investigations, focusing on postmortem changes, asphyxial deaths, and injuries. Students will learn to interpret medical evidence, differentiate between types of deaths, and apply forensic techniques to real-life scenarios. It blends medicine and law to ensure justice through scientific inquiry.

Course Outcomes: Students will be:

CO1: Understanding the physiological changes that occur after death, including immediate, early, and late changes, and their significance in estimating the time of death, along with the medico-legal aspects surrounding causes of death.

CO 2: Applying the various types and stages of asphyxial deaths, including important terms such as hypoxia and anoxia, and recognize the signs and symptoms associated with each type, including hanging, strangulation, suffocation, and drowning.

CO 3: Analyzing the procedures for conducting ante and post-mortem examinations during autopsies, emphasizing the collection, preservation, and packaging of viscera, as well as assessing and determining the time and cause of death.

CO 4: Evaluating detailed examinations of injuries caused by blunt and sharp forces, distinguishing between abrasions, bruises, lacerations, incised wounds, stab wounds, and punctured wounds, while considering their dimensions, causes, and medico-legal implications.

Course contents	**:45Hours**
Unit I: Changes after Death	**:10 Hours**
Immediate change, Early changes (Rigor mortis-postmortem hypostasis-Body cooling), Estimation of time of Death, Late Changes- (Decomposition, Adipocere, Mummification) Medico-legal aspects of death. Causes of death.	
Unit II: **Asphyxial Deaths**	**:11 Hours**
Important Terms in Asphyxial deaths (Hypoxia, Anoxia, Anoxic anoxia, Anemic anoxia, Histotoxic anoxia), Types and stages of Asphyxia, Signs of asphyxia deaths., stages of asphyxia deaths Types of Asphyxial deaths- Hanging and its types, Strangulation, Suffocation, Smothering, Drowning and its classification.	
Unit III: **Autopsy and introduction to wounds**	**:12 Hours**
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.	
Unit IV: **Injuries due to Blunt and sharp forces**	**:12 Hours**

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.

Learning Experience: This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of Forensic Medicine for legal and investigative purposes.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1.Formative: Quizzes and online discussions will provide continuous feedback.

2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

1. **Support:** The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes.

Textbooks:

1. Modi's Medical Jurisprudence and Toxicology,23rd Edition, by K. Mathiharan &Amrit K. Patnaik, Third reprint, 2009, LexisNexis, Butterworth, New Delhi

Reference Books:

1. Forensic Medicine and toxicology, JB Mukherjee, Vol I & II.
2. Keith Simpson's , Forensic Medicine.
3. Gleister's Medical Jurispridence and Toxicology, Churchill Livingstone Dental Anatomy Atlas, Whitaker

Open Educational Resources (OER)

1. https://rlmc.edu.pk/themes/images/gallery/library/books/Forensic%20Medicine/Forensic_Pathology__Second_Edition.pdf
2. https://milonm28.files.wordpress.com/2017/08/forensic-pathology-by-bernard-knight.pdf

3. http://ndl.ethernet.edu.et/bitstream/123456789/693/1/40.pdf

Examination scheme:

Evaluation Component	Weightage
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSCT502	**Forensic Chemistry and Toxicology**	**L**	**T**	**P**	**C**
Version1.0		**3**	**0**	**0**	**3**
Category of Course	**Core Course 15**				
Total Contact Hours	**45 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: This course provides a comprehensive understanding of the chemical principles and toxicological methods applied in forensic investigations. It covers the identification, analysis, and interpretation of various chemical substances, including drugs, poisons, and volatile compounds in arson, found in biological samples and crime scene evidence. The course aims to equip students with the theoretical knowledge and practical understanding necessary to contribute to forensic laboratories, interpret analytical data, and provide expert testimony in legal contexts.

Course Outcome:

Students will be:

CO 1: Understanding the fundamental principles of forensic chemistry and toxicology, including the classification and properties of common substances.

CO2: Applying various analytical techniques for the extraction, separation, identification, and quantification of drugs, poisons, and other chemical evidence.

CO3: Analysing and interpreting complex chemical and toxicological data from biological samples and crime scene materials.

CO4: Evaluating the significance and admissibility of chemical and toxicological findings in criminal and civil legal proceedings.

Course contents	**: 45 Hours**
Unit I: Fundamentals of Forensic Chemistry	**:10 Hours**
Introduction to Forensic Chemistry: Definition, scope, historical development, role in criminal justice system, ethical considerations. Basic Chemical Principles: Stoichiometry, solutions, pH, acid-base chemistry, redox reactions relevant to forensic analysis. Introduction to Analytical Techniques: Overview of qualitative and quantitative analysis, sampling techniques, sample preparation (extraction, clean-up). Presumptive and Confirmatory Tests: Color tests, microcrystal tests, spot tests for common drugs and poisons.	
Unit II: Forensic Toxicology	**:11 Hours**
Introduction to Forensic Toxicology: Definition, scope, post-mortem toxicology, human performance toxicology (alcohol, drugs and driving), drug facilitated sexual assault. Pharmacokinetics and Pharmacodynamics: Absorption, distribution, metabolism, excretion of drugs and poisons; mechanisms of action. Analysis of Common Drugs of Abuse: Opioids, cannabinoids, stimulants, hallucinogens, depressants; methods of detection in biological matrices (blood, urine, hair, oral fluid). Poisons and Toxins: Classification of poisons (e.g., metallic, volatile, plant-based), their effects, and analytical approaches for detection.	

Unit III: Fire and Arson-	**:12Hours**
Fire and Arson- Chemistry of Fire, Combustion reaction, Fire Triangle, Fire Tetrahedron, Conditions for fire, Backdraft, Accelerants & types of accelerants, Combustible and Flammable liquids, Flash point, Fire point, Ignition point, Auto Ignition point, vapour density, vapour pressure, Fire extinguisher. Arson: Legal Definition, Arson motives, Degrees of Arson, Forensic and legal Concepts, Determining origin and cause; Fire patterns, Collection/Preservation of Arson Evidences, Extraction of samples from debris	
UnitIV: Advanced Analytical Techniques	**:12Hours**
Spectroscopic Techniques: UV-Visible Spectrophotometry, Infrared (IR) Spectroscopy, Mass Spectrometry (MS) – principles, instrumentation, and applications in drug and poison identification. Chromatographic Techniques: Gas Chromatography (GC), High-Performance Liquid Chromatography (HPLC), Thin Layer Chromatography (TLC) – principles, instrumentation, and applications in separation and identification. Hyphenated Techniques: Gas Chromatography-Mass Spectrometry (GC-MS), Liquid Chromatography-Mass Spectrometry (LC-MS/MS) – components, data interpretation, and forensic applications. Immunoassays: Principles and applications of ELISA, for screening drugs in biological samples.	

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of the chemical principles and toxicological methods applied in forensic investigations.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

Formative: Quizzes and online discussions will provide continuous feedback.

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbook:

1. Textbook of Medical Jurisprudence & Toxicology, Parikh, C.K 2023 (T1)
2. Modi JP. Textbook of Medical Jurisprudence and Toxicology. MM Tripathy Publications, 2001.

Reference Books:

1. Textbook of Medical Jurisprudence & Toxicology, Modi, J. P (R1)
2. Handbook of Forensic Medicine and Toxicology, Pillay, V.V. (R2)

Open Educational Resources (OER)

- https://www.nist.gov/forensic-science/forensic-chemistry – NIST resources on forensic chemistry.
- https://www.unodc.org/unodc/en/scientific-forensics/ – UNODC scientific and forensic services.
- https://www.acs.org/content/acs/en/careers/college-to-career/areas-of-chemistry/forensic-chemistry.html – American Chemical Society resources on forensic chemistry.

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSCH503	Inorganic and Organic chemistry-II	L	T	P	C
Version1.0		2	0	0	2
Category of Course	Core Course 16				
Total Contact Hours	30				
Pre-requisites/ Co-requisites	--				

Course Perspective: This course explores the intricate relationship between matter and energy, as well as the structure, properties, and reactions of organic compounds. You'll delve into topics such as thermodynamics, kinetics, quantum mechanics, and organic reaction mechanisms

Course Outcome: Students will be:

CO1: **Understanding** the fundamental principles of metallurgy, including the use of Ellingham diagrams for predicting the feasibility of metal oxide reduction using carbon and various methods for purifying metals.

CO2: **Applying** the structures and properties of nitrogen hydrides and oxoacids of phosphorus, sulfur, and chlorine, along with their halides and oxohalides.

CO3: Analyzing the concepts of nomenclature and aromaticity to classify and differentiate between aromatic, anti-aromatic, and non-aromatic compounds, using Huckel's rule.

CO4: **Evaluating** the stability of cycloalkanes through conformational analysis, including Baeyer strain theory and energy diagrams of cyclohexane in its chair, boat, and twist-boat forms.

Course contents	**:30 Hours**
Unit I: Metallurgy	**:10Hours**
General Principles of Metallurgy: Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process.	
Unit II: Hybrids of Nitrogen	**:5 Hours**
Hydrides of nitrogen: (NH_3, N_2H_4, N_3H, NH_2OH) Oxoacids of P, S and Cl. Halides and oxohalides: PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2	
Unit III: Arenes and Aromaticity	**:5Hours**
Arenes and Aromaticity: Nomenclature of benzene derivatives. Aromatic nucleus and side chain, Aromaticity: Huckel rule, aromatic ions, aromatic, anti-aromatic and non-aromatic compounds.	
Unit IV: Cycloalkanes	**:10Hours**
Procedure and requirement for Crime Scene Reconstruction, Modus operandi, Expert team constitution for different crime scenes, Roles of Investigating Officer.	

Learning Experience:

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of thermodynamics, kinetics, quantum mechanics, and organic reaction mechanisms

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Allied Chemistry – Prof. Mathur and others.
2. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).

Reference books:

1. Electronic Principles and Applications – A.B. Bhattacharya, New Central Book Agency, Calcutta.
2. Introduction to Fiber optics by K. Thyagarajan and Ajay Ghatak, Cambridge, University Press (1999).

Open Educational Resources

1. Khan Academy: https://www.khanacademy.org/science/organic-chemistry
2. MIT OpenCourseWare: https://ocw.mit.edu/courses/chemistry/
3. Chemistry LibreTexts: https://chem.libretexts.org/

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective	40 Marks

blogs/peer reviews (minimum of five components to be covered)	
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSPC551	**Practical-Chemistry V**	**L**	**T**	**P**	**C**
Version1.0		**0**	**0**	**2**	**1**
Category of Course	**Core Course Lab V**				
Total Contact Hours	**15**				

Pre-requisites/ Co-requisites	**--**

Course Perspective: Chemistry Practical V provides a hands-on approach to foundational principles in physical chemistry. The experiments help students understand critical concepts like colligative properties (freezing point depression, boiling point elevation), surface tension, viscosity, potentiometric and conductometric titrations. This course enhances students' skills in measuring and analyzing data, enabling them to determine molecular weights and compare physical properties of various substances. These practicals emphasize accuracy in experimental techniques and the interpretation of results.

Course Outcome: Students will be:

CO1: Observe and understand the principles of colligative properties by measuring the depression in freezing point to determine the molecular weight of a non-volatile solute.

CO2: Imitate experimental procedures involving boiling point elevation to calculate the molecular weight of a non-volatile solute using standard laboratory techniques.

CO3: Practice comparing surface tension and viscosity of various liquids (e.g., water, ethanol, glycerol) at different temperatures using appropriate analytical methods.

CO4: Creating and analyzing potentiometric and conductometric titration curves for the titration of a strong acid with a strong base to determine equivalence points and understand electrochemical behavior.

List of experiments :

1. Measurement of the depression in freezing point of a solution to determine the molecular weight of a non-volatile solute.
2. Measurement of the elevation in boiling point of a solution to determine the molecular weight of a non-volatile solute.
3. Comparison of surface tension and viscosity of different liquids (e.g., water, ethanol, glycerol) at various temperatures.
4. Potentiometric titration of a strong acid with a strong base plotting the titration curve.
5. Conductometric titration of a strong acid with a strong base (e.g., HCl vs NaOH).

Learning experience

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of colligative properties (freezing point depression, boiling point elevation), surface tension, viscosity, potentiometric and conductometric titrations.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Vogel's **Textbook** of Quantitative Chemical Analysis by J. Mendham, R. C. Denney, J. D. Barnes, and M. J. K. Thomas
2. Advanced Practical Physical Chemistry by J.B. Yadav

Reference books:

1. Benjamin, D. M., Forensic Pharmacology. In Forensic Science Handbook (vol – 3), Saferstein, R. (Ed.), Prentice-Hall, Englewood Cliffs, New Jersey, 1993.
2. Practical Physical Chemistry by A.M. James & F.E. Prichard

Open Educational Resources

1. MIT OpenCourseWare - Chemistry
2. Khan Academy - Chemistry
3. ChemCollective Virtual Labs
4. Titration Experiments - Chemistry LibreTexts

UNMIDF501	Social Media Forensics and Data Privacy	L	T	P	C
Version 2.0		3	0	2	4
Category of Course	Minor IV				
Total Contact Hours	45 Hours + 30 Hours				
Pre-requisites/ Co-requisites	Knowledge of Social Media Forensics and Cyber Laws				

Course Perspective: This course examines the role of social media platforms in digital investigations, covering evidence extraction, metadata analysis, and privacy laws. Students will learn to investigate cybercrimes (e.g., impersonation, cyberbullying) using OSINT tools, API-based data scraping, and graph analysis while addressing ethical and legal challenges like jurisdictional conflicts and data anonymisation.

Course Outcome: Students will be able to:

CO1: Understanding social media platform structures, types of online evidence, and OSINT fundamentals relevant to forensic investigation.

CO2: Applying techniques for collecting, preserving, and analysing digital evidence from social media using tools like Maltego, Hunchly, and ExifTool.

CO3: Analysing user behaviours, metadata, relationships, and fake profile patterns through graph mapping, content history, and trend monitoring.

CO4: Evaluating legal frameworks, data privacy laws, and platform compliance policies in handling social media evidence across jurisdictions.

CO5: Creating forensic reports, simulated breach scenarios, and response strategies by integrating technical findings with legal and ethical considerations.

Course contents	**:45 Hours + 30 Hours**
UNIT 1: Introduction to Social Media Forensics	**:10 Hours**
Evolution of social media in investigations., Platform-specific data structures: Facebook, X (Twitter), Instagram, LinkedIn, TikTok, Cybercrimes: Cyberbullying, grooming, impersonation, defamation, Metadata analysis: Timestamps, geolocation, EXIF data. Introduction to OSINT.	
UNIT 2: Data Collection and Analysis Techniques	**:11 Hours**
Evidence types: Text, images, videos, chat logs, Collection methods: OSINT tools (Maltego, SpiderFoot), API-based scraping (Twint, Facebook Graph API), Legal admissibility and documentation, Case studies: Fake accounts, botnets, graph analysis for relationship mapping.	
UNIT 3: Data Privacy Principles and Laws	**:10 Hours**
Core concepts: Consent, data minimization, right to erasure, Global privacy laws: GDPR (EU), CCPA (USA), India's PDP Bill, PIPEDA (Canada), Platform policies: Privacy settings, data retention, breach notifications.	
UNIT 4: Ethical, Legal & Regulatory Aspects	**:14 Hours**
jurisdictional issues in social media investigations. Intermediary guidelines and platform compliance (e.g., Twitter, Meta). Surveillance, proportionality, and privacy concerns in forensic investigations. Counter-forensics on social media: self-destructing messages, fake news, VPN use. Case studies: Blue Whale Challenge, Cambridge Analytica, Cyberbullying on Instagram. Role of CERT-In and law enforcement in social media crimes.	
List of Practical	**: 30 Hours**
1. Perform OSINT on a Mock Profile Using Maltego 2. Extract Metadata from Social Media Images (ExifTool, etc.) 3. Analyze Fake Profiles Using Tools (Social Catfish, Spokeo) 4. Capture & Preserve Online Evidence Using Hunchly 5. Detect Deepfakes Using Deepware Scanner, Microsoft Authenticator	

6. Monitor Real-Time Trends Using Hoaxy, TweetDeck

Learning Experience: This course provided a clear overview of social media forensics, covering the evolution of platforms and the types of digital evidence they hold. I learned practical skills in data collection using OSINT tools and API scraping, alongside understanding legal requirements for evidence handling. Overall, the course gave me a balanced understanding of technical, legal, and ethical aspects crucial for conducting responsible social media investigations.

Instruction Methods:

Lectures: Covering platform data structures, cybercrimes, OSINT, privacy laws, and legal issues.
Interactive Sessions: Real case discussions, group tasks, and scenario-based analysis.
Hands-on Labs: Using tools like Maltego, Social Catfish, ExifTool, Hunchly, Gephi, and Deepware Scanner.
Simulations: Practical exercises on data subject requests, fake profile detection, and breach response.

Technology Use

- **Tools**: Maltego, SpiderFoot, ExifTool, Hunchly, Gephi, NodeXL, Twint, Wayback Machine, Deepware Scanner.
- **Platforms**: LMS with access to digital tools, mock datasets, legal templates, and recorded demos.

Assessments

1. Formative: Tool-based tasks, online quizzes, metadata analysis, and OSINT exercises.

2. Summative: Simulated case report writing, fake profile investigations, and legal scenario evaluations.

Support: Faculty mentoring, collaborative tasks, access to documentation templates, and personalized feedback throughout the course.

Textbooks

1. *Social Media Forensics* – Jens Kessler; 2018, 1st Edition (Springer)
2. *OSINT Techniques* – Michael Bazzell; 2021, 10th Edition

Reference Books

1. *NIST Guide to OSINT (SP 800-150)* – NIST; 2019 (Special Publication)
2. *EU GDPR Handbook* – Various Authors; 2018, 1st Edition

3. Kritika Singh. Essentials of Digital Forensics: Fundamental, Procedure and Practical Application. 1st Edition 2025

4. *The Art of Invisibility* – Kevin Mitnick; 2017, 1st Edition

Open Educational Resources (OER)

1. OSINT Framework – https://osintframework.com
2. GDPR Text – https://gdpr-info.eu
3. Bellingcat's OSINT Guides – https://www.bellingcat.com/resources
4. Coursera: Digital Privacy (University of Pennsylvania).

Evaluation components	**Weightage**
Internal marks (Theory)	**40 Marks**
I. Continuous Assessment All the components are to be evenly spaced. (minimum of five elements to be evaluated)	
Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals	**20**
Practical Assessment I & II	**20**
Midterm Exam	**20 Marks**
External Marks (Theory): End Term Examination	**40 Marks**

BSFSFP552	**Forensic Practical V**	**L**	**T**	**P**	**C**
Version1.0		**0**	**0**	**4**	**2**
Category of Course	**Core Course Lab V**				
Total Contact Hours	**90 Hours**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: This practical course provides a comprehensive introduction to the techniques used in forensic chemistry. Through a series of experiments, you'll gain practical experience in analyzing common drugs of abuse, determining physical properties, and identifying various cations and anions. This course is designed to equip you with the skills needed to contribute to forensic investigations and understand the scientific principles behind forensic analysis.

Course Outcomes: Students will be:

CO1: Observing the principles and techniques of color/spot tests for common drugs of abuse.

CO2: Imitating analytical methods to evaluate phenolphthalein in trap cases for forensic investigations.

CO3: Practice the analysis of cations, including Arsenic, Copper, Lead, Zinc, Barium, and Aluminium, using appropriate techniques.

CO4 : Creating the results of anion analysis for Nitrate, Phosphates, Oxalate, Chloride, Iodide, and Sulphates in forensic samples.

List of experiments
1. Colour/spot tests for common drugs of abuse
2. Determination of boiling and melting points.
3. Analysis of phenolphthalein in trap cases.
4. Analysis of Cations (Arsenic, Copper, Lead, Zinc, Barium, Aluminium)
5. Analysis of Anions (Nitrate, Phosphates, oxalate, chloride, iodide, sulphates)

Learning Experience:By conducting experiments on color/spot tests for common drugs of abuse, determining boiling and melting points, analyzing phenolphthalein in trap cases, and identifying cations and anions, you'll develop a strong foundation in forensic chemistry. This hands-on approach will allow you to apply theoretical knowledge to real-world scenarios and gain practical skills that are essential for forensic scientists.

Instruction Methods:

Practical Sessions: Experiments will be taught using practical demonstrations.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. Formative: Quizzes and online discussions will provide continuous feedback.

2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Thomas Kubic, Nicholas Petraco Forensic Science Laboratory Manual and Workbook, ThirdEdition 2009
2. Laboratory Protocols CIMMYT Applied Molecular Genetics Laboratory Third Edition.
3. Vogel **Textbook** of Practical organic Chemistry including Qualitative organic analysis

Suggested Readings:

1. Kathy Mirakovits, Gina Londino, The Basics of Investigating Forensic Science: A LaboratoryManual 2015
2. Washington state patrol Forensic Laboratory services: Crime Laboratory: Technical &Training Manuals Isolation and identification of Drugs by E.G.C. Clark

Open Educational Resources (OER)

1 Training Procedure for Preliminary Color Tests — Forensic Resources PDF: https://forensicresources.org/wp-content/uploads/2020/09/Preliminary-Color-Tests.pdf Forensic Resources

2 Illinois State Police – Drug Chemistry Procedures Manual (has "Color and Functional Group" section etc.) — PDF at: https://isp.illinois.gov/StaticFiles/docs/ForensicServices/ForensicScienceCommandManuals/Drug%20Chemistry.pdf Illinois State Police

3 NIJ Standard: Color Test Reagents/Kits for Preliminary Identification of Drugs of Abuse — PDF: https://www.ojp.gov/pdffiles1/nij/183258.pdf

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

BSFSEZ504	Evolutionary Zoology	L	T	P	C
Version1.0		3	0	0	3
Category of Course	DSE V				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: This course explores the concepts and mechanisms of evolution, focusing on how zoological diversity has emerged through natural processes. It covers classical and modern evolutionary

theories, population genetics, phylogenetics, adaptation, and speciation. Students will understand the significance of evolutionary biology in the development of life, biodiversity conservation, and forensic anthropology.

Course Outcome: Students will be

CO1: **Understanding** foundational principles of evolutionary biology and zoological diversity.

CO2: **Applying** the processes of natural selection, genetic drift, and gene flow.

CO3: **Analysing** fossil evidence and phylogenetic relationships in evolutionary studies.

CO4: **Evaluating** the evolutionary basis of behavior, adaptation, and speciation.

Course contents :45 Hours
Unit I: Introduction to Evolutionary Zoology :10 Hours
History of evolutionary thought: Lamarck, Darwin, Wallace, Modern synthetic theory of evolution, Evidence for evolution: fossil records, embryology, molecular data, Origin of life: chemical evolution, early Earth conditions.
Unit II: Mechanism of Evolution :12 Hours
Natural selection: types and examples, Genetic drift and gene flow, Mutation and recombination, Hardy-Weinberg equilibrium and its applications, Speciation and isolation mechanisms.
Unit III: Types of evolution :12 Hours
Adaptive radiation and convergent evolution, Evolution of major animal phyla, Molecular evolution and molecular clocks, Constructing and interpreting phylogenetic trees, Human evolution: fossil hominids, genetic lineage.
Unit IV: Applications of Evolutionary Concepts :12 Hours
Evolutionary medicine and zoonotic diseases, Evolution and animal behaviour, Evolutionary perspectives in conservation biology, Evolutionary anthropology and forensic relevance, Ethical issues in human evolutionary research

Learning Experience:

Students will gain a solid foundation in evolutionary zoology and its applications in zoological research and forensic sciences. The course fosters critical thinking through analysis of case studies and real-world genetic conditions, enhancing their understanding of molecular processes in animals and humans.

Instruction Methods:

Practical Sessions: Experiments will be taught using practical demonstrations.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. Formative: Quizzes and online discussions will provide continuous feedback.

2.Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. **Evolution** by Mark Ridley, Wiley-Blackwell, 4th Edition, 2008, ISBN: 9781405103459.
2. **Evolutionary Biology** by Douglas J. Futuyma, Sinauer Associates (Oxford University Press), 3rd Edition, 1998, ISBN: 9780878931897.

Reference Books:

1. Strickberger's Evolution by Brian K. Hall & Benedikt Hallgrímsson, Jones & BartlettLearning, 5th Edition, 2008, ISBN: 9780763739649.

2. Evolutionary Analysis by Scott Freeman & Jon C. Herron, Pearson Education, 5th Edition, 2014, ISBN: 9780321616678.

OPEN EDUCATIONAL RESOURCES

1. A Primer of Evolution—An Introduction to Evolutionary Thought through Theory, Evidence, and Practice
   https://irl.umsl.edu/oer/36/
2. Evolution through natural selection (OpenLearn Free Course)
   https://www.open.edu/openlearn/nature-environment/natural-history/evolution-through-natural-selection/content-section-0

3. Introduction to Biology: Evolution (Coursera)
   https://www.coursera.org/learn/introduction-to-biology-evolution
4. Evolutionary principles and their practical application - PMC article
   https://pmc.ncbi.nlm.nih.gov/articles/PMC3352551/
5. Open Educational Resources: Biology (NIU LibGuides with various free textbooks)
   https://libguides.niu.edu/biology/oer

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

BSFSTP505	Thermal Physics	L	T	P	C
Version1.0		3	0	0	3
Category of Course	DSE V				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: The course offers an in-depth exploration of thermodynamics and kinetic theory, focusing on foundational laws and principles that govern energy transformations. It bridges classical and modern physics, linking theory with real-world applications in gases and thermodynamic processes. Students will gain a comprehensive understanding of entropy, thermodynamic potentials, and the behavior of real gases.

Course Outcome: Students will be:

CO1: Understanding the foundational principles of thermodynamics, including the First and Second Laws, thermodynamic variables, equilibrium, and the concepts of temperature, work, heat, and internal energy.

CO3: Applying the concept of entropy and its implications in thermodynamic processes, including Clausius's theorem, entropy changes in reversible and irreversible processes, and the principles of the Third Law of Thermodynamics.

CO4: Analyzing the kinetic theory of gases to explain molecular behavior, including the distribution of velocities, molecular collisions, and the Maxwell-Boltzmann law, as well as specific heats and degrees of freedom in ideal gases.

CO5: Evaluating calculations related to the behavior of real gases, focusing on deviations from the ideal gas equation and understanding critical constants, Boyle temperature, and the Van der Waals equation of state.

Course contents
Unit I: Introduction to Thermodynamics: First & Second Law of Thermodynamics: Thermodynamic, Variables & Equilibrium, Concept of Temperature, Work & Heat, Internal Energy, Applications of First Law
Unit II: Entropy & Thermodynamic Potentials: Concept of Entropy, Clausius Theorem. Second Law of Thermodynamics in terms of Entropy. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Principle of Increase of Entropy. Temperature–Entropy diagrams. Third Law of Thermodynamics
Unit III: Kinetic Theory of Gases: Distribution of Velocities, Molecular Collisions, Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases, Mean Free Path, Collision Probability.
Unit IV: Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases

Learning Experience: Through this course, students will engage in both theoretical discussions and practical problem-solving related to thermodynamics and gas laws. By applying concepts such as the laws of thermodynamics, entropy, and the kinetic theory of gases, students will explore phenomena like heat transfer, energy distribution, and real gas behavior. The course will enhance critical thinking by challenging students to analyze reversible and irreversible processes, understand the universe's entropy, and evaluate deviations in ideal gas behavior. Hands-on experiments and simulations will enrich the learning process.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Allied Physics – Prof. Dhanalakshmi and others.
2. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
3. Modern Physics – R. Murugesan S. Chand & Co. (2004).

Suggested Readings:

1. Electronic Principles and Applications – A.B. Bhattacharya, New Central Book Agency, Calcutta.
2. Introduction to Fiber optics by K. Thyagarajan and Ajay Ghatak, Cambridge, University Press(1999).]

Open Educational Resources (OER)

1. MIT OpenCourseWare - Thermodynamics
2. Khan Academy - Thermodynamics
3. NPTEL - Thermodynamics and Statistical Physics

Examination scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

	Arithmetic Reasoning and Skills-III	L	T	P	C
Version 1.0		**2**	**0**	**0**	**2**
Category of Course	**Ability Enhancement Course**				
Total Contact Hours	**30**				
Pre-Requisites/ Co-Requisites					

Course Perspective: The course aims to improve basic arithmetic skills, speed, and accuracy in mental calculations, and logical reasoning. These abilities are essential for a strong math foundation, helping students succeed in academics and various practical fields.

Course Outcomes:

Upon completion of the course, the learner will be:

CO1: Understanding arithmetic algorithms required for solving mathematical problems**.**

CO2: Applying arithmetic algorithms to improve proficiency in calculations.

CO3: Analyzing cases, scenarios, contexts and variables, and understanding their inter-connections in each problem.

CO4: Evaluating & deciding approaches and algorithms to solve mathematical & reasoning problems.

Course contents
Unit I: Mathematical Essentials :12 Hours
Traditional Indian Calculation methods, Number types and divisibility principles, Practical uses of Percentage in calculating changes and discount, understanding Ratio and Proportion in everyday context.
Unit II: Fundamentals of Logical Reasoning :10 Hours
Blood Relations, Direction Sense, Coding Decoding
Unit III: Elementary Quantitative

Simple and Compound Interest in everyday situations like loans, investment, Practical problems involving Averages, Real life examples and scenarios involving Partnership
Unit IV: Reasoning Skills : 5 Hours
Introduction to reasoning, logical reasoning, Analytical reasoning, deductive reasoning, Inductive reasoning, Abductive reasoning, Reasoning in Communication, reasoning in decision making, Reasoning in Research and analysis

Learning Experience:

The course will be conducted using experiential and participatory methods such as practical problem-solving sessions, group discussions, and real-life applications. Students will practice traditional Indian calculation techniques and apply mathematical concepts like percentages, ratios, and interest to everyday situations. Logical and analytical reasoning skills will be developed through exercises in blood relations, direction sense, and reasoning techniques. Case studies and scenarios will help students apply reasoning to communication, decision-making, and research contexts, ensuring hands-on learning and active participation.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

i. Guha Abhijit: Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill Publication

ii. Quantitative Aptitude by R.S. Aggarwal

iii. Verbal & Non-Verbal Reasoning by R.S. Aggarwal

Reference Books:

i. Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal

ii. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal

iii. How to Prepare for Quantitative Aptitude for CAT by Arun Sharma

OPEN EDUCATIONAL RESOURCES

1. **Open Educational Resources (OER): Mathematics (general math topics including calculation, percentage, ratio)**
   https://instr.iastate.libguides.com/oer/math
2. **Logic for All: An Introduction to Logical Reasoning (Step-by-step accessible text)**
   https://batch.libretexts.org/print/Letter/Finished/math-182561/Full.pdf
3. **Quantitative Aptitude Basics - Free course covering interest, averages, partnership topics**
   https://free.aicte-india.org/Quantitative-Aptitude-Basics.php
4. **Logical Reasoning - Open Textbook Library (focus on critical thinking and reasoning skills)**
   https://open.umn.edu/opentextbooks/textbooks/745
5. **Open Educational Resources and Mathematics (collection of math textbooks and course materials)**
   https://asccc-oeri.org/open-educational-resources-and-mathematics/

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks

External Marks (Theory): – End Term Examination	40 Marks

BSFSIN506	Summer Internship-II	L	T	P	C
Version 1.0		0	0	0	2
Category of Course	SI				
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:

CO1: Understanding the theoretical knowledge by effectively integrating concepts learned in coursework into practical situations encountered during the internship experience.

CO2: Applying professional skills such as communication, teamwork, problem-solving, and time management, enhancing overall readiness for future career opportunities.

CO3: Analysing the research or projects relevant to the organization's goals, contributing valuable insights and demonstrating initiative in real-world applications.

CO4: Evaluating 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

UNMIDF502	Digital Forensic Project	L	T	P	C
Version1.0		0	0	0	4
Category of Course	Minor V				
Total Contact Hours					
Pre-Requisites/ Co-Requisites	Practical exposure				

Course Perspective: In the first week of Semester V, students can be divided into groups and will be assigned a suitable Digital Forensic topic under the supervision of the expert faculty. The group will work on the assigned research topic during semesters V in regular consultation with his/her assigned teacher. The group will write the project and also prepare power point presentation for the same, each group has to deliver a seminar talk on his/ her digital forensic project work.

Course Outcomes

On completion of this course, the students will be:

CO1. Carrying out the extensive literature survey.

C02. Applying the learning techniques to write and present technical reports/articles.

CO3. Analyzing various methods and techniques applicable to the topic to study and contribute to domain knowledge.

CO4. Evaluating the result of the project carried out and presenting the results using data visualization methods.

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.

Evaluation Scheme

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

SIXTH SEMESTER

BSFSPS601	**Forensic Psychology**	**L**	**T**	**P**	**C**
Version1.0		**3**	**0**	**0**	**3**
Category of Course	**Core Course 17**				
Total Contact Hours	**45 Hours**				
Pre-requisites/ Co-requisites	**Basic Knowledge of punishments**				

Course Perspective: Forensic psychology explores the application of psychological principles to the legal system. You'll delve into topics such as criminal profiling, eyewitness testimony, jury selection, and the evaluation of mental disorders in legal contexts. This course provides a unique blend of theoretical knowledge and practical applications, preparing you for a career in forensic psychology or related fields.

Course Outcome: Students will be:

CO1: Understanding the intersection of forensic psychology and the law, including ethical issues, mental competency assessments, and the role of psychological factors in criminal behavior.

CO2: Analyse psychological assessment tools and deception detection methods, including polygraphs and advanced techniques like Brain Electrical Oscillation Signature Profiling.

CO3: Analyzing principles of polygraphy and narco-analysis in forensic investigations, ensuring adherence to legal and ethical standards.

CO4: Evaluating the implications of forensic psychological findings on criminal profiling, eyewitness testimony, and the relationship between genetics and criminal behavior.

Course content
Unit I: Basics of Forensic Psychology :10 hours

Basics: 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, Genetics and Crime, Serial murders, Modus Operandi.
Unit II : **Psychological Assessment** **:15 hours**
Psychological Assessment: Psychological Assessment Tools, Detection of deception, Various methods for detection of deception, Interview, Non-verbal detection, statement assessment, Hypnosis, Psychological assessment, voice stress analyzer, Polygraph, thermal imaging, Brain Electrical Oscillation Signature Profiling, Functional Magnetic Resonance study, Current research in detection of deception/truth finding mechanisms
Unit III: Polygraph **: 10 Hours**
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.
Unit IV: Narco-Analysis **;10Hours**
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: Through lectures, case studies, and practical exercises, you'll gain a comprehensive understanding of the psychological factors that influence criminal behavior, the legal system, and the administration of justice. You'll also have the opportunity to develop critical thinking, research skills, and ethical decision-making abilities.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.
Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

1. **Formative:** Quizzes and online discussions will provide continuous feedback.
2. **Summative:** Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

2. Forensic Science in Criminal Investigation & Trials – B.R.Sharma.
3. The Hand Book of Forensic Psychology – Weiner Hass
4. Hand Book of Forensic Psychology – O' Donohue Levensky s

Reference books:

1. Brain Experience – C.R.Mukun
2. Criminal Profilling – B.Turvey
3. Investigative Forensic Hypnosis – J. Niehans
4. Art & Science of the Polygraph Techniques – J.A.Matte
5. Hand Book of Polygraph Testing – M.Kloinen 9.Detecting Lies & Deceit – A.Vri

Open Educational Resources (OER)

1. Forensic Psychology - OpenLearn (The Open University)
   https://www.open.edu/openlearn/health-sports-psychology/forensic-psychology
2. Basic Theory and Concepts of Forensic Psychology - Alison
   https://alison.com/course/basic-theory-and-concepts-of-forensic-psychology
3. Forensic Psychological Assessment of Criminal Behaviour - E-Gyankosh (PDF)
   https://egyankosh.ac.in/bitstream/123456789/24200/1/Unit-3.pdf
4. The Polygraph and Lie Detection (PDF)
   https://evawintl.org/wp-content/uploads/10420.pdf
5. Narco Analysis Test, Concerns & Criticism Explained - Testbook
   https://testbook.com/ias-preparation/narco-analysis

Examination scheme:

Evaluation Component	Weightage
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSCH602	Inorganic and Organic Chemistry-III	L	T	P	C
Version1.0		**2**	**0**	**0**	**2**
Category of Course	**Core Course 18**				
Total Contact Hours	**30**				
Pre-requisites/ Co-requisites	--				

Course Perspective:This course provides a comprehensive understanding of coordination chemistry through crystal field theory, emphasizing electronic structure and molecular geometry. It explores the reactivity and mechanisms of alkyl and aryl halides, including organometallic applications. The study of natural products like alkaloids and terpenes enhances knowledge of bioactive molecules. Additionally, it introduces inorganic polymers, comparing their properties and applications with organic counterparts.

Course Outcome: Students will be:

CO1: Understanding the principles of Crystal Field Theory, including CFSE, symmetry aspects of coordination complexes, and key concepts such as spectrochemical series and Jahn-Teller distortion, along with the chemistry and reactivity of alkyl and aryl halides, and natural products like alkaloids and terpenes**.**

CO2: Applying knowledge of reaction mechanisms such as SN1, SN2, and SNAr in the synthesis and transformation of organic halides, and employing synthetic techniques for organometallic compounds and natural product derivatives.

CO3: Analysing the stereochemical and mechanistic differences between nucleophilic substitution and elimination reactions, the structural elucidation of natural compounds, and the influence of ligand fields on the geometry and stability of metal complexes.

CO4: **Evaluating** the structural, synthetic, and application-oriented differences between organic and inorganic polymers, including silicones, borazines, phosphazenes, and biologically significant natural products, based on theoretical and practical insights.

Course contents
Unit I: Crystal Field Theory **:8 Hours**
: Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination
Unit II Alkyl halides **:10 Hours**
Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and S I mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination. Aryl halides: Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; SNAr, Benzyne mechanism.Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.Organometallic compounds of Mg and Li and their use in synthesis.
Unit III: Natural Products **:7 Hours**
Natural occurrence, General structural features, Isolation and their physiological action Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine. Terpenes: Occurrence,classification,isoprenerule;Elucidationof structure andsynthesis of Citral, Neraland α-terpineol.
Unit IV: Organic and Inorganic Polymers **: 5 Hours**
Types of inorganic polymers, Comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes.Borazines, silicates and phosphazenes, and polysulphates.

Learning Experience;

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of reactivity and mechanisms of alkyl and aryl halides, including organometallic applications.

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:
Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.
Assessments:
Formative: Quizzes and online discussions will provide continuous feedback.
Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes.

Textbooks:

1. Kalsi, P. S. *Organic reactions and their mechanisms*, New Age Science(2010).
2. Lee, J. D. Concise Inorganic Chemistry, Wiley, 5th Edn.

Reference books:

1. Morrison, R. T., Boyd, R. N., Bhatterjee, S.K., Organic Chemistry, 7thEdn., Pearson.
2. Acheson, R.M. *Introduction to the Chemistry of Heterocyclic compounds,* John Welly & Sons (1976).
3. Solomons, T.W., Fryhle Craig, *Organic Chemistry,* John Wiley & Sons, Inc(2009).

Open Educational Resources

1. Crystal Field Theory - MIT OpenCourseWare Lecture and Notes https://ocw.mit.edu/courses/5-111sc-principles-of-chemical-science-fall-2014/resources/lecture-28-transition-metals-crystal-field-theory-part-i/
2. Crystal Field Theory - LibreTexts Inorganic Chemistry Chapter https://chem.libretexts.org/Courses/East_Tennessee_State_University/CHEM_3110:_Descriptive_Inorganic_Chemistry/09:_Coordination_Chemistry-_Bonding/9.01:_Crystal_Field_Theory
3. Alkyl Halides - PPT and Study Material https://www.slideshare.net/slideshow/alkyl-halide-131723782/131723782
4. Natural Products Chemistry and Pharmacognosy - Course Description and Content https://odinlister.sdu.dk/fagbesk/internkode/FA505/en
5. Inorganic Polymers - PDF and Overview of Structure, Properties, and Applications https://drhazhan.com/Inorganic_Polymers_0195131193.p

Evaluation Component	**Weightage**

Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSPC651	**Practical-Chemistry VI**	**L**	**T**	**P**	**C**
Version1.0		**0**	**0**	**2**	**1**
Category of Course	**Core Course Lab VI**				
Total Contact Hours	**15**				
Pre-requisites/ Co-requisites	**--**				

Course Perspective: This course offers hands-on experience in fundamental techniques for the purification and characterization of organic compounds. Students will learn crystallization, distillation, sublimation, and chromatography methods, enhancing their practical laboratory skills. Emphasis is placed on determining melting and boiling points accurately and understanding the effect of impurities. The course fosters analytical thinking and precision essential for organic qualitative analysis.

Course Outcome: Students will be:

CO1: Observe the principles and procedures involved in the purification of organic compounds through crystallization, distillation, decolouration, and sublimation.

CO2: Imitate standard methods for determining melting and boiling points using techniques such as Kjeldahl method, electrically heated apparatus, and capillary method, including observation of impurity effects.

CO3: Practice separation techniques using chromatography, including paper chromatography and TLC, for the identification and analysis of amino acids, sugars, and isomeric compounds.

CO4: Creating systematic laboratory procedures for organic compound purification and analysis, integrating multiple techniques to achieve effective separation, identification, and purity determination.

List of experiments :

1. Purification of organic compounds by crystallization using the following solvents:
   a.Water b. Alcohol c. Alcohol-Water
2. Purification by Distillation, Decolouration (Charcoal treatment) and Sublimation.
3. Determination of the melting points of given organic compounds and unknown organic compounds (using Kjeldahl method and electrically heated melting point apparatus).
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)
6. Chromatography

- Separation of a mixture of two amino acids by ascending and horizontal paper chromatography
- Separation of a mixture of two sugars by ascending paper chromatography
- Separation of a mixture of *o*-and *p*-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC).

Learning experience

This course will be a mix of lectures, interactive sessions, and hands-on learning to deepen the understanding of crystallization, distillation, sublimation, and chromatography methods, enhancing their practical laboratory skills

Instruction Methods:

Lectures: Core concepts will be taught using multimedia presentations and problem-solving sessions.

Interactive Sessions: Q&A segments, live quizzes, and discussions will engage students and reinforce learning.

Technology Use:

Online Platforms: An LMS will provide resources, recorded lectures, and discussion forums for extended learning.

Assessments:

Formative: Quizzes and online discussions will provide continuous feedback.

Summative: Exams, peer reviews, and presentations will evaluate overall understanding.

Support: The course instructor will be available for additional guidance, and peer collaboration will be encouraged. Regular feedback will help students improve and achieve course outcomes

Textbooks:

1. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
2. Modern Chemistry – S. Chand & Co. (2006).

Reference books:

1. Vogel's Textbook of Practical Organic Chemistry" by Brian S. Furniss et al.
2. "Physical Chemistry: A Molecular Approach" by Donald A. McQuarrie and John D. Simon
3. "Inorganic Chemistry" by J.D. Lee
4. "Reaction Kinetics" by Keith J. Laidler

Open Educational Resources

1. Khan Academy – Chemistry
2. MIT OpenCourseWare – Chemistry
3. LibreTexts Chemistry Library

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

UNMIDF601	Digital Forensics and Cyber Security	L	T	P	C
Version 2.0		3	0	2	4
Category of Course	Minor VI				
Total Contact Hours	45 Hours (Theory) + 30 Hours (Practical)				
Pre-requisites/ Co-requisites	Basic knowledge of operating systems and networking, as well as introductory digital forensics.				

Course Perspective: This course explores advanced cyber threats, incident response, and forensics in modern environments (cloud, IoT, AI). Students will analyse APTs, ransomware, and network intrusions using frameworks like MITRE ATT&CK, while gaining hands-on experience with SIEM tools, live forensics, and secure configuration policies for enterprises.

Course Outcome: The Student will be :

CO1: Understanding advanced cyber threats, network protocols, IoT, and drone systems relevant to forensic investigation.

CO2: Applying incident response procedures and forensic techniques to collect and preserve digital evidence from networks, IoT devices, and drones.

CO3: Analysing system logs, network traffic, cloud artifacts, and telemetry data to reconstruct cyber incidents and identify attack patterns.

CO4: Evaluating forensic tools, secure configuration practices, and legal regulations in addressing modern threats and digital investigations.

CO5: Creating structured forensic reports, threat maps, and secure system configurations using tools like

MITRE ATT&CK, Suricata, and DJI Log Viewer.

Course contents	**:45 Hours + 30 Hours**
UNIT 1: Advanced Cyber Threats and Incident Response	**:08 Hours**
Evidence lifecycle management in real-time systems, Threats: APTs, ransomware (e.g., Colonial Pipeline), supply chain attacks (SolarWinds), Social engineering: Deepfake scams, phishing kits, Frameworks: MITRE ATT&CK, Cyber Kill Chain. Incident response phases: Containment to recovery,	
UNIT 2: Network Forensics	**:12 Hours**
Basics of network forensics: Definition, scope, and importance. Common network attacks: Sniffing, spoofing, DDoS, MITM. Key protocols: TCP/IP, HTTP, DNS, ARP. Packet capture and analysis using tools like Wireshark and tcpdump. Log analysis: Firewall, IDS/IPS, server logs, NetFlow. Intrusion detection: Snort, Suricata, signature vs. anomaly detection. Evidence handling and chain of custody. Case studies: DDoS, malware over network, data leaks. Tools: Splunk, Wireshark, Suricata (IDS/IPS), Forensic imaging & timeline reconstruction, Case studies: Equifax breach, Log4j vulnerability.	
UNIT 3: Introduction to IoT	**:10 Hours**
Introduction to the Internet of Things (IoT) and its architecture. Types of IoT devices and common communication protocols (MQTT, CoAP, Zigbee, BLE). Security and forensic challenges in IoT environments. Evidence sources: Device memory, mobile apps, cloud storage, network traffic. IoT log acquisition and timeline reconstruction. Forensic tools for IoT investigation (e.g., IoT Inspector, Autopsy, Wireshark). Case studies: Smart home breach, wearable device evidence, connected car forensics. Legal and privacy concerns in IoT investigations	
UNIT 4: Drone & Secure Configurations	**:15 Hours**
Introduction to Drones (UAVs): Types, architecture, and communication systems (Wi-Fi, GPS, RF). Forensic relevance: Use of drones in crimes and investigations. Data sources: Onboard storage (SD cards), flight logs, controller logs, and mobile apps. Acquisition techniques: Imaging memory cards, extracting telemetry and metadata. Drone forensic tools: Autopsy, DJI Flight Log Viewer, OpenDroneMap. Secure configurations: Firmware updates, access control, encryption, GPS spoofing prevention. Case studies: Drone-based surveillance, smuggling, unauthorized area intrusion. Legal and regulatory aspects: Drone laws, airspace regulations, privacy concerns	
List of Practical	**: 30 Hours**

1. Simulate APT and ransomware threats using lab environments
2. Detect phishing/deepfake scams using social engineering simulation
3. Map attacks with MITRE ATT&CK and Cyber Kill Chain
4. Perform incident response phases: containment, eradication, recovery
5. Capture and analyse network traffic using Wireshark and Suricata
6. Forensic imaging and timeline creation from compromised devices
7. Analyse IoT devices: Smart cameras, home assistants
8. Extract drone flight logs (DJI, Parrot), telemetry
9. Handle encrypted data and proprietary formats

Learning Experience:

Students will gain hands-on skills in cyber forensics, threat analysis, and incident response using tools like Splunk, Wireshark, and MITRE ATT&CK. Through labs, case studies (e.g., SolarWinds, ransomware attacks), and simulations, they will learn to investigate cloud, IoT, and drone-based threats while maintaining legal and forensic standards. The course emphasises real-world scenarios, from evidence collection to secure system hardening, preparing students for enterprise and law enforcement challenges.

Instruction Methods

- **Lectures**: Covering platform data structures, cybercrimes, OSINT, privacy laws, and legal issues.
- **Interactive Sessions**: Real case discussions, group tasks, and scenario-based analysis.
- **Hands-on Labs**: Using tools like Maltego, Social Catfish, ExifTool, Hunchly, Gephi, and Deepware Scanner.
- **Simulations**: Practical exercises on data subject requests, fake profile detection, and breach response.

Technology Use

- **Tools**: Maltego, SpiderFoot, ExifTool, Hunchly, Gephi, NodeXL, Twint, Wayback Machine, Deepware Scanner.
- **Platforms**: LMS with access to digital tools, mock datasets, legal templates, and recorded demos.

Assessments

- **Formative**: Tool-based tasks, online quizzes, metadata analysis, and OSINT exercises.
- **Summative**: Simulated case report writing, fake profile investigations, and legal scenario evaluations.

Support

- Faculty mentoring, collaborative tasks, access to documentation templates, and personalized feedback throughout the course.

Textbooks

1. *Incident Response & Cyber Warfare* – Pascal Ackerman; 2011, 1st Edition (Syngress)
2. *Cloud Forensics* – Darren Quick; 2019, 1st Edition (Springer)
3. *AI in Cybersecurity* – Yuri Diogenes; 2020, 1st Edition (O'Reilly)

Reference Books

1. NIST Guide to OSINT (SP 800-150) – NIST; 2019 (Special Publication)
2. Kritika Singh. Essentials of Digital Forensics: Fundamental, Procedure and Practical Application. 1st Edition 2025
3. EU GDPR Handbook – Various Authors; 2018, 1st Edition
4. The Art of Invisibility – Kevin Mitnick; 2017, 1st Edition

Open Educational Resources (OER)

- MITRE ATT&CK Matrix: https://attack.mitre.org
- NIST IR Guidelines: SP 800-61r2.
- SANS AI Security Papers: https://www.sans.org/ai

Evaluation components	**Weightage**
Internal marks (Theory)	**40 Marks**
I. Continuous Assessment All the components are to be evenly spaced. (minimum of five elements to be evaluated)	
Test/Project/quizzes/assignment and essays/presentation/ participation/attendance/case studies/reflective journals	**20**
Practical Assessment I & II	**20**
Midterm Exam	**20 Marks**
External Marks (Theory): End Term Examination	**40 Marks**

BSFSFP652	FORENSIC PRACTICAL VI	L	T	P	C
Version1.0		0	0	4	2
Category of Course	SEC VI				
Total Contact Hours	45				
Pre-requisites/ Co-requisites	--				

Course Perspective: This course provides a hands-on introduction to psychological assessment techniques, focusing on personality assessment. You'll learn about various personality theories, research methods, and the practical application of assessment tools. Through laboratory exercises, you'll gain experience administering, scoring, and interpreting different personality tests.

Course Outcome: Students will be:

CO1: **Observe** ethical guidelines in psychological experiments and apply them in forensic psychology.

CO2: **Imitating** experimental data in forensic psychology to draw valid conclusions.

CO3: Practice research findings in forensic psychology to identify patterns and implications.

CO4: **Creating** research findings and methodologies in forensic psychology.

List of experiments :

1. Type A/ Type B personality Test 2. Social Problem Scale 3. Eysenck's Personality Questionnaire 4. Raven's Standard Progressive Matrices. 5. Buss Perry- Aggression Scale 6. Parenting Scale 7. Free Association Test

Learning Experience

Instruction Methods:

Interactive sessions with role-plays, case studies, and hands-on practice of forensic assessment tools.

Technology Use:

Use of psychometric software, virtual simulations, and online platforms for tests and learning materials.

Assessments:

Evaluation through practical exams, case reports, scoring accuracy, and class participation.

Support:

Faculty guidance, peer collaboration, and access to test manuals and mentoring sessions.

Textbook:

The Hand Book of Forensic Psychology – Weiner Hass

Reference books:

Art & Science of the Polygraph Techniques – J.A.Matte

Hand Book of Polygraph Testing – M.Kloinen 9.Detecting Lies & Deceit – A.Vri

Open Educational Resources

1. Open Source Psychometrics Project (personality tests including Type A/Type B) https://openpsychometrics.org
2. Eysenck's Personality Questionnaire (PDF version for use) https://americancollege.edu.in/wp-content/uploads/2022/02/PSY-EYSENK_S-PERSONALITY-INVENTORY-DR-M-SURESH-KUMAR.pdf
3. Free Raven's Standard Progressive Matrices Practice Tests https://www.iprep.online/courses/ravens-progressive-matrices/

4. Buss Perry Aggression Questionnaire details and resources https://novopsych.com/assessments/formulation/buss-perry-aggression-questionnaire-bpaq/
5. The Multidimensional Assessment of Parenting Scale (research article and scale) https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2021.652884/full

Examination Scheme:

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

BSFSAZ605	**Applied Zoology**	**L**	**T**	**P**	**C**
Version1.0		3	0	0	3
Category of Course	Core				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: Applied Zoology emphasizes the practical use of animal science in sectors such as agriculture, industry, medicine, pest control, and environmental management. The course introduces students to economically important animals, animal husbandry, sericulture, aquaculture, and wildlife conservation, linking zoological knowledge with real-world applications and sustainability.

Course Outcome: Students will be:
CO1: **Understanding** economically significant animals and their roles in human welfare.

CO2: **Applying** the biological principles behind animal-based industries.

CO3: Analysing Apply techniques of animal husbandry, aquaculture, and pest control.

CO4: **Evaluating** the role of zoology in environmental management and biodiversity conservation.

Course contents	**:45 Hours**
Unit I: Economic and Agricultura Zoology	**:10 Hours**
Domestication of animals: principles and scope, Cattle and poultry farming: breeds, diseases, management, Sericulture: types of silkworms, lifecycle, rearing, Apiculture: bee species, behaviour, products, Vermiculture: methods and benefits.	
Unit II: Aquaculture and Fisheries	**:11 Hours**
Freshwater and marine aquaculture, Breeding and culture of carps, prawns, mollusks, Fish diseases and control, Ornamental fish breeding, Role of fisheries in rural economy.	
Unit III: Medical and Veterinary Zoology	**:12Hours**
Zoonotic diseases and vectors: malaria, leishmaniasis, dengue, Parasites of public health importance, Insect pests of crops and stored grains, Forensic entomology: applications and techniques, Animal models in biomedical research.	
Unit IV: Wildlife and Environmental Applications	**:12 Hours**
Wildlife conservation strategies and protected areas, Role of zoology in environmental impact assessment, Biodiversity management and threatened species, Zoo biology and ex-situ conservation, Legal and ethical aspects in applied zoology	

Learning Experience:

Students will gain a solid foundation in applied biology and its applications in zoological research and forensic sciences. The course fosters critical thinking through analysis of case studies and real-world genetic conditions, enhancing their understanding of applications of zoological processes in animals and humans.

Instruction Methods:

Lectures with visual aids and models, Practical hands-on sessions and field visits, Group discussions and case studies, Interactive tutorials and e-learning modules;

Technology Use:

Multimedia presentations and videos, Digital microscopy and image analysis software, Online databases and GIS tools for biodiversity, Virtual labs and simulations, E-learning platforms for supplementary content;

Assessments:

Written quizzes and assignments, Practical exams and identification tests, Project reports and case study presentations, Group activities and fieldwork participation, Continuous assessment through class engagement;

Support:

Well-equipped laboratories and field sites, Access to textbooks, online resources, and OER, Faculty mentorship and academic guidance, Online forums for doubt clearing and peer interaction, Career counseling and expert sessions

Textbooks:

1. **An Introduction to Sericulture** by G. Ganga & C. Sulochana, Oxford & IBH Publishing Co. Pvt. Ltd., 2nd Edition, 1997, ISBN: 9788120409095.
2. **Modern Textbook of Zoology: Applied Zoology** by R.L. Kotpal, Rastogi Publications, Latest Edition, ISBN: 9788171338368.
3. **Medical Parasitology** by D.R. Arora & B. Brij Bala Arora, CBS Publishers & Distributors Pvt. Ltd., 4th Edition, ISBN: 9788123926742.
4. **Fisheries Science: Indian Perspective** by W.S. Lakra, Narendra Publishing House, 2010, ISBN: 9788183601081.
5. **Beekeeping in India** by G.K. Ghosh, A.P.H. Publishing Corporation, Reprint Edition, ISBN: 9788170245889.

Reference Books:

1. The Handbook of Communication Skills edited by Owen Hargie
2. Leadership: Theory and Practice by Peter G. Northouse
3. Negotiation: Theory and Strategy by Jeff Weiss, Gary Richardson, and David L. Wissink

Open Educational Resources (OER):

1. Introduction to Communication Skills - Saylor Academy: https://learn.saylor.org/course/view.php?id=59
2. Developing Assertiveness - OpenLearn, The Open University: https://www.open.edu/openlearn/skills-development/developing-assertiveness
3. Building Effective Teams - Coursera (Free to audit): https://www.coursera.org/learn/teams-effectiveness
4. Emotional Intelligence at Work - FutureLearn: https://www.futurelearn.com/courses/emotional-intelligence-at-work

5. Negotiation and Conflict Resolution - MIT OpenCourseWare: https://ocw.mit.edu/courses/sloan-school-of-management/15-671-negotiation-and-conflict-management-spring-2010/

BSFSSP604	Solid state physics	L	T	P	C
Version1.0		3	0	0	3
Category of Course	DSE VI				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: Solid State Physics provides a comprehensive exploration of the properties and behavior of condensed matter. You'll delve into the quantum mechanical principles underlying solids, from crystal structures to electronic properties.

Course Outcome: Students will be:

1. Understanding the principles of elementary lattice dynamics, including lattice vibrations and phonons in linear monoatomic and diatomic chains.
2. Analyse dielectric and ferroelectric properties of materials, focusing on concepts like electric susceptibility, polarizability, and plasma oscillations.
3. Analyzing the classical and quantum mechanical theories to explore the magnetic properties of matter, including diamagnetic, paramagnetic, and ferromagnetic materials.
4. Performing investigations into superconductivity, examining critical temperature, critical magnetic field, and the Meissner effect in type I and type II superconductors.

Course contents
Unit I: Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains; Acoustical and Optical Phonons, Qualitative Description of the Phonon Spectrum in Solids.
Unit II: Dielectric and Ferroelectric Properties of Materials: Electric Susceptibility. Polarizability Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Langevin-Debye equation. Plasma Oscillations, Plasma Frequency, Plasmons, Structural phase transition, Classification of

crystals.
Unit III: Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia and Paramagnetic Domains. Quantum Mechanical Treatment of Para magnetism.
Unit IV: Superconductivity and Elementary band theory: Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Band Gap, Conductor, Semiconductor (P and N type) and insulator.

Learning Experience: Through lectures, problem-solving exercises, and laboratory experiments, you'll gain a hands-on understanding of solid-state physics concepts. This course will equip you with the knowledge and skills needed for research in materials science, condensed matter physics, and related fields.

Instruction Methods:

Lectures with detailed theoretical explanations, Use of models and simulations to illustrate lattice vibrations and phonon concepts, Problem-solving sessions on dielectric, magnetic, and superconductivity properties, Discussions and case studies on crystal classification and phase transitions & Demonstrations of band theory applications in semiconductors.

Technology Use:

Simulation software for lattice dynamics and phonon spectrum visualization, Digital tools for exploring dielectric and magnetic properties, Multimedia presentations on superconductivity phenomena., Computational labs using band theory and plasma oscillation models, and Online platforms for interactive learning and assessments.

Assessments:

Written exams covering theoretical concepts and calculations, Problem sets and assignments on lattice vibrations and dielectric equations, Lab reports from simulations and computational exercises, Quizzes on magnetic properties and superconductivity and Project work analyzing materials' electrical and magnetic behavior.

Support:

Access to physics labs equipped with simulation software, Supplementary reading materials and research papers, Faculty mentoring for theory and practical understanding, Online forums for doubt clearance and peer discussion and Technical support for software and virtual labs.

Textbooks:

1. Allied Physics – Prof. Dhanalakshmi and others.
2. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
3. Modern Physics – R. Murugesan S. Chand & Co. (2004).
4. Electronic Principles and Applications – A.B. Bhattacharya, New Central Book Agency, Calcutta.

Reference Books

1. The Quantum Theory of Matter by Feynman
2. Quantum Mechanics by Griffiths

Open Educational Resources (OER):

1. MIT OpenCourseWare: Solid State Physics I (https://ocw.mit.edu/courses/8-231-physics-of-solids-i-fall-2006/pages/
2. Khan Academy: Solid State Physics (https://www.khanacademy.org/science/physics)
3. National Physical Laboratory (NPL) Open Access Repository (https://eprintspublications.npl.co.uk/)

Examination scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

	Managing People and Organizations	L	T	P	C
Version1.0		**2**	**0**	**0**	**2**
Category of Course	**AEC IV**				
Total Contact Hours	**30**				
Pre-Requisites/ Co-Requisites					

Course Objectives (COs)

CO1: Understand and apply the principles of Transactional Analysis for effective interpersonal interactions.

CO2: Develop interpersonal communication skills and enhance empathy, assertiveness, and social awareness.

CO3: Demonstrate teamwork, collaboration, and feedback processing in group settings.

CO4: Analyze and manage conflict, trust, and influence in professional relationships.

CO5: Understand organizational behavior through motivation, culture, leadership, and negotiation strategies.

Course Content

Session	Topic	Expanded Content Focus	Activities
1	Introduction to People Skills	Overview of course scope, importance of self-awareness and interpersonal effectiveness in academic and professional life. Introduction to people-centered behavior and workplace relevance.	Icebreaker + Group Values Exercise

2	Transactional Analysis (TA) Basics	Introduction to Eric Berne's model. Understanding Parent, Adult, and Child ego states; identifying types of transactions (complementary, crossed, ulterior); recognizing life positions (I'm OK – You're OK).	TA Role-play, Ego Quiz
3	Strokes & Life Positions	Concepts of recognition hunger, positive and negative strokes, impact of internal dialogue. Reaffirming life positions and fostering self-worth through conscious reinforcement.	Self-reflection sheet
4	Assertive vs Aggressive	Differentiating passive, aggressive, and assertive styles. Identifying behavioral cues and practicing verbal/non-verbal assertiveness techniques for conflict-free expression.	Assertiveness Practice Drill
5	Interpersonal Communication	Emphasis on active listening, empathetic feedback, and perspective-taking. Understanding barriers to communication and how empathy influences team behavior.	Empathy Circles
6	Relationships & Social Behavior	Exploring trust-building, establishing healthy boundaries, social contracts, and relational transparency. Recognizing signs of toxic vs supportive social behavior.	Case-based Discussion
7	Group & Team Dynamics	Exploring Tuckman's stages of team development (Forming, Storming, Norming, Performing). Role's people play in teams, synergy, and team cohesion.	Team Exercise – Marshmallow Challenge

8	Effective Teams & Feedback	Identifying feedback blind spots, Johari Window application, effective feedback loops. Emphasizing constructive critique, peer appreciation, and growth mindset.	360° Feedback Activity
9	Conflict Styles & Resolution	Thomas-Kilmann Conflict Mode Instrument (TKI): Competing, Avoiding, Accommodating, Collaborating, Compromising. Application of conflict resolution models in personal and professional settings.	Conflict Style Quiz + Scenario Roleplay
10	Influence & Trust	Examining influence mechanisms (authority, credibility, reciprocity), power dynamics, and the behavioral science behind trust-building in interpersonal and team contexts.	Trust Fall + Influence Mapping
11	Collaboration & Motivation	Dissecting intrinsic vs extrinsic motivators. Applying Maslow's and Herzberg's theories. Understanding motivational alignment in team and leadership settings.	Motivation Self-test
12	Psychological Safety	Understanding team psychological safety, signs of burnout, and emotional triggers. Encouraging vulnerability, shared goals, and inclusive culture for open communication.	Psychological Safety Diagnostic
13	Organizational Culture	Defining organizational culture and subculture. Analyzing Google vs Amazon work culture case to understand morale, inclusivity, and value systems.	Culture Case Study: Google vs Amazon

14	Leadership & Change	Exploring leadership styles (transformational, servant, transactional), managing people through change, resistance management, and emotional intelligence in leadership.	Leadership Styles Activity
15	Negotiation & Persuasion	Introduction to BATNA, ZOPA, and Harvard's principles of negotiation. Understanding influence tactics and win-win frameworks in professional settings.	Mock Negotiation Simulation

Assessment Structure

Component	Weightage
Peer Feedback & Team Activities	20%
Conflict Case Analysis	15%
Communication Skills Practical	15%
Organizational Behaviour Reflection	20%
Final Simulation (Leadership or Negotiation)	30%

Learning Experience:

Engaging sessions promoting self-awareness, interpersonal effectiveness, and practical application of people skills; role-playing, self-reflection, group exercises, case discussions, and real-world simulations enhance understanding and skill development.

Instruction Methods:

Interactive lectures, role-plays, group discussions, case studies, simulations, self-assessment exercises, and experiential learning activities.

Technology Use:

Multimedia presentations, e-learning platforms, online quizzes, video role-play demonstrations, virtual collaboration tools, and digital feedback systems.

Assessments:

Quizzes, self-reflection sheets, group presentations, participation in role-plays and simulations, case study analyses, peer and instructor feedback, and practical negotiation exercises.

Supports:

Faculty mentoring, access to online resources and readings, discussion forums for collaboration and doubt clearing, continuous feedback mechanisms, and career guidance sessions.

Textbooks:

1. People Skills: How to Assert Yourself, Listen to Others, and Resolve Conflicts by Robert Bolton
2. Transactional Analysis in Psychotherapy by Eric Berne
3. Organizational Behavior: Improving Performance and Commitment in the Workplace by Jason A. Colquitt, Jeffery A. LePine, Michael J. Wesson

Reference Books:

1. The Handbook of Communication Skills edited by Owen Hargie
2. Leadership: Theory and Practice by Peter G. Northouse
3. Negotiation: Theory and Strategy by Jeff Weiss, Gary Richardson, and David L. Wissink

Open Educational Resources (OER):

1 Introduction to Communication Skills - Saylor Academy: https://learn.saylor.org/course/view.php?id=59
2 Developing Assertiveness - OpenLearn, The Open University: https://www.open.edu/openlearn/skills-development/developing-assertiveness
3 Building Effective Teams - Coursera (Free to audit): https://www.coursera.org/learn/teams-effectiveness
4 Emotional Intelligence at Work - FutureLearn: https://www.futurelearn.com/courses/emotional-intelligence-at-work
5 Negotiation and Conflict Resolution - MIT OpenCourseWare: https://ocw.mit.edu/courses/sloan-school-of-management/15-671-negotiation-and-conflict-management-spring-2010/

BSFSQM605	Quality Management	L	T	P	C
Version1.0		2	0	0	2
Category of Course	Core Course 19				
Total Contact Hours	32 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: In the evolving landscape of forensic science, ensuring accuracy, reliability, and credibility of analytical results is paramount. The **Quality Management** course provides an essential foundation for students to understand and implement quality standards in forensic laboratories. As forensic evidence often plays a critical role in the criminal justice system, maintaining high standards of quality and integrity is not optional—it is a professional and legal necessity. This course offers students insight into the development and application of **Quality Management Systems (QMS)** tailored to forensic settings. It introduces internationally recognized standards such as **ISO/IEC 17025**, **Good Laboratory Practices (GLP)**, and **NABL accreditation requirements**, equipping students with the skills to contribute effectively to quality assurance and compliance efforts in forensic labs.

Course Outcomes (COs):

CO1: Understanding fundamental quality concepts, terminologies, and the evolution of quality management systems in industrial and service sectors.

CO2: Applying various quality tools and techniques such as control charts, Six Sigma, and Total Quality Management (TQM) principles to solve quality-related problems.

CO3: Analysing the structure and implementation of quality standards like ISO 9001 and assess their impact on organizational performance and compliance.

CO4: Evaluating the effectiveness of continuous improvement strategies, audits, and benchmarking practices in enhancing product and process quality.

Course contents :45Hrs
Unit I: **Introduction to Quality Management** :8Hrs
Definition and importance of quality, Quality in forensic science, Evolution of quality management (TQM, Six Sigma, Kaizen), Quality culture and ethics in forensic science, Quality Management Systems (QMS) and Elements of QMS

Unit II: **Quality Manual and Standard Operating Procedures (SOPs) :12 Hrs**
Quality Assurance (QA) vs Quality Control (QC), Document control and record keeping, Non-conformance, corrective and preventive actions (CAPA), Standards and Guidelines (7 lectures), ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories and ISO/IEC 17020 and ISO/IEC 17011 (overview)
Unit III: **Good Laboratory Practices (GLP) :15Hrs**
NABL (National Accreditation Board for Testing and Calibration Laboratories) guidelines, Laboratory Accreditation and Validation (6 lectures), Accreditation process and bodies, Scope and requirements of accreditation, Validation and verification of methods, Measurement uncertainty and traceability, Audits and Proficiency Testing, Types of audits: internal, external, and third-partyAudit planning, execution, and reporting, Proficiency testing and inter-laboratory comparisons
Unit IV: **Quality Tools and Techniques :10Hrs**
Statistical Quality Control (SQC), Control charts and capability analysis, Risk assessment and root cause analysis, 5S, Fishbone diagram, PDCA cycle, Case Studies and Applications in Forensic Labs (4 lectures), Case studies of quality failure and improvement and Role of quality management in different forensic disciplines (toxicology, DNA, ballistics, etc.)

Learning Experience: The **Quality Management** course is designed to provide students with both theoretical knowledge and practical exposure to the principles and practices of quality systems in forensic science. Through a combination of lectures, case studies, assignments, group discussions, and hands-on activities, students will engage deeply with the concepts of quality assurance, standard compliance, and continuous improvement. Students will explore real-world examples of forensic laboratory operations, interact with quality documentation such as SOPs and audit checklists, and analyze case studies of accreditation and non-compliance.

Instruction methods

For the Quality Management in Forensic Science course include interactive lectures, case studies, and group discussions to introduce concepts such as TQM, ISO standards, and quality tools. Practical workshops and role-plays simulate document control, audits, and proficiency testing to reinforce learning through real-world application.

Technology use

Incorporates virtual labs, online quality management system (QMS) software demonstrations, and digital document control platforms to help students practice SOP writing, non-conformance handling, and audit processes. E-learning modules and webinars facilitate flexible learning and deeper understanding of ISO/IEC standards and accreditation frameworks.

Assessments

Involve quizzes, written assignments on quality manuals and SOPs, practical evaluations of audit planning and execution, and case study analysis of quality failures and improvements in forensic labs. Peer reviews and presentations help develop critical thinking and application skills in managing forensic quality systems.

Support

Includes access to online resources such as quality manuals, ISO guidelines, and video tutorials. Students receive mentoring via discussion forums, periodic feedback during workshops, and one-on-one guidance to help with complex quality assurance concepts and procedural clarity in forensic contexts.

Textbooks:

1. Konieczka, P., & Namieśnik, J. (2009). Quality Assurance and Quality Control in the Analytical Chemical Laboratory: A Practical Approach
2. Barker, R. (2013). Quality Assurance: Theory and Practice in the Laboratory Royal Society of Chemistry

Reference Books:

1. Quality Assurance and Quality Control in the Analytical Chemical Laboratory by Piotr Konieczka & Jacek Namieśnik
2. Forensic Science: An Introduction to Scientific and Investigative Techniques by Stuart H. James & Jon J. Nordby
3. ISO/IEC 17025:2017 Standard (latest version)
4. NABL Documents and Guidelines (available at: https://nabl-india.org)

Open Educational Resources

1. Monash University - FOR5023 Quality Management in the Forensic Sciences (Course Overview)
2. Delhi Forensic Science Laboratory - Quality Management Division materials including Quality Manual
3. Alison - Forensic Science Simplified (Free Online Course covering forensic principles including quality practices)
4. SlideShare - Forensic Laboratory Good Laboratory Practices (GLP) presentation
5. ForensicResources.org - CCBI Forensic Science Quality Manual document

Examination Scheme:

Evaluation Component	Weightage

Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks
Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSCCRM606	Research methodology	L	T	P	C
Version1.0		3	0	0	3
Category of Course	Core Course 20				
Total Contact Hours	45 Hours				
Pre-requisites/ Co-requisites	--				

Course Perspective: This course equips undergraduate science students with core research skills, including literature review, experimental design, data collection and analysis, and understanding of research ethics. It introduces learners to qualitative and quantitative methods and supports the development of critical thinking and problem-solving abilities for academic and applied research.

Course Outcome: Students will be:

1. CO1 (Understand): Explain fundamental research concepts, including theory,hypothesis, variable, sampling, and ethics.

2. CO2 (Apply): Use appropriate research design methods and sampling techniques to structure basic research inquiries.
3. CO3 (Analyze): Organize, compare, and interpret data using descriptive and inferential statistical methods.
4. CO4 (Evaluate): Assess the credibility and ethical considerations in literature and research practices.
5. CO5 (Create): Develop structured research proposals, design experiments, and present data and conclusions effectively.

Course contents
Unit I: **Introduction to Research and Fundamentals:** Meaning, objectives, and motivation for research; Characteristics of scientific research; Concepts: theory, hypothesis, concept, construct, variable; Empiricism, deductive and inductive reasoning; Types of research: basic vs. applied; theoretical vs. empirical
Unit II: **Research Design and Ethics:** Elements of research design; Types: Exploratory, Descriptive, Experimental; Variables: Independent,

Dependent, Controlled; Causality, generalization, replication; Qualitative vs. Quantitative approaches; Ethical considerations: informed consent, integrity, confidentiality, research misconduct
Unit III: **Literature Review and Sources of Information:** Primary, secondary, and tertiary sources; Abstracts, reviews, monographs, encyclopedias, handbooks; Chemical and scientific databases: Chemical Abstracts, PubMed, Scopus, ScienceDirect, ChemSpider; Citation metrics: impact factor, h-index, citation index; How to identify high-quality publications and authorship standards
Unit IV: **Sampling Techniques and Data Collection:** Concepts: population, sample, sampling frame; Sampling methods: simple random, stratified, systematic, multi-stage; Sample size determination, sampling error; Types of data: qualitative, quantitative; Data collection tools: questionnaires, observations, interviews
Unit V: Data Analysis and Interpretation: Descriptive statistics: mean, median, mode, SD, variance; Graphical representation: bar charts, pie charts, histograms; Inferential statistics: hypothesis testing, Chi-square test; Analysisof; variance (ANOVA), regression, correlation; Designing experiments and analyzing residuals ; Data interpretation and reporting findings

Learning Experience: This course provides a concise yet thorough introduction to research methods, guiding undergraduate students through fundamental concepts, ethical considerations, research design, literature review, data collection, and analysis. It balances theoretical knowledge with practical activities like ethical case discussions, literature surveys, sampling simulations, and statistical data interpretation. By the end, students develop critical thinking, problem-solving, and communication skills essential for conducting and presenting rigorous research responsibly and effectively.

Instruction Methods:

Lectures, seminars, small group discussions, case studies, workshops, presentations, one-to-one supervision, problem-solving exercises;

Technology Use:

E-learning platforms, online databases, research software (statistical and qualitative analysis tools), digital libraries, virtual collaboration tools, multimedia presentations;

Assessments:

Written assignments, quizzes, research proposal development, data analysis projects, literature reviews, presentations, final research project or dissertation;

Support:

Faculty mentoring, online discussion forums, access to research resources and databases, technical support for software, peer study groups, academic writing help.

Textbook:

1. Kothari, C.R. – Research Methodology: Methods and Techniques, New Age
2. International Panneerselvam, R. – Research Methodology, Prentice Hall of India
3. Bryman, A. & Bell, E. – Business Research Methods
4. Heiman, G.W. – Basic Statistics for the Behavioral Sciences
5. Creswell, J.W. – Research Design: Qualitative, Quantitative, and Mixed Methods Approaches

Reference Books:

1. Kumar, R. – Research Methodology: A Step-by-Step Guide for Beginners
2. Hibbert, D.B. & Gooding, J.J. – Data Analysis for Chemistry
3. Moore, D.S. – Introduction to the Practice of Statistics
4. Ruxton, G.D. & Colegrave, N. – Experimental Design for the Life Sciences
5. Open Educational Resources from OER Commons, ChemCollective, and Khan Academy

Open Educational Resource

1. Research Methods - comprehensive free teaching and learning materials https://library.shu.edu/oer/researchmethods
2. Research Design and Ethics overview and materials https://www.apa.org/pubs/books/supplemental/Designing-Proposing-Research-Project/research_design.pdf
3. Literature Review guide and resources https://institute-academic-development.ed.ac.uk/study-hub/learning-resources/literature-review
4. Sampling Methods explained with examples https://byjus.com/maths/sampling-methods/

Examination scheme:

Evaluation Component	**Weightage**
Internal Marks (Theory): - **I) Continuous Assessment (40 Marks)** **(All the components to be evenly spaced)** Projects/ Quizzes/ Assignments and Essays/ Presentations/ lab work/design sprints/case write up/studio critiques/reflective blogs/peer reviews (minimum of five components to be covered)	40 Marks

Mid Term Exam	20 Marks
External Marks (Theory): – End Term Examination	40 Marks

BSFSPR67	Research Project	L	T	P	C
Version1.0			0	0	8
Category of Course	Project				
Total Contact Hours	45 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 VI, each faculty member will assign a suitable research topic to the students from the selected topics in the areas of forensic sciences. The student will write a dissertation based on the research work carried out during the semester 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 the 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.

CO1 Understand the process of identifying and formulating a relevant research question or hypothesis addressing a significant issue in the field of study.

CO2 Analyse existing literature to identify research gaps, establish a theoretical framework, and contextualize the research topic within the current body of knowledge.

CO3 Apply appropriate research methodologies and techniques for data collection and analysis while ensuring adherence to ethical standards.

CO4 Evaluate and interpret research data using suitable statistical or qualitative tools to derive valid and meaningful conclusions.

CO5 Create and present a comprehensive research report or presentation that effectively communicates findings with clarity, coherence, and academic rigor.

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