

**CHEMISTRY 107**

**FORENSIC CHEMISTRY**

**BULLETIN INFORMATION**

CHEM 107 – Forensic Chemistry (4 credit hrs)

**Course Description:**

Surveys chemical aspects of criminal investigation and adjudication including drug, arson, DNA, paint, and fiber identification.
Note: Three lecture and three laboratory hours per week.

**SAMPLE COURSE OVERVIEW**

This course is an introduction to forensic chemistry intended for non-science majors. The course examines the many ways that chemical principles and scientific techniques are applied in modern crime investigation: the chemical characteristics of fuels and explosives as well as arson-related methods; other ways of identifying criminals through chemical processes, including blood and bodily fluid analyses, the chemical characteristics found in paints, fibers, hair, DNA, and fingerprinting; and the chemical properties of drug analysis. Through readings, lectures, demonstrations, homework, and laboratory exercises, students learn the fundamentals of forensic chemistry and its applications in crime investigation and adjudication. Student learning is evaluated through exams, assignments, participation in class discussions and activities, a case study project, and laboratory reports.

**ITEMIZED LEARNING OUTCOMES**

**Upon successful completion of CHEM 107, students will be able to:**

1. Demonstrate understanding of the scientific method.
2. Discuss the basic principles, concepts, terms, and scientific techniques associated with forensic chemistry.
3. Evaluate the relationships between science, technology, and society as these affect forensic issues.

  By specifically being able to:

* Identify steps of scientific method; describe and perform various forensic analytical techniques.
* Explain the characteristics of fuels and explosives, and their chemical evidence.
* Classify drugs, identify their chemical properties, and conduct their analysis.
* Describe the characteristics and properties of various materials such as hair, paint, polymers, fibers.
* Categorize the different types of bodily fluid and their related analysis.
* Explain the processes involved in sampling and conserving evidence.
* Define forensic and legal concepts.
* Apply metrology to analyze real case scenarios.
* Research a science topic and communicate findings for a non-scientific audience.
* Use laboratory safety procedures; conduct and document an experiment.
* Identify common laboratory supplies and equipment.
* Explain how the principles and techniques of forensic chemistry are applied in criminal investigations and discuss how forensic chemical evidence can used in the adjudication of legal cases.

**SAMPLE REQUIRED TEXTS/SUGGESTED READINGS/MATERIALS**

*Criminalistics: An Introduction to Forensic Science*, R. Saferstein

Course slides and lab manual

**SAMPLE ASSIGNMENTS AND/OR EXAMS**

The expected learning outcomes will be assessed through exams, assignments, participation in class discussions and activities, a case study project, and laboratory reports.

1. **Five (5) exams**. Exams consist of multiple choice, true/false, short answer, and essay questions. Four of the exams are administered periodically in the semester, and the fifth exam is given as the final, cumulative exam.
2. Exam 1: topics for assessment on exam 1 include Chemistry and the Law, Measurements, Uncertainty, and Statistics, Locard’s Exchange Principle, Quality Assurance and Quality Control, Lifting Fingerprints Dusting, Reporting Defensible Uncertainty and Representative Samples.
3. Exam 2: topics for assessment on exam 2 include Forensic Drugs Analysis (organic and inorganic), Classification of Fingerprints, Drugs in the Body, and Forensic Toxicology (ethanol toxicity).
4. Exam 3: topics for assessment on exam 3 include Explosives, Firearms and Associated Chemical Evidence, The Chemistry of Colors and Colorants, The Chemistry of Polymers (hair and fibers), and Forensic Analysis of Inks and Paints.
5. Exam 4: topics for assessment on exam 4 include tool marks and other impressions, analysis of glass, forensic pathology, forensic anthropology, and computer forensics.
6. Exam 5: cumulative topics from exams 1-4 will be included on exam 5.
7. **Assignments**: A short assignment, consisting of 3-5 multiple choice questions or short answer questions, is given to accompany each chapter in the text. Assignments are intended to assess how well students can recall, identify, describe, and analyze the chemical properties/characteristics of materials and the techniques used in forensic investigations.
8. **Participation**: Includes attendance at both lecture and laboratory sessions, participation in class discussions and activities, and compliance with laboratory safety rules and procedures.
9. **Case study project**: Students will be assigned a case study. Using knowledge gained in the course and the documents and analysis of the case, students will research problems presented in the case, investigate the case, and build a forensic report. Students will then summarize their case and findings for a non-scientific audience in a brief presentation. The case study project is designed to assess how well students can apply the principles, concepts, and techniques of forensic chemistry to the investigation and adjudication of specific criminal cases.
10. **Laboratory reports**: The laboratory component of the course consists of eleven labs. Each lab consists of a set of pre-lab questions and discussion, a procedural explanation, safety requirements and precautions, a student-led experiment, and post-lab questions and discussion. For each lab, students complete a laboratory report designed to assess how well students can employ scientific techniques to identify, classify, and analyze the chemical properties/characteristics of materials in forensic investigations and evaluate their applications in criminal cases.

**SAMPLE COURSE OUTLINE WITH TIMELINE OF TOPICS, READINGS/ ASSIGNMENTS, EXAMS/PROJECTS**

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| **Class** | **Lecture Topic** | **Lab Topic** |
|  |  |  |
| 1 | Introduction | Locard’s Exchange Principle |
| 2 | Chemistry and the Law |   |
| 3 | Foundations: Measurements, Uncertainty, and Statistics  | Lifting Fingerprints Dusting |
| 4 | Foundations: Measurements, Uncertainty, and Statistics  |   |
| 5 | Quality Assurance and Quality Control | Crime Scene Sketching and Evidence Collection |
| 6 | Reporting Defensible Uncertainty and Representative Samples |   |
| 7 | **Exam 1;**Chemical Fundamentals  | Microscopy Use and Function |
| 8 | Chemical Fundamentals |   |
| 9 | Instrumentation | Latent Detection Methods |
| 10 | Instrumentation |   |
| 11 | Drugs as Physical Evidence: Seized Drugs and Their Analysis | Classification of Fingerprints |
| 12 | Drugs as Physical Evidence: Seized Drugs and Their Analysis |   |
| 13 | **Exam 2;**Forensic Drugs Analysis |   |
| 14 | Forensic Drugs Analysis |   |
| 15 | Drugs in the Body |   |
| 16 | Drugs in the Body |   |
| 17 | Forensic Toxicology | Arson Investigation |
| 18 | Forensic Toxicology |   |
| 19 | **Exam 3;**Chemistry of Combustion and Arson | Explosives and Explosive Residues |
| 20 | Explosives |   |
| 21 | Firearms and Associated Chemical Evidence | Analysis of Soils |
| 22 | The Chemistry of Colors and Colorants |   |
| 23 | The Chemistry of Polymers | Analysis of Glass |
| 24 | Forensic Analysis of Inks and Paints |   |
| 25 | **Exam 4;**Chemical Analysis of Materials | Analysis of Hair, Fiber, and Paint |
| 26 | Chemical Analysis of Materials |  |
| 27 | **Case Studies** |  |
| 28 | **Case Studies** |  |
|   | **Exam 5 (cumulative) according to University exam schedule** |  |