30.07 Studies in Forensic Science
3 hours; 3 credits

Introduction to forensic science, including modern techniques of forensic analysis. Collection and preservation of physical evidence at crime scenes. Authentic criminal cases. 
Prerequisite: Junior standing and satisfaction of all lower-tier requirements in Scientific Inquiry

Common Goals Addressed by Core Course

To develop the ability to think critically and creatively, to reason logically, to reason quantitatively, and to express one’s thoughts orally and in writing with clarity and precision. (9, 10, 11, 12, 13, 15, 16, 17, 18)
To be capable of integrating knowledge from diverse sources. (28)
To produce informed and responsible citizens. (8)

Objectives of Core Course

Students will develop skills of conceptual analysis and argumentation. (9, 10)
Students will be able to demonstrate that issues may be regarded from multiple viewpoints, and the value of acknowledging those viewpoints in an argument. (28)
Students will be able to use quantitative reasoning in interpreting and evaluating information. (15)
Students will develop facility with evaluating analytical data. (13)
Students will recognize the importance of becoming informed and responsible citizens. (8)

Outcomes for this Core Course

Students can explain how evidence supports a particular conclusion or rules it out. (9, 10, 13, 18)
Students can explain how chemical, biochemical, and physical issues impact the evaluation of a particular criminal case. (28)
Students can explain the importance of units and scale. (13, 15)
Students can use quantitative information in constructing a critical essay relating to the implications of that information. (10, 11)
Students can assess certain governmental laws concerning criminal situations within the context of scientific issues impacting those laws. (8, 28)
Course Outline (Lectures based on required text4.)

Week 1: Chapter 1, “Introduction;” Chapter 17, “Forensic Science on the Internet”
Objectives: To acquire an overview of forensic science and the related utility of the Internet.
Outcomes: Students become aware of the scope of forensic science and the areas of science and the law involved in its operation.
Assessment: Students report orally on the information they have acquired.

Week 2: Chapter 2, “The Crime Scene”
Objectives: To develop enhanced observation techniques concerning the identification of physical evidence and to address related legal considerations.
Outcomes: Students become more aware of their surroundings, pay more attention to physical details, and appreciate legal ramifications of evidence gathering.
Assessment: Students are briefly shown pictures of various buildings, or other structures, or certain objects, and detail in writing as many observable features as possible; students report orally on the legal significance of handling evidence according to appropriate chain-of-custody protocol.

Week 3: Chapter 3, “Physical Evidence”
Objectives: To focus on the importance of recognizing and gathering all types of physical evidence, including, for example, blood, hair, documents, and fibers.
Outcomes: Students enhance their ability to consider as important all aspects of a physical situation and to avoid the careless practice of disregarding what may appear to be insignificant.
Assessment: Students report orally on as many items as possible that characterize their own apartments/homes that would be significant in the hypothetical situation where their dwellings would become crime scenes.

Week 4: Chapter 4, “Physical Properties: Glass and Soil”
Objectives: To recognize the importance of physical properties such as temperature, density, and refractive index within the context of glass and soil evidence.
Outcomes: Students become familiar with (or review) the metric system, with calculations involving the densities of various substances and temperature conversions (Fahrenheit to Celsius), and with the differences between physical and chemical properties of matter.
Assessment: Students report on the physical properties of various substances—including data obtained from the Handbook of Chemistry and Physics—as distinguishing features of those substances.

Week 5: Chapter 5, “Organic Analysis”
Objectives: To become aware of the carbon-based nature of organic compounds, and to become familiar with analytical tools, including chromatography and spectroscopy, used in the analysis of evidence involving organic compounds.
Outcomes: Students become knowledgeable concerning various analytical methodologies employed in forensic laboratories to identify organic materials.
Assessment: Students report on some of the methodologies currently in use, such as the utility of infrared spectrophotometry to measure breath- and blood-alcohol concentrations in DWI arrestees; the use of gas chromatography to analyze blood samples for alcohol and other drugs; and the use of mass spectrometry to confirm the identity of various compounds associated with organic-based evidence.

Week 6: Chapter 6, “Inorganic Analysis”
Objectives: To become aware of the non-carbon-based nature of inorganic materials, and to become familiar with analytical tools used to identify such materials, including emission and absorption spectra, neutron activation analysis, and X-ray diffraction.
Outcomes: Students recognize that many pieces of physical evidence contain elements other than carbon, including, for example, potassium chlorate in an explosive formulation, or arsenic in a suspected poisonous powder, or thallium nitrate or sulfate in a poisonous mixture.
Assessment: Students report on crimes involving inorganic materials. These might include the JFK assassination and various cases of poisoning that have been described on the Internet and in newspapers and other literary sources.

Week 7: Chapter 7, “The Microscope”
Objectives: To recognize that the microscope is an optical instrument used to analyze forensic specimens and that various types of microscopes exist.
Outcomes: Students become familiar with the uses of the basic compound microscope, the comparison microscope, the stereoscopic microscope, the polarizing microscope, and the scanning electron microscope.
Assessment: Students identify common crime scene specimens and the type of microscope used in the characterization of such specimens.

Week 8: Chapter 8, “Hairs, Fibers, and Paint”
Objectives: To become familiar with the nature of hairs, fibers, and paints, which are among the types of physical evidence commonly encountered at crime scenes.
Outcomes: Students can detail the morphology of hair, distinguish between common natural and synthetic fibers, and identify key paint components.
Assessment: Students report on the types of fibers and paints present in their homes/apartments, and on cases where hairs, fibers, and/or paint were critical to the solution of the crimes involved.

Week 9: Chapter 9, “Drugs”
Objectives: To distinguish between members of various categories of drugs, including narcotics, central nervous system (CNS) depressants and stimulants, and hallucinogens; to become familiar with testing for drugs and with drug-control laws.
Outcomes: Students can describe the general effects of drugs in the categories cited above, be aware of the various penalties for drug possession and use, and comment on the analytical techniques employed in the analysis of drug specimens.
Assessment: Students report on the effects of non-prescription drugs, such as aspirin (including the danger associated with simultaneous aspirin and alcohol intake) and
Tylenol, and common illicit drugs, such as cocaine, heroin, amphetamines, Ecstasy, and anabolic steroids.

Week 10: Chapter 10, “Forensic Toxicology”
Objectives: To define the role of the toxicologist and to become familiar with the use of breath-alcohol analyzers, the metabolism of alcohol, and the components of the drug recognition process.
Outcomes: Students become familiar with the techniques used by toxicologists to detect and identify drugs and poisons in body fluids, the types of instruments used to evaluate suspected drunk drivers, and the symptoms of drug intake that drug recognition experts look for in suspected drug users.
Assessment: Students report on DWI laws in New York, the distinction between driving while intoxicated (DWI) by alcohol and driving while impaired by alcohol (DWAI), the scientific underpinnings of breath-alcohol analysis, and the physical performance tests that DWI and DWAI arrestees are subjected to by police evaluators.

Week 11: Chapter 11, “Forensic Aspects of Arson and Explosion Investigations”
Objectives: To define the role of the arson investigator at fire and explosion scenes.
Outcomes: Students become aware of some of the signs of arson, such as evidence of separate and unconnected fires, and the use of accelerants; students also recognize the important role of gas chromatography in the analysis of evidence that would assist in the identification of accelerants and explosives.
Assessment: Students report on confirmed cases of arson and on the methods used by the arsonist as identified by forensic toxicologists.

Week 12: Chapter 12, “Forensic Serology”
Objectives: To detail the nature of blood and bloodstain analysis, forensic characterization of semen, and collection of rape evidence.
Outcomes: Students will be able to distinguish between blood, serum, and plasma, they will recognize the types of physical evidence to be collected from rape victims, and they will become familiar with blood typing.
Assessment: Students report on documented cases of paternity testing as examples involving blood testing and/or on documented cases where blood evidence played a role in the solution of the crime.

Week 13: Chapter 13, “DNA: The Indispensable Forensic Science Tool”
Objectives: To explore the role of DNA typing in the solution of crimes.
Outcomes: Students can identify the location and sources of DNA at crime scenes, and describe the techniques employed in DNA typing.
Assessment: Students report on the use of DNA evidence in familiar cases, such as the O. J. Simpson case, and on the use of such evidence to reverse the convictions of individuals unjustly convicted of serious crimes.

Week 14: Chapter 14, “Fingerprints”
Objectives: To address the nature of fingerprint analysis and the basic principles underlying the use of fingerprints in criminal investigations.
Outcomes: Students will be able to describe fingerprint classification systems, the methods of detecting fingerprints, and automated fingerprint identification systems. Assessment: Students report on the distinction between visible prints, plastic prints, and latent prints, and on detecting such prints.

Method of Evaluation: The evaluation of student performance in “Core Curriculum Scientific Inquiry 4.7: Studies in Forensic Science” is based on a threefold protocol: midterm and final examinations, each accounting for 30% of the final grade, and a term paper accounting for 40% of the final grade.

Method of Assessment

Students are asked to assess the evidence in a certain case and to confirm or rule out the proposed outcome of the case. (9, 10, 13, 18).

Students are asked to evaluate the role played by chemical, biochemical, and physical evidence in a given case and to determine if such evidence confirms or rules out a particular conclusion. (28)

Students are asked to evaluate the units and scale associated with each item of evidence in a particular case—for example, the units and scale of critical factors such as mass, temperature, and concentration—and to determine the accuracy of that data. (13, 15)

Students are asked to incorporate their assessment of all quantitative evidence in a given case into a carefully crafted critical essay that details the basis of their conclusions regarding the case. (A sampling of sources that would provide students with cases of interest include the Cable/Satellite Court TV channel, and literary sources that are Internet-accessible, such as Chemical & Engineering News, Newsday, and Science.) (10, 11)

Students are asked to evaluate certain governmental laws, such as those pertaining to drunk driving, and to confirm whether or not the scientific issues concerned with those laws are consistent with their enforcement. (8, 28)

Bibliography


