

COURSE OUTLINE

Introduction to Forensic Science Laboratory

Course Description

BI 222. Introduction to Forensic Science Laboratory. 4.0 credit hours. Prerequisite: CH 110, BI 106 or equivalent, MA 120 or above with a C or better, and previous or concurrent enrollment in AJ 121. This course will enable the student to apply the principles and techniques of the physical and natural sciences to the analysis of various types of crime scene evidence. This will include evidence collection, identification and analysis using microscopy, PCR, GC and spectrometry

Course Relevance

Forensic science plays a crucial role in the justice system by providing scientific and foundational information for investigations and the courts. This course will help the student gain insight into the meaning and significance of common types of physical evidence encountered at crime scenes and its role in criminal investigations by combining the principles and techniques of forensic science with scientific logic.

Required Materials

Saferstein, R. (2004). *Criminalistics: An introduction to forensic science*. (8th ed) Upper Saddle River, New Jersey: Pearson.

Laboratory Notebook: Purchased from the BCC Bookstore.

Laboratory Manual: Under consideration.

Learning Outcomes

The intention is for the student to be able to

1. Demonstrate the competent use of field related equipment
2. Analyze crime scene evidence
3. Apply scientific reasoning to real world circumstances

Primary Learning PACT Skills that will be DEVELOPED and/or documented in this course

Through the students involvement in this course, he/she will develop his/her ability in the following primary PACT skill areas:

1. Critical Thinking
 - The student will demonstrate critical thinking through a variety of mathematical, graphic, experimental, and written assignments.
2. Field Related Technology
 - The student will demonstrate proficiency in the use of microscopy, chromatography, electrophoresis, and DNA sequencing.

Secondary skills (developed but not documented):

- Problem Solving
- Teamwork
- Computer Literacy
- Writing
- Ethical Conduct

Major Summative Assessment Task(s)

These learning outcomes and the primary Learning PACT skills will be demonstrated by

1. Evaluation and analysis of crime scene evidence collected from a mock crime scene using discipline specific technology.

Course Content

- I. Themes – Key recurring concepts that run throughout this course:
 - A. Scientific method
 - B. Scientific reasoning
- II. Issues – Key areas of conflict that must be understood in order to achieve the intended outcome:
 - A. Limitations of technology
 - B. Balance between theory and practice
 - C. Ethics in scientific practice
- III. Concepts – Key concepts that must be understood to address the issues:
 - A. Scientific methods
 - B. Scientific reasoning
 - C. Scientific writing
 - D. Scientific principles
 - E. Characteristics and impact of science in criminal investigation
- IV. Skills/Competencies - Actions that are essential to achieve the course outcomes:
 - A. Mathematics
 - B. Writing
 - C. Reading
 - D. Speaking
 - E. Computer Literacy
 - F. Computer Spreadsheet/Graphing
 - G. Internet Use
 - H. Teamwork
 - I. Word processing
 - J. Field specific software
 - K. Graphing

Lecture – Learning Units

- I. Identify the functions of the forensic scientist as well as the services of the crime laboratory.
 - A. Physical science unit
 - B. Biology unit
 - C. Firearms unit

- D. Toxicology unit
- E. Fingerprint unit

- II. Recognize the legal issues surrounding physical evidence encountered at a crime scene.
 - A. Analyze physical evidence
 - B. Importance of chain of custody

- III. Utilize conversions between the English and metric system as well as within the metric system
 - A. Recognize standard/reference samples
 - B. Recognize units of measure
 - C. Demonstrate use of dimensional Analysis

- IV. Distinguish between the various classes of matter and differentiate between physical and chemical properties and changes
 - A. Elements, compounds, and mixtures
 - B. Classification and separation of mixtures
 - C. Physical and chemical properties and changes

- V. Identify and utilize the basic concepts of chemistry in the analysis of evidence
 - A. Describe the general properties of solids, liquids, and gases.
 - B. Identify an element from its symbol and/or provide a symbol for a given element
 - C. Recognize the three major subatomic particles and their general arrangement in the atom

- VI. Relate the properties of the elements to their relative positions in the periodic table
 - A. Development of the periodic table
 - B. Trends in key periodic atomic properties
 - C. Connection between atomic structure and chemical reactivity

- VII. Relate spectroscopic observations to the absorption and emission of light by chemical substances.
 - A. Ultraviolet light spectrophotometry
 - B. Visible light spectrophotometry
 - C. Infrared spectrophotometry

- VIII. Identify different types of microscopes and demonstrate their uses
 - A. Compound microscope
 - B. Comparison microscope
 - C. Stereoscopic microscope
 - D. Electron microscope

- IX. Analyze of physical evidence encountered most often at crime scenes

- A. Morphology of hair fibers
 - B. Nuclear vs. mitochondrial DNA analysis of hair
 - C. Identification of fibers
 - D. Properties of natural vs. man-made fibers
 - E. Characteristics and uses of fibers
 - F. Physical properties of paint
 - G. Paint finishes
- X. Describe the physiological effects of drugs
- A. Drug dependence
 - B. Psychological dependence
 - C. Physical dependence
- XI. Relate specific drug categories to patterns of abuse and dependency
- A. Narcotics
 - B. Hallucinogens
 - C. Depressants
 - D. Stimulants
 - E. Steroids
- XII. Describe the current drug control laws
- A. Controlled substance act
- XIII. Describe the toxicology of:
- A. Alcohol
 - B. Drugs
- XIV. Illustrate techniques in toxicology
- A. Thin-layer chromatography
 - B. Gas chromatography
 - C. Immunoassay
- XV. Recognize forensic characteristics of arson
- A. Chemistry
 - B. Classification and use of accelerant
 - C. Collection and preservation of evidence
 - D. Analysis of flammable residues
 - E. Types of explosives
 - F. Collection and analysis of explosives
- XVI. Distinguish between body fluids and differentiate specific properties of each.
- A. Blood
 - B. Semen
- XVII. Evaluate blood splatter patterns

- A. Surface texture
 - B. Direction of blood travel
 - C. Impact angle
 - D. Origin of blood spatter
- XVIII. Identify structure and genetic properties of DNA
- A. Alleles
 - B. Chromosomes
 - C. Complementary base pairing
 - D. Homozygous vs. heterozygous
 - E. Patterns of heredity
 - F. Genotype vs. phenotypes
- XIX. Analyze DNA typing techniques
- A. RFLP
 - B. PCR
 - C. STR
- XX. Describe the fundamental principles of fingerprints
- A. Ridge characteristics
 - B. Latent fingerprints
 - C. Loops, whorls and arch patterns
- XXI. Evaluate methods of fingerprint detection
- A. Automated fingerprint identification systems (AFIS)
 - B. Iodine fuming
 - C. sublimation

Laboratory – Learning Units

- I. Gather and record qualitative and quantitative data accurately
 - A. Acquire data using balances and volumetric glassware
 - B. Make and record visual observations
 - C. Use computers, when appropriate, as data acquisition tools
- II. Calculate the concentration of a solution
- III. Describe and apply the general properties of solutions and solution preparation
 - A. Identify difference between suspensions and colloids
 - B. Demonstrate methods of dilution
- IV. Evaluate evidence using different microscopic techniques
 - A. Identification of physical evidence
 - B. Identify and compare hair and fiber samples
 - C. Identification if hair is of human or animal origin
 - D. Compare samples to possible suspect

- V. Handle and evaluate data in logical, productive, and meaningful ways
 - A. Create notebooks and laboratory reports that are clear, understandable, and accurately represent the data collected
 - B. Display computer data in a spreadsheet or graphically, as appropriate
 - C. Correlate observations with chemical and/or physical properties
 - D. Carry out suitable calculations with quantitative data, recognizing when data and calculates are within a reasonable range
 - E. Use observations of experimental data to present relevant conclusions pertaining to the physical evidence

- VI. Demonstrate competent use of equipment and chemicals
 - A. Use of triple beam balance
 - B. Use of acids and bases

- VII. Demonstrate safe work habits in the lab
 - A. Lab space organization
 - B. Appropriate equipment usage and storage
 - C. Use of appropriate safety equipment

- VIII. Correlate laboratory work with principal topics in Introduction to Forensic Science.
 - A. Completion of calculations
 - B. Completion of post lab assignments
 - C. Maintenance of a laboratory notebook

- IX. Show understanding of drug identification procedures
 - A. Use Color Test to identify specific drugs
 - B. Analyze chemical substances through gas chromatography
 - C. Identify chemical compounds using spectrometry

- X. Evaluate serological evidence through laboratory testing
 - A. Immunoassay

- XI. Identify DNA evidence using typing techniques
 - A. Demonstrate techniques used in Polymerase Chain Reaction
 - B. Demonstrates procedure and differences between gel electrophoresis techniques

- XII. Demonstrate competent use of fingerprint identification techniques

Learning Activities

Independent and collaborative learning activities will be assigned inside and outside the classroom and laboratory to achieve the intended course outcomes. Classroom discussion, lecture, and textbook reading assignments will also contribute to the learning process.

Grade Determination

Grade determination will be based on the successful completion of tests, projects, quizzes, homework, written assignments and laboratory experiments. Other methods may be used at the discretion of the instructor.