# Scope & Sequence

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| Course Name: Forensic Science **TSDS PEIMS Code:** 13029500 | | | **Course Credit:** 1.0  **Course Requirements:** Grade Placement: 11 – 12.  **Prerequisites:** Biology and Chemistry.  **Recommended Prerequisites/Corequisites:** Any Law, Public Safety, Corrections, and Security Career Cluster course. |
| **Course Description:** Forensic Science is a course that introduces students to the application of science to connect a violation of law to a specific criminal, criminal act, or behavior and victim. Students will learn terminology and procedures related to the search and examination of physical evidence in criminal cases as they are performed in a typical crime laboratory. Using scientific methods, students will collect and analyze evidence such as fingerprints, bodily fluids, hairs, fibers, paint, glass, and cartridge cases. Students will also learn the history and the legal aspects as they relate to each discipline of forensic science. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. | | | |
| **NOTE:** This is a suggested scope and sequence for the course content. This content will work with any textbook or instructional materials. If locally adapted, make sure all TEKS are covered. | | | |
| **Total Number of Periods**  **Total Number of Minutes**  **Total Number of Hours** | 175 Periods  1,875 Minutes  131.25 Hours | \*Schedule calculations based on 175/180 calendar days. For 0.5 credit courses, schedule is calculated out of 88/90 days. Scope and sequence allows additional time for guest speakers, student presentations, field trips, remediation, extended learning activities, etc. | |
| **Unit Number, Title, and Brief Description** | **# of Class Periods\***  (assumes 45-minute periods)  Total minutes per unit | **TEKS Covered**  **130.339. (C) Knowledge and skills** | |
| **Unit 1: Professional Standards and Employer Expectations**  A large portion of this course will be devoted to students conducting lab and/or field investigations. Students in this unit will discuss how to safely conduct quality investigations. Students will also learn and discuss safe, environmentally appropriate, and ethical practices.  In the introductory unit, students will discuss the lab and field component as well as professional standards and employer expectations. Students will also explore and discuss employability skills, and the importance of working toward personal/team goals every day, and ethical use of technology in small groups and/or as a class. Students will also discuss resources available through CTSO or other extracurricular organization(s) to further develop leadership, teamwork, and interpersonal skills. | 10 Periods  450 Minutes | (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to achieve business and industry employability skills standards such as attendance, punctuality, meeting deadlines, working toward personal/team goals every day, and ethical use of technology.  (2) The student, for at least 40% of instructional time, conducts laboratory and/or field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:  (A) demonstrate safe practices during laboratory and field investigations; and  (B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials. | |
| **Unit 2: Forensic Science and Career Options**  In this unit, students will explore the history, legal aspects, and career options within forensic science. Students will use appropriate technology and/or assigned materials to distinguish between criminalistics and criminology, identify and illustrate roles, functions, and responsibilities of different forensic science disciplines such as serology-DNA, controlled substances, toxicology, trace evidence, firearms, fingerprints, and questioned documents, and research and discuss the history of forensic science as well as major contributors in the development of forensic science.  In brief presentations, reports, and or class discussions, students will discuss and summarize the ethical standards required of a forensic science professional, explore, and demonstrate an understanding of the terminology and the procedures employed in the criminal justice system, and compare and contrast the roles of forensic scientists and crime scene investigators. | 10 periods  450 minutes | (5) The student explores the history, legal aspects, and career options within forensic science. The student is expected to:  (A) distinguish between criminalistics and criminology;  (B) identify and illustrate roles, functions, and responsibilities of different forensic science disciplines such as serology-DNA, controlled substances, toxicology, trace evidence, firearms, fingerprints, and questioned documents;  (C) summarize the ethical standards required of a forensic science professional;  (D) identify and illustrate roles, functions, and responsibilities of professionals in the criminal justice system, including crime scene investigators, criminalists, attorneys, and medical examiners;  (E) explore and demonstrate an understanding of the terminology and the procedures employed in the criminal justice system; and  (F) illustrate the history of forensic science and recognize the major contributors in the development of forensic science.  (4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:  (F) research and describe the history of science and contributions of scientists within the criminal justice system.  (6) The student recognizes the procedures of evidence collection while maintaining the integrity of a crime scene. The student is expected to:  (A) compare and contrast the roles of forensic scientists and crime scene investigators. | |
| **Unit 3: Using Scientific Methods and Reasoning**  Understanding what scientific methods are as well as knowing the associated terminology is essential for students pursuing careers in forensic science. In this unit, students will learn how to apply scientific methods and safely use science equipment during their laboratory and field investigations. In their classroom and lab activities, students will also plan, present, and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology, collect and organize qualitative and quantitative data, make measurements with accuracy and precision, and communicate valid conclusions supported by the data through methods such as investigative reports, lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.  Students will work together in teams/small groups to communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials, and demonstrate and use their critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. In unit culminating activities/discussions, students will distinguish between scientific hypotheses and scientific theories, discuss the definition of science, and evaluate the impact of scientific research on criminal investigation, society, and the environment. | 20 periods  450 minutes | (3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:  (A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section;  (B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;  (C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;  (D) distinguish between scientific hypotheses and scientific theories;  (E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;  (F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;  (G) analyze, evaluate, make inferences, and predict trends from data; and  (H) communicate valid conclusions supported by the data through methods such as investigative reports, lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.  (4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:  (A) analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, to encourage critical thinking;  (B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;  (C) draw inferences based on data related to criminal investigation;  (D) evaluate the impact of scientific research on criminal investigation, society, and the environment; and  (E) evaluate models according to their limitations in representing biological objects or events. | |
| **Unit 4: Evidence Collection**  In this unit students will learn the procedures of collecting evidence and demonstrate those skills in a simulated activity. Students will work together in teams to conduct a systematic search of a simulated crime scene for physical evidence following crime scene search patterns such as spiral, line, grid, and strip, apply their knowledge of the elements of criminal law that guide search and seizure of persons, property, and evidence, outline the chain-of-custody procedure for evidence discovered in a crime scene, demonstrate proper techniques for collecting, marking, photographing, packaging, and preserving physical evidence found at a crime scene, and develop a crime scene sketch using coordinates/measurements from fixed points. After the activity has been completed, students will analyze and describe the elements of their crime scene sketches, such as measurements, compass directions, scale of proportion, legend-key, and title. | 20 periods  900 minutes | (6) The student recognizes the procedures of evidence collection while maintaining the integrity of a crime scene. The student is expected to:  (B) demonstrate the ability to work as a member of a team;  (C) conduct a systematic search of a simulated crime scene for physical evidence following crime scene search patterns such as spiral, line, grid, and strip;  (D) apply knowledge of the elements of criminal law that guide search and seizure of persons, property, and evidence;  (E) describe the elements of a crime scene sketch such as measurements, compass directions, scale of proportion, legend-key, and title;  (F) develop a crime scene sketch using coordinates/measurements from fixed points;  (G) outline the chain of custody procedure for evidence discovered in a crime scene; and  (H) demonstrate proper techniques for collecting, packaging, and preserving physical evidence found at a crime scene. | |
| **Unit 5: Processing and Analyzing Trace Evidence**  There are specific methods students need to learn about processing and analyzing trace evidence commonly found in a crime scene. In this unit students will participate in “hands on” activities and simulations to learn and demonstrate trace evidence process and analysis techniques. | 15 periods  675 minutes | (7) The student recognizes the methods to process and analyze trace evidence commonly found in a crime scene. The student is expected to:  (A) demonstrate how to process trace evidence such as glass, paint, fibers, hair, soil, grass, and blood collected in a simulated crime scene;  (B) compare and contrast the composition of various types of glass such as soda lime, borosilicate, leaded, and tempered;  (C) determine the direction of a projectile by examining glass fractures;  (D) define refractive index and explain how it is used in forensic glass analysis;  (E) describe the instrumental analysis of trace evidence such as microscopy and spectrometry;  (F) compare and contrast the microscopic characteristics of human hair and animal hair, including medulla, pigment distribution, and scales;  (G) describe and illustrate the different microscopic characteristics used to determine the racial and somatic origin of a human hair sample;  (H) differentiate between natural and synthetic fibers; and  (I) describe various examinations performed in forensic paint analysis, including microscopic morphology, binder, and pigment characterization. | |
| **Unit 6: Impression Evidence**  In this unit students will participate in “hands on” activities and occupational task simulations to learn and demonstrate compare the three major fingerprint patterns of arches, loops, and whorls and their respective subclasses, identify minutiae of fingerprints, including bifurcations, ending ridges, islands, dots, short ridges, and enclosures, and distinguish among patent, plastic, and latent impressions. In addition, students will perform laboratory procedures for lifting latent prints on porous and nonporous objects using chemicals such as iodine, ninhydrin, silver nitrate, and cyanoacrylate resin as well as perform laboratory procedures for lifting latent prints on nonporous objects using fingerprint powders such as black powder and florescent powders. In classroom discussions and/or brief presentations, students will compare impression evidence collected at a simulated crime scene with the known impression and explain the Automated Fingerprint Identification System (AFIS) and describe the characteristics examined in AFIS. | 10 periods  450 minutes | (8) The student analyzes impression evidence in forensic science. The student is expected to:  (A) compare the three major fingerprint patterns of arches, loops, and whorls and their respective subclasses;  (B) identify the minutiae of fingerprints, including bifurcations, ending ridges, dots, short ridges, and enclosures;  (C) distinguish among patent, plastic, and latent impressions;  (D) perform laboratory procedures for lifting latent prints on porous and nonporous objects using chemicals such as iodine, ninhydrin, silver nitrate, and cyanoacrylate resin;  (E) perform laboratory procedures for lifting latent prints on nonporous objects using fingerprint powders such as black powder and florescent powders;  (F) explain the Automated Fingerprint Identification System (AFIS) and describe the characteristics examined in the AFIS; and  (G) compare impression evidence collected at a simulated crime scene with the known impression. | |
| **Unit 7: Blood Spatter Analysis**  Students in this unit will learn how to analyze blood spatter as well as identify invisible blood stains at a simulated crime scene. Students will explain the method of chemically identifying and locating an invisible blood stain using reagents such as luminol and analyze blood stain patterns based on source, direction, and angle of trajectory. | 10 periods  450 minutes | (9) The student analyzes blood spatter at a simulated crime scene. The student is expected to:  (A) analyze blood stain patterns based on source, direction, and angle of trajectory; and  (B) explain the method of chemically isolating an invisible blood stain using reagents such as luminol. | |
| **Unit 8: Toxicology Laboratory Procedures**  In this unit, students will explore and learn toxicology laboratory procedures in crime labs. Students will analyze the absorption, distribution, and elimination of alcohol through the human body and research the blood alcohol laboratory procedures as they relate to blood alcohol concentration, and share their findings in discussions and/or brief presentations. Students will also explain the levels of tolerance and impairment due to alcohol consumption as well as explain the precautions necessary for proper preservation of blood samples while at a crime scene. | 10 periods  450 minutes | (10) The student explores toxicology laboratory procedures in forensic science. The student is expected to:  (A) explain the absorption, distribution, and elimination of alcohol through the human body;  (B) describe the blood alcohol laboratory procedures as they relate to blood alcohol concentration;  (C) explain the levels of tolerance and impairment due to alcohol consumption; and  (D) explain the precautions necessary in the forensic laboratory for proper preservation of blood samples. | |
| **Unit 9: Serology Laboratory Procedures**  In this unit students will learn serology laboratory procedures and research methodologies used to collect and analyze blood and other body fluids. Students will explain and demonstrate crime laboratory procedures to determine if a stain detected in a crime scene is blood and identify the red blood cell antigens and antibodies as they relate to human blood types. | 10 periods  450 minutes | (11) The student explores serology laboratory procedures in forensic science. The student is expected to:  (A) explain forensic laboratory procedures to determine if a stain detected in a crime scene is blood;  (B) identify the red blood cell antigens and antibodies as they relate to human blood types;  (C) determine genotypes and phenotypes in the human red blood cell system using Punnet Squares; and  (D) research methodologies used to collect and analyze other body fluids. | |
| **Unit 10: Analyzing DNA**  In this unit, students will learn and describe the structure of a DNA molecule and its function, learn and describe the steps used in extraction of DNA, learn, and explain the analytical procedure for forensic DNA typing, including electrophoresis, polymerase chain reaction, and short tandem repeat, and discuss and interpret the components of an electropherogram. | 10 periods  450 minutes | (12) The student analyzes deoxyribonucleic acid (DNA) laboratory procedures in forensic science. The student is expected to:  (A) describe the structure of a DNA molecule and its function;  (B) describe the steps used in extraction of DNA;  (C) explain the analytical procedure for forensic DNA typing, including electrophoresis, polymerase chain reaction, and short tandem repeat; and  (D) interpret the components of an electropherogram. | |
| **Unit 11: Identifying Drugs**  Identifying controlled substances at a crime scene is common in crime scene investigations. In this unit, students will identify identifies drugs found at a simulated crime scene using laboratory procedures such as microchemical tests, microscopy, chromatography, and spectrophotometry, and classify controlled substances using the schedules under the Controlled Substances Act. | 10 periods  450 minutes | (13) The student identifies drugs found at a simulated crime scene. The student is expected to:  (A) classify controlled substances using the schedules under the Controlled Substances Act; and  (B) identify controlled substances using laboratory procedures such as microchemical tests, microscopy, chromatography, and spectrophotometry. | |
| **Unit 12: Bullet and Tool Mark Impressions**  In this unit, students will evaluate bullet and tool mark impressions in a simulated criminal investigation. In brief presentations, students will explain the individual characteristics of tool marks, describe the mechanism of modern firearms, describe the composition and method of analysis for gunshot residue and primer residue, discuss the characteristics of bullet and cartridge cases, and explain the type of information available through the National Integrated Ballistics Information Network. | 10 periods  450 minutes | (14) The student evaluates bullet and tool mark impressions in a criminal investigation. The student is expected to:  (A) explain the individual characteristics of tool marks;  (B) describe the mechanism of modern firearms;  (C) recognize characteristics of bullet and cartridge cases;  (D) describe the composition and method of analysis for gunshot residue and primer residue; and  (E) recognize the type of information available through the National Integrated Ballistics Information Network. | |
| **Unit 13: Questioned Document Analysis**  Students willexplore principles of questioned document analysis in forensic science in “hands on” activities and presentations. Students will be given opportunities to examine samples as well as perform handwriting comparisons of an unknown sample with exemplars by analyzing characteristics such as letter, line, and formatting. Students will learn and describe different types of examinations performed by a questioned document examiner in a forensic laboratory, including counterfeiting, handwriting, ink, and paper analysis, the security features incorporated in the U.S. currency to prevent counterfeiting, and the process of ink analysis using chromatography. | 10 periods  450 minutes | (15) The student explores principles of questioned document analysis in forensic science. The student is expected to:  (A) describe different types of examinations performed by a questioned document examiner in a forensic laboratory, including counterfeiting, handwriting, ink, and paper analysis;  (B) describe the security features incorporated in the U.S. currency to prevent counterfeiting;  (C) perform handwriting comparisons of an unknown sample with exemplars by analyzing characteristics such as letter, line, and formatting; and  (D) describe the process of ink analysis using chromatography. | |
| **Unit 14: Anthropology and Forensic Science**  In this unit students will learn to identify the major bones of the skeletal system as well as how to differentiate between human and animal bones. Students will participate in “hands on” activities to identify the major bones of the human skeletal system and compare composition and structure of human bones with other animals. Students will also participate in class discussions and presentations that describe the techniques used to excavate bones from a crime scene, explain the characteristics of the human skeletal system indicative of specific gender, racial origin, and approximate range of age and height, and explain the role of dental records in identification of human remains. | 10 periods  450 minutes | (16) The student explores principles of anthropology relevant to forensic science. The student is expected to:  (A) identify the major bones of the human skeletal system;  (B) compare composition and structure of human bones with other animals;  (C) describe the techniques used to excavate bones from a crime scene;  (D) explain the characteristics of the human skeletal system indicative of specific gender, racial origin, and approximate range of age and height; and  (E) explain the role of dental records in identification of human remains. | |
| **Unit 15: Decomposition of the Human Body**  Calculating time and cause of death is vital for some crime scene investigations. Students in this unit will learn the science behind body decomposition and how to determine cause of death. Students will explain the process and timeline of rigor mortis and its role in calculating time of death, explain post mortem lividity and its importance when processing a crime scene, determine time of death using entomology, and determine time and cause of death methodologies through case studies. | 10 periods  450 minutes | (17) The student calculates the time and cause of death in relationship to decomposition of the human body. The student is expected to:  (A) explain the process and timeline of rigor mortis and its role in calculating time of death;  (B) explain post mortem lividity and its importance when processing a crime scene;  (C) determine time of death using entomology; and  (D) determine time and cause of death methodologies through case studies. | |