ATTACHMENT V
Text of Proposed New 19 TAC

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter M. Information Technology

§127.689. Advanced Cloud Computing (One Credit), Adopted 2025.

(a) General requirements. Students shall be awarded one credit for successful completion of this course. This course is recommended for students in grades 10-12. Recommended Prerequisites: At least one credit in a Level 2 or higher course in computer science, programming, software development, or networking systems.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services.

(3) The Advanced Cloud Computing course is an exploration of cloud computing. Upon completion of the course, students are prepared to sit for cloud computing professional certifications. In this course, students explore cloud computing services, applications, and use cases. Students dive deeply into cloud computing best practices and learn how cloud computing helps users develop a global infrastructure to support use case at scale while also developing and inventing innovative technologies.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:

(A) demonstrate and explain the importance of positive workplace behaviors that enhance employability and job advancement such as regular attendance, promptness, attention to proper attire, maintenance of a clean and safe work environment, appropriate voice, and pride in work;

(B) demonstrate and explain the importance of positive personal qualities such as flexibility, open-mindedness, initiative, listening attentively to speakers, and willingness to learn new knowledge and skills;

(C) employ and describe effective reading and writing skills;

(D) solve problems and think critically; and

(E) demonstrate and explain the importance of leadership skills and function effectively as a team member.

(2) The student defines cloud computing and its impacts and benefits and compares the major services offered by cloud computing providers. The student is expected to:

(A) describe the benefits of cloud computing and the reasons companies have started to switch from on-premise computing to cloud computing;

(B) demonstrate knowledge of and explain the three major types of cloud computing;

(C) generate sample cloud usage plans for a business case study, describing how each of the four services can be used to improve the business; and

(D) explain the purpose of a region, availability zone, and edge location.

(3) The student demonstrates how to store and share content in the cloud. The student is expected to:

(A) identify features and functions of commonly used cloud services;

(B) access and navigate to commonly used services in cloud computing consoles;

(C) analyze how cloud services are used in real-world industries;

(D) explain the functions of a domain name system (DNS);

(E) create an object storage bucket;

(F) explain benefits and uses of a content delivery network;

(G) configure web content distribution via edge locations and attach it to a website;

(H) identify the benefits, features, and use cases of different types of block storage;

(I) analyze a use case and recommend the best type of virtual storage for the particular situation;

(J) create a block storage volume or physical record;

(K) attach a block storage volume to a virtual computing instance; and

(L) create a virtual computing instance that hosts a simple website.

(4) The student applies cloud security best practices in relation to identity and access management (IAM) and knows how to use the top cloud monitoring services. The student is expected to:

(A) identify best practices for IAM;

(B) analyze the cultural and societal impacts of cloud security;

(C) differentiate among a role, user, and policy in cloud security;

(D) use a process to resolve vulnerabilities in a web server;

(E) determine whether security best practices are being followed and recommend steps to fix any security lapses;

(F) identify the best cloud security service for a given scenario;

(G) use an IAM system to set up a text alert event; and

(H) compare monitoring and logging services.

(5) The student describes when to use various databases, the benefits of caching data, and how to build a virtual private cloud (VPC). The student is expected to:

(A) compare online transactional processing and online analytical processing;

(B) describe the benefits of caching data;

(C) attach a load balancer to a webpage;

(D) evaluate the performance of a load balancer;

(E) describe features and benefits of load balancing;

(F) create an application using a Platform as a Service (PaaS); and

(G) use a template infrastructure as code (IaC) tool to build a virtual private cloud (VPC).

(6) The student describes the landscape of emerging technologies in the cloud. The student is expected to:

(A) define machine learning and discuss its impacts on society, business, and technology;

(B) identify potential use cases for emerging technology in the cloud;

(C) assess value propositions of using cloud technology using calculator tools;

(D) identify cloud services that can analyze and protect data and manage networks;

(E) define blockchain technology and explain its benefits; and

(F) explain the infrastructure of cloud development kits or services and use a software development framework to model and provision a cloud application.

(7) The student resolves common security alerts, diagrams instance states and transitions, and explains how to choose the most cost-efficient instance type. The student is expected to:

(A) describe the shared responsibility security model;

(B) determine security responsibility for cloud resources;

(C) analyze how the shared security model accounts for common threats to the cloud computing model;

(D) list the steps required to resolve an automated security alert;

(E) describe the six instance states, including pending, running, stopping, stopped, shutting down, and terminated;

(F) diagram the transitions between instance states from launch to termination;

(G) explain instance usage billing for each instance state; and

(H) determine the most appropriate instance state for a given situation.

(8) The student differentiates between dynamic and static websites. The student is expected to:

(A) recall the process for setting up a static website;

(B) compare static and dynamic websites;

(C) create a content delivery network distribution to increase the speed of a website;

(D) use a process to launch a dynamic web server;

(E) create a serverless compute function using a serverless compute console;

(F) describe the main functions of auto scaling;

(G) create a launch template and an auto scaling group; and

(H) develop a plan for monitoring an auto scaling instance or group.

(9) The student demonstrates the benefits and risks of using big data. The student is expected to:

(A) define big data and identify use cases for it within various industries;

(B) evaluate the pros and cons of big data;

(C) explain how blockchain ensures the validity and immutability of transactions, particularly in the cloud; and

(D) evaluate the pros and cons of blockchain business applications.

§127.690. Foundations of User Experience (One Credit), Adopted 2025.

(a) General requirements. This course is recommended for students in grades 9-12. There are no recommended prerequisites. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services.

(3) In Foundations of User Experience (UX), students will analyze and assess current trends in a career field that creates meaningful, approachable, and compelling experiences for users of an array of products, services, and or initiatives of companies, governments, and organizations. Students will gain knowledge of introductory observation and research skills; basic design thinking and applied empathy methodologies; collaborative problem-solving and ideation; and interaction design and solution development. The knowledge and skills acquired from this course enable students to identify real-world problems through research and data-driven investigation to design solutions while participating in collaborative problem-solving. Students will be introduced to agile practices and methodologies to develop skills to take solutions from conceptual sketch to digital designs using professional software tools. Students will explore how to improve the quality of user interactions and perceptions of products, experiences, and any related services.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills in the information technology (IT) field with a focus in the area of user experience (UX). The student is expected to:

(A) identify job opportunities in UX and accompanying job duties and tasks;

(B) employ effective verbal and nonverbal communication skills;

(C) create resumes and portfolios for UX professions;

(D) use critical thinking skills and creativity to present a solution to a user problem; and

(E) work collaboratively in a team to devise and present an efficiency or enhancement solution to a user issue within a given timeline, while incorporating empathy methodology, agile, and design principles.

(2) The student applies professional communications strategies. The student is expected to:

(A) adapt presentations for audience, purpose, situation, and intent;

(B) interpret and communicate information, data, and observations;

(C) apply active listening skills to obtain and clarify information;

(D) collect multiple viewpoints of potential diverse users; and

(E) define and exhibit public relations skills that are used by UX designers.

(3) The student describes the field of UX along with the common elements in user-centered design. The student is expected to:

(A) analyze and articulate the current trends and challenges of the UX field;

(B) analyze and document the diversity of roles and career opportunities across the UX field;

(C) identify terminology associated with UX, including user, user experience, empathy, human-centered design, design thinking, persona, user journey, empathy map, mind maps, roadmaps, wireframes, prototypes, and portfolios;

(D) identify and explain the differences between relevant, friendly, and useful experience design;

(E) identify and explain the connection between psychology and behavior with regard to usability;

(F) explain the components of the design thinking methodology for ideation, iteration, co-creation, development, and execution; and

(G) explain how UX design affects everyday lives.

(4) The student discusses and applies the legal and ethical practices that UX designers follow when working with technology, designs, and clients. The student is expected to:

(A) explain and identify ethical use of technology;

(B) explain intellectual property laws, including copyright, trademarks, and patents, and consequences of violating each type of law;

(C) identify violations of intellectual property laws;

(D) explain the consequences of plagiarism; and

(E) demonstrate ethical use of online resources, including citation of sources.

(5) The student identifies and demonstrates introductory observation and research methods. The student is expected to:

(A) describe the difference between qualitative and quantitative data;

(B) conduct user interviews to gather insights into what users think about a site, an application, a product, or a process;

(C) organize ideas and data using software tools;

(D) analyze and make conclusions from qualitative data collection;

(E) observe and document how users perform tasks through task analysis observations;

(F) define affinity and explain the benefits of affinity and customer journey maps;

(G) use data summaries from user interviews to create personas; and

(H) create a report or presentation, including user interview and observation data summaries, data analysis, and additional findings, for a target audience.

(6) The student applies an understanding of psychological principles used in user-centered design. The student is expected to:

(A) identify and define design principles;

(B) describe how visceral reactions inform the creation of a positive user experience;

(C) select colors to influence human behavior, mind, and reaction toward an intended outcome;

(D) explain recognition and scanning patterns and their importance in user-centered design;

(E) define Hick's Law and Weber's Law and explain their impact on UX design decisions;

(F) describe sensory adaptation phenomenon and perceptual set; and

(G) explain the stages of human information processing, including sensing, perceiving, decision-making, and acting.

(7) The student creates effective, accessible, usable, and meaningful solutions for the end user by using UX design principles. The student is expected to:

(A) identify end-user problems and needs in real-world environments;

(B) identify principles of accessibility, such as perceivable, operable, understandable, and robust (POUR);

(C) identify and discuss the differences and connections between UX Design, Visual Design, and UI User Interaction in regard to usability;

(D) communicate solution ideas with a storytelling approach;

(E) sketch and refine designs within wire-framing and prototypes; and

(F) implement iterations for a design solution using structured testing protocols.

(8) The student collaborates with others to apply UX project management methods. The student is expected to:

(A) identify the relationship between UX research and design-thinking methods; and

(B) explain three different stages and roles of UX project management methods, such as agile.

(9) The student applies UX design practices and uses technology to create digital assets. The student is expected to:

(A) use design elements such as typeface, color, shape, texture, space, and form to create a visual narrative;

(B) implement design principles such as unity, harmony, balance, scale, novelty, hierarchy, alignment, and contrast to create visual narratives;

(C) identify and explain common elements of HyperText Markup Language (HTML), such as tags, style sheets, and hyperlinks;

(D) apply UX design techniques in order to:

(i) create effective user interfaces for browser-based, native, and hybrid mobile applications;

(ii) demonstrate proper use of vector and raster-based design software;

(iii) explain the difference between back-end and front-end development in UX; and

(iv) create a web page containing links, graphics, and text using appropriate design principles;

(E) demonstrate basic sketching skills;

(F) create wireframes using design software;

(G) explain how design fidelity, from sketch to wireframe to prototype to visuals, aligns with and supports agile methodology; and

(H) produce digital assets.

§127.691. Advanced User Experience Design (One Credit), Adopted 2025.

(a) General requirements. Students shall be awarded one credit for successful completion of this course. This course is recommended for students in grades 10-12. Required prerequisite course: Foundations of User Experience.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, digital interactions, multimedia, and systems integration services.

(3) The Advanced User Experience (UX) Design course allows students to apply skills in science and art to integrate technology as a useful, meaningful, memorable, and accessible source for all users. Students will use knowledge from the Foundations of User Experience Design course to expand the research, design process, testing, and communication skills essential for success in this user-focused career field.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills in the information technology (IT) field with a focus in the area of user experience (UX). The student is expected to:

(A) identify job opportunities in UX and individual skills and abilities to apply;

(B) employ effective interpersonal and communication skills to work collaboratively;

(C) achieve at least one UX professional certification as well as build resumes and portfolios for UX positions; and

(D) demonstrate adaptability and flexibility for teamwork by adjusting project outcomes from peer-review and critique.

(2) The student understands and demonstrates legal and ethical procedures for UX designers as they apply to the use of information technology. The student is expected to:

(A) identify intellectual property violations within given scenarios; and

(B) write a summary of the ramifications and consequences of plagiarism and copyright infringement within a business context.

(3) The student connects and applies UX Design conceptual foundations with real-world scenarios. The student is expected to:

(A) present arguments to support findings, potential ideas, and peer-review interventions; and

(B) use proper terms and professional language for UX Design context, both orally and in written form.

(4) The student uses different options of project management to produce a successful UX design. The student is expected to:

(A) identify and apply different stages of the UX design process, including research, identification of problem, ideation, prototyping, and testing, to refine or create products;

(B) analyze and test partial products during the process to inform the refinement phase;

(C) explain the conceptual design, content strategy, and ways to get feedback from various users and stakeholders in the project; and

(D) demonstrate time-management awareness and planning ability to achieve tasks.

(5) The student collects and interprets data to US tools and protocols. The student is expected to:

(A) create templates for questionnaires, data collection, summary reports, as well as project conclusions to include insights into affordances and constraints for the design;

(B) distinguish differences in various qualitative research methods such as user interviews, ethnography, field studies, focus groups, and usability testing; and

(C) identify quantitative methods such as A/B testing, card sorting, heat maps, analytics, and user surveys.

(6) The student creates and analyzes prototypes for UX design products. The student is expected to:

(A) identify pain-points and come up with potential solutions;

(B) determine requirements and desirable features in order to create an action plan;

(C) create a presentable content strategy;

(D) develop conceptual designs and symbolic messages;

(E) generate possible solutions with ideation methods such as unstructured discussion, storyboards, brainstorming, role playing, game storming, mind mapping, teamwork games, sketching, and written ideation;

(F) refine and select ideas for prototyping with a people-centered rationale for the decision;

(G) create low-fidelity prototypes, including sketches, paper models, and click-through prototypes; and

(H) create mockups and high-fidelity prototypes, including digital and physical versions.

(7) The student structures solutions while applying UX design principles. The student is expected to:

(A) explain how the connected layouts, blocks of content, visual designs, and navigation requirements enhance user experience;

(B) distinguish channels and formats to develop website usability across different devices;

(C) develop and implement design activities for co-creation, peer-review, and collaborative work;

(D) evaluate and test navigation experiences contrasting with current competitors; and

(E) incorporate best practices from references, adding designer's voice and signature.

(8) The student describes best practices and plans for a usability test. The student is expected to:

(A) create a usability test plan, including cognitive, perceptual, emotional, cultural information about users, data collection requirements, and user testing methods;

(B) execute testing methodologies and collect data for analysis purposes; and

(C) present conclusions and recommendations that apply design principles, communication, and creative skills.

§127.692 Internetworking Technologies I (One Credit), Adopted 2025.

(a) General requirements. This course is recommended for students in Grades 9-12. Students shall receive one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) This course is suitable for the Information Technology (IT) career cluster, which focuses on building linkages in IT occupations for entry level, technical, and professional careers related to

the design, development, support, and management of hardware, software, multimedia, and systems integration services.

(3) In Internetworking Technologies I, students obtain necessary skills to compete in the global economy. Students learn hands-on technical skills to help them prepare for IT careers as well as postsecondary IT-related degrees. This course provides students with practical skills in networking.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify and demonstrate positive work behaviors that enhance employability and job advancement such as regular attendance, promptness, attention to proper attire, maintenance of a clean and safe work environment, appropriate voice, and pride in work;

(B) identify and demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, listening attentively to speakers, and willingness to learn new knowledge and skills;

(C) use effective reading and writing skills;

(D) solve problems and think critically;

(E) demonstrate leadership skills and function effectively as a team member;

(F) identify and implement proper safety procedures for the workplace; and

(G) identify and demonstrate planning and time-management skills.

(2) The student identifies various employment opportunities in the information technology field. The student is expected to:

(A) develop a personal career plan that includes education, job skills, and experience necessary to achieve career goals; and

(B) develop a resume and portfolio appropriate to chosen career plan; describe and practice interview skills for successful job placement.

(3) The student understands the operation of data networks. The student is expected to:

(A) describe the purpose and functions of various network devices;

(B) describe the components required for network and Internet communications;

(C) select the correct components required to meet a given network specification;

(D) describe the purpose and basic operation of the protocols in the Open Systems Interconnection (OSI) and Transmission Control Protocol (TCP) models and their associated protocols;

(E) describe the impact of multiple personal wireless devices on a wireless network;

(F) interpret network diagrams;

(G) predict the path between two hosts across a network; and

(H) differentiate between local area networks (LAN) and wide area networks (WAN) operation and features.

(4) The student configures, verifies, and troubleshoots switches in the network. The student is expected to:

(A) select the appropriate media, cables, ports, and connectors to connect switches to other network devices and hosts;

(B) explain the technology and media access control method for Ethernet technologies;

(C) explain network segmentation and basic traffic management concepts;

(D) explain the operation and concepts of basic switching;

(E) perform, save, and verify initial switch configuration, including switched virtual interfaces (SVI) and default gateway;

(F) verify network status and switch operation using basic utilities;

(G) implement and verify basic security for a switch; and

(H) identify, prescribe, and resolve common switched network media issues, configuration issues, auto negotiation, and switch hardware failures.

(5) The student implements Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6), addressing services to meet network requirements.
The student is expected to:

(A) describe the need and role of IP addressing in a network;

(B) compare Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6);

(C) create and apply appropriate IP addressing schemes to a network;

(D) assign and verify valid IP addresses to hosts, servers, and networking devices in a LAN environment;

(E) describe the operation and benefits of using private and public IPv4 addressing;

(F) implement static services for hosts in a LAN environment; and

(H) identify and correct IP addressing issues.

(6) The student configures, verifies, and troubleshoots routing. The student is expected to:

(A) identify and describe basic routing concepts;

(B) describe the operation of routers;

(C) compare methods of routing and routing protocols;

(D) configure, verify, and troubleshoot static routing;

(E) connect, configure, and verify operation status of a device interface;

(F) verify device configuration and network connectivity using ping, traceroute, telnet, Secure Shell (SSH), or other utilities;

(G) perform and verify routing configuration tasks for a static or default route given specific routing requirements;

(H) manage internetwork operating system (IOS) and configuration files, including saving and editing;

(I) implement password protection and physical network security; and

(J) troubleshoot and correct network and configuration issues.

§127.693 Internetworking Technologies II (One Credit), Adopted 2025.

(a) General requirements. Students shall receive one credit for the successful completion of this course. This course is recommended for students in Grades 10-12. Prerequisite: Internetworking Technologies I.

(b) Introduction.

(1) Career and Technical education provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) This course is suitable for the Information Technology (IT) career cluster, which focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services.

(3) In Internetworking Technologies II, students obtain necessary skills to compete in the global economy. As in the first Internetworking Technologies course, students learn hands-on technical skills to help them prepare for IT careers as well as postsecondary IT-related degrees. This course delves much deeper into networking and troubleshooting skills, such as switch security, wireless configurations, and routing technologies.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify and demonstrate positive work behaviors that enhance employability and advancement such as regular attendance, promptness, attention to proper attire, maintenance of a clean and safe work environment, appropriate voice, and pride in work;

(B) identify and demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, listening attentively to speakers, and willingness to learn new knowledge and skills;

(C) use effective reading and writing skills;

(D) solve problems and think critically;

(E) demonstrate leadership skills and function effectively as a team member;

(F) identify and implement proper safety procedures for the workplace; and

(G) demonstrate planning and time-management skills.

(2) The student identifies various employment opportunities in the information technology field. The student is expected to:

(A) add student identifies various employment opportunities in the information technology field. The student is expected certifications;

(B) edit the resume or portfolio created in the first course to reflect the new skills learned, and;

(C) expand interview skills for successful job placement.

(3) The student configures, verifies, and troubleshoots advanced switching. The student is expected to:

(A) describe enhanced switching technologies;

(B) configure a switch port to be assigned to a Virtual Local Area Network (VLAN) based on requirements;

(C) configure a trunk port on a Local Area Network (LAN) switch;

(D) configure Dynamic Trunking Protocol (DTP);

(E) configure, verify, and troubleshoot spanning tree versions;

(F) configure, verify, and troubleshoot EtherChannel technologies;

(G) interpret the output of various show commands to verify the operational status of a Cisco switched network;

(H) implement switch security to mitigate LAN attacks; and

(I) implement port security to mitigate media access control (MAC) address table attacks.

(4) The student configures, verifies, and troubleshoots advanced routing. The student is expected to:

(A) configure basic settings on a router using command line interface (CLI) to route between two directly connected networks;

(B) verify connectivity between two networks that are directly connected to a router;

(C) implement dynamic host configuration protocol version 4 (DHCPv4) to operate across multiple LANs;

(D) configure a router as a DHCPv4 server and client;

(E) configure dynamic address allocation in Internet Protocol version 6 (IPv6) networks;

(F) configure a stateful and stateless dynamic host configuration protocol version 6 (DHCPv6) server;

(G) configure inter-VLAN routing;

(H) configure IPv4 and IPv6 static, floating static, and default routing;

(I) compare static and dynamic routing concepts;

(J) troubleshoot routing implementation issues; and

(K) verify router hardware and software operation using show commands;

(5) The student implements and verifies Wireless LANs (WLANs). The student is expected to:

(A) explain how WLANs enable network connectivity and configure and verify a basic WAN serial connection;

(B) describe WLAN technology and standards;

(C) describe the components of a WLAN infrastructure;

(D) distinguish between and discuss variables that may affect a child's verbal fluency; and

(E) configure a wireless LAN controller (WLC) wireless local area network (WLAN) to use the management interface and Wi-Fi Protected Access 2 – Pre-Shared-Key (WPA2 PSK) authentication;

(F) configure a WLC WLAN to use a VLAN interface, a DHCP server, and WPA2 Enterprise authentication; and

(G) troubleshoot common wireless configuration issues.

(6) The student troubleshoots switching and routing networks. The student is expected to:

(A) analyze and implement proper troubleshooting methods;

(B) identify and correct switching and routing network problems; and

(C) identify and select software troubleshooting tools.

§127.694 Introduction to C# Programming Applications (One Credit), Adopted 2025.

(a) General requirements. This course is recommended for students in Grades 11-12. Recommended Prerequisites: At least one credit in a Level 2 or higher course in programming or software development. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provide content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry-level, technical, and professional careers related to design, development, support, and management of hardware, software, multimedia, and systems integration services.

(3) In Introduction to C# Programming, students will acquire knowledge of C# syntax including data types, control structures, functions, syntax, and semantics of language, classes, class relations, and exception handling. Students will analyze the social responsibility of business and industry regarding the significant issues relating to the environment, ethics, health, safety, and diversity in society and in the workplace as related to computer programming. Students will apply technical skills to address business applications of emerging technologies.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards and employability skills as required by the computer programming industry. The student is expected to:

(A) express ideas in a clear, concise, and effective manner;

(B) explain the importance of cooperating, contributing and collaborating as a team member of a team;

(C) describe effective reading and writing skills;

(D) describe effective verbal and nonverbal communication skills;

(E) solve problems and think critically;

(F) explain the importance of leadership skills and function effectively as a team member;

(G) identify and implement proper safety procedures;

(H) describe environmental issues related to the field of information technology (IT);

(I) explain and discuss the relevance of diversity in society and the workplace;

(J) explain legal and ethical responsibilities in relation to the field of IT; and

(K) describe planning and time-management skills such as project management.

(2) The student identifies various employment opportunities in the information technology field. The student is expected to:

(A) identify job opportunities and accompanying job duties and tasks;

(B) investigate emerging and innovative technologies that are potential career opportunities;

(C) identify careers of personal interest along with the education, job skills, and experience required to achieve personal career goals; and

(D) outline the functions of resumes and portfolios.

(3) The student identifies basic concepts and defines terminology associated with computer systems and program development. The student is expected to:

(A) identify and describe appropriate terminologies, such as C# terms, syntax, data types, objects, concepts, purposes, control structures, exceptions, classes, and arrays;

(B) identify and describe various software applications;

(C) compare the various ways that computers and programming languages are used for personal, workgroup, and enterprise computing;

(D) identify and describe multiple logic structures used in software design;

(E) explain the hardware and software aspects of computer systems that support application software development; and

(F) identify the fundamental principles of programming, including those of algorithm analysis, software design, operating systems, and database.

(4) The student demonstrates the use of software development tools and applies problem-solving skills to implement software design. The student is expected to:

(A) explain the general problem-solving concepts and steps used in software design;

(B) apply C# terms, syntax, data types, objects, concepts, purposes, control structures, exceptions, classes, and arrays to software design;

(C) explain the use of procedural programming structure;

(D) describe the use of arrays in solving problems;

(E) apply sequential logic structure in software design; and

(F) apply data structures and algorithms in software design.

(5) The student develops and writes documented C# programs, including designing, debugging and analyzing code. The student is expected to:

(A) explain the use of C# development tools;

(B) choose appropriate data and control structures based on assigned criteria;

(C) explain the use of loops and case logic structures;

(D) apply file and database concepts;

(E) design and develop correct executable projects;

(F) develop C# desktop graphical user interface (GUI) programs;

(G) create appropriate documentation; and

(H) describe and demonstrate debugging and exceptions handling.

§127.695 Information Technology Troubleshooting (One Credit), Adopted 2025.

(a) General requirements. This course is recommended for students in grades 10-12. Recommended prerequisites: Principles of Information Technology and Computer Maintenance/Lab. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry-level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services.

(3) The IT Troubleshooting course is about applying logic over technical components to identify and resolve problems. The course focuses on developing a methodical approach in IT troubleshooting and leveraging those skills in a workplace environment. In this course, students will learn and use proven troubleshooting methods and apply those in a collaborative workplace setting. Students will develop personal success skills, including time management and personal accountability measures, strategies for collaboration and teamwork, and effective written and verbal communication skills. The knowledge and skills acquired in the course will allow students to use information technology (IT) resources, information, and data safely, ethically, and following legal guidelines. Students will work within a service level model that helps them to interpret, clarify, and diagnose issues with hardware, software, and networking.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates personal success factors and professional employability skills. The student is expected to:

(A) describe the benefits of effective time management and explain how to manage the use of one’s time efficiently;

(B) identify and employ the behaviors of an effective team member;

(C) explain the importance of emotional intelligence to the role of an IT Support Specialist;

(D) describe a protocol for handling an emotional hijack, or variance in reasoning skills, either of oneself or another;

(E) describe and apply strategies to resolve conflicts when they arise;

(F) employ active listening skills, including paraphrasing and asking questions for clarification;

(G) communicate effectively when writing to and speaking with team members, clients/customers, and others;

(H) follow best practices for email communications;

(I) interpret technical language, documents, and diagrams and translate them into lay terminology when needed;

(J) demonstrate the use of proper grammar, spelling, and capture complete thoughts in communications and documentation; and

(K) investigate potential IT career pathways to becoming IT Support Specialist.

(2) The student develops and models customer-service skills. The student is expected to:

(A) identify and model the characteristics of excellent customer service;

(B) list and demonstrate the steps for opening and greeting a contact;

(C) explain the benefits of using a client’s name;

(D) identify habits and situations to avoid when interacting with a client;

(E) explain the importance of keeping clients informed of status changes and list the steps for putting a client on hold or transferring a call;

(F) identify techniques and strategies for diffusing difficult calls and customers; and

(G) document all communications and process outcomes clearly and appropriately.

(3) The student applies procedures for various support interaction types. The student is expected to:

(A) describe the primary responsibilities and top skills of an IT Support Specialist and identify how a professional can deliver consistent, quality service;

(B) explain and demonstrate safety procedures for unpacking, handling, and repacking replacement parts;

(C) demonstrate fluency with methods and technologies such as in-person, email, phone, web, or remote access used for delivering support and describe which support delivery methods for different types of support;

(D) demonstrate the use of remote access technologies to troubleshoot an issue; and

(E) describe the purpose and value of the security management process and the IT Support Specialist's role in that process.

(4) The student implements proven troubleshooting methods and strategies within the context of a service level model. The student is expected to:

(A) apply a troubleshooting process for diagnosing issues with hardware, software, and the network;

(B) explain the importance of clearly documenting progress through the troubleshooting process;

(C) describe activities common to a Help Desk Service Level Model (Incident Management) process;

(D) interpret and clarify different types of incidents, problems, and events submitted in the Help Desk Service Model or trouble ticketing system;

(E) describe an operational level agreement (OLA) and the role of the IT Support Specialist related to an OLA;

(F) describe what is meant by escalation and the reasons an incident may be escalated;

(G) access and apply relevant system updates for supported devices; and

(H) describe service and support center metrics, including a service level target, and the IT Support Specialist's role in monitoring and reviewing data related to these metrics.

(5) The student describes and applies best practices for the safe, ethical, and legal use of resources and information. The student is expected to:

(A) demonstrate and promote positive digital citizenship and acceptable use in all interactions when using digital resources;

(B) describe best practices for creating passwords such as increasing password length, password complexity, password blacklists, password resets, limiting attempts, or multi-factor authentication;

(C) examine and adhere to guidelines for using media, information, and applications protected by copyright;

(D) compare copyright, Fair Use, Public Domain, and Creative Commons licensing;

(E) apply and enforce licensing guidelines for software, media, and other resources;

(F) explain the importance and uses of encryption;

(G) describe and follow principles for handling confidential information;

(H) analyze cyber threats and social engineering vulnerabilities and ways to prevent them;

(I) describe various types of security policies and summarize the importance of physical security measures and logical security concepts;

(J) explain the importance of reporting security compromises such as addressing prohibited content and activity; and

(K) determine and implement appropriate data destruction and disposal methods relevant to a given scenario.

(6) The student applies foundational knowledge and skills for the installation, configuration, operation, and maintenance of desktops and workstations. The student is expected to:

(A) explain the procedure used to install and configure motherboards, central processing units (CPUs), and add-on cards relevant to a given scenario, such as a custom PC configuration to meet customer specifications;

(B) describe how to implement security best practices to secure a workstation, including software-based computer protection tools such as software firewalls, antivirus software, and anti-spyware;

(C) demonstrate how to identify symptoms or error codes, including no power, no POST, no BOOT, and no video that indicate device issues and explain how to troubleshoot them;

(D) describe the process used to install, troubleshoot, or replace RAM types and data storage;

(E) describe how to troubleshoot, clean, repair, or replace internal components, including heat sink units and thermal paste; exhaust vents and fans; power supply units, power adapters, and batteries; and wireless and wireless wide area network (WWAN) antenna routing;

(F) explain the importance of conducting periodic system maintenance, including both physical and electronic cleaning, disk checks, routine reboots, data dumps, and testing; and

(G) describe and demonstrate how to prevent, detect, and remove malware using appropriate tools and methods.

(7) The student applies foundational knowledge and skills about the installation, configuration, operation, and maintenance of operating systems (OS) and software. The student is expected to:

(A) demonstrate the use of OS features and tools relevant to given scenarios;

(B) demonstrate the use of OS utilities relevant to given scenarios;

(C) execute OS command-line tools such as, ipconfig, netstat, dir, nbtstat;

(D) troubleshoot OS problems relevant to a given scenario;

(E) demonstrate how to use features and tools of the Mac OS, Linux, and Chrome client/desktop operating systems;

(F) explain troubleshoot problems in the Mac OS, Linux, and Chrome Client/desktop operating systems; and

(G) explain database concepts and the purpose of a database.

(8) The student installs, configures, operates, maintains, and troubleshoots issues related to peripheral devices relevant to a given scenario. The student is expected to:

(A) explain and demonstrate how to install, configure, maintain, and troubleshoot storage devices;

(B) explain and demonstrate how to install, configure, maintain, and troubleshoot printers, copiers, and scanners, including Small Office Home Office (SOHO) multifunction devices and printers;

(C) explain and demonstrate how to install, configure, maintain, and troubleshoot video, projector, and displays; and

(D) explain and demonstrate how to install, configure, maintain, and troubleshoot multimedia devices, such as sound cards, speakers, microphones, and webcams.

(10) The student monitors current issues related to the installation, configuration, operation, and maintenance of laptops, tablets, and other mobile devices, including Internet of Things (IoT) devices. The student is expected to:

(A) explain and demonstrate how to install and configure laptop and netbook hardware and components as well as a custom configuration to meet customer specifications;

(B) explain and demonstrate how to install components within the display of a laptop;

(C) explain and demonstrate how to connect and configure accessories and ports of mobile devices;

(D) analyze and apply methods used to secure mobile devices;

(E) configure mobile device network connectivity and application support;

(F) demonstrate, apply, and implement methods to perform mobile device synchronization, such as to a laptop or desktop computer; and

(G) explain and demonstrate how to troubleshoot mobile device, OS, and application issues relevant to a given device.

(11) The student troubleshoots issues with wired and wireless networks and cloud computing resources. The student is expected to:

(A) explain and demonstrate how to install, configure, and secure a wired network;

(B) explain and demonstrate how to install, configure, and secure a basic wired network;

(C compare and describe wireless security protocols and authentication methods;

(D) analyze and describe troubleshoot wired and wireless network problems;

(E) demonstrate the use of appropriate networking tools safely to fix network issues;

(F) explain how computing devices such as laptops and cell phones connect and share data; and

(G) describe the components of cloud-computing architectures and features of cloud-computing platforms.

§127.696. Engineering Applications of Computer Science Principles (1 Credit), Adopted 2025.

(a) General requirements. This course is recommended for students in grades 9-12. Prerequisite: Algebra 1. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.

(3) Engineering Applications of Computer Science Principles teaches rigorous engineering design practices, engineering habits of mind, and the foundational tools of computer science. Students apply core computer science principles to solve engineering design challenges that cannot be solved without such knowledge and skills. Students use a variety of computer software and hardware applications to complete projects.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;

(B) present written and oral communication in a clear, concise, and effective manner;

(C) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results;

(D) identify and complete tasks with the highest standards to ensure quality products and services; and

(E) analyze cost savings by using a simulation to run experiments before committing more resources.

(2) The student applies concepts of critical thinking and problem solving. The student is expected to:

(A) analyze elements of an engineering problem to develop creative and innovative solutions;

(B) analyze the elements and structure of a programming problem to develop creative and innovative solutions;

(C) examine information from a customer and existing program to identify pertinent information for the problem-solving task;

(D) compare alternatives using a variety of problem-solving and critical-thinking skills; and

(E) conduct technical research to gather information necessary for decision making.

(3) The student conducts computer science and engineering laboratory activities using safe and environmentally appropriate practices. The student is expected to:

(A) identify and demonstrate safe practices during hands-on cutting and building activities;

(B) identify and demonstrate safe use and storage of electrical components; and

(C) identify and demonstrate and apply appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.

(4) The student applies ethical considerations in designing solutions. The student is expected to:

(A) define and evaluate constraints pertaining to a problem;

(B) incorporate safety considerations with respect to the system, engineer, and user; and

(C) investigate and explain the importance of relevant legal and ethical concepts in computer science such as intellectual property, use of open-source software, attribution, patents, and trademarks.

(5) The student demonstrates an understanding of the structured methods used to collect and analyze information about customer needs. The student is expected to:

(A) analyze all information provided by the customer;

(B) describe joint angle conventions;

(C) create a process flow diagram based on customer needs to generate ideas for potential user actions, product functions, and design opportunities;

(D) develop a flowchart for a program using the results of a process flow diagram;

(E) create a target specifications table;

(F) describe similar existing solutions; and

(G) construct a functional model based on customer needs to generate ideas for potential user actions, product functions, and design opportunities.

(6) The student develops a user interface and thorough but concise supplemental instructions. The student is expected to:

(A) identify the essential tasks to be done by the user;

(B) identify points of potential confusion or unexpected input by the user;

(C) design a software or user interface that clearly communicates to the user how to achieve desired tasks;

(D) develop supplemental user instructions to inform the user of items that cannot be incorporated into the interface, such as how to start the program or frequently asked questions;

(E) test the instructions and program with a student who is not familiar with the project;

(F) evaluate the feedback and results from new user testing;

(G) improve and refine the instructions and program based on feedback and results of testing; and

(H) re-test the instructions and program as necessary.

(7) The student systematically reverse engineers a product, examines ways to improve it, and identifies the type of redesign required to make that improvement. The student is expected to:

(A) test and try to “break” an existing program to determine functionality;

(B) describe unexpected findings from deconstructing existing code;

(C) examine relevant software libraries to determine their uses and functionality;

(D) construct a flowchart for an existing program;

(E) compare the program’s current functionality to the customer’s needs;

(F) add to the flowchart to meet customer needs;

(G) develop new code to achieve all desired outcomes; and

(H) compare the predicted versus actual functionality of the product to generate ideas for redesign.

(8) The student applies concept generation and selection skills. The student is expected to:

(A) create a black box and functional model of the system;

(B) implement brainstorming, mind mapping, concept sketching, and gallery walk activities to produce new ideas; and

(C) apply concept selection techniques such as a Pugh chart or a weighted decision matrix.

(9) The student develops and applies other engineering skills. The student is expected to:

(A) select and use appropriate tools and techniques to support design activities;

(B) report information about software design solutions in an engineering notebook;

(C) develop, test, and refine programming concepts throughout the development process;

(D) interpret an electrical diagram and use it to build a circuit;

(E) create a circuit using a microcontroller, a breadboard, and multiple components;

(F) apply the design process from different starting points by beginning with a baseline design;

(G) use a model or simulation which represents phenomena and mimics real-world events to develop and test hardware;

(H) evaluate the simulator's strengths and weaknesses for use in improving rocket performance;

(I) critique the usefulness and limitations of certain models;

(J) develop a prototype solution, test the prototype solution against requirements, constraints, and specifications, and refine the prototype solution; and

(K) report and describe the finalized design.

(10) The student applies mathematics and algorithms in programs. The student is expected to:

(A) apply mathematical concepts from algebra, geometry, trigonometry, and calculus to calculate the angle of a joint;

(B) apply mathematical calculations cyclically in a program using algorithms; and

(C) evaluate and verify algorithms for appropriateness and efficiency.

(11) The student develops computer programs to support design solutions. The student is expected to:

(A) design software interfaces that communicate with hardware;

(B) identify and apply relevant concepts from computer science, science, and mathematics such as functions, electricity, and mechanics; and

(C) employ abstraction in a program by representing numerical sensor readouts distance and brightness ranges in more intuitive variables and functions.

(12) The student develops and applies other computer science skills. The student is expected to:

(A) apply systems-thinking skills, emphasizing the integration of small discrete programs into a larger complete program solution;

(B) use intuitive variable names and add comments to code to improve readability;

(C) employ abstraction in a program by representing images as data arrays and representing numerical tone frequencies as variables;

(D) convert image information into the correct data type necessary for given library functions;

(E) develop an algorithm that includes logic, such as "while" and "if", to accept user trackbar input and display image changes in real time;

(F) document software design solutions through developing flowcharts, pseudocode, and commented code;

(G) design software interfaces that communicate with users and hardware;

(H) employ abstraction to program to an interface, treating imported code as a "black box;"

(I) employ abstraction by representing a joint as four points in a plane; and

(J) apply a well-defined programming vocabulary and skill set.

(13) The student develops and uses computer programs to process data and information to gain insight and discover connections to support design solutions. The student is expected to:

(A) organize complex image and video data appropriately for processing;

(B) analyze complex data to make decisions and instruct users; and

(C) develop programs that use incoming data and algorithms to create output data, information, and commands.

§127.697. Geographic Information Systems (One Credit), Adopted 2025.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Art, Audio/Video Technology, Principles of Information Technology, or Principles of Technology. Students shall be awarded one credit for successful completion of this course.

(b) Introduction

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services and research and development services.

(3) The Geographic Information Systems (GIS) course employs an analytic process using industry standard software to find trends and patterns in collected data. Whether collecting data first-hand or from reputable websites, GIS aims to use scientific methods to find solutions to various problems and issues. students

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) employ effective reading and writing skills;

(B) employ effective verbal and nonverbal communication skills;

(C) identify career development and opportunities in the GIS industry and related industries;

(D) apply competencies related to resources, information, and systems of operation in the geographical information technology industry;

(E) demonstrate knowledge of personal and occupational safety practices in the workplace; and

(F) identify employers' expectations, appropriate work habits, and good citizenship skills.

(2) The student demonstrates knowledge and appropriate use of computer hardware components, software programs, and their connections. The student is expected to:

(A) use operating systems, software applications, and communication and networking components appropriately;

(B) compare, contrast, and appropriately use the various input, processing, output, and primary/secondary storage devices;

(C) make decisions regarding the selection, acquisition, and use of software taking into consideration its quality, appropriateness, effectiveness, and efficiency; and

(D) delineate and make necessary adjustments regarding compatibility issues, including digital file formats and cross platform connectivity.

(3) The student uses data input skills appropriate to the task. The student is expected to:

(A) use a variety of input devices such as keyboard, scanner, or mouse by appropriately incorporating such components into the product; and

(B) use digital keyboarding standards for the input of data.

(4) The student demonstrates knowledge and understanding of what GIS is and the use of GIS technology in different career fields. The student is expected to:

(A) identify the historical and contemporary developments in GIS;

(B) identify the basic components of GIS; and

(C) identify appropriate application of GIS technologies in different career fields.

(5) The student demonstrates knowledge and appropriate use of database software. The student is expected to:

(A) use database software to design and construct a relational database using a geographic data model;

(B) use joins, hyperlinks, and relational linking within the database;

(C) demonstrate proficiency in data depiction and classification;

(D) transfer data from different sources into a database for storage and retrieval;

(E) identify characteristics of maps and spatial data; and

(F) identify and use geographical scales, coordinates, and specific map projections.

(6) The student demonstrates knowledge and appropriate use of spatial databases and sources. The student is expected to:

(A) identify and utilize digital terrain models, digital orthophoto quadrangles, geographic databases, land use and land cover data, digital imagery, hydrographic spatial data, and demographic data; and

(B) demonstrate appropriate use of spatial analysis.

(7) The student demonstrates knowledge and appropriate use of GIS software. The student is expected to:

(A) log in to and launch GIS software;

(B) determine the appropriate software tool from GIS to use for a given task or project; and

(C) create queries and spatial queries for finding features, borders, centroids, and networks, as well as determining distance, length and surface measurements and shapes.

(8) The student demonstrates knowledge and appropriate use of GIS data collection devices. The student is expected to:

(A) plan and conduct supervised GIS and Global Positioning System (GPS) experiences.

(B) use a GPS receiver by initializing and preparing it for data collection;

(C) use a GPS receiver to collect geographical coordinates; and

(D) transfer data from a GPS device to a personal computer.

(9) The student acquires electronic information in a variety of formats with appropriate supervision. The student is expected to:

(A) acquire information in various electronic formats used for text, audio, video, graphics, and other digital content; and

(B) use a variety of resources, including the Internet, foundation and enrichment curricula, and various productivity tools, to gather authentic data as a basis for individual and group GIS projects.

(10) The student uses appropriate computer-based productivity tools to create and modify solutions to problems. The student is expected to:

(A) identify project management guidelines for designing and developing GIS projects; and

(B) use visual organizers to design solutions such as flowcharts or schematic drawings.

(11) The student delivers a product in a variety of media with appropriate supervision. The student is expected to:

(A) publish information in a variety of formats, including hard copies and digital formats; and

(B) present GIS information in oral presentations using graphs, charts, maps and presentation software.

(12) The student will define and describe maps, reports, and graphs. The student is expected to:

(A) create map displays with industry-standard legends;

(B) use symbols, scaling, and other map elements; and

(C) generate reports and graphs.

§127.698 Raster-Based Geographic Information Systems (One Credit), Adopted 2025.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Geographic Information Systems. Students shall be awarded one credit for successful completion of this course.

(b) Introduction

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing and providing scientific research and professional and technical services, including laboratory and testing services and research and development services.

(3) In Raster-Based GIS students will study local problems, acquire information, including images or aerial photographs, process the acquired data, and merge the acquired data with vector data. Students will plan, conduct, and present solutions for locally-based problems.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) employ effective reading and writing skills;

(B) employ effective verbal and nonverbal communication skills;

(C) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession and worksite;

(D) use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities;

(E) demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed; and

(F) demonstrate respect for diversity in the workplace.

(2) The student demonstrates knowledge of the GIS field and related careers. The student is expected to:

(A) identify employment and career opportunities in GIS-related fields;

(B) explore career preparation learning experiences, including job shadowing, mentoring, apprenticeship training, and preparation programs;

(C) identify industry certifications for GIS related careers, including careers related to raster-based GIS; and

(D) discuss ethical issues related to GIS and technology and incorporate proper ethics in submitted projects;

(3) The student participates in team projects in various roles. The student is expected to:

(A) explain the importance of teamwork in the field of GIS;

(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution; and

(C) cooperate, contribute, and collaborate as a member of a group to attain agreement and achieve a collective outcome;

(D) demonstrate proper attitudes as a team leader and team member.

(4) The student investigates the history and use of photography in aerial photography. The student is expected to:

(A) explain the fundamental principles of cameras and lenses as they pertain to GIS and aerial photography;

(B) conduct and present research on the history of photography, particularly in regard to aerial platforms;

(C) compare and contrast vertical and oblique aerial photography; and

(D) identify cities, bridges, shorelines, roads and other important features in aerial photos.

(5) The student develops an understanding of electromagnetic and thermal radiation. The student is expected to:

(A) explain how forms of radiation propagate through space and interact with matter;

(B) investigate the behavior of waves, including refraction, scattering, absorption, and reflection, in relation to radiation;

(C) describe the properties and laws of thermal radiation;

(D) compare and contrast the particle and wave models of electromagnetic energy;

(E) differentiate maps based on electromagnetic versus thermal radiation imagery; and

(F) evaluate whether electromagnetic or thermal radiation imagery is appropriate based on the conditions.

(6) The student explores active and passive microwave remote sensing. The student is expected to:

(A) compare and contrast active and passive microwave remote sensing;

(B) explain geographic characteristics, including surface roughness, moisture content, vegetation, backscatter and biomass, and urban structures, detected by remote sensing images; and

(C) give detailed analysis of radar images.

(7) The student learns the functions and applications of the tools, equipment, and materials used in GIS and raster-based analysis. The student is expected to:

(A) demonstrate the use of raster-based software;

(B) download spatial data and raster images and re-project them to match the Digital Orthophoto Quadrangle (DOQ) or Digital Orthophoto Quarter Quadrangle (DOQQ);

(C) identify remote sensing equipment and the difference between the Global Positioning System (GPS) and the Global Navigation Satellite System (GLONASS);

(D) describe and perform measurements with handheld GPS devices using GPS or GLONASS systems; and

(E) compare the advantages, disadvantages, and limitations of remote or unmanned sensing.

(8) The student uses scientific methods in imagery analysis. The student is expected to:

(A) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology;

(B) collect data individually or collaboratively;

(C) organize, analyze, evaluate, make inferences, and predict trends from data; and

(D) communicate valid conclusions using essential vocabulary and supportive maps, summaries, oral reports, and technology-based reports.

(9) The student uses project management skills to research and analyze locally-based problems. The student is expected to:

(A) identify and collect data necessary to evaluate a local problem, including defining the problem and identifying locations of the concern;

(B) develop a plan and project schedule for completion of a project;

(C) Create a GIS map to illustrate a problem using remote sensing images gathered from sites such as the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administrations (NOAA), and United

§127.699 Spatial Technology and Remote Sensing (One Credit), Adopted 2025.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Geographic Information Systems and Raster-Based GIS. Students shall be awarded one credit for successful completion of this course.

(b) Introduction

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.

(3) In Spatial Technology and Remote Sensing, students will receive instruction in industry standard geospatial extension software and geospatial tools, including global positioning systems (GPS), and continued training in GIS project management and problem solving.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(2) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected:

(A) employ advanced reading and writing skills;

(B) employ advanced verbal and nonverbal communication skills;

(C) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession and work site;

(D) cooperate, contribute, and collaborate as a member of a group to attain agreement and achieve a collective outcome;

(E) demonstrate effective use of time-management skills in prioritizing tasks, following schedules, and tending to goal relevant activities in a way that optimizes efficiency and results;

(F) consistently demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks with little or no direction; and

(G) identify and demonstrate appropriate actions and identify consequences related to discrimination, harassment, and inequality in the workplace.

(3) The student demonstrates knowledge of the GIS field and GIS-related careers. The student is expected to:

(A) identify employment and career opportunities in GIS-related fields, including spatial technology;

(B) explore or participate in career preparation learning experiences, including job shadowing, mentoring, apprenticeship training; and preparation programs;

(C) identify industry certifications for GIS related careers, including careers that use or benefit from spatial technology; and;

(D) evaluate ethical issues related to spatial technology and remote sensing and technology and incorporate proper ethics in submitted projects.

(4) The student applies basic GIS software knowledge and skills to explore the use of various geographic projections in GIS software. The student is expected to:

(A) use and identify Mercator map projection;

(B) use and identify Albers conic map projection; and

(C) evaluate the evolution of and need for different map projections.

(5) The student applies the application of global positioning system (GPS) technology. The student is expected to:

(A) identify and use data terminology related to GPS;

(B) identify and use appropriately GPS receiver components;

(C) propose potential applications of GPS coordinates such as locating fire hydrants, extinguishers, lighting, and parking lots; and

(D) appraise the accuracy of GPS coordinates from different receivers such as smartphones, tablets, and GPS handheld devices.

(6) The student demonstrates knowledge and understanding of the types and components of unmanned remote sensing platforms. The student is expected to:

(A) identify major components of aerial, terrestrial, and submersible remote sensing platforms;

(B) evaluate conditions for using one type of platform over another;

(C) differentiate the types of sensing systems used by each type of platform, including active, passive, spectrometer, radar, LiDAR, scatter meter, and laser altimeter, and

(D) compare and contrast situations in which different platforms and sensing systems might be used.

(7) The student demonstrates skills related to GIS data analysis. The student is expected to:

(A) apply critical thinking skills to evaluate findings and potential problems using GIS data;

(B) create models that represent collected data

(C) create, query, map, and analyze cell-based raster data; and

(D) analyze density, distance, and proximity of various data points using spatial analyst tools.

(8) The student analyzes geospatial socioeconomic data to create three-dimensional maps to demonstrate findings. The student is expected to:

(A) identify key sources of and gather and organize geospatial socioeconomic data;

(B) plan, organize, and create two-dimensional themes;

(C) convert two- dimensional themes to a three- dimensional map to demonstrate features, distributions, and themes; and

(D) generate summaries, generalizations, or thesis statements to interpret, draw conclusions about, and justify findings.

(9) The student uses spatial technology to develop and analyze a location map. The student is expected to:

(A) identify and collect data using GPS and/or unmanned systems and identify the boundaries and topography of the location;

(B) analyze how the location of a community impacts the resources and hardships such as jobs or traffic in the community;

(C) create a map of a location that includes buildings and facilities, adjacent streets, and transportation sites, using GIS software; and

(D) develop and include categories for a facility's features such as restrooms, spaces allocated for core activities, emergency equipment, and excavation routes.

(10) The student documents technical knowledge and skills. The student is expected to:

(A) create a portfolio to include information such as:

(i) attainment of technical skill competencies related to spatial technology and remote sensing; and

(ii) samples of work such as location maps and spatial technology and remote sensing-based reports; and

(B) present a portfolio to peers or interested stakeholders.