Chapter 130. Texas Essential Knowledge and Skills for Career and Technical Education

Subchapter K. Information Technology

§130.301. Implementation of Texas Essential Knowledge and Skills for Information Technology, Adopted 2015.

(a)   The provisions of this subchapter shall be implemented by school districts beginning with the 2017-2018 school year.

(b)   No later than August 31, 2016, the commissioner of education shall determine whether instructional materials funding has been made available to Texas public schools for materials that cover the essential knowledge and skills for career and technical education as adopted in §§130.302-130.314 [§§130.302-130.312] of this subchapter.

(c)   If the commissioner makes the determination that instructional materials funding has been made available under subsection (b) of this section, §§130.302-130.314 [§§130.302-130.312] of this subchapter shall be implemented beginning with the 2017-2018 school year and apply to the 2017-2018 and subsequent school years.

(d)   If the commissioner does not make the determination that instructional materials funding has been made available under subsection (b) of this section, the commissioner shall determine no later than August 31 of each subsequent school year whether instructional materials funding has been made available. If the commissioner determines that instructional materials funding has been made available, the commissioner shall notify the State Board of Education and school districts that §§130.302-130.314 [§§130.302-130.312] of this subchapter shall be implemented for the following school year.

§130.302. Principles of Information Technology (One Credit), Adopted 2015.

(a)   General requirements. This course is recommended for students in Grades 9 and 10. 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 Principles of Information Technology, students will develop computer literacy skills to adapt to emerging technologies used in the global marketplace. Students will implement personal and interpersonal skills to prepare for a rapidly evolving workplace environment. Students will enhance reading, writing, computing, communication, and reasoning skills and apply them to the information technology environment.

        (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 work behaviors and qualities that enhance employability and job advancement such as regular attendance, attention to proper attire, maintenance of a clean and safe work environment, pride in work, flexibility, and initiative;

(B) employ effective verbal and nonverbal communication skills;

(C) employ 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; and

(G) demonstrate planning and time-management skills such as [project management and] storyboarding and project management, including initiating, planning, executing, monitoring and controlling, and closing a project .

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

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

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

(C) describe the functions of resumes and portfolios.

(3) The student uses evolving and emerging technologies to exchange information. The student is expected to:

(A) identify and describe functions of various evolving and emerging technologies;

(B) send and receive text information and file attachments using electronic methods such as email, electronic bulletin boards, and instant message services;

(C) demonstrate effective Internet search strategies, including keywords and Boolean logic, using various available search engines;

(D) identify the various components of a Uniform Resource Locator;

(E) demonstrate ability to effectively test acquired information from the Internet for accuracy, relevance, and validity;

(F) explain issues concerning computer-based threats such as computer viruses, malware, and hacking; and

(G) explain issues concerning Internet safety such as identity theft, online predators, cyber-bullying, and phishing.

(4) The student demonstrates knowledge of the hardware components associated with information systems. The student is expected to:

(A) identify major hardware components and their functions;

(B) use available reference tools as appropriate; and

(C) connect and use a variety of peripheral devices such as mouse, keyboard, microphone, digital camera, and printer.

(5) The student demonstrates knowledge of the different software associated with information systems. The student is expected to:

(A) differentiate between systems and application software;

(B) identify and explain major operating system fundamentals and components such as disk operations, graphical user interface components, and hardware drivers;

(C)   explain the purpose of file types across software products;

(D)   demonstrate use of computer numbering systems and internal data representation such as identifying the hexadecimal value of a color;

(E)   compare and contrast open source and proprietary software;

(F)   explain use of system management tools;

(G)   apply proper file management techniques such as creating, naming, organizing, copying, moving, and deleting files;

(H)   use appropriate file protection and security; and

(I)   explain the process for discovering, quarantining, and removing viruses from a computer system.

(6)   The student analyzes network systems. The student is expected to:

     (A)   identify hardware associated with telecommunications and data networking such as servers, routers, switches, and network connectors;

     (B)   identify and describe various types of networks such as peer-to-peer, local area networks, wide area networks, wireless, and Ethernet;

     (C)   identify functions of network operating systems; and

     (D)   explain troubleshooting techniques for various network connection issues.

(7)   The student applies word-processing technology. The student is expected to:

     (A)   identify the terminology associated with word-processing software;

     (B)   edit a variety of text documents using functions such as pagination, appropriate white space, tab settings, and font style, size, and color; and

     (C)   create professional documents such as memorandums, technical manuals, or proposals using advanced word-processing features.

(8)   The student applies spreadsheet technology. The student is expected to:

     (A)   identify the terminology associated with spreadsheet software;

     (B)   use numerical content to perform mathematical calculations;

     (C)   use student-created and preprogrammed functions to produce documents such as budget, payroll, statistical tables, and personal checkbook register;

     (D)   identify, generate, and describe the function of comma separated value files;

     (E)   create and analyze spreadsheets incorporating advanced features such as lookup tables, nested IF statements, subtotals, cell protection conditional formatting, charts, and graphs; and

     (F)   perform sorting, searching, and data filtering in documents.

(9)   The student explores computer programming concepts. The student is expected to:

     (A)   identify the function of compilers and interpreters;

     (B)   explain the difference between the operation of compilers and interpreters;

     (C)   identify various computer languages and how the languages are used in software development;

     (D)   recognize data representation in software development such as string, numeric, character, integer, and date;

     (E)   identify and explain the concept of algorithms; and

  (F) describe the flow of a structured algorithm, including linear and iterative instructions such as using a flow chart.

 (10) The student explores database technology. The student is expected to:

  (A) identify the terminology associated with database software and database functions;

  (B) explore the application of databases;

  (C) identify and explain the purpose and elements of a query language;

  (D) identify and explain the purpose of fields and records; and

  (E) describe the process of constructing a query, including multiple search parameters.

 (11) The student applies presentation management technology. The student is expected to:

  (A) identify the terminology and functions of presentation software; and

  (B) create, save, edit, and produce presentations incorporating advanced features such as links, hyperlinks, audio, and graphics.

 (12) The student applies design and web publishing techniques. The student is expected to:

  (A) identify the terminology associated with web page development and interactive media;

  (B) identify and explain design elements such as typeface, color, shape, texture, space, and form;

  (C) identify and explain design principles such as unity, harmony, balance, scale, and contrast;

  (D) identify and explain common elements of Hyper Text Markup Language (HTML) such as tags, stylesheets, and hyperlinks; and

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

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

  (A) explain and demonstrate ethical use of technology and online resources;

  (B) adhere to intellectual property laws;

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

  (D) examine the consequences of plagiarism;

  (E) identify and explain unethical practices such as hacking, online piracy, and data vandalism; and

  (F) demonstrate ethical use of online resources, including citation of source.

§130.303. Computer Maintenance (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Information Technology. Recommended corequisite: Computer Maintenance Lab. [~~Districts are encouraged to offer this course in a consecutive block with Computer Maintenance Lab to allow students sufficient time to master the content of both courses.~~] 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 Computer Maintenance, students will acquire knowledge of computer maintenance and creating appropriate documentation. 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 maintenance. Students will apply technical skills to address the IT industry and 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/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)   solve problems and think critically;

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

(E)   identify and implement proper safety procedures;

(F)   demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and

(G)   demonstrate planning and time-management skills such as project management , including initiating, planning, executing, monitoring and controlling, and closing a project .

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

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

(B)   examine the role of certifications, resumes, and portfolios in the IT profession.

(3)   The student applies academic skills to the requirements of computer technologies. The student is expected to:

(A)   demonstrate effective verbal and written communication skills with individuals from varied cultures such as fellow workers, management, and customers; and

(B)   interpret appropriate documentation such as schematics, drawings, charts, diagrams, technical manuals, and bulletins.

(4)   The student acquires an understanding of computer hardware technologies. The student is expected to:

(A)   explain the fundamentals of microprocessor theory;

(B)   define the use of Boolean and Binary logic in computer technologies;

(C)   explain the theories of magnetism, electricity, and electronics as related to computer technologies;

(D)   explain proper troubleshooting techniques as related to computer hardware;

(E)   differentiate among digital and analog input and output electronics theory;

(F)　　　explain the relationships relative to data-communications theory;

(G)　　　describe the architecture of various computer systems;

(H)　　　describe the function of computer components such as central processing units, storage devices, and peripheral devices;

(I)　　　explain computer system environmental requirements and related control devices; and

(J)　　　identify new and emerging technologies that may affect the field of computer technology.

(5)　　　The student uses hardware design, operation, and maintenance knowledge and skills to identify major computer components. The student is expected to:

(A)　　　identify the purpose and function of computer components in the operation of the computer system such as central processing unit, mother board, sockets, chipsets, basic input and output system and their drivers, memory, hard drive technologies, video cards, input and output devices and ports, and modem and network interface cards (NIC);

(B)　　　identify how mobile devices such as personal data assistants and cell phones operate;

(C)　　　identify how mobile devices such as personal data assistants and cell phones connect and share data;

(D)　　　demonstrate an understanding of the rationale behind error messages and symptoms of hardware failures;

(E)　　　research interrupt sequences and beep codes; and

(F)　　　identify priorities and interrupts at the system level.

(6)　　　The student acquires knowledge of operating system design, including operation and maintenance. The student is expected to:

(A)　　　explain the fundamentals of an operating system;

(B)　　　compare and contrast different operating systems; and

(C)　　　identify the operating systems of mobile devices.

(7)　　　The student acquires knowledge of the theory behind the installation, configuration of software programs, and updates in IT systems. The student is expected to:

(A)　　　identify the operational features and proper terminology related to computer software systems;

(B)　　　evaluate application software packages;

(C)　　　verify that software is properly licensed prior to installation;

(D)　　　differentiate between types of software such as Software as a Service, single-user, per-seat, enterprise, freeware, shareware, and open-source licensing; and

(E)　　　explain proper troubleshooting techniques related to computer software.

(8)　　　The student acquires knowledge of the installation and configuration of network connections. The student is expected to:

(A)　　　explain the fundamentals of network connections and interface requirements;

(B)　　　explain the steps required to install and configure a computer on a network; and

(C)　　　identify the steps to troubleshoot network connectivity.

§130.304. Computer Maintenance Lab (One Credit), Adopted 2015.

(a)　　　General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Information Technology. Corequisite: Computer Maintenance. This course must

be taken concurrently with Computer Maintenance and may not be taken as a stand-alone course. Districts are encouraged to offer this course in a consecutive block with Computer Maintenance to allow students sufficient time to master the content of both courses. 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 Computer Maintenance Lab, students will acquire knowledge of computer maintenance and creating appropriate documentation. 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 maintenance. Students will apply technical skills to address the IT industry and 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/employability skills as required by business and industry. The student is expected to:

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

        (C)   employ effective reading and writing skills;

        (D)   employ effective verbal and nonverbal communication skills;

        (E)   solve problems and think critically;

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

        (G)   identify and implement proper safety procedures;

        (H)   demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and

        (I)   demonstrate planning and time-management skills such as project management , including initiating, planning, executing, monitoring and controlling, and closing a project .

    (2)   The student applies academic skills to the requirements of computer technologies. The student is expected to:

        (A)   complete work orders for repair and installation;

        (B)   estimate supplies, materials, and labor costs for installation, maintenance, and repair work orders; and

        (C)   locate and interpret appropriate documentation such as schematics, drawings, charts, diagrams, technical manuals, and bulletins.

(3)   The student demonstrates the proper function and application of the tools, equipment, and materials used in computer technologies. The student is expected to:

   (A)   demonstrate safe use of equipment in computer technologies such as hand and power tools;

   (B)   employ available reference documentation such as tools, materials, and Internet sources to access information as needed;

   (C)   demonstrate proper handling and disposal of environmentally hazardous materials used in computer technologies; and

   (D)   research new and emerging technologies that may affect the field of computer technology.

(4)   The student applies the concepts and skills of the trade in simulated work situations. The student is expected to:

   (A)   use electronic test equipment to measure current, voltage, power, and resistance;

   (B)   describe digital circuits and bus design;

   (C)   demonstrate the operational features and proper terminology related to computer systems;

   (D)   demonstrate proper usage of the various components of a computer system such as the central processor, basic input and output system, read-only memory, and random access memory; and

   (E)   troubleshoot computer peripheral devices.

(5)   The student uses hardware design, operation, and maintenance knowledge and skills to identify major computer components. The student is expected to:

   (A)   assemble and install a basic computer system; and

   (B)   install and configure computer components such as printers and other peripherals.

(6)   The student uses troubleshooting skills to solve client problems. The student is expected to:

   (A)   diagnose error messages and symptoms of hardware failures;

   (B)   research and identify interrupt sequences and beep codes;

   (C)   identify priorities and interrupts at the system level;

   (D)   test a system using diagnostic tools and software;

   (E)   diagnose problems in operating systems;

   (F)   differentiate between hardware and software failure;

   (G)   update Basic Input/Output System (BIOS);

   (H)   demonstrate hard drive maintenance procedures such as defrag scan and clear caches;

   (I)   gather information from the user;

   (J)   repair malfunctioning hardware systems;

   (K)   reinstall software as needed;

   (L)   demonstrate system backup and recovery;

   (M)   restore a system to various states such as safe modes and previous;

   (N)   demonstrate knowledge of operating system design such as operation and maintenance; and

   (O)   apply knowledge of operating system design to perform information support and service tasks of different operating systems.

(7)   The student installs and configures software programs and updates IT systems. The student is expected to:

        (A)   evaluate application software packages and test the functionality of a proposed software configuration;

        (B)   verify software is properly licensed prior to installation;

        (C)   install application and systems software using available resources as needed;

        (D)   resolve problems with installation if any occur such as recovery from system error;

        (E)   perform software customization as requested;

        (F)   document all procedures; and

        (G)   install and maintain security software.

(8)   The student installs, configures, and verifies active network connection. The student is expected to:

        (A)   demonstrate an understanding of network connection and interface requirements;

        (B)   install and configure a computer on a network; and

        (C)   verify and troubleshoot network connectivity.

(9)   The student provides support to computer users to maintain service. The student is expected to:

        (A)   develop a written disaster recovery plan; and

        (B)   develop a written preventive maintenance plan.

§130.305. Networking (One Credit), Adopted 2015.

(a)   General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Information Technology, Computer Maintenance, and Computer Maintenance Lab. [Corequisite: Networking Lab.] Recommended corequisite: Networking Lab. [Districts are encouraged to offer this course in a consecutive block with Networking Lab to allow students sufficient time to master the content of both courses.] 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 Networking, students will develop knowledge of the concepts and skills related to data networking technologies and practices in order to apply them to personal or career development. To prepare for success, students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and 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 the professional standards/employability skills as required by business and industry. The student is expected to:

(A)   identify and demonstrate 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)   employ effective reading and writing skills;

(D)   employ effective verbal and nonverbal communication skills;

(E)   solve problems and think critically;

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

(G)   identify and implement proper safety procedures;

(H)   demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and

(I)   demonstrate planning and time-management skills such as project management . including initiating, planning, executing, monitoring and controlling, and closing a project .

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

(A)   select and research a specific job area with its accompanying duties and tasks;

(B)   formulate a personal career plan along with the education, job skills, and experience necessary to achieve career goals; and

(C)   develop a resume.

(3)   The student relates core academic skills to the requirements of telecommunications and data network services. The student is expected to:

(A)   demonstrate effective verbal and written communication skills with individuals from varied cultures such as fellow workers, management, and customers;

(B)   complete work orders for repair and installation;

(C)   estimate supplies, materials, and labor costs on installation, maintenance, and repair work orders; and

(D)   interpret technical documentation such as schematics, drawings, charts, diagrams, technical manuals, and bulletins.

(4)   The student acquires an understanding of telecommunications and data network services. The student is expected to:

(A)   explain digital and analog electronics theory;

(B)   demonstrate knowledge of binary in relation to Internet Protocol (IP) addressing;

(C)   distinguish the differences between a data packet and voice communications;

(D)   define the layers and functions of the Open System Interconnection model;

(E)   explain Transport Control Protocol and IP fundamentals, including subnetting;

(F)   distinguish between public and private networks;

(G)   describe the standards and operations of wireless technologies in telecommunications and data networks;

(H)   differentiate between types of networks;

(I)   identify national standards for data communication; and

(J)   identify the potential benefits and problems for the future of telecommunications and data networking.

(5)   The student analyzes various types of configurations and upgrading. The student is expected to:

(A)   demonstrate understanding of components of telecommunications and data networks;

(B)   identify major network operating systems;

(C)   distinguish between different types of cables used in the telecommunications and data networking;

(D)   describe telecommunications and data networking media and connectors;

(E)   differentiate among computer network topologies;

(F)   explain the distinction between connectionless and connection transport;

(G)   explain the use of Transport Control Protocol and IP utilities;

(H)   explain how to test, validate, and troubleshoot IP connectivity; and

(I)   identify good practices to ensure network security.

(6)   The student recognizes and recommends the various types of network components to address industry needs. The student is expected to:

(A)   analyze various types and components of networks; and

(B)   analyze the characteristics of networks to select the optimum configuration for an industry solution.

(7)   The student develops a network design plan. The student is expected to:

(A)   produce planning documentation required prior to network implementation;

(B)   explain the impact of environmental factors on computer networks;

(C)   identify common peripheral ports and common network components such as hubs, routers, and switches;

(D)   develop an addressing scheme, including a subnetting chart;

(E)   specify the tools that are commonly used to resolve network equipment problems;

(F)   identify vendor testing documentation such as patches, fixes, and upgrades;

(G)   demonstrate standard backup procedures and backup media storage practices; and

(H)   identify the factors that might affect performance in a network environment such as logic or frequency spectrum interference.

(8)   The student provides support to computer users to maintain service. The student is expected to:

(A)   develop a written disaster recovery plan; and

(B)   develop a written preventive maintenance plan.

§130.306. Networking Lab (One Credit), Adopted 2015.

(a)   General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Information Technology, Computer Maintenance, and Computer Maintenance Lab. Corequisite: Networking. This course must be taken concurrently with Networking and may not be taken as a stand-alone course. Districts are encouraged to offer this course in a consecutive block with Networking to allow students sufficient time to master the content of both courses. 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 Networking Lab, students will develop knowledge of the concepts and skills related to telecommunications and data networking technologies and practices in order to apply them to personal or career development. To prepare for success, students must have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and 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)   identify and demonstrate 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)   employ effective reading and writing skills;

(D)   employ effective verbal and nonverbal communication skills;

(E)   solve problems and think critically;

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

(G)   identify and implement proper safety procedures;

(H)   demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and

(I)   demonstrate planning and time-management skills such as project management . including initiating, planning, executing, monitoring and controlling, and closing a project .

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

(A)   select and research a specific job area with its accompanying duties and tasks;

(B)   formulate a personal career plan along with the education, job skills, and experience necessary to achieve career goals; and

(C)   develop a resume.

(3)   The student applies related core academic skills to the requirements of telecommunications and data network services. The student is expected to:

(A)   demonstrate effective verbal and written communication skills with individuals from varied cultures such as fellow workers, management, and customers;

(B)　　complete work orders for repair and installation;

(C)　　estimate supplies, materials, and labor costs on installation, maintenance, and repair work orders; and

(D)　　interpret technical documentation such as schematics, drawings, charts, diagrams, technical manuals, and bulletins.

(4)　　The student recognizes and recommends the various types of network components to address industry needs. The student is expected to:

(A)　　analyze various types and components of networks;

(B)　　use knowledge of the characteristics of networks to select the optimum configuration for an industry solution; and

(C)　　recommend data network solutions based on scenario-driven problems.

(5)　　The student develops a network design plan. The student is expected to:

(A)　　produce necessary documentation required prior to network implementation such as administrative and test accounts, passwords, Internet Protocol addressing, and configurations;

(B)　　analyze the impact of environmental factors on computer networks;

(C)　　indicate common peripheral ports and common network components;

(D)　　develop an addressing scheme, including a subnetting chart;

(E)　　specify the tools that are commonly used to resolve network equipment problems;

(F)　　identify vendor testing documentation such as patches, fixes, and upgrades;

(G)　　demonstrate awareness of standard backup procedures and backup media storage practices;

(H)　　distinguish between common types of telecommunications and data network cabling;

(I)　　identify the factors that might affect performance in a network environment such as logic or frequency spectrum interference; and

(J)　　research new and emerging technologies that may affect the field of telecommunications and data networking services.

(6)　　The student implements a data network plan. The student is expected to:

(A)　　demonstrate awareness of compatibility and cabling issues;

(B)　　implement an addressing scheme, including a subnet;

(C)　　install various types of data connectors and cabling used in computer networking and data communications;

(D)　　connect various types of data connectors and cabling used in computer networking and data communications;

(E)　　troubleshoot physical and logical indicators of trouble;

(F)　　employ a systematic approach to identify a network problem, distinguish between operator or system error, and select the appropriate steps to correct the error;

(G)　　determine the cause of a problem and select the appropriate corrective action for the network problem; and

(H)　　maintain a hierarchical structure for the storing and organizing of data on networks.

(7)　　The student implements network security systems. The student is expected to:

(A)   assess potential security threats to information systems;

(B)   identify the range of security needs and the problems that can occur on a data network due to security lapses;

(C)   define and identify unethical practices such as hacking, phone fraud, online piracy, and data vandalism;

(D)   evaluate issues related to privacy, depersonalization, and government control of data communications;

(E)   develop and implement a network security plan; and

(F)   identify the role that network components such as routers, firewalls, intrusion detection systems, and virtual private networks play in security.

(8)   The student knows the function and application of the tools, equipment, technologies, and materials used in telecommunications services. The student is expected to:

(A)   demonstrate safe use of equipment commonly employed in telecommunications services such as hand and power tools; and

(B)   demonstrate proper handling and disposal of environmentally hazardous materials used in telecommunications services.

(9)   The student provides support to computer users to maintain service. The student is expected to:

(A)   develop a written disaster recovery plan; and

(B)   develop a written preventive maintenance plan.

§130.307. Digital Media (One Credit), Adopted 2015.

(a)   General requirements. This course is recommended for students in Grades 9-12. 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 Digital Media, students will analyze and assess current and emerging technologies, while designing and creating multimedia projects that address customer needs and resolve a problem. Students will implement personal and interpersonal skills to prepare for a rapidly evolving workplace environment. The knowledge and skills acquired and practiced will enable students to successfully perform and interact in a technology-driven society. Students will enhance reading, writing, computing, communication, and critical thinking and apply them to the IT environment.

(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 work behaviors and qualities that enhance employability and job advancement such as regular attendance, attention to proper attire, maintenance of a clean and safe work environment, pride in work, flexibility, and initiative;

(B) employ effective verbal and nonverbal communication skills;

(C) employ effective reading and writing skills;

(D) solve problems and think critically;

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

(F) demonstrate an understanding of legal and ethical responsibilities in relation to the field of information technology; and

(G) demonstrate planning and time-management skills such as [project management and] storyboarding and project management, including initiating, planning, executing, monitoring and controlling, and closing a project .

(2) The student identifies employment opportunities in the IT field with a focus in the area of digital media. The student is expected to:

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

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

(C) demonstrate an understanding of the functions of resumes and portfolios; and

(D) create a digital portfolio.

(3) The student uses emerging technologies to exchange and gather information and resources. The student is expected to:

(A) collaborate using various electronic technologies such as email, blogs, chat rooms, discussion threads, social media, podcasting, and wikis;

(B) demonstrate appropriate search strategies for finding resources or assets on the Internet;

(C) discuss recent digital media technologies; and

(D) evaluate and select appropriate software for the development of projects.

(4) The student complies with standard practices and behaviors that meet legal and ethical responsibilities. The student is expected to:

(A) explain and demonstrate ethical use of technology and online resources;

(B) compare and contrast fair use, open source, and creative commons;

(C) adhere to intellectual property laws and regulations;

(D) differentiate between copyright and trademarks;

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

(F) define and identify unethical practices such as hacking, online piracy, and data vandalism;

(G) demonstrate ethical use of Internet and online resources, including citation of source; and

(H) describe the function of a non-disclosure agreement and intellectual property agreement.

(5) The student analyzes and applies design and layout principles in digital media. The student is expected to:

(A) compare and contrast printed and digital communications products that demonstrate appropriate and inappropriate use of design and layout principles;

(B)   identify and apply perspective such as backgrounds, light, shades, shadows, and scale to capture a focal point and create depth;

(C)   identify and apply principles of proportion, balance, variety, emphasis, harmony, symmetry, unity, and repetition in type, color, size, line thickness, shape, and space;

(D)   identify and apply three-dimensional effects such as foreground, middle distance, and background images;

(E)   identify and apply concepts of typography;

(F)   identify and apply color theory; and

(G)   create and improve digital products by applying the appropriate design and layout principles.

(6)   The student designs and creates digital graphics. The student is expected to:

(A)   compare and contrast the characteristics of raster-based bitmap graphics and vector-based graphics;

(B)   create and modify digital graphics using appropriate vector-based and raster-based software following standard design principles;

(C)   export and set graphics to be used in both print and digital formats;

(D)   demonstrate knowledge of graphic resolution, file size, file formats, and file management;

(E)   determine the type of data stored in a file based on its file extension and select appropriate software to modify, create, and view the file; and

(F)   differentiate between the color mode selections in determining product output.

(7)   The student demonstrates appropriate use of digital photography equipment and techniques. The student is expected to:

(A)   demonstrate proper use of safety procedures while using digital photography equipment;

(B)   capture still shot images using digital photography equipment incorporating various photo composition techniques such as lighting, perspective, candid versus posed, rule of thirds, and level of horizon;

(C)   transfer still shot images from equipment to the computer; and

(D)   demonstrate photographic enhancement techniques such as feathering, layering, masking, and color enhancement using appropriate photo editing software.

(8)   The student demonstrates appropriate use of video equipment and techniques. The student is expected to:

(A)   demonstrate proper use of safety procedures while using digital video equipment;

(B)   demonstrate proper use of terminology in relation to video technology;

(C)   demonstrate proper ethics in the use of digital video photography equipment to capture video images;

(D)   transfer video images from equipment to the computer;

(E)   apply videographic enhancement and editing techniques such as panning, transitioning, zooming, content editing, and synchronizing audio and video using appropriate digital manipulation software; and

(F)   export video files in digital formats to be used in various delivery systems such as podcasts, downloadable media, social media, and streaming video.

(9) The student demonstrates appropriate use of audio equipment and techniques. The student is expected to:

    (A) demonstrate proper use of safety procedures while using digital audio equipment;

    (B) demonstrate proper use of terminology and concepts in relation to audio technology;

    (C) demonstrate proper use of digital audio equipment to capture audio files;

    (D) transfer audio files from equipment to the computer;

    (E) demonstrate proper use of audio editing software such as adding effects, fading, volume control, and manipulation of waveforms using appropriate digital manipulation software; and

    (F) export audio files to be used in digital formats in various delivery systems such as podcasts, downloadable files, social media, and streaming video.

(10) The student demonstrates appropriate use of animation. The student is expected to:

    (A) plan and create a linear and non-linear animation using accepted standards such as design principles, frames and key frames, integration of audio into an animation, and user interactive controls;

    (B) deploy animation to be used in various digital formats and on various video animation players; and

    (C) create an interactive animation.

(11) The student demonstrates appropriate project management in the creation of digital media projects. The student is expected to:

    (A) initiate a project, including identifying [identify] the purpose, audience, and audience needs for design plans;

    (B) develop a plan for a media project such as a storyboard and [,] stage development [,] and identify [identification of] equipment and resources; [and]

    (C) execute and monitor and control [evaluate] a project [plan] along its timeline and make suggested revisions until completion of the project ; and [.]

    (D) close a project, including identifying lessons learned.

(12) The student deploys digital media into print, web-based, and video products. The student is expected to:

    (A) incorporate video, audio, text, graphics, and animations into a web page;

    (B) incorporate various digital media products into an electronic document such as a newsletter, social media outlet, poster, or report; and

    (C) incorporate various digital media products into an interactive product such as an animation, computer program, simulation, interactive website, or application.

§130.308. Web Technologies (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Information 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 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 Web Technologies, students will learn to make informed decisions and apply the decisions to the field of IT. Students will implement personal and interpersonal skills to prepare for a rapidly evolving workplace environment. The knowledge and skills acquired and practiced will enable students to successfully perform and interact in a technology-driven society. Students will enhance reading, writing, computing, communication, and critical thinking and apply them to the IT environment.

(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 work behaviors and qualities that enhance employability and job advancement such as regular attendance, attention to proper attire, maintenance of a clean and safe work environment, pride in work, flexibility, and initiative;

        (B)   employ effective verbal and nonverbal communication skills;

        (C)   examine the role of certifications, resumes, and portfolios in the web technology profession;

        (D)   solve problems and think critically;

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

        (F)   demonstrate planning and time-management skills such as [project management and] storyboarding and project management, including initiating, planning, executing, monitoring and controlling, and closing a project .

    (2)   The student identifies employment opportunities in the IT field with a focus in the area of interactive media. The student is expected to:

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

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

        (C)   demonstrate an understanding of the functions of resumes and portfolios; and

        (D)   create a portfolio.

    (3)   The student demonstrates knowledge and appropriate use of hardware, software, and connectivity technologies. The student is expected to:

        (A)   identify networking components and define the impact of networking components on web development;

        (B)   evaluate the various input, processing, output, and storage devices and storage services;

        (C)   identify current and future Internet protocols such as hypertext transfer protocol, file transfer protocol, telnet, and email; and

        (D)   describe new trends in web technology and evaluate their impact on web development.

    (4)   The student complies with practices and behaviors that meet legal and ethical responsibilities. The student is expected to:

     (A)   explain and demonstrate ethical use of technology and online resources;

     (B)   differentiate between copyright and trademarks;

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

     (D)   examine the consequences of plagiarism;

     (E)   adhere to copyright and trademark intellectual property laws and regulations, including demonstrating correct acquisition and citation of sources;

     (F)   discuss the process of acquiring rights to use copyrighted and trademarked content in a website;

     (G)   demonstrate appropriate behavior and adherence to acceptable use policies when accessing and using online resources;

     (H)   explain the importance of information privacy such as securing credit card information, passwords, and personal information;

     (I)   describe the function of a non-disclosure agreement; and

     (J)   discuss website accessibility concerns.

(5)   The student evaluates electronic information. The student is expected to:

     (A)   identify appropriate methods to analyze the design and functionality of web pages;

     (B)   demonstrate skill in testing the accuracy and validity of information acquired; and

     (C)   synthesize information from data acquired from online resources.

(6)   The student creates and modifies web and digital media designs. The student is expected to:

     (A)   implement functional design elements such as proximity, repetition, contrast, alignment, color theory, consistency, image file size, and typography;

     (B)   identify, create, modify, and use common file formats such as text, image, video analog and digital, and audio files;

     (C)   select, create, modify, and integrate effective digital content such as vector-based and raster graphics, motion graphics, video, and audio;

     (D)   create web pages using current web standards and web development skills such as version control, documentation, web application security, validation, accessibility, and compatibility across multiple browsers and devices;

     (E)   demonstrate proper use of folder structure hierarchy; and

     (F)   use web coding standards to evaluate the design and functionality of web pages such as the World Wide Web Consortium (W3C) guidelines.

(7)   The student demonstrates and employs knowledge of Internet programming strategies to develop and maintain web applications. The student is expected to:

     (A)   explain the importance of Internet programming standards;

     (B)   differentiate among various web coding standards such as HyperText Markup Language, and cascading style sheets;

     (C)   use standard applications to develop web applications such as text-based editing programs, word processors, and web authoring software;

     (D)   compare and contrast the impact of different browsers on web development;

     (E)   explain client-server applications and describe the process of a client-server transaction;

     (F)   identify the advantages and disadvantages of client-side processing;

(G)   identify security issues related to client-side processing;

(H)   use standard scripting languages to produce interactive web applications;

(I)   identify characteristics of various scripting languages; and

(J)   explain the process to construct secure transaction interfaces from the web server to the customer.

(8)   The student employs knowledge of web administration to develop and maintain web applications. The student is expected to:

(A)   compare the advantages and disadvantages of running a personal server versus using a server provider;

(B)   explain the Transmission Control Protocol/Internet Protocol;

(C)   identify hardware and software requirements for web servers;

(D)   evaluate server providers;

(E)   describe the process of establishing a domain name;

(F)   simulate the administration of web servers, including uploading and managing files;

(G)   collect and analyze usage statistics;

(H)   maintain documentation of the server environment such as specifications, passwords, and software versions;

(I)   summarize the process of server backup and restoration of software features;

(J)   propose security measures to protect web servers from electronic threats such as unauthorized access and negative intentions; and

(K)   evaluate security measures such as using a firewall, Secure Socket Layer (SSL) connections, and Hypertext Transfer Protocol Secure (HTTPS) transactions.

(9)   The student evaluates a problem and creates a project management plan for meeting client requirements. The student is expected to:

(A)   communicate with clients to analyze requirements to meet the needs of the client and target audience;

(B)   document design properties, necessary tools, and resources and identify and address risks;

(C)   develop and use a timeline task list such as critical milestones, potential challenges, and interdependencies; and

(D)   use various methods to evaluate the progress of the plan and modify as necessary.

(10)   The student creates and implements a web product using a project management plan. The student is expected to:

(A)   create and simulate the publication of a multipage web product using client required content and web design concepts;

(B)   develop a test plan for a multipage web product for testing usability, effectiveness, reliability, and customer acceptance;

(C)   explain the quality assurance process; and

(D)   develop and implement a quality assurance plan.

§130.309. Computer Programming I (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Information Technology and Algebra I. [~~This course satisfies a high school languages other than English graduation requirement.~~] 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 Computer Programming I, students will acquire knowledge of structured programming techniques and concepts appropriate to developing executable programs and creating appropriate documentation. 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 the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected:

(A) employ effective reading and writing skills;

(B) employ effective verbal and nonverbal communication skills;

(C) solve problems and think critically;

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

(E) demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT;

(F) demonstrate planning and time-management skills such as project management , including initiating, planning, executing, monitoring and controlling, and closing a project ; and

(G) identify job opportunities and accompanying job duties and tasks.

(2) The student differentiates the concepts of integrity and confidentiality as related to technology in the business environment. The student is expected to:

(A) define business ethics;

(B) distinguish between honest and dishonest business practices;

(C) examine copyright and licensing issues in the software industry; and

(D) analyze the effects of unethical practices on a business.

(3) The student identifies and analyzes the client project software needs and requirements. The student is expected to:

(A) gather data to identify client and project requirements;

       (B)   identify input and output requirements;

       (C)   identify system processing requirements; and

       (D)   develop program requirements and specifications.

(4)   The student develops an IT-based project plan to solve a specific problem. The student is expected to:

       (A)   define scope of work to meet client-based project needs;

       (B)   identify software development processes and issues; and

       (C)   explain the software system life cycle approach.

(5)   The student designs a software application plan. The student is expected to:

       (A)   articulate the principles of system design such as procedural, object-oriented, and event-driven processes;

       (B)   perform a logical design using appropriate software tools;

       (C)   apply algorithmic and data structure concepts;

       (D)   identify constraints;

       (E)   identify modular design concepts; and

       (F)   document the design specification using a defined procedure.

(6)   The student solves problems using different types and levels of programming languages and quality assurances. The student is expected to:

       (A)   differentiate among the concepts of data such as procedural, object-oriented, and event-driven representation;

       (B)   identify current programming languages and the environment in which each is used;

       (C)   produce procedural and object-oriented programs using structured coding with appropriate style and clarity of expression;

       (D)   demonstrate skill in program testing;

       (E)   compare computed results with anticipated results to determine the reasonableness of the solutions;

       (F)   troubleshoot technological problems;

       (G)   explain the software quality assurance process; and

       (H)   follow established quality assurance procedures for testing, identifying problems, and tracking resolutions.

(7)   The student recognizes issues and complies with procedures for maintaining the security of computerized information. The student is expected to:

       (A)   identify risks to information systems facilities, data communications systems, and applications;

       (B)   comply with federal and state legislation pertaining to computer crime, fraud, and abuse;

       (C)   identify and select controls for information systems facilities, data communications, and applications appropriate to specific risks; and

       (D)   apply procedures used to recover from situations such as system failure and computer virus.

§130.310. Computer Programming II (One Credit), Adopted 2015.

(a)   General requirements. This course is recommended for students in Grades 11 and 12. Recommended prerequisites: Principles of Information Technology and Computer Programming I. [~~This course satisfies a high school languages other than English graduation requirement.~~] 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 Computer Programming II, students will expand their knowledge and skills in structured programming techniques and concepts by addressing more complex problems and developing comprehensive programming solutions. Students will analyze the social responsibility of business and industry regarding the significant issues relating to 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/employability skills as required by business and industry. The student is expected:

        (A)   employ effective reading and writing skills;

        (B)   employ effective verbal and nonverbal communication skills;

        (C)   illustrate interview skills for successful job placement;

        (D)   solve problems and think critically;

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

        (F)   identify and implement proper safety procedures;

        (G)   demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and

        (H)   demonstrate planning and time-management skills such as project management , including initiating, planning, executing, monitoring and controlling, and closing a project .

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

        (A)   create a personal career plan along with education, job skills, and experience necessary to achieve career goals; and

        (B)   develop a resume that includes letters of recommendation appropriate to a chosen career plan.

    (3)   The student identifies project software needs and requirements. The student is expected to:

        (A)   identify input and output requirements;

(B)   identify system processing requirements;

(C)   identify hardware, networking, and software system functional requirements;

(D)   conduct a project needs analysis;

(E)   define a problem to be solved by a created application;

(F)   analyze requirement specifications using current approaches;

(G)   identify project constraints; and

(H)   use advanced modeling and analysis of functional requirements.

(4)   The student produces an IT-based strategy and project plan to solve a provided class problem. The student is expected to:

(A)   identify key functions and subsystem capabilities of modern software products;

(B)   identify software resources and individual product risks; and

(C)   identify software development methodologies.

(5)   The student demonstrates knowledge of the software development environment. The student is expected to:

(A)   apply prototyping techniques;

(B)   use appropriate configuration management tools;

(C)   apply language-specific programming techniques;

(D)   develop programs using appropriate language;

(E)   apply the appropriate development environment for each selected language such as the compiler, debugger, test generator, and analyzer;

(F)   use appropriate modeling and analysis tools; and

(G)   use appropriate requirement tracking tools.

(6)   The student demonstrates knowledge of the software development process. The student is expected to:

(A)   articulate the information system life cycle;

(B)   identify system analysis issues related to design, testing, implementation, and maintenance;

(C)   identify the use of program design tools in a software-development process; and

(D)   identify current information life cycle models.

(7)   The student designs a software application. The student is expected to:

(A)   apply principals of system design such as structured, object-oriented, and event-driven processes;

(B)   develop a logical design;

(C)   document design specifications according to a defined procedure;

(D)   design system input, output, processing, and interfaces;

(E)   identify the characteristics and uses of data processing such as batch, interactive, event driven, and object oriented;

(F)   explain algorithmic and data structure concepts;

(G)   identify constraints;

(H)	identify modular design concepts;

(I)	identify the features, functions, and architectures of client-server computing;

(J)	articulate database-management concepts;

(K)	define the objectives of a client-server application;

(L)	design static and dynamic online processing systems; and

(M)	employ interface techniques.

(8)	The student codes a software application. The student is expected to:

(A)	apply programming language concepts;

(B)	identify the hardware-software connection;

(C)	articulate the concept of data representation;

(D)	apply structured, object-oriented, and event-driven programming techniques;

(E)	articulate how a programming language can support multitasking and exception handling;

(F)	identify how current key programming languages work in different operating system environments;

(G)	translate data structures and program design into code in an appropriate language;

(H)	demonstrate key constructs and commands specific to a language;

(I)	identify current programming languages used in software development;

(J)	explain how to resolve program implementation issues such as debugging, documentation, and auditing;

(K)	articulate software development issues such as correctness, reliability, and productivity;

(L)	explain code analysis issues related to design, testing, implementation, and maintenance;

(M)	demonstrate how to design and implement programs in a top-down manner;

(N)	demonstrate how to translate algorithmic and modular design into computer code;

(O)	explain how programming control structures are used to verify correctness;

(P)	compile and debug computer code; and

(Q)	prepare appropriate commenting within code.

(9)	The student demonstrates knowledge of software testing. The student is expected to:

(A)	develop a test plan;

(B)	define test procedures;

(C)	develop test cases; and

(D)	perform software testing.

(10)	The student performs quality assurance testing. The student is expected to:

(A)	explain the software quality assurance process;

(B)	apply standard requirements for software quality assurance;

(C)	perform software quality assurance tasks to determine a quality software product; and

(D)	conduct code inspection.

(11)	The student applies procedures for maintaining the security of computerized information. The student is expected to:

(A)   identify risks to information systems facilities, data, communication systems, and applications;

(B)   comply with federal and state legislation pertaining to computer crime, fraud, and abuse;

(C)   identify and select controls for information systems facilities, data communications, and applications appropriate to specific risks; and

(D)   apply procedures used to recover from situations such as system failure and computer virus.

§130.311. Computer Technician Practicum (Two Credits), Adopted 2015.

(a)   General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Information Technology, Computer Maintenance, Computer Maintenance Lab, Networking, and Networking Lab. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(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) [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 the Computer Technician Practicum, students will gain knowledge and skills in the area of computer technologies, including advanced knowledge of electrical and electronic theory, computer principles, and components related to the installation, diagnosis, service, and repair of computer-based technology systems. Students will reinforce, apply, and transfer their knowledge and skills to a variety of settings and problems. Proper use of analytical skills and application of IT concepts and standards are essential to prepare students for success in a technology-driven society. Critical thinking, IT experience, and product development may be conducted in a classroom setting with an instructor, with an industry mentor, or both.

(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 required by business and industry. The student is expected to:

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

(C)   employ effective reading and writing skills;

(D)   employ effective verbal and nonverbal communication skills;

(E)   solve problems and think critically;

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

(G)   identify and implement proper safety procedures;

(H)   demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and

(I)   demonstrate planning and time-management skills such as [project management and] storyboarding and project management, including initiating, planning, executing, monitoring and controlling, and closing a project .

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

(A)   improve on a personal career plan along with education, job skills, and experience necessary to achieve career goals;

(B)   develop a resume appropriate to a chosen career plan, including letters of recommendation; and

(C)   illustrate interview skills for successful job placement.

(3)   The student relates core academic skills to the requirements of computer technologies. The student is expected to:

(A)   demonstrate effective verbal and written communication skills with individuals from varied cultures such as fellow workers, management, and customers;

(B)   complete work orders and related paperwork for repair and installation;

(C)   estimate supplies, materials, and labor costs for installation, maintenance, and repair work orders; and

(D)   read and interpret technical documentation such as schematics, drawings, charts, diagrams, technical manuals, and bulletins.

(4)   The student applies communication, mathematics, English, and science knowledge and skills to research and develop projects. The student is expected to:

(A)   demonstrate proper use of written, verbal, and visual communication techniques consistent with IT industry standards;

(B)   demonstrate proper use of mathematics concepts in the development of products or services; and

(C)   demonstrate proper use of science principles to the development of products or services.

(5)   The student knows the concepts and skills that form the basis of computer technologies. The student is expected to:

(A)   explain microprocessor theory;

(B)   define the use of Boolean logic in computer technologies;

(C)   describe the theories of magnetism, electricity, and electronics as they apply to computer systems;

(D)   identify proper troubleshooting techniques;

(E)   differentiate among digital and [,] analog [, and] input and output electronics theories;

(F)   describe the architecture of various computer systems;

(G)   describe the function of central processing units, storage devices, peripheral devices, and microprocessor units; and

(H)   explain computer system environmental requirements and related control devices.

(6)   The student knows the proper function and application of the tools, equipment, technologies, and materials used in computer technologies. The student is expected to:

(A)   demonstrate safe use of equipment in computer technologies such as hand and power tools;

(B)   employ available reference tools, materials, and Internet sources to access information as needed;

(C)   demonstrate the proper handling and disposal of environmentally hazardous materials used in computer technologies; and

(D)   identify new and emerging technologies that may affect the field of computer technology such as quantum computing, photonics, and nanotechnology.

(7)   The student applies the essential knowledge and skills for computer technologies to career preparation, job shadowing, mentoring, or apprenticeship training in simulated and actual work situations. The student is expected to:

(A)   identify a problem relating to information technology;

(B)   develop a solution using appropriate technologies, IT concepts, and IT industry standards;

(C)   explain how the proposed technological solution will resolve the problem and the methodologies involved;

(D)   apply decision-making techniques to the selection of technological solutions;

(E)   identify areas where quality, reliability, and safety can be designed into a product or service;

(F)   apply critical-thinking strategies to analyze and evaluate the proposed technological solution;

(G)   develop a sustainability plan for the product or service;

(H)   select and use the appropriate technological resources to conduct, research, design, and develop activities;

(I)   develop the documentation of the research and development process; and

(J)   present the solution to a panel of professionals using formal presentation skills.

(8)   The student employs project management knowledge to oversee IT projects. The student is expected to:

(A)   implement project methodologies , including initiating, planning, executing, monitoring and controlling, and closing a project, to manage information system projects;

(B)   define the scope of work to achieve individual and group goals;

(C)   develop time and activity plans to achieve objectives;

(D)   implement or participate with cross-functional teams to achieve IT project goals;

(E)   develop and implement quality assurance test plans; and

(F)   create a contingency plan.

(9)   The student recognizes and analyzes potential IT security threats to develop and maintain security requirements. The student is expected to:

(A)   describe potential security threats to information systems;

(B)   identify the range of security needs and the problems that can occur due to security lapses;

(C)   develop and implement plans to address security threats;

(D)   document security procedures; and

(E)   describe the use of computer forensics in countering security threats such as IT crimes and security breaches.

(10)   The student provides support to computer users to maintain service. The student is expected to:

     (A)   employ effective listening skills when working with clients to identify support needs;

     (B)   identify customer need and formulate a support plan;

     (C)   create queries and reports and assess critical system information;

     (D)   employ problem-solving skills in performing support, maintenance, and repair;

     (E)   use hardware and software diagnostics;

     (F)   report to the user the cause of and solution to the problem; and

     (G)   create written documentation indicating the cause of and solution to the problem.

(11)   The student demonstrates and applies knowledge of security risks and safeguards. The student is expected to:

     (A)   install security software;

     (B)   update security software; and

     (C)   use security software to clean an infected machine.

(12)   The student provides support to computer users to maintain service. The student is expected to:

     (A)   develop a written disaster recovery plan; and

     (B)   develop a written preventive maintenance plan.

(13)   The student creates a personal portfolio. The student is expected to:

     (A)   create a portfolio that documents all projects and accomplishments such as academics, volunteer experience, employment experience, awards, and certifications;

     (B)   organize and prioritize information within the portfolio; and

     (C)   use written, verbal, and visual communication techniques consistent with IT industry standards.

§130.312. Practicum in Information Technology (Two Credits), Adopted 2015.

(a)   General requirements. This course is recommended for students in Grade 12. Prerequisite: a minimum of two high school information technology (IT) courses. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(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) [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 the Practicum in Information Technology, students will gain advanced knowledge and skills in the application, design, production, implementation, maintenance, evaluation, and assessment of products, services, and systems. Knowledge and skills in the proper use of analytical skills and application of IT concepts and standards are essential to prepare students for success in a technology-driven society. Critical thinking, IT experience, and product development may be

conducted in a classroom setting with an industry mentor, as an unpaid or paid internship, as part of a capstone project, or as career preparation.

    (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 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 qualities such as flexibility, open-mindedness, initiative, listening attentively to speakers, and willingness to learn new knowledge and skills;

        (C)   employ effective reading and writing skills;

        (D)   employ effective verbal and nonverbal communication skills;

        (E)   solve problems and think critically;

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

        (G)   identify and implement proper safety procedures;

        (H)   demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and

        (I)   demonstrate planning and time-management skills such as [project management and] storyboarding and project management, including initiating, planning, executing, monitoring and controlling, and closing a project .

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

        (A)   improve on a personal career plan along with education, job skills, and experience necessary to achieve career goals;

        (B)   develop a resume that includes letters of recommendation and a portfolio appropriate to a chosen career plan; and

        (C)   illustrate interview skills for successful job placement.

    (3)   The student applies academic knowledge and skills to research and develop projects. The student is expected to:

        (A)   demonstrate proper use of written, verbal, and visual communication techniques consistent with IT industry standards;

        (B)   demonstrate proper use of mathematics concepts in the development of products or services; and

        (C)   demonstrate proper use of science principles in the development of products or services.

    (4)   The student selects an approach for conducting research to discover a problem in the field of IT with the appropriate supervision and guidance. The student is expected to:

        (A)   identify a problem relating to information technology; and

        (B)   describe and use an approach such as top-down or bottom-up for conducting a research activity.

(5)   The student creates a technological solution for a problem in the field of IT. The student is expected to:

   (A)   apply critical-thinking strategies to develop a solution using appropriate technologies and resources, IT concepts, and industry standards;

   (B)   apply decision-making techniques to the selection of technological solutions; and

   (C)   explain how the proposed technological solution will resolve the problem.

(6)   The student designs, creates, and implements a product or service that addresses a problem in the field of IT and incorporates the solution. The student is expected to:

   (A)   work closely with a mentor throughout the design, creation, and implementation process;

   (B)   develop a product or service that meets a specified need following a problem-solving strategy;

   (C)   identify areas where quality, reliability, and safety can be designed into a product or service;

   (D)   develop and implement a security management plan to address security requirements;

   (E)   develop a sustainability plan for the product or service;

   (F)   develop an evaluation method for analyzing the effect of the product or service on client satisfaction and problem resolution;

   (G)   develop a project portfolio that documents the research and development process; and

   (H)   present the portfolio to a panel of professionals using formal presentation skills.

(7)   The student creates a personal portfolio. The student is expected to:

   (A)   create a portfolio that documents all projects and accomplishments such as academics, volunteer experience, employment experience, awards, and certifications;

   (B)   organize and prioritize information within the portfolio; and

   (C)   use written, verbal, and visual communication techniques consistent with IT industry standards.