Information Technology Foundations

Primary Career Cluster:	Information Technology (IT)
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code:	6095
Prerequisite(s):	None
Credit:	1 credit for core and two focus areas. 2 credits for all 28 standards.
Grade Level:	9
Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other IT courses.
Programs of Study and Sequence:	This is the first course in the *Networking Systems, Programming and Software Development,* and *Web Design* programs of study.
Necessary Equipment:	Refer to the Teacher Resource page.
Aligned Student Organization(s):	Future Business Leaders of America (FBLA) www.fblatn.org Sarah Williams, (615) 532-2829, Sarah.G.Williams@tn.gov Skills USA: http://www.tnskillsusa.com Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, he or she can offer appropriate placement. To learn more, please visit: http://www.tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	None
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	311, 435, 436, 475, 476, 582, 595
Required Teacher Certifications/Training:	CompTIA A+ OR CompTIA Network+ OR CISCO Industry certification
Teacher Resources:	http://www.tn.gov/education/cte/InformationTechnology.shtml

Course Description

Information Technology Foundations (ITF) is a course intended to provide students with exposure to various information technology occupations and pathways such as Networking Systems, Programming and Software Development, and Web Design. As a result, students will complete all core standards, as well as standards in two of three focus areas. Proficient students will be able to describe various information technology (IT) occupations and professional organizations. Moreover, they will be able to demonstrate logical thought processes and discuss the social, legal, and ethical issues encountered in the IT profession. Depending on the focus area, proficient students will also demonstrate an understanding of electronics and basic digital theory; project management and teamwork; client relations; causes and prevention of Internet security breaches; and writing styles appropriate for web publication. Upon completion of the ITF course, students will be prepared to make an informed decision about which Information Technology program of study to pursue. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee State Standards in Mathematics.*****

The following implementation options are encouraged:
- 1 credit for core and two focus areas (listed below)
- 2 credits for all 28 standards

Core standards are required for both one and two credit implementation options.
Core standards: 1, 2, 7, 8, 22

Focus Areas	**Standards**
Networking Systems:	3, 4, 5, 6, 10, 12, 15, 24
Programming & Software Development:	16, 26, 27, 28
Web Design:	9, 11, 13, 14, 17, 18, 19, 20, 21, 23 25

Program of Study Application

This is the first course in the *Networking Systems, Programming and Software Development,* and *Web Design* programs of study. For more information on the benefits and requirements of implementing these programs in full, please visit the Information Technology website at http://www.tn.gov/education/cte/InformationTechnology.shtml.

Course Standards

Safety

1) Accurately read and interpret safety rules, including (1) rules published by the National Science Teachers Association (NSTA), (2) rules pertaining to electrical safety, (3) Internet safety, (4) Occupational Safety and Health Administration (OSHA) guidelines, and (5) state and national code requirements. Be able to distinguish between rules and explain why certain rules apply. (TN Reading 3, 4)

2) Identify and explain the intended use of safety equipment available in the classroom. For example, demonstrate how to properly inspect, use, and maintain safe operating procedures with tools and equipment. (TN Reading 3, 4)

Electronics and Basic Digital Theory

3) Demonstrate understanding of electrical circuits and devices, and relate to the physical laws (such as Ohm's Law and power laws) that govern behaviors of electrical circuits and devices. Accurately apply these physical laws to solve problems. For example, calculate the resistance of a DC circuit with a given DC voltage and current. (TN Reading 3, 4; TN Math N-Q, A-CED, A-REI, F-BF)

4) Assemble the required connections of electronic test equipment to properly test the operation of basic electronic circuit behavior and performance, using equipment such as a digital multimeter. For example, demonstrate the proper use of a digital multimeter by measuring resistance of a circuit in a typical computer system; compare this finding by calculating the resistance given the voltage and current. (TN Reading 3; TN Math N-Q)

5) Distinguish between the binary and hexadecimal counting systems. Using appropriate units, provide examples of each system and identify specific instances when IT professionals rely on them. (TN Reading 4; TN Math N-Q, A-CED)

6) Explain the functions of gates in logic circuits (e.g., AND, OR, NOT). For example, construct a truth table for the seatbelt warning light in an automobile. (TN Reading 3, 7; TN Writing 4, 7)

Career Exploration

7) Research various occupations in information technology industries, such as programmers, web designers, webmasters, networking administrators, computer systems administrators, and telecommunications line installers. Compose an informative table or chart that includes the following: work activities typically performed, tools and technology used, nature of work environment, and the knowledge and skills needed for success. (TN Reading 7; TN Writing 2, 4)

8) Explore various professional societies related to information technology and identify the services and benefits provided by each member. Create a table that lists their purposes, benefits to membership, and any certifications affiliated with the organization. For example, investigate the Institute for Electrical and Electronics Engineers (IEEE), Computing Technology Industry Association (CompTIA), and the Association for Computing Machinery (ACM). (TN Reading 1, 7; TN Writing 2, 4)

Overview of the Internet

9) Drawing on multiple sources (i.e., internet, textbooks, videos, and journals), research the history of the Internet. Create a timeline or infographic, illustrating the Internet's historical evolution from its inception to the present time. Discuss the needs that led to the creation of the Internet; discuss both the benefits and disadvantages of the Internet to society, as well as potential implications for the future. Provide examples drawn from the research to support claims. (TN Reading 1, 7; TN Writing 2, 8)

Overview of Operating Systems

10) Drawing on multiple sources (i.e., internet, textbooks, videos, and journals), research the history and development of operating systems (e.g., Microsoft Windows, Linux, UNIX). Create a presentation, illustrating their historical evolution, from their inceptions to the present. Compare and contrast the general capabilities of a variety of operating systems, and explain how their designs and functionalities have improved over time. (TN Reading 1, 7; TN Writing 2, 8)

Terminology and Concepts

11) Demonstrate an understanding of basic web terminology and concepts. Practice explaining these terminologies and concepts by creating methods to help students learn and remember the information. For example, students should be able to explain the purpose of terminology such as server, domain name system (DNS) , internet service provider (ISP), hardware and software connective devices, cloud computing, remote access protocols, map protocols, content management systems (CMS), cascading style sheets (CSS), and social networking terms. (TN Reading 1, 4)

12) Demonstrate a basic understanding of computer hardware components. Identify these components using pictures or actual models and briefly explain the function of each. Components should include, but are not limited to:
    a. Hardware used for input and output
    b. Hardware inside the computer case
    c. Motherboard
    d. Processor and the chipset
    e. Storage devices (e.g., primary, secondary)
    f. Expansion cards
    g. Electrical system
    (TN Reading 1, 4, 7)

Keyboard Shortcuts

13) Identify, explain, and demonstrate the use of common keyboard shortcuts. Create a quick reference guide that would be user-friendly for a novice web designer. For example, students may create a multiple column table showing keyboard shortcuts for navigation, text editing, and text formatting. The table would identify which shortcuts are applicable to using Windows versus Mac OS. (TN Reading 1, 7, 9; TN Writing 4)

Introduction to Logical Thought Process

14) There are different versions of the web design and development process. For example, most versions of the web design and development process involve project definition, site structure, visual design, site development, testing, refining, and launch. Using various resources, research, identify, and explain the steps involved in the process. As a class, develop an agreed-upon framework for applying the logical thought process to web design projects in the form of a flowchart or logic model. Explain why it is an iterative process and always involves refinement. (TN Reading 7; TN Writing 1, 4)

15) Troubleshooting a computer problem is a systematic process that can be performed in various ways. For example, the following steps represent a general problem solving approach: 1) gather information from the user or operator and back up data, 2) verify the problem exists, 3) isolate the cause of the problem and generate alternative solutions, 4) plan a solution and resolve the problem, 5) verify that the problem was resolved and prevent a future occurrence, and 6) document findings, resolution, and preventative maintenance plan. Using various resources, research, identify, and explain the steps involved in the above process. Create a presentation that details the specific activities involved at each step. Explain why it is important to document the process throughout. (TN Reading 7; TN Writing 1, 4)

16) Demonstrate an understanding of flowcharts and know what various symbols mean. Identify a problem that a programmer would solve using the logical thinking process, and create a flowchart that would guide the code development. For example, create a flowchart that incorporates at least three decisions, or paths, to solve a problem. (TN Reading 3, 4, 7; TN Writing 2, 4)

Teamwork & Project Management

17) Explore how teams are formed to complete and manage web design and development projects. Using the information gained from research, identify and explain various roles and responsibilities for members of a web design and development team. Include why teams are more efficient than individuals in the web design and development process. Present the findings to classmates. (TN Reading 7; TN Writing 2, 4, 9)

18) Synthesize common principles and templates for successful project management. Explain, using examples, why strong management skills are important in the web design and development process. (TN Reading 1, 4; TN Writing 1)

Client Relations

19) Research and identify the skills that are required to communicate effectively with a client. Develop a questionnaire that would be used to determine the needs of a client for a prospective web development project. Using the questionnaire, conduct mock client interviews with classmates and provide each other with constructive feedback. (TN Reading 1; TN Writing 4)

Writing and Editing for Web Publication

20) As a team, list primary rules to guide writing content that is appropriate for a web site publication. Apply these rules to a variety of web-based writing assignments throughout the course. For example, develop and maintain a blog throughout the course to practice appropriate writing techniques and style for web publication. (TN Reading 1, 3; TN Writing 4, 5)

21) Given a specific client's vision, create a simple web site using a content management system (CMS) such as WordPress. Follow the multistep process to download the software application of choice, and demonstrate how to upload and store files. Practice proofreading and critiquing other classmates' sites, and provide constructive feedback on one another's writing and layout design. (TN Reading 3; TN Writing 4, 5, 6)

Social, Legal, and Ethical Issues

22) Drawing on multiple sources (i.e., internet, textbooks, videos, and journals), research the various social, legal, and ethical issues encountered by IT professionals. Using these findings, identify the roles and responsibilities one must consider while developing a prospective project or addressing an IT problem. For example, web developers and programmers must apply copyright laws understand uses of open source software. (TN Reading 1, 4)

Security

23) Demonstrate an understanding of the various security breaches that can occur with the Internet. Prepare a text explaining enterprise-level security, the purpose of encryption, and the protocols that can be implemented to secure web sites. Evaluate personal privacy issues versus employers' rights to regulate computing resources. (TN Reading 2, 4, 5; TN Writing 2, 4)

24) Identify various security practices for computer and network systems, such as how to control access to secured resources and computer resources. Give specific examples of methods that an administrator can use, like encryption techniques, basic input/output system (BIOS) features, and strategies for dealing with malware. (TN Reading 1, 4)

Organization of Materials

25) Understand and demonstrate the effective use of file and folder management techniques to maintain directory structure for a web site. Describe the most efficient methods for digital file management, including the use of site root and subfolders for assets (e.g., images, templates, CSS). (TN Reading 3, 4)

Programming

26) Explore and identify various languages, such as Python, HTML, PHP, C++, Visual Basic, Java, JavaScript, and C#. Explain how programmers use these languages to solve a variety of IT problems, furnishing examples of how they are applied. (TN Reading 1, 4, 7)

27) There are different versions of the software development life cycle. For example, in most versions the process involves planning, designing, coding, testing, deployment, and maintenance. Using various resources, research, identify, and explain the steps involved in the process. Create a presentation that details the specific activities involved at each step of the process. Explain why it is an iterative process and always involves refinement. (TN Reading 6, 7; TN Writing 1, 4)

28) Demonstrate an understanding of how batch files function within a programming environment. Identify common commands to create code for batch files (e.g., title, echo, echo off, pause, CLS, ipconfig, and ping). For example, list various scenarios for using batch files to complete specific programming tasks. Create and execute batch file code to perform one of the tasks identified. (TN Reading 3, 4, 8)

Standards Alignment Notes

*References to other standards include:
- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects;]() Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
    http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf
- TN Math: [Tennessee State Standards for Mathematics](); Math Standards for High School: Number and Quantity, Algebra, Functions (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project-based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, algebraic, and functional reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning]()
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

Programming & Software Development Practicum

Primary Career Cluster:	Information Technology (IT)
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code(s):	TBD
Prerequisite(s):	*Algebra I* (3012), *Information Technology Foundations* (6095), and *Programming & Logic I* (6098), *Programming & Logic II* (6099)
Credit:	1
Grade Level:	11-12
Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Information Technology courses.
Programs of Study and Sequence:	This is the capstone course in the *Programming & Software Development* program of study.
Necessary Equipment:	Computer laboratory
Aligned Student Organization(s):	Skills USA: whttp://www.tnskillsusa.com Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, appropriate student placement can be offered. To learn more, visit http://tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	TBD
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	037, 041, 055, 056, 057, 203, 204, 311, 434, 435, 436, 474, 475, 476, 595, 742
Required Teacher Certifications/Training:	Refer to the Correlation of Course Codes document.
Teacher Resources:	http://www.tn.gov/education/cte/InformationTechnology.shtml

Course Description

Programming & Software Development Practicum is a capstone course intended to provide students with the opportunity to apply the skills and knowledge learned in previous *Programming & Software Development* courses toward the completion of an in-depth project with fellow team members. Students who have progressed to this level in the program of study take on more responsibilities for producing independent work and managing processes involved in the planning, designing, refinement, and production of original software applications. The course is designed to allow students to choose their specific application of interest, be it the development of a mobile app, an animation package, a game or other educational tool, or any other approved program that requires coding and development skills. Upon completion of the practicum, proficient students will be prepared for postsecondary study and career advancement in programming and software development, and will be equipped to market their finished product should they choose. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee State Standards in Mathematics.**

Note: Practicum activities may take the form of work-based learning opportunities (such as internships, cooperative education, service learning, and job shadowing) or industry-driven project-based learning. As such, this course must be taught by a teacher with an active WBL Certificate issued by the Tennessee Department of Education and follow policies outlined in the Work-Based Learning Policy Guide available online at http://www.tn.gov/education/cte/work_based_learning.shtml.

Program of Study Application

This is the fourth course in the *Programming & Software Development* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Information Technology website at http://www.tn.gov/education/cte/InformationTechnology.shtml.

Course Standards

Programming & Software Development Career Planning

1) Research a company or organization that employs computer programmers or specializes in software design and development solutions. Companies could range from large software developers, to niche organizations that retain programmers on staff to serve their particular clients' needs. For the chosen company, cite specific textual evidence from the company's literature, as well as available press coverage (if available) to summarize:
   a. The mission and history of the organization
   b. Headquarters and organizational structure
   c. Products or services provided
   d. Credentials required for employment and how they are obtained and maintained
   e. Policies and procedures
   f. Reports, newsletters, and other documents published by the organization
   g. Website and contact information
   (TN Reading 1, 2; TN Writing 7)

2) Analyze the requirements and qualifications for various programming and development job postings identified from specific company websites or online metasearch engines. Gather

information from multiple sources, such as sample resumes, interviews with professionals, and job boards, to determine effective strategies for realizing career goals. Create a personal resume modeled after elements based on the findings above, then complete an authentic job application as part of a career search or work-based learning experience. (TN Reading 4, 9; TN Writing 4, 7, 8)

3) Participate in a mock interview. Prior to the interview, prepare a paper that includes the following: tips on dress and grooming, most commonly asked interview questions, appropriate conduct during an interview, and recommended follow-up procedures. Upon completion of the interview, write a thank you letter to the interviewer in a written or email format. (TN Reading 2; TN Writing 2, 4, 7, 9)

Professional Ethics and Legal Responsibilities

4) Investigate current issues surrounding the use of software applications to collect and track user data. Explore a range of arguments concerning privacy rights as they relate to the mining of personal data; determine when it is ethical and legal to collect data for profit versus for security purposes. Advance an original argument that debates the pros and cons and summarizes the potential ramifications for clients, users, the public, and one's own personal reputation, drawing on evidence gathered from news media, company policies, and state and federal laws. (TN Reading 1, 2, 4, 8, 9; TN Writing 1, 4, 6, 7)

5) Research a case study involving an ethical issue related to intellectual property rights. Examine a variety of perspectives surrounding the issue, then develop an original analysis explaining the impact of the issue on those involved, using persuasive language and citing evidence from the research. Potential issues include copyright infringement, piracy, plagiarism, art licensing, creative commons, and the state/federal laws that govern them. (TN Reading 1, 2; TN Writing 1, 4, 6, 7)

Course Project

6) In teams, develop a written proposal for an original program or software application that involves advanced refinement and transfer of skills and knowledge acquired in previous *Programming & Software Development* courses. The proposal should be narrative in nature but supplemented by relevant data and graphic illustrations as needed, such as flowcharts of development processes and diagrams or sketches of what the end product would resemble. Sample projects include: developing a mobile app; designing an animation package or plug-in; writing an original game program; or any other programming-based project as approved by the instructor. Present the proposal to the class, and continually revise based on feedback from peers. (TN Reading 3, 7, 9; TN Writing 4, 5, 6, 7)

7) Throughout the design and development process, develop supplementary documents, presentations, and strategies to support the production and promotion of the program, app, or product. Identify the target market for the product, and devise a tentative plan to inform, promote, and convince prospective users of the product's functions and value. Research marketing plan templates and sample presentations, and synthesize information to produce an original plan outlining how the team intends to market the product once it is finished. (TN Reading 3, 7, 9; TN Writing 4, 5, 6, 7)

8) Apply coding skills learned in previous courses to novel contexts and development environments. For example, develop skills in an emerging technology that would support the completion of the course project, or learn a new programming language not previously studied in order to enhance the functionality of the product. (TN Writing 6, 7)

Advanced Troubleshooting, Critiquing, & Problem Solving

9) In the course of developing the project, regularly test for functionality, compatibility, and other design aspects related to user friendliness. Conduct and document the proper code validation to resolve errors encountered in the design process. (TN Reading 3, 8; TN Writing 6, 7)

10) Analyze the code written by another team member or peer and create a flowchart for suggesting changes to improve functionality. Cite specific examples in the code to support recommendations. (TN Reading 1, 2, 3, 4, 5, 6, 7, 8; TN Writing 1, 4, 6)

11) Research and test for potential security threats related to the intended uses of the app, program, or product. For example, if a mobile app is developed, determine the most common security threats and identify areas of vulnerability in the product that could be remedied by adjusting for the proper code, patching, or system update. If possible, develop and incorporate security measures into the final product to ensure user safety. (TN Reading 2, 4)

Portfolio

12) Create a portfolio, or similar collection of work, that illustrates mastery of skills and knowledge outlined in the previous courses and applied in the practicum. The portfolio should reflect thoughtful assessment and evaluation of the progression of work involving the application of steps of the design process, as outlined by the instructor. The following documents will reside in the student's portfolio:
    a. Personal code of ethics
    b. Career and professional development plan
    c. Resume
    d. Project proposal with supporting documents
    e. List of responsibilities undertaken through the course
    f. Examples of visual materials developed and used during the course (such as drawings, models, presentation slides, videos, and demonstrations)
    g. Marketing plan
    h. Description of technology used, with examples if appropriate
    i. Periodic journal entries reflecting on tasks and activities
    j. Feedback from instructor and/or supervisor based on observations
    (TN Reading 7; TN Writing 4)

Communication of Project Results

13) Produce technical reports highlighting the purpose, content, and use of the app, program, and product developed for this course. Cite evidence from multiple authoritative sources in order to justify design and development decisions and maximize the user experience. Incorporate

supporting graphics, sketches, and data as needed to summarize the technical specifications of the product. (TN Reading 1, 2, 3, 4, 5, 7, 8, 9; TN Writing 1, 5, 6, 7, 8, 9)

14) Upon completion of the practicum, develop a technology-enhanced presentation showcasing highlights, challenges, and lessons learned from the experience. The presentation should be delivered orally, but supported by relevant graphic illustrations, such as diagrams, flowcharts, and/or market data on the target users. Prepare the presentation in a format that could be presented to both a technical and a non-technical audience, as well as for a career and technical student organization (CTSO) competitive event. (TN Reading 1, 3, 7, 9; TN Writing 2, 4, 5, 6, 9)

Standards Alignment Notes

*References to other standards include:
- TN Reading: Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - o Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - o Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- P21: Partnership for 21st Century Skills Framework for 21st Century Learning
  - o Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

Computer Systems

Primary Career Cluster:	Information Technology (IT)
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code:	6094
Prerequisite(s):	*Information Technology Foundations (6095), Algebra I (3102)*
Credit:	1
Grade Level:	10-11
Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other IT courses.
Programs of Study and Sequence:	This is the second course in the *Networking Systems* program of study.
Necessary Equipment:	Refer to the Teacher Resource page.
Aligned Student Organization(s):	Skills USA: http://www.tnskillsusa.com Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (6150 532-6270, Amanda Hodges@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, he or she can offer appropriate placement. To learn more, please visit: http://www.tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	CompTIA A+
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	311, 435, 436, 475, 476, 582, 595 and CompTIA A+ or CISCO Industry Certification
Required Teacher Certifications/Training:	See above
Teacher Resources:	http://www.tn.gov/education/cte/InformationTechnology.shtml

Course Description

Computer Systems is an intermediate course designed to prepare students with work-related skills and aligned certification in the information technology industry. Content provides students the opportunity to acquire knowledge in both theory and practical applications pertaining to hardware, operating

systems, safe mode, command prompt, security, networking, printers, peripheral devices, laptops, mobile devices, troubleshooting, and customer service management. Upon completion of the course, proficient students will have acquired skills and knowledge to install, configure, and maintain computer systems. Students who are proficient in this course will be eligible to pursue the IT industry-standard credential, CompTIA's A+ certification. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects.**

Program of Study Application

This is the second course in the *Networking Systems* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Information Technology website at http://www.tn.gov/education/cte/InformationTechnology.shtml.

Course Standards

Safety

1) Accurately read and interpret safety rules, including rules published by the (1) National Science Teachers Association (NSTA), (2) rules pertaining to electrical safety, (3) Internet safety, (4) Occupational Safety and Health Administration (OSHA) guidelines, and (5) state and national code requirements. Be able to distinguish between rules and explain why certain rules apply. (TN Reading 3, 4)

2) Identify and explain the intended use of safety equipment available in the classroom. For example, demonstrate how to properly inspect, use, and maintain safe operating procedures with tools and equipment. (TN Reading 3, 4)

Career Exploration

3) Explore the types of technical certifications recognized in the IT industry. Write a brief paper that distinguishes between vendor neutral and vendor specific certifications, providing examples of each. Explain why earning technical certification is advantageous to IT professionals. Cite evidence from technical literature and industry standards to support claims. (TN Reading 2, 4; TN Writing 2, 4)

4) Locate and access the Computer Technology Industry Association (CompTIA) website and analyze its structure, policies, and requirements for CompTIA A+ certification. Identify what steps are required to obtain the certification, and explain how to prepare for the examination. (TN Reading 2, 3, 4)

Hardware

5) Research the following storage devices and backup media. Create a table or other graphic organizer that lists examples of each device and details their purpose, characteristics, and proper maintenance. Demonstrate proper installation and configuration of each device while using the appropriate media.
    a. Optical drives
    b. Combo drives and burners

c.   Connection types
    d.   Hard drives
    e.   Solid state / flash drives
    f.   RAID types
    g.   Floppy drive
    h.   Tape drive
    i.   Media capacity
(TN Reading 2, 4, 8; TN Writing 2, 4)

6) Identify and explain the following motherboard components. Citing specific examples, write a brief paper differentiating between the components and describing the purpose, properties, and characteristics of each.
    a.   Expansion slots
    b.   RAM slots
    c.   CPU sockets
    d.   Chipsets
    e.   Jumpers
    f.   Power connections and types
    g.   Fan connectors
    h.   Front panel connectors
    i.   Bus speeds
(TN Reading 2, 4; TN Writing 2, 4)

7) Given an assignment with defined hardware specifications, identify the appropriate power supply. Noting the following technical components, write a text explaining the various types of power supply that were considered. Citing specific evidence, explain the characteristics of each and how the final selection was determined. Install the appropriate power supply.
    a.   Connector types and their voltages
    b.   Specifications (e.g., wattage, size, number of connectors, etc.)
    c.   Dual voltage options
(TN Reading 2, 3, 4; TN Writing 1, 4)

8) Explore various types of central processing units (CPU). In a group discussion with classmates, describe the following characteristics of the CPU types. Identify appropriate cooling methods (e.g., heat sink, fans, thermal paste, liquid-based) for each type discussed and justify the selection with supporting evidence.
    a.   Speeds
    b.   Cores
    c.   Cache size/type
    d.   Hyperthreading
    e.   Virtualization support
    f.   Architecture (32-bit vs 64-bit)
    g.   Integrated GPU
(TN Reading 2, 4; TN Writing 1, 4)

9) Investigate the following memory types. Create a table or other graphic organizer that describes, compares, and contrasts each type. Explain the memory compatibility and speed, as

well as the appropriate application of each memory type. Cite evidence supporting each application prescribed.
   a. DDR
   b. DDR2
   c. DDR3
   d. SDRAM
   e. SODIMM
   f. RAMBUS
   g. DIMM
   h. Parity vs. non-parity
   i. ECC vs. non ECC
   j. RAM configurations
   k. Single sided vs. double sided
(TN Reading 2, 4, 7; TN Writing 4)

Operating Systems

10) Research the features and requirements of Microsoft operating systems. Write a brief paper that compares and contrasts the operating systems. Drawing on multiple resources, explain why it is important to know this information when installing and configuring an operating system. (TN Reading 3, 4, 5; TN Writing 2, 4)

11) Identify and explain various alternatives to install and configure an operating system. For a given assignment, install and configure an operating system by selecting the most appropriate method. Upon completion of the work, write an explanation and justify the actions by citing supporting evidence from technical manuals and industry standards. The explanation should include, but is not limited to, information on the following:
   a. Boot methods (e.g., USB, CD-ROM, DVD, PXE)
   b. Type of installations (e.g., creating image, unattended installation, upgrade, multiboot, etc.)
   c. Partitioning (e.g., dynamic, basic, primary, extended, logical)
   d. File system types/formatting (e.g., FAT, FAT32, NTFS, CDFS, quick format vs. full format)
   e. Loading alternate third party drivers
   f. Workgroup vs. Domain group
   g. Driver installation
   h. Factory recovery partition
(TN Reading 2, 3, 4; TN Writing 2, 4)

12) Demonstrate an understanding of how to apply the following command line tools to identify problems with networking and operating systems. For a given assignment, follow the multistep process to execute an appropriate command and justify why it was selected to perform a specific action.
   a. Networking (e.g., PING, TRACERT, NETSTAT, IPCONFIG, NET, NSLOOKUP, NBTSTAT)
   b. Operating system (e.g., TASKKILL, BOOTREC, SHUTDOWN, TASKLIST, MD, RD, CD, DEL, FORMAT, COPY, XCOPY, ROBOCOPY, DISKPART, SFC, CHKDSK)
(TN Reading 2, 3, 4; TN Writing 4)

13) Demonstrate the proper selection and use of the following operating system features and tools. For a given assignment, explain the selection of the tools and the results.
   a. Administrative (e.g., local security policy, Windows firewall, performance monitor, etc.)
   b. MSCONFIG (e.g., general, boot, services, startup, and tools)
   c. Task Manager (e.g., applications, processes, performance, networking, users)
   d. Disk management (e.g., drive status, mounting, extending partitions, splitting, adding drives, adding arrays, etc.)
   e. Command line utilities (e.g., MSCONFIG, REGEDIT, CMD, SERVICES.MSC, MMC, MSTSC, NOTEPAD, EXPLORER, MSINFO32, DXDIAG)
   (TN Reading 2, 3, 4)

14) Demonstrate the proper application of the following control panel utilities that are common to all Microsoft operating systems, as well as those specific to unique Windows operating systems. Write a text describing the utilities and explain the results of the various applications.
   a. Internet options (e.g., connections, security, general, privacy, programs, advanced)
   b. Display/Display settings
   c. User accounts
   d. Folder options (e.g., view hidden files, hide extensions, general options, view options)
   e. System (e.g., performance, remote settings, system protection)
   f. Windows firewall
   g. Power options (e.g., hibernate, power plans, sleep/suspend, standby)
   (TN Reading 2, 3, 4; TN Writing 2, 4)

15) Identify and describe the differences among the following basic operating system security settings. Write a brief paper that discusses when each setting is most applicable. Provide specific examples to support the claims.
   a. User and groups (e.g., administrator, power user, guest, standard user)
   b. NTFS vs. share permissions (e.g., allow vs. deny, moving vs. copying file folders and files, file attributes)
   c. Shared files and folders (e.g., administrative vs. local folders, permission propagation, inheritance)
   d. System files and folders
   e. User authentication (e.g., single sign-on)
   (TN Reading 2, 3, 4; TN Writing 1, 4)

Safe Mode and Command Prompt

16) Demonstrate an understanding and application of safe mode versus the command prompt. Describe specific scenarios when the safe mode should be used to solve a problem, as well as provide specific examples of the types of tasks that can be completed using the command prompt. Also, describe when the safe mode should be used with the command prompt. For example, safe mode can be used to solve problems with corrupted and/or malicious applications. (TN Reading 2, 3, 4)

Preventative Maintenance Procedures

17) Create and execute a plan for preventative maintenance for a computer system. The plan should include a schedule and description of the following procedures. Write a justification that explains to a client why preventative maintenance is important.
   a. Backup
   b. Check disk
   c. Defragmentation
   d. Windows updates
   e. Patch management
   f. Driver/firmware updates
   g. Antivirus updates
   (TN Reading 2, 3, 4; TN Writing 1, 4)

Security

18) Research and describe the most common security threats to computer systems, such as social engineering, malware, phishing, viruses, etc. Investigate and distinguish among the following common prevention methods to secure a computer system. For a given scenario, identify the most applicable best practice to secure a workstation as well as describe methods for data destruction and disposal. Implement these practices and write a justification for each scenario solution. Provide supporting evidence for each solution, drawing on technical texts and industry standards. Prevention methods include:
   a. Physical security (e.g., lock doors, tailgating, biometrics, badges, key fobs, retinal, etc.)
   b. Digital security (e.g., antivirus, firewalls, antispyware, user authentication, etc.)
   c. User education
   d. Principles of least privilege
   (TN Reading 2, 4; TN Writing 1, 4, 6)

Networking

19) Identify and describe the following fundamental principles of a small office / home office (SOHO) network (wireless and wired router).
   a. MAC filtering
   b. Channels (1 -11)
   c. Port forwarding, port triggering
   d. SSID broadcase (on/off)
   e. Wireless encryption
   f. Firewall
   g. DHCP (on/off)
   h. DMZ
   Create and execute a plan to configure, install, and upgrade a SOHO network. Upon completion of the work, write an explanation and justify the actions by citing supporting evidence from technical manuals and industry standards. (TN Reading 2, 3, 4; TN Writing 1, 4, 8, 9)

20) Given scenarios for both wired and wireless small office home office (SOHO) networks, develop and execute an appropriate plan to secure the network. The plan should address, but is not limited, to the following:
   a. Wireless network
      • Change default user-names and passwords

- Changing SSID
- Setting encryption
- Disabling SSID broadcast
- Enable MAC filtering
- Antenna access point placement
- Radio power levels
- Assign static IP addresses

   b. Wired network
- Change default usernames and passwords
- Enable MAC filtering
- Assign static IP addresses
- Disabling ports
- Physical security

Justify the plan with evidence supported by technical literature and industry standards. (TN Reading 2, 3, 4)

Servers

21) Create a document that explains the purpose and components of a server. Include descriptions of the various types of servers (e.g., file, email, web, etc.) and the hardware specifications required to support each type. Using multiple resources, cite evidence to support the information identified and discussed. For example, a file server used in a home office will not require as much RAM (random access memory) as one that supports a large office building. (TN Reading 2, 4, 7; TN Writing 2, 4)

Printers and Peripheral Devices

22) Explore and distinguish among the following printer types. Briefly describe their similarities and differences, as well as the imaging process required for applicable printer types. Explain why it is important to know this information when installing and configuring printers.
   a. Laser
   b. Inkjet
   c. Thermal
   d. Impact
   (TN Reading 2, 3, 4)

23) For a given assignment, write and execute a plan to install, configure, and maintain a printer that is most appropriate for each of the following example situations. Explain and justify the selection with supporting evidence from technical manuals and computer systems texts.
   a. Installing and configuring onto a specific operating system
   b. Print device sharing (e.g., wired, wireless, printer hardware print server)
   c. Printer sharing (e.g., via operating system settings)
   (TN Reading 2, 3, 4; TN Writing 1, 4, 7)

24) Distinguish among and describe the following peripheral devices commonly found in computer systems. Install and configure these devices conforming to technical manuals and industry standards.

a. Input devices (e.g., mouse, keyboard, touch screen, scanner, barcode reader, etc.)
b. Multimedia devices (e.g., digital cameras, microphone, webcam, camcorder, MIDI enabled devices)
c. Output devices (e.g., printers, speakers, display devices)
(TN Reading 2, 3, 4, 7)

Laptops

25) Identify and explain the following laptop components. Citing specific examples, write a brief paper differentiating between the components and describing the purpose, properties, characteristics, and proper maintenance of each. Demonstrate proper installation and configuration of each component. For example, replace an optical drive in a laptop.

a. Expansion options (e.g., express card, PCMIA, SODIMM, flash)
b. Keyboard
c. Hard drive
d. Memory
e. Optical drive
f. Wireless card
g. Mini-PCIe
h. Screen
i. DC jack
j. Battery
k. Touchpad
l. Plastics
m. Speaker
n. System board
o. CPU

(TN Reading 2, 4; TN Writing 2, 4)

26) Compare and contrast the following components within the display of a laptop and the laptop features. Citing specific examples, write a brief paper differentiating between the components and describing the purpose and characteristics of each. Demonstrate the execution of the features. For example, turn on the keyboard back light.

a. Components:
- Types (e.g., LCD, LED, OLED, plasma)
- Wi-Fi antenna connector/placement
- Inverter
- Backlight
b. Features
- Special key functions
- Docking station vs. port replicator
- Physical laptop lock and cable lock

(TN Reading 4; TN Writing 2, 4)

Mobile Devices

27) Explore the following basic features of mobile operating systems. Write a brief paper that compares and contrasts these systems on the following features. Drawing on multiple resources, explain why it is important to know this information when installing and configuring an operating system.

a. Open source vs. closed source/vendor specific
b. App source (app store and market)
c. Screen orientation (accelerometer/gyroscope)
d. Screen calibration

e. GPS and geotracking
(TN Reading 4, 7; TN Writing 2, 4)

28) Research and describe the most common security threats related to mobile devices. Investigate and distinguish among the following common prevention methods to secure a mobile device.
   a. Passcode locks
   b. Remote wipes
   c. Locator applications
   d. Remote backup applications
   e. Failed login attempts restrictions
   f. Antivirus
   g. Patching/OS updates
(TN Reading 2, 4)

Troubleshooting

29) Investigate a simple problem and create a flowchart, or other graphic illustration, that explains the following steps representing a general troubleshooting theory.
   a. Gather information from the user or operator and back up data
   b. Verify the problem exists
   c. Isolate the cause of the problem and generate alternative solutions
   d. Plan a solution and resolve the problem
   e. Verify that the problem was resolved and prevent a future occurrence
   f. Document findings, resolution, and preventative maintenance plan
   Compare and contrast the findings, resolution, and maintenance plan with those of other classmates. Provide supporting evidence for any selections that differ from classmates, and work together to come to a consensus on a resolution. (TN Reading 2, 3, 4; TN Writing 1, 4)

30) Given a problem related to the following components, follow the troubleshooting theory using appropriate tools. Identify the problem and document the findings and resolution. Include an explanation of the common symptoms, diagnostic procedures, and specific tools used that led to the problem resolution.
   a. Motherboards, RAM, CPU, and power
   b. Hard drives and RAID arrays
   c. Video and display
   d. Wired and wireless networks
   e. Client-side network connectivity
   f. Operating systems
   g. Security issues
   h. Laptops
   i. Printers
(TN Reading 3, 4, 9; TN Writing 1, 4)

Customer Service and Client Relations

31) Compare and contrast the processes of servicing customers on the phone, online, on-site, or in a shop. Based on the findings, write a brief description of how to service a customer in each of these situations. Include the following in the description:

a. Identify questions that a customer should be asked to identify his/her problem
b. Approaches to dealing with difficult customers
c. When it is appropriate to escalate a problem to a senior support team member
d. How to document the services provided
(TN Reading 2, 3, 4, 6; TN Writing 2, 4)

Standards Alignment Notes

*References to other standards include:
- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning]()
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

Networking

Primary Career Cluster:	Information Technology (IT)
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code:	6097
Prerequisite(s):	*Information Technology Foundations (6095), Computer Systems (6094), Algebra I (3102)*
Credit:	1
Grade Level:	11-12
Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other IT courses.
Programs of Study and Sequence:	This is the third course in the *Networking Systems* program of study.
Necessary Equipment:	Refer to the Teacher Resource page.
Aligned Student Organization(s):	Skills USA: http://www.tnskillsusa.com Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, he or she can offer appropriate placement. To learn more, please visit: http://www.tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	CompTIA Network+
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	311, 435, 436, 475, 476, 582, 595 and CompTIA A+ or CompTIA Network+ or CISCO Industry Certification
Required Teacher Certifications/Training:	See above
Teacher Resources:	http://www.tn.gov/education/cte/InformationTechnology.shtml

Course Description

Networking is an advanced course designed to emphasize the conceptual and practical skills necessary to design, manage, and diagnose network hardware and software. Proficient students will identify types

of networks, understand the layers of the open systems interconnection (OSI) model, prevent security risks, and apply troubleshooting theory to the successful execution of networking tasks. Course content covers transmission control protocol, internet protocol, wired and wireless topologies, switching and routing, network hardware, wireless networking, and network operating systems (NOS). Upon completion of this course, proficient students will be prepared to sit for the CompTIA Network+ exam. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee State Standards in Mathematics.**

Program of Study Application

This is the third course in the *Networking Systems* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Information Technology website at http://www.tn.gov/education/cte/InformationTechnology.shtml.

Course Standards

Safety

1) Accurately read and interpret safety rules, including but not limited to rules published by the National Science Teachers Association (NSTA), rules pertaining to electrical safety, Internet safety, Occupational Safety and Health Administration (OSHA) guidelines, and state and national code requirements. Be able to distinguish between rules and explain why certain rules apply. Complete safety test with 100 percent accuracy. (TN Reading 3, 4)

2) Identify and explain the intended use of safety equipment available in the classroom. For example, demonstrate how to properly inspect, use, and maintain safe operating procedures with tools and equipment. (TN Reading 3, 4)

Career Exploration

3) Locate and access the Computer Technology Industry Association (CompTIA) website and analyze its structure, policies, and requirements for CompTIA Network+ certification. Explain what steps are required to obtain the certification, methods to prepare for the examination, and how it can be a stepping stone to more advanced certifications. (TN Reading 2, 3, 4)

4) Research the following networking standards organizations and write an informative paper explaining the industry standards that are managed by each. Describe why these standards are important and how they influence the work of a network administrator or other IT professional.
   a. American National Standards Institute
   b. Electronic Industries Alliance and Telecommunications Industry Association
   c. Institute of Electrical and Electronics Engineers
   d. International Organization for Standardization
   e. International Telecommunication Union
   f. Internet Society
   g. Internet Assigned Numbers Authority
   h. Internet Corporation for Assigned Names and Numbers
   (TN Reading 2, 4; TN Writing 2, 4, 7)

Types of Networks

5) In teams, define a network. Using graphic illustrations, or other diagrams, identify and describe the following types of networks. Outline the features that distinguish each network from the others.
   a. Peer-to-peer networks
   b. Client/server networks
   c. Local area networks (LAN)
   d. Metropolitan area networks (MAN)
   e. Wide area networks (WAN)
   (TN Reading 1, 4; TN Writing 2, 4)

6) Drawing on multiple sources, deliver a team presentation that defines the following functions provided by a network. Distinguish between these network services in a large office versus an office with few users, providing specific examples.
   a. File and print services
   b. Access services
   c. Communication services
   d. Internet services
   e. Management services
   (TN Reading 2, 3, 4; TN Writing 4, 8)

Open Systems Interconnection Model (OSI) Model

7) Create and use diagrams to explain the Open Systems Interconnection (OSI) Model and the flow of data through it. Define the functions and identify the associated hardware components of the OSI Model's following seven layers. For example, explain how each layer interacts to ensure that data arrives in the correct place without errors.
   a. Application
   b. Presentation
   c. Session
   d. Transport
   e. Network
   f. Data Link
   g. Physical
   (TN Reading 2, 3, 4, 5, 7; TN Writing 2, 4)

Data Transmission

8) Develop a chart identifying and describing a range of standard cable types (e.g., coaxial cable, shielded twisted pair, unshielded twisted pair, single-mode fiber, multimode fiber, serial, plenum, and non-plenum). Explain why it is necessary to consider the following properties when selecting and installing the appropriate cables for a networking task, and why these decisions must conform to industry standards.
   a. Transmission speeds
   b. Distance

   c. Duplex
   d. Noise immunity (e.g., security, electromagnetic interference (EMI))
   e. Frequency
  (TN Reading 2, 3, 4, 7; TN Writing 2, 4)

Transmission Control Protocol (TCP)/Internet Protocol (IP)

9) Research and identify the common subprotocols associated with transmission control protocol (TCP) and internet protocol. Using a combination of text and graphic illustrations, explain their functions and how they correlate to the layers of the open systems connection (OSI) model. Examples of subprotocols include, but are not limited to: hypertext transfer protocol (HTTP), user diagram protocol (UDP), internet control message protocol (ICMP), internet group management protocol (IGMP), address resolution protocol (ARP), domain name system (DNS), network time protocol (NTP), file transfer protocol (FTP), and trivial file transfer protocol (TFTP). (TN Reading 2, 3, 4, 5, 9; TN Writing 2, 4)

10) Describe the following address formats: IPv6, IPv4, and MAC. Using the advantages and disadvantages as supporting evidence, identify and explain the application of each format. (TN Reading 2, 4)

Topologies

11) In a group discussion with classmates, define each of the following physical network topologies, and draw diagrams to distinguish among the layouts. Include examples of the most effective applications, as well as identify the advantages and disadvantages of each topology.
   a. Star
   b. Mesh
   c. Bus
   d. Ring
   e. Point to point
   f. Point to multipoint
   g. Hybrid
  (TN Reading 2, 3, 4; TN Writing 2, 4)

12) Compare and contrast logical network topologies to physical network topologies. Explain how these two types of topologies differ. Identify the common logical network topologies and describe their characteristics. Provide examples demonstrating how logical network topologies are useful in troubleshooting. (TN Reading 2, 3, 4, 9)

Switching and Routing

13) Define switching and detail the role that it occupies in a logical network topology. Describe the following three methods of switching with another classmate. Identify the specific details that distinguish how each method establishes paths between nodes.
   a. Circuit
   b. Message
   c. Packet
  (TN Reading 2, 4)

14) Define routing and explain why a router is protocol dependent. Create a presentation that identifies a router's properties and explains its basic functions. Drawing on multiple resources, include examples of various types of routers in the presentation. (TN Reading 2, 4, 7; TN Writing 2, 4, 8)

15) Write descriptive text that outlines the process used to determine the most efficient path (e.g., route) for data to flow across a network. Identify and describe that variables the influence the best path, including the following most common routing protocols.
    a. Link-state (e.g., open shortest path first (OSPF), intermediate system to intermediate system (IS-IS))
    b. Distance-vector (e.g., routing information protocol (RIP), routing information protocol version 2 (RIPv2), border gateway protocol (BGP))
    c. Hybrid (e.g., enhanced interior gateway routing protocol (EIGRP))
    (TN Reading 2, 3, 4; TN Writing 1, 4)

Network Hardware

16) Research the following types of network interface cards (NICs). Create a table or other graphic organizer that lists examples and characteristics of NICs, as well as steps to selecting the appropriate NIC. Demonstrate proper installation and configuration of each device, attending to appropriate measurements and units. Verbally summarize the multistep procedure to install and configure the various NICs.
    a. Internally attached (internal bus standards)
    b. Externally attached (peripheral bus standards)
    c. On-board
    d. Wireless
    (TN Reading 2, 3, 4, 5; TN Writing 2, 4, 6; TN Math N-Q)

17) Define a repeater and explain its limitations. Describe the characteristics of a hub; explain how it is a type of repeater, yet it still differs from the repeater. Install and configure the following types of hubs and identify their distinguishing characteristics.
    a. Passive
    b. Intelligent
    c. Managed
    d. Stand-alone
    e. Workgroup
    (TN Reading 2, 3, 4; TN Math N-Q)

18) Compare and contrast bridges with repeaters and hubs. In a group discussion with other students, share specific examples of advantages that bridges have over these devices. Provide supporting evidence to justify each example. (TN Reading 2, 4, 9)

19) Create and execute a plan to first install multiple nodes to a small switch, and then to connect the switch to another connectivity device. Verbally describe the steps of the procedure as they are being demonstrated. (TN Reading 2, 3, 4; TN Writing 2, 4; TN Math N-Q)

20) Identify common gateway devices and explain how they are different from connectivity devices. Further, explain why the gateways must operate on multiple layers of the open systems interconnection (OSI) model. (TN Reading 2, 4)

Wireless Networking

21) Demonstrate understanding of wireless transmission technology. Use a combination of graphic illustrations and text to describe how a wireless signal originates from an electrical current and travels along a conductor. Include definitions and functions of the following concepts.
   a. Antenna
   b. Signal propagation
   c. Signal degradation
   d. Frequency ranges
   e. Narrowband, broadband, and spread spectrum signals
   f. Fixed vs. mobile
   (TN Reading 2, 4, 7, 9; TN Writing 2, 4)

22) Compare and contrast wireless local area network (WLAN) infrastructure to that of wired network topologies. Create diagrams to identify and explain the differences between the two layout types. (TN Reading 2, 4; TN Writing 2, 4)

23) Locate and access the 802.11 standards (wireless fidelity or Wi-Fi) developed by the Institute for Electrical and Electronics Engineers (IEEE). Explain the purpose of these standards, as well as how IT professionals should apply them to networking systems. (TN Reading 2, 4)

24) Explore Bluetooth technology. Create a table to summarize and compare Bluetooth standards to Institute for Electrical and Electronics Engineers (IEEE) 802.11 standards, including how the purpose of each is different from the other. (TN Reading 2, 4, 5; TN Writing 2, 4)

25) Given specifications to install and configure a basic wireless network in a home or small office, write and execute a plan that includes, but is not limited to, the following:
   a. Install the client
   b. Locate and place the access point
   c. Install the access point
   d. Verify installation
   Provide details of the multistep procedure and justify the plan by providing supporting evidence that conforms to industry standards (e.g., Institute for Electrical and Electronics Engineers (IEEE) 802.11, Bluetooth). (TN Reading 2, 3, 4; TN Writing 1, 4; TN Math N-Q)

26) Given specifications to install and configure a wireless network in a large office, conduct a site survey to assess requirements of the clients, facility characteristics, and coverage area. Using the survey results, write and execute a plan that includes, but is not limited to, the following:
   a. Wireless access point placement
   b. Antenna types
   c. Interference
   d. Frequencies
   e. Channels
   f. Wireless standards

g. Service set identifier (SSID) (e.g., enable/disable)

Provide details of the multistep procedure and justify the plan by providing supporting evidence that conforms to the Institute for Electrical and Electronics Engineers (IEEE) 802.11 standards. (TN Reading 2, 3, 4, 7; TN Writing 1, 4)

Network Operating Systems

27) In teams, research various types of network operating systems (NOS) (e.g., Microsoft Windows server, Linux enterprise server, UNIX, etc.). Identify the basic functions of a NOS, and synthesize the findings to write an explanatory text that includes, but is not limited to, the following:
   a. Guiding questions to determine the optimal software requirements
   b. Client support features
   c. Organization of network elements
   d. Sharing applications
   e. Managing system resources (e.g., memory, multitasking, multiprocessing)
   f. Why it is important to consider future needs

Present the paper to other teams and revise it based on constructive feedback from peers. (TN Reading 2, 3, 4, 9; TN Writing 2, 4)

Security

28) Develop a plan for a regularly scheduled audit to examine a network's security risks. The plan should include, but is not limited to, the following:
   a. How often and when the audit will be conducted
   b. Security threats to be examined
   c. Rating system to assess the security threats
   d. Security policy goals and content
   e. How security breaches will be addressed

Implement the security plan for the duration of the course, revising as necessary. (TN Reading 2, 3, 4; TN Writing 2, 4, 5)

29) Research and describe the most common security risks associated with people; data transmission and hardware; protocols and software; and internet access. Investigate and distinguish among the following common prevention methods to secure a network system.
   a. Physical security
   b. Security in network design
   c. Network operating system security
   d. Encryption
   e. Authentication protocols
   f. Wireless network security

Given various scenarios, identify the most applicable best practices to secure a network. Implement these practices and write a justification for each scenario solution. Provide supporting evidence drawing on industry standards. (TN Reading 2, 3, 4, 6, 9; TN Writing 1, 4)

30) Explore the application of firewalls to secure networks. Describe their features and functions while distinguishing between the types (e.g., software and hardware). Install and configure a basic firewall. Verbally explain each step of the implementation process as it is executed. Cite any applicable industry standards. (TN Reading 1, 2, 3, 4)

31) Define fault tolerance, distinguishing between failures and faults in a network. Write a paper describing the following aspects that should be monitored and managed to sustain fault tolerance.
    a. Environment
    b. Power
    c. Topology and connectivity
    d. Servers
    e. Storage
Identify those aspects that are most influential on fault tolerance and justify the claim with supporting evidence. Demonstrate the application of these practices and compare the changes (if any) in the tolerance to results generated by other classmates. (TN Reading 2, 4, 5; TN Writing 1, 2, 4)

Troubleshooting

32) For each network system problem given, apply the following general troubleshooting theory.
    a. Gather information from users or the system, back up data, and document findings
    b. Verify the problem exists and how many users are affected
    c. Isolate the cause of the problem and generate alternative solutions
    d. Determine whether escalation is necessary
    e. Plan a solution and resolve the problem
    f. Verify that the problem was resolved and prevent a future occurrence
    g. Document findings, resolution, and preventative maintenance plan
Following the steps of the general troubleshooting theory, select a problem to present to classmates as a case study. (TN Reading 3, 4; TN Writing 2, 4)

33) For a given assignment related to the following common problems, follow the troubleshooting theory using appropriate hardware and software tools (e.g., cable tester, butt set, multimeter, protocol analyzer, throughput testers, connectivity software, etc.).
    a. Wireless problems (e.g., interference, signal strength, configurations, latency)
    b. Router and switch problems (e.g., switching loop, bad cables, port configuration)
    c. Physical connectivity problems (e.g., connectors, wiring, split cables, cable placement)
Identify the problem(s) and document the findings and resolution. Include an explanation of the common symptoms, diagnostic procedures, and specific tools used that led to the problem resolution. (TN Reading 2, 3, 4, 8; TN Writing 2, 4, 7, 9)

Standards Alignment Notes

*References to other standards include:
- TN Reading: Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
    o Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.

- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Math: [Tennessee State Standards for Mathematics](); Math Standards for High School: Number and Quantity (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project-based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning]()
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

IT Clinical Internship

Primary Career Cluster:	Information Technology
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code(s):	6096
Prerequisite(s):	Two to three credits in the *Networking Systems* program of study
Credit:	1
Grade Level:	11-12
Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Information Technology courses.
Programs of Study and Sequence:	This is the final course in the *Networking Systems* program of study.
Necessary Equipment:	Refer to the Teacher Resources page.
Aligned Student Organization(s):	Skills USA: http://www.tnskillsusa.org Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	Teachers who supervise this experience must have completed the state-approved 40-hour work-based learning training. For more information, please visit http://www.tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	CompTIA A+ and CompTIA Network+
Dual Credit or Dual Enrollment Opportunities:	There are dual credit/dual enrollment opportunities for this course when combined with pre-requisite courses. Contact a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	311, 435, 436, 475, 476, 582, 595 and CompTIA Network+ or CISCO Industry Certification
Teacher Resources:	http://www.tn.gov/education/cte/InformationTechnology.shtml

Course Description

IT Clinical Internship is a capstone course and work-based learning experience designed to provide students with real-world application of skills and knowledge obtained in previous Networking Systems courses. Students are eligible to take the *IT Clinical Internship* if they have successfully completed all the prerequisites in the Networking Systems program of study. Prospective students must apply for admission to the class (acceptance at the discretion of the instructor). The internships are designed to

be completed in an IT Support environment, such as the student's school, a community-based shop that provides IT Support, or the IT Support department of a local business. This course puts to practical use all of the skills attained in previous courses, and provides the student with valuable hands-on experience. It meets the recommended 500 hours' work experience to prepare each student to sit for the CompTIA A+ exams, which certifies industry-recognized IT Support technicians. Upon completion of this course, proficient students will be prepared to pursue further training at a Tennessee College of Applied Technology (TCAT) or other postsecondary institution. Standards in this course are aligned with Tennessee State Standards in English Language Arts & Literacy in Technical Subjects.*

Program of Study Application

This is the capstone course in the *Networking Systems* program of study. For more information on the benefits and requirements of implementing these programs in full, please visit the Information Technology website at http://www.tn.gov/education/cte/InformationTechnology.shtml.

Course Standards

1) Accurately read and interpret safety guidelines appropriate for the roles and responsibilities of an employee in an IT setting. Listen to safety instructions and be able to explain why certain rules apply. Demonstrate safety techniques and follow all applicable guidelines related to the clinical placement. Based on placement, document completion of training topics on the appropriate work-based learning (WBL) and work site forms. (TN Reading 2, 3, 4; TN Writing 4, 9)

2) Develop a personalized student-learning plan, in accordance with approved policies, to address the methods for practicing and demonstrating each of the skills identified in the pre-requisite IT course standards. Relate how each skill applies to a placement in an IT setting, and document day-to-day applications. Participate in ongoing review and communications around progress of plan with WBL Coordinator. (TN Reading 1, 2, 3, 4, 9; TN Writing 2, 4, 5, 6, 7, 8, 9)

3) Observe and analyze organizational culture and practices, e.g., how to interact with supervisors, clients, and co-workers, and how to recognize and address health, safety, and sustainability issues. Seek information from supervisors and other employees about appropriate methods of pursuing employment in the industry, and determine what knowledge, skills, and educational credentials are required. (TN Reading 2, 9)

4) Apply learning experiences from internship placement to review and update an education and career pathways plan based on the knowledge and feedback acquired. Proactively identify areas of strength and opportunities for professional growth, encourage and act on feedback from peers, supervisors, and customers, and seek and use resources and support to improve skills. (TN Reading 4; TN Writing 8, 9)

5) Identify and ask significant questions to solve problems in the workplace. Use inductive and deductive reasoning methods to recognize faulty reasoning, and to understand problems and alternative solutions. (TN Reading 2, 8; TN Writing 7, 8, 9)

6) Analyze quality assurance methods used by IT professionals in a variety of industries. Solve problems using systems thinking, e.g., by understanding problems in terms of complex

processes and environments. Identify key components and relationships that enable, influence, and produce outcomes. (TN Reading 3, 7, 8; TN Writing 7, 8, 9)

7) Demonstrate integrity and ethical behavior when engaging in all worksite activities, including the secure use of client data, responsible Internet use, use of tools and materials, documentation of services provided, sharing of information, client relations, and completion of all personnel-related forms. (TN Reading 4; TN Writing 8)

8) Articulate ideas effectively in written personal communications with supervisors, coworkers, and customers using appropriate IT terminology. Verbally articulate ideas effectively in interpersonal communications with supervisors, coworkers, and customers. Develop and deliver messages effectively in oral presentations. Demonstrate effective listening skills, attending to the meaning and intention of communication, and accurately paraphrasing what has been heard. Communicate effectively with individuals of diverse backgrounds who may also speak languages other than English, using foreign language skills as appropriate. (TN Reading 3, 4, 9; TN Writing 4, 5)

9) Work effectively as a member of a team and address conflict with sensitivity and respect for diverse points of view. Demonstrate understanding of one's own impact and build on different perspectives to strengthen joint efforts. Demonstrate leadership where appropriate to collaborate on workplace tasks. Effectively employ meeting management strategies, such as agenda setting, time keeping, and meeting facilitation strategies, and list action items to identify and schedule next steps. (TN Reading 9)

10) Access information efficiently, using sources appropriate to task, purpose, and audience. Distinguish between credible and non-credible sources, including the difference between advertising and legitimate research. Evaluate information for usefulness, bias, and accuracy, and question information that may not originate from credible sources. Demonstrate the ability to organize and manage information effectively and efficiently. Demonstrate ethical and legal use of information, including adherence to all rules and regulations related to sharing of protected information. For example, when a user reports a network system problem, investigate and verify that the problem exists, determine how many users are affected, and diagnose the problem using the information at hand. (TN Reading 2, 3, 4, 9; TN Writing 4, 8, 9)

11) Use appropriate technology for information search and retrieval, synchronous and asynchronous communications, multimedia presentations, document production, quantitative and qualitative analysis, and information management. Use social networking and online collaboration tools such as shared documents and web conferencing to create, integrate, and manage information in group projects. (TN Reading 2, 9; TN Writing 6, 9)

12) Access and manage online communication and information, such as a customer relationship management system, using multiple digital devices. Demonstrate adherence to all rules and regulations related to the use of electronic tools and the Internet, including appropriate protection of passcodes and adherence to all security protocols. (TN Reading 3, 7, 8, 9; TN Writing 6, 9)

13) Complete tasks as directed without direct supervision, knowing when questions or guidance should be requested. Exhibit resourcefulness and initiative in taking on new tasks and solving

problems on one's own as appropriate to the workplace setting. Demonstrate how to learn and exhibit personal agency in identifying and achieving instrumental and ultimate learning objectives. Demonstrate curiosity to learn more about the tasks, workplace, and/or industry. Explore deeper content on one's own and request opportunities for professional development. Demonstrate self-efficacy and confidence in one's ability to succeed in specific situations. (TN Reading 3, 4; TN Writing 8, 9)

14) Present oneself professionally and respectfully when interacting with coworkers, supervisors, and customers. Demonstrate reliability and responsibility in attendance and in following through on agreed upon tasks, and communicate with supervisor when circumstances change. Understand and adhere to appropriate workplace non-discrimination standards on the basis of sex, race, color, age, national origin, religion, disability, marital status, sexual orientation, gender identity, pregnancy, veteran status, or any characteristic of a person or group unrelated to the workplace. Respect cultural differences and work effectively with people from diverse social and cultural backgrounds. (TN Reading 9; TN Writing 7)

15) Exhibit flexibility by adapting to varied roles, jobs responsibilities, schedules and contexts; working effectively in a climate of ambiguity and changing priorities; and dealing positively with praise, setbacks, and constructive criticism. (TN Reading 9)

16) Manage time and projects effectively by setting goals; developing and using a system for prioritizing, planning and managing daily work; persisting in the face of challenges; and seeking assistance and adjusting plans to adapt to changing circumstances. Demonstrate attention to detail and accuracy appropriate to the task. Demonstrate accountability to supervisors, coworkers, and customers by delivering work to agreed-upon standards; accepting constructive criticism; completing agreed-upon projects on time; and exhibiting pride in workmanship. (TN Reading 4, 9; TN Writing 4, 8, 9)

17) Create a portfolio, or similar collection of work, that illustrates mastery of skills and knowledge outlined in the previous Networking Systems courses and applied in the internship experience. The portfolio should reflect thoughtful assessment and evaluation of the progression of work involving the application of steps of the troubleshooting process, as outlined by the instructor. The following documents will reside in the career portfolio:
   a. Career and professional development plan
   b. Resume
   c. Documentation of work hours at each site
   d. List of responsibilities undertaken throughout the placement
   e. Examples of materials developed and used throughout the placement
   f. Periodic journal entries reflecting on tasks and activities
   g. Supervisor evaluations and observations
   h. Approved WBL forms
   i. WBL coordinator evaluations and observations
   (TN Reading 1, 3, 4, 9; TN Writing 4, 8, 9)

Standards Alignment Notes

*References to other standards include:
- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5, and 10 at the conclusion of the course.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

Web Design Foundations

Primary Career Cluster:	Information Technology (IT)
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code:	6100
Pre-requisite(s):	*Information Technology Foundations, Algebra I, Geometry*
Credit:	1
Grade Level:	10
Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other IT courses.
Programs of Study and Sequence:	This is the second course in the *Web Design* program of study.
Necessary Equipment:	Refer to the Teacher Resources page.
Aligned Student Organization(s):	Future Business Leaders of America (FBLA) www.fblatn.org Sarah Williams, (615) 532-2829, Sarah.G.Williams@tn.gov Skills USA: http://www.tnskillsusa.com Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, he or she can offer appropriate placement. To learn more, please visit: http://www.tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	CIW Internet Business Associate
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	070, 203, 204, 230, 231, 232, 233, (042 and 043), (042 and 044), (042 and 045), (042 and 046), (042 and 047), (042 and 077), (042 and 078), (042 and 079), (043 and 044), (043 and 045), (043 and 046), (043 and 047), (043 and 077), (043 and 078), (043 and 079), (044 and 045), (044 and 046), (044 and 047), (044 and 077), (044 and 078), (044 and 079), (045 and 046), (045 and 047), (045 and 077), (045 and 078), (045 and 079), (046 and 047), (046 and 077), (046 and 078), (046 and 079), (046 and 047), (047 and 079), (047 and 077), (047 and 078), (077 and 078), (077 and 079), (078 and 079), 311, 435, 436, 470, 477 475, 476, 516, 519, 582, 583, 595

Required Teacher Certifications/Training:	None
Teacher Resources:	http://www.tn.gov/education/cte/InformationTechnology.shtml

Course Description

Web Design Foundations is a course that prepares students with work-related web design skills for advancement into postsecondary education and industry. The course is intended to develop fundamental skills in both theory and practical application of the basic web design and development process, project management and teamwork, troubleshooting and problem solving, and interpersonal skill development. Laboratory facilities and experiences simulate those found in the web design and development industry; where interaction with a "client" is indicated in the standards, it is expected that students' peer clients or the instructor may serve as mock clients in lieu of an actual relationship with an industry partner. Upon completion of this course, proficient students will be prepared for more advanced coursework in the Web Design program of study. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee State Standards in Mathematics.*****

Program of Study Application

This is the second course in the *Web Design* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Information Technology website at http://www.tn.gov/education/cte/InformationTechnology.shtml.

Course Standards

Safety

1) Accurately read and interpret safety rules, including rules published by the (1) National Science Teachers Association (NSTA), (2) rules pertaining to electrical safety, (3) Internet safety, (4) Occupational Safety and Health Administration (OSHA) guidelines, and (5) state and national code requirements. Be able to distinguish between rules and explain why certain rules apply. (TN Reading 3, 4)

Client Relations

2) Create a questionnaire and conduct an interview with a client to gather specific information to guide the web development project. Develop interview questions that will determine the purpose; target audience; branding and perception goals; content sources; and any factors that will affect the project schedule. (TN Reading 1; TN Writing 4)

3) Using the information gathered from the client interview, write a project brief that identifies the goals, audience profile, audience perception, primary message of the web site, and the competitive advantage of the client. Allow the client to review the project brief and make corrections based on client feedback. (TN Reading 1; TN Writing 2, 4, 5)

4) Research the specifications that will be required to produce a web site that meets the needs of the project brief. Using the findings, produce technical specifications for the web site. For

example, the specifications should consider the screen resolution, browser compatibility, download time for the web site, and accessibility. (TN Reading 2, 3; TN Writing 4)

5) Demonstrate an understanding of maintenance requirements for a web site that is aligned with the project brief. Develop a plan that thoroughly describes how the site will be consistently updated and reviewed. Write a text explaining the maintenance requirements and plan to a client. *For example, a web site maintenance plan should include, but is not limited to, any automated processes for changing content, required training for content contributors, and assignments for specific updates (e.g., keyword, search engine, Meta data, and graphics).* (TN Reading 2; TN Writing 2, 4)

Site Mapping

6) Conduct a brainstorming session to solicit a client's feedback on web site content. Create an outline that organizes the content into categories. Ensure that the outline is aligned with the project brief and that there is space for future expansion. Present the outline to the client for review and approval. *For example, use a mind mapping process to capture all the ideas and topics for a web site development project.* (TN Reading 1, 2; TN Writing 2, 4, 5)

7) Applying the content outline, develop a diagram that visually represents the web site structure. The site map (or web site wireframe) should show the interconnection of features such as the homepage, links, and content for each link. *For example, use software like Google Drawings, Microsoft Visio, OmniGiraffe, Adobe Illustrator, or Microsoft Office to create a web site wireframe.* (TN Reading 2, 4, 7; TN Writing 4)

8) Convert the web site wireframes to individual web page wireframes. A wireframe should consider each element (e.g., navigation, images, content, functionality, and footer) and group the information of its corresponding page. (TN Reading 2, 4, 7; TN Writing 4)

Copyright/Licensing

9) Explore the use of stock images and demonstrate an understanding of the various types of stock images like stock photography, microstock photography, and free (e.g., open source) images. Identify the advantages and disadvantages of using these images. (TN Reading 1, 9)

10) Compare and contrast royalty-free and rights-managed licensing and explain how each licensing affects the use of images. Research and describe the process to obtain permission to use copyrighted photography. (TN Reading 2, 9)

11) Investigate multiple photosharing services and how they embed metadata within images to assist in keyword searches. As a class, create a photosharing system (class use only) for student-created images that include embedded metadata. (TN Reading 1, 2)

Introduction to Design and Layout

12) Demonstrate an understanding for how specific characteristics affect the quality and size of a digital image. Define the following terminology and explain their effects on digital images:
    a. Pixels

b. Color depth
c. Resolution
d. Palettes
e. Dithering
(TN Reading 1, 4)

13) Compare and contrast raster and vector graphics and provide scenarios when it is best to use each format. Further, explore their applications to vector-based drawing and paint programs. Describe advantages and disadvantages of using each program type. (TN Reading 2, 5, 9)

14) Research and identify the extensions of various image file formats like Bitmap, Tagged Image File Format, Windows Metafile, Joint Photographic Experts Group, Portable Network Graphics, and Graphics Interchange Format. Describe which file formats are supported by all browsers and which formats require special software or a plug-in to view an image. Explain when it is most appropriate to apply specific image file formats. (TN Reading 4, 9; TN Writing 1)

15) In teams, investigate image optimization and its importance. Describe how file formats influence image optimization and identify optimization guidelines and sources to apply to web graphics. (TN Reading 1, 4)

16) Explain the graphic design concept of composition. Include various applications like visual hierarchy, grouping, visual cues, and integration of elements. (TN Reading 1, 4)

17) Explore the use of grid-based layout and why it is used to create coherent, organized web pages. Give examples of when it is suitable to use one-, two-, and three-column layouts to display content. For example, research and discuss how the golden ratio (golden mean) is used to create a design grid. (TN Reading 4, 9)

18) Drawing on multiple resources, demonstrate an understanding of typography, including related definitions like measure and lead. Explain a designer's application of the following typography characteristics to create balance and relationship between elements on a web page.
a. Legibility
b. Typeface
c. Case
d. Emphasis
e. Type size and accessibility
(TN Reading 2, 4)

Composition

19) Conduct research to determine how various colors are perceived by specific audiences and cultures. Citing evidence from research findings, explain the following concepts:
a. Symbols, objects and images that attract or repel audiences.
b. Color combinations that complement each other
c. Smooth color transitions and the effects on download time
For example, create a class demonstration showing which colors are most complementary and how many colors define a color scheme. (TN Reading 4, 9)

20) Demonstrate an understanding of the relationship between pixels and display color. Explain how black and white are each created using color schemes CMYK (cyan, magenta, yellow, and black) and RGB (red, green, blue) respectively. Furthermore, describe the differences between subtractive and additive colors and how they are applied to print media versus a computer monitor display. (TN Reading 4, 9)

21) Consider the two standardized numeric formats for color on the computer screen—RGB values and Hexadecimal code. Compare and contrast the format of values for each and briefly explain how they are applied to represent color. (TN Reading 4, 9; TN Math N-Q, A-CED)

Writing, Critiquing, and Publishing Content for the Web

22) In teams, research writing styles on various web sites (include sites of well-known organizations and companies). Identify characteristics that are consistently used and include examples of what made the text memorable and easy to scan. Use the research findings to create guidelines for the class to apply to upcoming web design and development projects. During the survey of writing styles on the web, take notice of the following:
      a. Location of important information on the page
      b. Use of bulleted lists and tables
      c. Length and simplicity of paragraphs
      d. Headlines and introduction sentences
      e. Tone and voice used
      f. Accuracy of information (current or outdated)
   (TN Reading 2, 9; TN Writing 4)

23) Given a specific topic from a web development project, write content for a web page and apply the class writing guidelines. Proofread and rewrite the content to align with the class guidelines. Give the writing assignment to multiple classmates for review. Revise the content based on reviewer feedback. Follow this multistep process until the written product is appropriate for publication on a web site. (TN Reading 1, TN Writing 4, 5)

Marketing, Branding, Identity, and eCommerce

24) Research various logos of well-known companies and organizations on the web. Identify shapes and colors that are consistently used and include examples of what made the logos unique, attractive, and memorable. (TN Reading 1, 4, 9)

25) Drawing from various resources, identify several ways that a web designer can apply and strengthen brand management and identity. Consider the concepts consistent color and logo placement and explain the application of each. (TN Reading 1, 4, 9)

26) Investigate how to setup and implement a secure e-commerce site. Citing evidence from reliable resources, describe 1) measures to prevent shopping cart vulnerabilities, 2) pre-built shopping software, and 3) hosting options for shopping cart software. (TN Reading 2, 3)

27) In teams, examine how demographics, psychographics, and audience data are used to market a product or service online. Using this information, create a questionnaire to survey people about

a product or service. *For example, the questionnaire could survey alternative promotion methods, market growth drivers and barriers.* (TN Reading 2 , TN Writing 4, 5, 8, 9)

28) As a team, use the survey results and develop a marketing plan that identifies the following for a web development project.
    a. Promotions for both global (mass) and niche (micro) markets
    b. Web marketing strategies and goals
    c. Market growth drivers and barriers
    d. Product distribution and availability
    e. Product or service pricing
    f. Advertising options to be used (e.g., links, banner ads, viral marketing, social media)
    (TN Reading 1, 3; TN Writing 4, 5)

Introducing Coding Skills

29) Research the history of markup languages; briefly describe the function of markup languages and why they are different from programming languages. (TN Reading 1, 9)

30) Explore the origin of the HTML standard and creation of the World Wide Web Consortium (W3C). Discuss the six versions of the HTML standard and how each differs from the other. Explain the role of standardization and provide examples of how it promotes universality for all web users. (TN Reading 1, 4, 9)

31) Define HTML tags distinguishing between empty tags and container tags. Explain their application to web development, why Hypertext Markup Language (HTML) evolved, and provide examples of tags frequently used. Create a simple web page that consists of paragraph text, text hyperlinks, tables, and elements in frames. (TN Reading 1, 4)

32) Demonstrate understanding of Cascading Style Sheets (CSS). Investigate and report how CSS separate formatting elements from HTML and solve a number of design limitations like:
    a. Proprietary HTML extensions
    b. Text-to-image conversion to retain fonts
    c. Page layout using tables
    d. Images controlling white space
    (TN Reading 1, 4, 6)

33) Explore the use of Cascading Style Sheets (CSS) for page layout and cite evidence why CSS provides more flexible and precise layout capabilities than tables and frames. Explain and demonstrate coding for the following elements of CSS page layout.
    a. CSS Box Model (e.g., inline, block)
    b. Document Flow and Positioning (e.g., static, relative, absolute, fixed, float, z-index)
    c. CSS Positioning Schemes (e.g., two-column layout, three-column layout)
    (TN Reading 1, 3, 4, 8; TN Writing 6)

Organization

34) As a class, define the guidelines for effective use of file and folder management techniques to maintain directory structure for forthcoming web site class projects. The guidelines should

address efficient methods for maintaining site root and subfolders for assets (e.g., images, templates, CSS), as well as the correct way to use file paths for relative, site root relative, and absolute links. (TN Reading 1, 2, 4; TN Writing 7)

Troubleshooting & Problem Solving

35) Troubleshooting and formal testing is a systematic quality assurance process and should be routinely completed throughout the life cycle of a web site. There are various multistep testing procedures for a web site. The following recommendations provide a general approach to testing:
    a. Review the content for accuracy, spelling, and grammar
    b. Review site for broken links
    c. Test the functionality of the web site as defined by the project specifications
    d. Validate the HTML and CSS coding
    e. Check the accessibility using automated tools
    f. Test site on various browsers that the target audience uses
    g. Analyze the connection speed and size of web pages
    h. Conduct usability testing with target audience
    i. Work with the server administrator to conduct load testing
    j. Conduct authentication testing and review file authorizations

As a class, develop a quality assurance plan that incorporates the above testing procedures, as well as outlines how the testing will be managed, how the issues will be prioritized, and how problems will be solved. (TN Reading 7; TN Writing 1, 4)

Standards Alignment Notes

*References to other standards include:
- TN Reading: Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Math: Tennessee State Standards for Mathematics; Math Standards for High School: Number and Quantity, Algebra (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project-based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative and algebraic reasoning as applied to specific technical

concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.

- P21: Partnership for 21st Century Skills Framework for 21st Century Learning
    - o Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

Web Site Development

Primary Career Cluster:	Information Technology (IT)
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code:	6101
Prerequisite(s):	Information Technology Foundations (6095) and Web Design Foundations (6100)
Credit:	1
Grade Level:	11-12
Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other IT courses.
Programs of Study and Sequence:	This is the third course in the *Web Design* program of study.
Necessary Equipment:	Refer to the Teacher Resources page.
Aligned Student Organization(s):	Future Business Leaders of America (FBLA) www.fblatn.org Sarah Williams, (615) 532-2829, Sarah.G.Williams@tn.gov Skills USA: http://www.tnskillsusa.com Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, he or she can offer appropriate placement. To learn more, please visit http://www.tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	CIW Internet Business Associate Certification
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	070, 203, 204, 230, 231, 232, 233, (042 and 043), (042 and 044), (042 and 045), (042 and 046), (042 and 047), (042 and 077), (042 and 078), (042 and 079), (043 and 044), (043 and 045), (043 and 046), (043 and 047), (043 and 077), (043 and 078), (043 and 079), (044 and 045), (044 and 046), (044 and 047), (044 and 077), (044 and 078), (044 and 079), (045 and 046), (045 and 047), (045 and 077), (045 and 078), (045 and 079), (046 and 047), (046 and 077), (046 and 078), (046 and 079), (046 and 047), (046 and 077), (047 and 079), (047 and 077), (047 and 078), (077 and 078), (077 and 079), (078 and 079), 311, 435, 436, 470, 477, 475, 476, 516, 519, 582, 583, 595

Required Teacher Certifications/Training:	CIW Web Foundations Associate Certification OR CIW Web Design Specialist Certification. For endorsements 037, 041, 055, 056, 057, 203, 204, 311, 434, 435, 436, 475, 476, CIW Web Design Specialist Certification OR CIW Web Foundations Associate Certification required in 2015-16
Teacher Resources:	http://www.tn.gov/education/cte/InformationTechnology.shtml

Course Description

Web Site Development builds on the skills and knowledge gained in *Web Design Foundations* to further prepare students for success in the web design and development fields. Emphasis is placed on applying the design process toward projects of increasing sophistication, culminating in the production of a functional, static website. As students work toward this goal, they acquire key skills in coding, project management, basic troubleshooting and validation, and content development and analysis. Artifacts of the work completed in this course will be logged in a student portfolio demonstrating mastery of skills and knowledge. Upon completion of this course, proficient students will be prepared to pursue a variety of postsecondary programs in the computer sciences, sit for industry certification, or apply their skills in a capstone *Web Design Practicum*. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee State Standards in Mathematics.*****

Program of Study Application

This is the third course in the *Web Design* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Information Technology website at http://www.tn.gov/education/cte/InformationTechnology.shtml.

Course Standards

Safety

1) Accurately read and interpret safety rules, including rules published by the (1) National Science Teachers Association (NSTA), (2) rules pertaining to electrical safety, (3) Internet safety, (4) Occupational Safety and Health Administration (OSHA) guidelines, and (5) state and national code requirements. Be able to distinguish between rules and explain why certain rules apply. (TN Reading 3, 4)

2) Throughout the course, practice safe habits and procedures when sharing and sending files, navigating websites, and connecting to servers and networks. As a class, work collaboratively to develop a professionalism policy that outlines rules regarding responsible technology use in the classroom. The policy must adhere to all school and district technology policies. (TN Reading 3, TN Writing 4)

3) Determine how companies, organizations, and individuals keep their data secure from theft and identity fraud. Summarize and produce a list of best practices from industry magazines and professional organizations such as the World Wide Web Consortium (W3C). Identify steps for safe use and transfer of data that can applied in the Web Design classroom. (TN Reading 1, 2; TN Writing 4)

Career Exploration

4) Investigate opportunities for personal and professional growth in the web design and computer science fields, including but not limited to opportunities to enter design contests, assist with the maintenance or development of the school's website, and participate in initiatives such as the national Hour of Code. In addition, explore postsecondary programs in the computer sciences, such as web design and development, animation and graphics, or website administration, and document the search in the course portfolio. (TN Reading 1, 2)

The Design Process

5) Select a website whose content is appropriate and adheres to the course policy, as approved by the instructor. Critically evaluate the site on the merits of its design features, applying knowledge and skills related to webpage composition (learned in *Web Design Foundations*) to critique the following:
   a. Navigational hierarchy
   b. Balance
   c. Color unity
   d. Typography, formatting, and other aspects of text layout and style
   e. Compatibility across multiple browsers and devices
   f. Flow and arrangement of content
   Develop a presentation, written paper, or blog post analyzing these elements, supported by screen shots of the website and other specific evidence drawn from the site. Be able to answer the question, "What makes this website compelling, attractive, and functional?" (TN Reading 1, 2, 5, 6, 8; TN Writing 1, 7, 9)

6) Synthesize the steps of the web design process learned in previous courses with research into emerging or alternative design models. In groups, produce a sophisticated flowchart, diagram, or other logic model that will serve as a template to guide the development of all projects and activities undertaken in this course. Annotate the model with the inputs, constraints, activities, and target outcomes involved in a given project; demonstrate where inputs flow from one stage of a project to the next. (TN Reading 7, 8, 9; TN Writing 4)

Project Management

7) Research how web development teams use project management tools to divide roles and responsibilities among team members, track progress toward goals, and satisfy client specifications. Explore a variety of such tools and develop systems for applying selected tools to projects and assignments in this course. For example, download a Gantt chart template in Excel or other format and use it to assign tasks and monitor deliverables under a deadline. (TN Reading 1, 2, 9; TN Writing 4, 7)

Coding Skills

8) Demonstrate technical fluency in a variety of programming and markup languages, including but not limited to HTML, XML, CSS, JavaScript, JQuery, PHP, and/or SQL. Describe the particular functions and environments in which each language operates, detailing the benefits, limitations,

and unique features of each. Justify when one programming language would be ideal for a given project or design solution. (TN Reading 2, 3, 4; TN Writing 1, 6)

9) Correctly apply tags, embed links, manipulate space, customize attributes, and incorporate style elements related to typography, margins, and spanning and padding. Demonstrate the ability to code web page elements such as tables and forms according to the specifications of the client. (TN Reading 3; TN Writing 6)

10) Distinguish between different units and measurement systems used in website development. Be able to accurately define terms such as size, aspect ratio, percentage units, and pixels as they relate to specific style commands (i.e., in a cascading style sheet). Given a set of design constraints or client specifications, accurately apply and modify the appropriate units when writing and editing code for objects/text in a programming environment. (TN Reading 3, 7; TN Writing 6; TN Math N-Q)

11) Throughout the course, apply, edit, and continually revise code using software approved by the instructor, ranging from proprietary software such as Dreamweaver to simple applications like Microsoft Notepad. Practice teamwork and revision skills by: 1) critiquing the work of peers; and 2) furnishing recommendations for resolving errors in syntax and improving elements of design. Annotate recommendations in the programming environment to facilitate peer review. (TN Reading 3, 4, 5, 6; TN Writing 1, 4, 5, 6)

12) Create and edit graphics and other multimedia for web pages, evaluating and customizing their attributes according to client/instructor specifications. For example, write code for a scalable vector graphic (SVG) with a predetermined height, width, shape, and color, using appropriate units in order to maximize visibility and continuity of design. (TN Reading 3; TN Writing 6; TN Math N-Q)

13) Summarize the functions of plug-ins for content management systems as well as static websites. Describe a range of plug-ins and justify when they are needed for a specific application. Demonstrate the ability to download and install plug-ins for selected assignments in support of a specified design goal. (TN Reading 2, 3; TN Writing 6)

Basic Troubleshooting and Validation

14) Apply basic troubleshooting strategies to resolve errors in syntax, fix broken links, edit distorted images, and align website content for seamless navigation. As part of a course assignment or project, practice troubleshooting techniques to meet the vision or specifications of a mock client. For example, pretend a client complains that the alpha version of his/her website has rendered the dimensions of an interactive form too small for customers to read. Accurately diagnose the problem, then make adjustments to the code to resolve the issue to the client's satisfaction. (TN Reading 3, 5, 7, 8; TN Writing 6, 7)

15) Research methods of performing code validation on a completed or in-progress web page. Validate code for compatibility across browsers and devices. Explain the results of the validation test to the class in the form of a brief presentation as would a team of developers. (TN Reading 1, 9; TN Writing 2, 6, 7)

Content Development and Analysis

16) Conduct a preliminary investigation of various branding strategies (i.e., social media marketing, web advertising, etc.) used by companies that sell their products and services online. Evaluate selected companies' websites to determine how such strategies are deployed throughout the sites. Describe how one or more of these strategies could be incorporated into a future website for this or another course. (TN Reading 1, 2, 5, 6, 7; TN Writing 4, 9)

17) Define web analytics, and discuss the increasingly sophisticated role that analytics play in the marketing and management of content for websites. Interpret simple analytics in the dashboard interface of a content management system such as WordPress. Use quantitative reasoning and appropriate terminology to describe trends, analyze performance, and explain to peers how a website's "reach" can be determined with analytics. (TN Reading 1, 3, 4, 7, 9; TN Writing 2, 9; TN Math N-Q)

18) Build on the work of previous Web Design courses and practice writing original web content for a particular audience. Adhere to client specifications regarding tone, length, and style of language, writing in a manner appropriate for the target audience. Regularly edit writing and solicit peer feedback for continuity of message and language. Collaboratively work to refine writing to be suitable for web publication. (TN Writing 4, 5, 6, 7)

Web Hosting and Publishing

19) Model the process for setting up a website. Investigate domain name availability, register with a hosting service, and download a File Transfer Protocol (FTP) program. As part of a course assignment or project, demonstrate the ability to upload and organize files onto a server and arrange content to map out a simple multi-page website. Maintain accurate and navigable directories for retrieving and storing files. Incorporate original writing content onto the site, and publish content online for the instructor or class to see on a standard Internet browser. (TN Reading 3, 4; TN Writing 4, 6)

Trends in Web Design and Development

20) Explore a range of new and emerging trends in web design and development. A trend could be a new software, strategy, programming language, or phenomenon that has seen rising or widespread usage on the Internet in recent years. Examples include the movement toward responsive design to expand website compatibility; the increasing use of HTML5; or the embedding of social media within websites for the purposes of sharing content or crowdsourcing a product idea. Research one or more of these trends in depth, and compile a presentation or a paper explaining both the technical aspects involved (i.e., how it works on a web page) and the practical applications it has for customers, webmasters, businesses, or other users. (TN Reading 1, 2, 9; TN Writing 2, 7, 8, 9)

Standards Alignment Notes

*References to other standards include:
- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Math: [Tennessee State Standards for Mathematics](#); Math Standards for High School: Number and Quantity (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project-based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

Web Design Practicum

Primary Career Cluster:	Information Technology (IT)
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code:	TBD
Prerequisite(s):	*Information Technology Foundations, Web Design Foundations, Web Site Development, Algebra I, Geometry*
Credit:	1
Grade Level:	11-12
Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other IT courses.
Programs of Study and Sequence:	This is the fourth course in the *Web Design* program of study.
Necessary Equipment:	Refer to the Teacher Resources page.
Aligned Student Organization(s):	Future Business Leaders of America (FBLA) www.fblatn.org Sarah Williams, (615) 532-2829, Sarah.G.Williams@tn.gov Skills USA: http://www.tnskillsusa.com Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, he or she can offer appropriate placement. To learn more, please visit http://www.tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	CIW Internet Business Associate
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	070, 203, 204, 230, 231, 232, 233, (042 and 043), (042 and 044), (042 and 045), (042 and 046), (042 and 047), (042 and 077), (042 and 078), (042 and 079), (043 and 044), (043 and 045), (043 and 046), (043 and 047), (043 and 077), (043 and 078), (043 and 079), (044 and 045), (044 and 046), (044 and 047), (044 and 077), (044 and 078), (044 and 079), (045 and 046), (045 and 047), (045 and 077), (045 and 078), (045 and 079), (046 and 047), (046 and 077), (046 and 078), (046 and 079), (046 and 047), (046 and 077), (047 and 079), (047 and 077), (047 and 078), (077 and 078), (077 and 079), (078 and 079), 311, 435, 436, 470, 477, 475, 476, 516, 519, 582, 583, 595

Required Teacher Certifications/Training:	CIW Web Foundations Associate Certification OR CIW Web Design Specialist Certification. For endorsements 037, 041, 055, 056, 057, 203, 204, 311, 434, 435, 436, 475, 476, CIW Web Foundations Associate Certification OR CIW Web Design Specialist Certification required in 2015-16.
Teacher Resources:	http://www.tn.gov/education/cte/InformationTechnology.shtml

Course Description

Web Design Practicum is a capstone course intended to provide students with the opportunity to apply the skills and knowledge learned in previous *Web Design* courses toward the completion of an in-depth project with fellow team members. Students who have progressed to this level in the *Web Design* program of study take on more responsibilities for producing independent work and managing processes involved in the planning, designing, refinement, and launch of a website. In addition to developing an understanding of the professional and ethical issues encountered by web design professionals in the workplace, students learn to refine their skills in problem solving, troubleshooting, teamwork, marketing and analytics, and project management. Upon completion of the practicum, proficient students will be prepared for postsecondary study and career advancement in web design. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects and Tennessee State Standards in Mathematics.*****

Note: Practicum activities may take the form of work-based learning opportunities (such as internships, cooperative education, service learning, and job shadowing) or industry-driven project-based learning. As such, this course must be taught by a teacher with an active WBL Certificate issued by the Tennessee Department of Education and follow policies outlined in the Work-Based Learning Policy Guide available online at http://www.tn.gov/education/cte/work_based_learning.shtml.

Program of Study Application

This is the fourth course in the *Web Page Design* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Information Technology website at http://www.tn.gov/education/cte/InformationTechnology.shtml.

Course Standards

Web Design Career Planning

1) Research a company or organization that provides web design/development services for clients. Companies could range from large design firms serving corporate clients, to independent freelance businesses operating in the local community. For the chosen company, cite specific textual evidence from the company's literature, as well as available press coverage (if available) to summarize:
    a. The mission and history of the organization
    b. Headquarters and organizational structure
    c. Products or services provided
    d. Credentials required for employment and how they are obtained and maintained
    e. Policies and procedures
    f. Reports, newsletters, and other documents published by the organization

g. Website and contact information
(TN Reading 1, 2; TN Writing 7)

2) Analyze the requirements and qualifications for various web design job postings identified from specific company websites or online metasearch engines. Gather information from multiple sources, such as sample resumes, interviews with web design professionals, and job boards, to determine effective strategies for realizing career goals. Create a personal resume modeled after elements based on the findings above, then complete an authentic job application as part of a career search or work-based learning experience. (TN Reading 4, 9; TN Writing 4, 7, 8)

3) Participate in a mock interview. Prior to the interview, prepare a paper that includes the following: tips on dress and grooming, most commonly asked interview questions, appropriate conduct during an interview, and recommended follow-up procedures. Upon completion of the interview, write a thank you letter to the interviewer in a written or email format. (TN Reading 2; TN Writing 2, 4, 7, 9)

Professional Ethics and Legal Responsibilities

4) Investigate a range of unethical and illegal behaviors frequently encountered by web design professionals. Summarize the legal and professional consequences for engaging in these behaviors, developing claims and counterclaims about the potential ramifications for clients, users, the public, and one's own personal reputation. Deliver findings in the form of a summary document or presentation supported by evidence from news media, company policies, and state and federal laws. Potential issues include spam, flaming, cyberbullying, libel, slandering, and mining of personal data for profit. (TN Reading 1, 2, 4, 8, 9; TN Writing 1, 4, 6, 7)

5) Research a case study involving an ethical issue related to intellectual property rights. Examine a variety of perspectives surrounding the issue, then develop an original analysis explaining the impact of the issue on those involved, using persuasive language and citing evidence from the research. Potential issues include copyright infringement, piracy, plagiarism, art licensing, creative commons, and the state/federal laws that govern them. (TN Reading 1, 2; TN Writing 1, 4, 6, 7)

Course Project

6) Meet with a potential or mock client who requires a web-based digital product, and discuss the client's wants and needs for the product. In teams, work to develop a project plan, set goals, delegate responsibilities, and determine deadlines to meet the client's specifications. Analyze available resources, then formulate and present a written proposal for the potential client detailing the following:
    a. Summary of product solution that can be offered
    b. Strategy for addressing the needs of the client
    c. Schedule of completion
    d. Cost to the client, including justification of expenses
(TN Reading 7; TN Writing 1, 2, 6)

7) In teams, develop a site map outlining the architecture of the web page(s) to be created in the project. Demonstrate the ability to group content in the form of a flowchart or other visual representation, and apply principles related to continuity of design. (TN Reading 3, 7)

8) Work together to assemble adequate documentation of project activities, including end-user documentation. Be able to explain to both lay and technical audiences how various aspects of the site and/or digital product were developed and how they function. For example, annotate code where appropriate such that another web designer could replicate it; or explain to a first-time user how a form developed for the site retrieves and stores information in a remote database. (TN Reading 3, 4, 5, 6; TN Writing 2, 4, 6, 7)

9) Maintain accurate and accessible directories of files relevant to the project, and develop agreements among team members surrounding data management, naming conventions, version control, editing permissions, and sharing of files (for example, through cloud-based services or shared drives). (TN Reading 3)

10) Use appropriate authoring software to execute the project plan in line with budget constraints, server size, deadlines, and all other specifications in order to meet the vision of the client. In the course of development, apply coding skills to design, organize, create, maintain, and update the site or digital product as needed. (TN Reading 3, 7; TN Writing 4, 6, 7)

Advanced Troubleshooting, Critiquing, & Problem Solving

11) In the course of developing the web-based project, regularly test the site for functionality, navigability, browser and device compatibility, and other design aspects related to user friendliness. Conduct and document the proper code validation to fix broken links, distorted images, and similar errors. (TN Reading 3, 8; TN Writing 6, 7)

12) Analyze the code written by another team member or peer and create a flowchart for suggesting changes to improve functionality. Cite specific examples in the code to support recommendations. (TN Reading 1, 2, 3, 4, 5, 6, 7, 8; TN Writing 1, 4, 6)

13) Apply coding skills learned in previous courses to novel contexts and development environments. For example, investigate methods for scaling the site or digital product onto a mobile device using responsive design. Where appropriate, incorporate the proper CSS code to render a site compatible on multiple web platforms. (TN Writing 6, 7)

Web Marketing and Analytics

14) Research factors that affect the sale and distribution of products and services over the Internet, such as the wide availability of customer feedback on sites like Amazon, Yelp, and Google. Select a company whose products/services are purchased online; describe how the factors identified above influence the design of the company's website. Critique the effectiveness of the site in promoting the company's product/service, citing evidence related to user friendliness, accessibility, tone, and composition. (TN Reading 5, 6, 8; TN Writing 1, 9)

15) Analyze a range of web marketing strategies and cite examples of how businesses use them to drive web traffic. Strategies include but are not limited to social media marketing, image-centric

content marketing, search engine optimization (SEO), email marketing, or mobile-friendly content. Deliver a mock presentation to "peer clients" outlining how one or more of these strategies could be incorporated to increase the web presence of a real or fictitious business. Drawing on success stories of similar companies, pitch the chosen strategy using persuasive language and relevant supporting data. (TN Reading 1, 4, 8, 9; TN Writing 1, 8)

16) Describe how companies collect data using web analytics. Summarize a range of statistics used when tracking web traffic, such as unique page views, session duration, and bounce rate. Demonstrate the ability to collect and interpret analytics to achieve marketing goals; if applicable, incorporate such analysis into the course project. (TN Reading 1, 4, 8, 9; TN Writing 2, 9; TN Math S-ID)

17) Investigate the ways companies use web data to analyze demographic and psychographic information about their customers. Model to a "peer client" how an ordinary business owner can use IP geolocation, surveys, forms, and other tools to make strategic marketing decisions. (TN Reading 1, 4, 9; TN Writing 4)

Portfolio

18) Create a portfolio, or similar collection of work, that illustrates mastery of skills and knowledge outlined in the previous courses and applied in the practicum. The portfolio should reflect thoughtful assessment and evaluation of the progression of work involving the application of steps of the design process, as outlined by the instructor. The following documents will reside in the student portfolio:
    a. Personal code of ethics
    b. Career and professional development plan
    c. Resume
    d. Links to web pages designed or contributed to
    e. List of responsibilities undertaken through the course
    f. Examples of visual materials developed and used during the course (such as graphics, drawings, models, presentation slides, videos, and demonstrations)
    g. Description of technology used, with examples if appropriate
    h. Periodic journal entries reflecting on tasks and activities
    i. Feedback from instructor and/or supervisor based on observations
    (TN Reading 7; TN Writing 4)

Communication of Project Results

19) Produce a technical report highlighting the purpose, content, use, and intended audience of the web-based project. Cite evidence from the code and from web development best practices in order to justify design decisions and maximize client satisfaction. Include appropriate documentation of license agreements, copyright protections, non-disclosure statements, and other legal issues if dealing with the ideas or data of others. (TN Reading 1, 2, 3, 4, 5, 7, 8, 9; TN Writing 1, 5, 6, 7, 8, 9)

20) Upon completion of the practicum, develop a technology-enhanced presentation showcasing highlights, challenges, and lessons learned from the experience. The presentation should be delivered orally, but supported by relevant graphic illustrations, such as diagrams, flowcharts,

sample code, and/or summary data generated from the site. Prepare the presentation in a format that could be presented to both a technical and a non-technical audience, as well as for a career and technical student organization (CTSO) competitive event. (TN Reading 1, 3, 7, 9; TN Writing 2, 4, 5, 6, 9)

Standards Alignment Notes

*References to other standards include:
- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Math: [Tennessee State Standards for Mathematics](); Math Standards for High School: Statistics and Probability (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project-based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate statistical reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning]()
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.