

# Computer Science Foundations

<b>Primary Career Cluster:</b>	Information Technology (IT)
<b>Course Contact:</b>	<a href="mailto:CTE.Standards@tn.gov">CTE.Standards@tn.gov</a>
<b>Course Code(s):</b>	C10H11
<b>Prerequisite(s):</b>	None
<b>Credit:</b>	1 credit for core and two focus areas. 2 credits for all 36 standards.
<b>Grade Level:</b>	9
<b>Focus Elective Graduation Requirement:</b>	This course satisfies one or two of three credits required for an elective focus when taken in conjunction with other <i>IT</i> courses.
<b>Program of Study (POS) Concentrator:</b>	This course satisfies one out of two required courses that meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
<b>Programs of Study and Sequence:</b>	This is the first course in the <i>Networking Systems, Coding, Web Design, and Cybersecurity</i> programs of study.
<b>Aligned Student Organization(s)</b>	SkillsUSA: <a href="http://www.skillsusatn.org/">http://www.skillsusatn.org/</a> Technology Student Association (TSA): <a href="http://www.tntsa.org">http://www.tntsa.org</a>
<b>Coordinating Work-Based Learning:</b>	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit <a href="https://www.tn.gov/education/educators/career-and-technical-education/work-based-learning.html">https://www.tn.gov/education/educators/career-and-technical-education/work-based-learning.html</a> .
<b>Promoted Tennessee Student Industry Credentials:</b>	Credentials are aligned with post-secondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit <a href="https://www.tn.gov/content/tn/education/educators/career-and-technical-education/student-industry-certification.html">https://www.tn.gov/content/tn/education/educators/career-and-technical-education/student-industry-certification.html</a> .
<b>Teacher Endorsement(s):</b>	037, 041, 055, 056, 057, 152, 153, 173, 203, 204, 311, 434, 435, 436, 470, 474, 475, 476, 477, 582, 595, 740, 742, 952, 953
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="https://www.tn.gov/education/educators/career-and-technical-education/career-clusters/cte-cluster-information-technology.html">https://www.tn.gov/education/educators/career-and-technical-education/career-clusters/cte-cluster-information-technology.html</a>  Best For All Central: <a href="https://bestforall.tnedu.gov/">https://bestforall.tnedu.gov/</a>

## Course at a Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21<sup>st</sup> century skills necessary to be successful in career and in life. In pursuit of ensuring every student in Tennessee achieves this level of success, we begin with rigorous course standards which feed into intentionally designed programs of study.

Students engage in industry relevant content through general education integration and experiences such as career and technical student organizations (CTSO) and work-based learning (WBL). Through these experiences, students are immersed with industry standard content and technology, solve industry-based problems, meaningfully interact with industry professionals, and use/produce industry specific, informational texts.

### Using a Career and Technical Student Organization (CTSO) in Your Classroom

CTSOs are a great resource to put classroom learning into real-life experiences for your students through classroom, regional, state, and national competitions, and leadership opportunities. Below are CTSO connections for this course, note this is not an exhaustive list.

- Participate in CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry specific skills that involve teamwork and project management.
- Participate in contests that highlight job skill demonstration, interviewing skills, community service activities, extemporaneous speaking, and job interview.
- Participate in leadership activities such as Student2Student Mentoring, National Week of Service, Officer Training, and Community Action Project.

For more ideas and information, visit Tennessee SkillsUSA at: <http://www.skillsusatn.org/>.

### Using Work-Based Learning (WBL) in Your Classroom

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- **Standards 1.1-1.2** | Invite an industry professional in to discuss safety equipment and protocols.
- **Standards 2.1-2.4** | Have the students partner with a physics professor on a real-life project.
- **Standards 3.1-5.1** | Invite an industry professional in to discuss the history and various occupations in the Information Technology field.
- **Standards 6.1-6.3** | Have students do a virtual exchange with an industry partner to explain job terminology and concepts.
- **Standards 7.1-8.6** | Have students work on-site with an industry cloud expert to do a real-world project.
- **Standards 9.1-9.3** | Discuss logical thought process with an Information Technology Specialist.
- **Standards 10.1-12.2** | Have students create an integrated project with interactions with professionals.
- **Standards 13.1-14.3** | Have students job shadow a cybersecurity specialist.
- **Standards 15.1-16.3** | Have students job shadow a computer programmer.

## Course Description

*Computer Science Foundations* (CSF) is a course intended to provide students with exposure to various information technology occupations and pathways such as Networking Systems, Coding, Web Design, and Cybersecurity. As a result, students will complete all core standards, as well as standards in two of four focus areas. Upon completion of this course, 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 CSF course, students will be prepared to make an informed decision about which Information Technology program of study to pursue.

The following implementation options are encouraged:

- 1 credit for core and two focus areas (listed below)
- 2 credits for all 36 standards

Core standards are required for both one and two credit implementation options.

**Core standards:** 1, 2, 3, 7, 8, 9, 15, 16, 17, 18, 19, 20, 29

### **Focus Areas**

Networking Systems:

Coding:

Web Design:

Cybersecurity:

### **Standards**

4, 5, 6, 10, 12, 13, 22, 23

23, 33, 34, 35, 36

10, 11, 14, 21, 24, 25, 26, 27, 28

13, 30, 31, 32

## Course Standards

### 1. Safety

1.1 Safety Rules: Accurately **read, interpret, and demonstrate adherence to 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.

1.2 Use of Safety Equipment: 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.

### 2. Electronics and Basic Digital Theory

2.1 Electrical Circuits and Devices: 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.

2.2 Basic Electronic Circuit Behavior: 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.

2.3 Counting Systems: 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.

2.4 Gates in Logic Circuits: 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.

### 3. Career Exploration

3.1 Occupations: **Research various occupations in information technology industries**, such as programmers, web designers, webmasters, networking administrators, computer systems administrators, telecommunications line installers, and informational security analysts. 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**.

3.2 Professional Societies: 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).

### 4. Overview of the Internet

4.1 History of the Internet: 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.

## 5. Overview of Operating Systems

5.1 Development of Operating Systems: 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, citing information found in research**. Compare and contrast the general capabilities of a variety of operating systems, and explain how their designs and functionalities have improved over time.

## 6. Terminology and Concepts

6.1 Web Terminology: 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.

6.2 Computer Hardware Components: 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, and
- g. electrical system.

6.3 Computer Networks: Demonstrate a **basic understanding of computer networking**. For example, explain the types of networks and what a client-server environment is.

## 7. Keyboard Shortcuts

7.1 Keyboard Shortcuts: **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.

## 8. Emerging Technologies

8.1 Evolution of Cloud Computing: Synthesize **research of historical and significant milestones that influenced the evolution of cloud computing**. Create an annotated timeline or visual graphic illustrating significant time periods and major impacts of technology trends that influenced the development of cloud computing. Use academic research and news media citing specific textual evidence from research.

- 8.2 Cloud Technologies Role: Identify, describe, and effectively **summarize cloud technology roles including: cloud computing customer, cloud service provider, and cloud service partner**. Create a written report or visual depiction outlining the characteristics of each.
- 8.3 Models of Cloud Technology: Research the **features and requirements of the four main deployment models for cloud technology: public, private, community, and hybrid**. Create a graphic illustration showing the roles of each and describe their differences.
- 8.4 Cloud Technologies: Consult a variety of sources to **describe how virtualization, storage, networking, and databases in cloud technologies are used**. Sources may include textbooks, manuals, websites, video tutorials, and more. Create a visual display with accompanying text comparing these methods.
- 8.5 Internet of Things (IoT): Explore the **onset of the Internet of Things (IoT) and explain how it is enabled by sensors, actuators, communication devices and computers that exchange and process data and can interface with users in a most instinctual way**. Using a specific example, summarize in a graphic illustration or narrative how the IoT combines information, automation, computation, software, sensing, and networking to make traditional processes more efficient.
- 8.6 Statistical Efficiency and Quality: Consult internet forums, textbooks, industry journals, and other instructional materials to **research the importance of developing and implementing databases, data collection systems, data analytics, and other strategies that optimize statistical efficiency and quality**. Write a brief paper that discusses the importance of these services in business today. Provide specific examples to support the claims.

## 9. Introduction to Logical Thought Process

- 9.1 Web Design Process: 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, justifying the reasoning behind each step. Explain why it is an iterative process and always involves refinement.
- 9.2 Troubleshooting Process: Research, identify, and describe the **specific activities involved at each step of the troubleshooting process**, including but not limited to: 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. Explain why it is important to document the process throughout.

9.3 Flowcharts: 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.

## 10. Teamwork and Project Management

10.1 Roles of Team Members: 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.

10.2 Importance of Management Skills: 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**.

## 11. Client Relations

11.1 Client Relations: 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 to revise the questionnaire and process.

## 12. Writing and Editing for Web Publication

12.1 Web-Based Writing Assignments: 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.

12.2 Website Creation: 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.

## 13. Social, Legal, and Ethical Issues

13.1 Social, Legal, and Ethical Issues: 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 and understand uses of open source software.

## 14. Cybersecurity

- 14.1 Data Security: Using various sources (i.e., internet, textbooks, videos, and journals), research and **identify reasons as to why data security should be a priority to technology professionals** through demonstrating an understanding of information security fundamentals on Confidentiality, Availability, and Integrity.
- 14.2 Security Breaches: 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.
- 14.3 Security Practices: 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.

## 15. Organization of Materials

- 15.1 Digital File Management: 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).

## 16. Programming

- 16.1 Programming Language: 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.
- 16.2 Software Development Life Cycle: Using various resources, **research, identify, and explain the steps involved in the software development life cycle**, including but not limited to: planning, designing, coding, testing, deployment, and maintenance. Explain why it is an iterative process and always involves refinement.
- 16.3 Batch Files: 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.

## Standards Alignment Notes

\*References to other standards include:

- 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.