



Cabling & Internetworking

Primary Career Cluster:	Information Technology
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C10H09
Prerequisite(s):	<i>Algebra I</i> (G02X02, G02H00) and <i>Networking</i> (C10H13)
Credit:	1
Grade Level:	12
Focus Elective Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other <i>Information Technology</i> courses.
Program of Study (POS) Concentrator:	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.
Programs of Study and Sequence:	This is the fourth and final course in the <i>Networking Systems</i> program of study.
Aligned Student Organization(s)	SkillsUSA: http://www.tnskillsusa.com Technology Student Association (TSA): http://www.tntsa.org
Coordinating Work-Based Learning:	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit https://www.tn.gov/content/tn/education/career-and-technical-education/work-based-learning.html .
Promoted Tennessee Student Industry Credentials:	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 https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html
Teacher Endorsement(s):	523, 532, 533, 537, 582, 595, 701, 740
Required Teacher Certifications/Training:	None
Teacher Resources:	https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-information-technology.html Best For All Central: https://bestforall.tnedu.gov/

Course-At-A-Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21st 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 & 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.tnskillsusa.com>.

Using Work-based Learning 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 1-3** | Have an industry partner explain safety protocols and job overview.
- **Standards 4-5** | Visit a local industry with this equipment and have the students see it in operation and being maintained.
- **Standards 6-7** | Invite industry experts to a panel discussion.
- **Standards 8-9** | Have students do a project with an industry mentor that is evaluated by a real company.
- **Standards 10-14** | Observe and/or assist a telecommunication specialist.

For more ideas and information, visit <https://www.tn.gov/education/career-and-technical-education/work-based-learning.html>.

Course Description

Cabling & Internetworking is an advanced course intended to equip students with the conceptual and practical skills necessary to install voice and data network cabling. This course emphasizes industry standards, types of media and cabling, physical and logical networks, and signal transmission. Upon completion of this course, proficient students will have skills in cable termination, reading network design documentation, pulling and mounting cable, setting up telecommunications rooms, basic cable testing and troubleshooting.

Program of Study Application

This is the fourth and final course in the *Networking Systems* program of study. For more information on the benefits and requirements of implementing this program in full, please see the program of study description documents found on the Information Technology website at <https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-information-technology.html>

Course Standards

Cabling Overview

- 1) Research the history and development of communications cabling to acquire knowledge of present-day network cabling concepts and uses, including but not limited to:
 - a. The history of telephone and wireless communications in the United States
 - b. The differences between analog and digital communication systems
 - c. The three main types and typical applications of twisted-pair cabling
 - d. Proper uses of plenum- and riser-rated cablingCreate and deliver a brief presentation on at least one of the above topics, citing specific textual evidence.

Safety

- 2) Assess a variety of situations requiring the use of network cabling and demonstrate the ability to follow procedures safely. Explain the applicability of various safety standards and procedures, including but not limited to:
 - a. Safety codes and standards for the cabling materials and installation methods
 - b. Safe practices working around electricity
 - c. Workplace safety practices
 - d. Personal safety equipment

Computers and Electronics

- 3) Compare and contrast aspects of communication signals carried by various types of cabling, identifying which types are best suited for different applications. Complete a graphic organizer to differentiate characteristics of:
 - a. Analog signals versus digital signals
 - b. Voltage signals versus optical signals
 - c. Multiplexed signals

Craft an argument on which type of signal is best suited for a specific application, developing both claim(s) and counterclaim(s) with fair evidence and reasoning.

Transmission Media

- 4) Compare and contrast the typical applications for various types of data cables (such as twisted pair, coaxial cable, fiber optic), and the conditions under which a technician may use them. Defend the choice of cable for an example application, coherently and respectfully expressing the rationale behind the choice to a mock customer.
- 5) Compare and contrast conducting data cables with fiber-optic data cables, including but not limited to:
 - a. Transmission modes (electrical conduction versus optical transmission)
 - b. Connectors
 - c. Installation issues
 - d. Advantages and disadvantages

Specifications and Standards

- 6) Research wiring standards and the organizations responsible for drafting and overseeing them. During a practice installation, explain how the communication of the standards impacts a user's ability to specify, install, and test the appropriate cabling. The subject organizations should include:
 - a. American National Standards Institute (ANSI)
 - b. Telecommunications Industry Association (TIA)
 - c. Electronics Industries Alliance (EIA)
- 7) During a practice installation of data cabling, describe the applicability of the National Electrical Code (NEC) and Underwriters Laboratories (UL) requirements, citing specific textual evidence.

Cabling System Design

- 8) Design a telecommunications closet (TC) for a Local Area Network (LAN) installation. Craft a full explanatory text that cites specific textual evidence in descriptions of:
 - a. Differences between TC and equipment rooms
 - b. Recommended number of TCs in a large building
 - c. TC construction standards (including required and prohibited features and dimensions)
 - d. Typical equipment and features in TC
 - e. Required environmental conditions inside the TC
- 9) Explain and demonstrate, in writing or a presentation, the role played by each component in a typical star network installation, including the Network Interface card (NIC), media converter, repeater, hub, bridge, switch, server, and router. For each component, detail the likely consequences in the event of failure, and prescribe strategies for prevention and maintenance.

Cabling Installations

- 10) Plan and implement a small-scale LAN installation, properly using the tools, techniques, and materials accepted in cabling industry, including but not limited to building schematics, wire cutters and wire strippers, cable crimpers, punch-down tool, "fish tape" and pull/pushrods, diagnostic test tools, lubricants, and cable identification tags. Before completing installation, design a summary document that includes a narrative of activities and a graphic illustration of sites to share with potential customer.
- 11) As part of a real or practice installation, explain and demonstrate the rough-in phase for both horizontal and vertical installations of data cabling in a small office, including but not limited to horizontal and vertical installations, fire stops, and telecommunications closet construction or upgrades.
- 12) As part of a real or practice installation, explain and demonstrate the trim-out phase of an installation, including but not limited to cable management, connectors and splices for copper media and fiber-optic media, and patch panels.
- 13) As part of a real or practice installation, explain and demonstrate the completion stage of an installation, including but not limited to cable testing and certification, performance testing, final dressing of the installation, and documentation and drawings representing the finished installation and test results.

Special Cabling Situations

- 14) Demonstrate an understanding of the special cabling situations required for high bandwidth scenarios, providing power over Ethernet (PoE), standards of SCADA systems, industrial-grade data cabling requirements, and preventive maintenance programs for cable systems. Create and deliver a brief presentation on at least one of the above topics, citing specific textual evidence.

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.