

# Cabling (10112)

## **Rationale Statement:**

The cabling course is based off the C-Tech cabling courses. The C-Tech cabling courses consist of three tiers. The tiers include introduction to telecommunications, introduction to network cabling for copper based systems, and introduction to network cabling for fiber optic systems.

In the introduction to telecommunications students begin to explore the open standards interconnection model for communication networks. This consists of the physical layer of telecommunications. Students learn about the basics and the history of data, voice, and video systems. This tier will help them as they enter into the copper based systems.

In the introduction to network cabling for copper based systems, students learn the knowledge and skills needed to become certified entry-level technicians. This tier does allow the students to become certified in copper through C-Tech. In this tier students learn about the proper tool use, construction techniques, industry standards, and troubleshooting and repair.

In the introduction to network cabling for fiber optic based systems, students are provided with the theoretical and hands-on knowledge of Fiber Optics. This tier also allows the students to become certified in fiber optic installation.

## **Course Description:**

Depending on the length of the course will depend on what tiers a course may complete. Generally the course will cover the introduction to telecommunications and copper. However these components could be used in other courses, or as a yearlong course and get through all three tiers. Depending on how you go about the outline of the course will dictate your description.

C-Tech Course Description can be found at the <http://c-techtraining.com>

### **Tier 1 – Introduction to Telecommunication**

Indicator #1: Students will understand the introductory concepts and some hands-on training required at the entry level of the telecommunications industry.

<http://c-techtraining.com/programs-telecom.htm>,

### **Tier 2 – Introduction to Network Cabling – Copper Based System**

Indicator #2: Students will understand the tool use and construction, characteristics of various industry standards, and troubleshooting and repair of a copper based system

<http://c-techtraining.com/programs-copper.htm>

### **Tier 3 – Introduction to Network Cabling – Fiber Optic Systems**

Indicator #3: Students will understand the tool use and construction techniques, characteristics of various industry standards, and trouble shooting and repair of a fiber optic system.

<http://c-techtraining.com/programs-fiber.htm>

**Grade Level:** 9 – 12

## **Topics Covered:**

- History and basics of telecommunications
- Tools and construction techniques in terminating cables
- Copper based systems for networking
- Safety precautions
- Fiber optic systems for networking

- Testing and troubleshooting of physical layer
- Physical layer of the OSI model

### Core Technical Standards & Examples

Indicator #1: Understand the introductory concepts and some hands-on training required at the entry level of the telecommunications industry.	
Bloom's Taxonomy Level	Standard and Examples
<b>Remembering</b>	<p><b>C1.1 Identify basic telecommunication systems and physical layer components present in the field of telecommunications.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify physical layer components in various telecommunication systems.</li> <li>• Trace the signal flow of a telecommunication system.</li> <li>• Demonstrate knowledge of testing equipment and how to use it to determine continuity.</li> </ul>
<b>Understanding</b>	<p><b>C1.2 Understand the history and function of various telecommunication systems.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Define the communication and telecommunication process.</li> <li>• Identify key developments in the history of telecommunications.</li> <li>• Identify cabling systems used for the distribution of data, voice, and video.</li> <li>• Identify diagrams showing the telecommunications process.</li> </ul>
<b>Remembering</b>	<p><b>C1.3 Identify and analyze the characteristics of the cabling systems and terminations that constitute the physical layer.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Define the level or category associated with the different types of twisted pair cabling systems.</li> <li>• Define techniques to eliminate noise reduction and cross talk.</li> <li>• Identify 2-pair and 4-pair cabling characteristics and identification.</li> <li>• Define the characteristics of twisted pair modular connecting systems.</li> <li>• Demonstrate and identify pair to pin configuration using the EIA/TIA 570 standard.</li> <li>• Define the characteristics of coaxial cable systems to include BNC and F-Type connections.</li> <li>• Define characteristics of Fiber Optic cable systems and the ST connector.</li> </ul>
<b>Remembering</b>	<p><b>C1.4 Identify general safety precautions.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify safety precautions that insure personal protection.</li> <li>• Define key points concerning safety on a job site.</li> <li>• Define safety in dealing with electrical equipment.</li> <li>• Identify and explain common safety procedures when working with hazardous materials.</li> <li>• Identify and explain the safety procedures and precautions that should be followed for fire prevention and safety.</li> </ul>

<p><b>Applying</b></p>	<p><b>C1.5 Identify tools, construction techniques, and test equipment utilized in network cabling.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Identify stripping and crimping tools use in network cabling.</li> <li>• Terminate 2-pair telephone and F-type coax cable.</li> <li>• Check for cable continuity using testing equipment.</li> </ul>
<p><b>Applying</b></p>	<p><b>C1.6 Identify and record faulty system identifications.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Define the terms testing, troubleshooting, and preventative maintenance.</li> <li>• Perform end-to-end signal testing.</li> <li>• Perform selective testing on individual systems</li> <li>• Identify the basic characteristics of basic troubleshooting techniques.</li> <li>• Demonstrate the use of patch cords, adapters, and bridging clips to simulate or correct malfunctions.</li> </ul>
<p><b>Remembering</b></p>	<p><b>C1.7 Identify positive and negative impacts of possible future technological developments</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Identify wiring infrastructure, personal computer, and smart devices in a smart home.</li> <li>• Identify future developments of wireless systems, cellular systems, and consumer electronics.</li> </ul>

**Indicator #2: Understand the tool use and construction, characteristics of various industry standards, and troubleshooting and repair of a copper based system**

Bloom's Taxonomy Level	Standard and Examples
<p><b>Remembering</b></p>	<p><b>C2.1 Identify the components of the advanced cable trainer and the data voice and electric test set.</b>            Examples:</p> <ul style="list-style-type: none"> <li>• Identify all the components of the advanced cable trainer (ACT).</li> <li>• Identify all aspects of the wiring configuration banner board.</li> <li>• Identify all components of the data voice and electric test set (DAVE-3) units.</li> <li>• Correctly identify all cables and test adapters.</li> <li>• Identify the tools used in cable construction.</li> </ul>
<p><b>Remembering</b></p>	<p><b>C2.2 Identify and describe the characteristics, application, and configurations of various cables and terminations.</b>            Examples:</p> <ul style="list-style-type: none"> <li>• Identify the characteristics and application of Twisted Pair Cables.</li> <li>• Identify the characteristics and application of 4-Pair UTP Cables.</li> <li>• Identify the three types of configurations for terminating twisted pair on modular patch cords, plugs, and outlets.</li> <li>• Identify configuration and application of 66-type terminal block.</li> <li>• Identify configuration and application of 110-type terminal block.</li> <li>• Identify configuration and application of a modular patch panel.</li> <li>• Identify configuration and application of shielded 4-pair cable.</li> <li>• Identify the characteristics and applications of 25-pair UTP cables.</li> </ul>
<p><b>Remembering</b></p>	<p><b>C2.3 Identify and explain the safety precautions, installation techniques, and tools used to install copper-based network cabling systems.</b>            Examples:</p> <ul style="list-style-type: none"> <li>• Identify and explain the safety procedures and precautions that should be followed for personal protection, at the work site, to prevent electrical hazards, working with hazardous materials, working with tools and equipment, and for fire prevention and safety.</li> <li>• Identify the minimum distance required between network cables and power sources.</li> <li>• Identify types and location for cable supports.</li> <li>• Identify and describe the step-by-step process used to install cable in buildings.</li> </ul>

<p><b>Applying</b></p>	<p><b>C2.4 Terminate twisted and test twisted pair cables.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Terminate an unshielded twisted pair cable to an 8P8C plug 568B.</li> <li>• Terminated a screened twisted pair cable to an 8P8C plug 568B.</li> <li>• Identify and troubleshoot shorts, opens, transposals, reversals, and pair to pin configurations.</li> <li>• Terminate and test 4-pair UTP cable to 66 and 100 connection blocks and modular jacks.</li> </ul>
<p><b>Applying</b></p>	<p><b>C2.5 Identify, terminate, and test 2-pair STP cabling systems.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Identify the application, configuration, construction and color code for 2-Pair STP cable.</li> <li>• Terminate an IBM 2-Pair cable with the 4-position UDC</li> <li>• Test an IBM cabling system and 2-Pair STP circuit</li> </ul>
<p><b>Applying</b></p>	<p><b>C2.6 Identify, describe, terminate, and test coaxial cable.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Identify the characteristics, type, and applications of coaxial cable.</li> <li>• Identify characteristics, type and application of coaxial connectors.</li> <li>• Identify tools for installing connectors on coaxial cable.</li> <li>• Terminate an test coaxial cable systems</li> </ul>
<p><b>Remembering</b></p>	<p><b>C2.7 Identify and explain the National Electric Code (N.E.C.) codes and American National Standard Institute Telecommunication Industry Association, Electronics Industry Alliance (ANSI/TIA/EIA) 568-A Standards.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Identify the purpose and application of the N.E.C. codes as they pertain to network cabling.</li> <li>• Identify N.E.C. electrical code limited energy articles.</li> <li>• Identify the major elements of the ANSI/TIA/EIA 568-A Standard.</li> <li>• Identify and explain the standards as applied to horizontal, new installation, and backbone cabling.</li> <li>• Identify and explain the 568-A standard for buildings, UTP, and ScTP cables.</li> </ul>

**Indicator #3: Understand the tool use and construction techniques, characteristics of various industry standards, and trouble shooting and repair of a fiber optic system.**

Bloom's Taxonomy Level	Standard and Examples
<p><b>Remembering</b></p>	<p><b>C3.1 Identify the tools and equipment used to terminate and test fiber optic cables.</b>            Examples:</p> <ul style="list-style-type: none"> <li>• Identify the tools and equipment found in the fiber optic termination kit.</li> <li>• Identify the contents of the Student Consumable Kit.</li> <li>• Demonstrate the ability to observe a connectorized fiber optic cable.</li> <li>• Demonstrate the ability to prepare and use the heat strip tool.</li> <li>• Use the buffer tube stripper to strip fiber optic cable.</li> <li>• Demonstrate the ability to use the SPOT tester to check a fiber optic cable.</li> </ul>
<p><b>Remembering</b></p>	<p><b>C3.2 Define the basic characteristics of light, optical sources, detectors, and continuity and attenuation.</b>            Examples:</p> <ul style="list-style-type: none"> <li>• Define the key characteristics and the relationships between the different characteristics of light.</li> <li>• Identify the three main elements of a fiber optic system.</li> <li>• Define advantages and disadvantages of fiber optic cabling systems.</li> <li>• Identify the primary light sources used in fiber optic systems and their key attributes.</li> <li>• Identify the structure and types of fiber optic cables</li> <li>• Identify the characteristics of various fiber optic cable systems.</li> <li>• Define continuity and identify how to configure test equipment.</li> <li>• Define attenuation and identify the causes of attenuation in fiber optic cables.</li> <li>• Identify the test equipment used in fiber cabling and define how to configure fiber cables for attenuation measurement.</li> </ul>
<p><b>Remembering</b></p>	<p><b>C3.3 Identify and describe the components used in a fiber optic system.</b>            Examples:</p> <ul style="list-style-type: none"> <li>• Identify the characteristics and construction and compare loose core and tight core fiber optic cable.</li> <li>• Identify and describe three types of fiber optic splices and closures.</li> <li>• Identify the characteristics of fiber optic cabinets and closure.</li> <li>• Identify fiber optic connectors and identify the characteristics and use of a fiber optic connector.</li> </ul>

<p><b>Remembering</b></p>	<p><b>C3.4 Identify the step-by-step procedure for placing fiber optic cables in a building.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Identify the twelve-step sequence for placing a fiber optic cable in a building.</li> <li>• Identify the steps to place a pulling string in a pathway.</li> <li>• Identify the steps required to attach a pulling string to fiber cable.</li> <li>• Identify the safety precautions and procedures that must be followed when placing fiber optic cable.</li> </ul>
<p><b>Application</b></p>	<p><b>C3.5 State the characteristics of continuity testing, testing with a power meter and light source, and the optical time domain reflect meter test.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Identify the differences between a continuity test, and attenuation test, and an OTDR test.</li> <li>• Perform a continuity test on a fiber optic patch cord utilizing the SPOT tester.</li> <li>• Perform both a subtraction and a zero set attenuation test utilizing a power meter and light source.</li> </ul>
<p><b>Applying</b></p>	<p><b>C3.6 Demonstrate the ability to use the tools and follow step-by-step process used to attach a fiber connector to an optical fiber.</b>  Examples:</p> <ul style="list-style-type: none"> <li>• Identify the step-by-step process of installing fiber optic connectors for both the epoxy method and the crimp-on method.</li> <li>• Identify and describe the safety procedures that must be followed when installing a fiber optic cable.</li> <li>• Terminate a fiber optic building cable using ST II+ connectors.</li> <li>• Terminate a fiber optic patch cord using ST II+ connectors.</li> <li>• Perform a continuity check and measure attenuation using the zero-set method.</li> </ul>