

MISSION TRAILS REGIONAL OCCUPATION PROGRAM

1. **COURSE TITLE:** Network Cable Technology

2. **CBEDS TITLE:** Telecommunications

3. **CBEDS NUMBER:** 4618

4. **JOB TITLES:**

- PC Network Technician
- Communications Technician – DOT 828.261-022
- Telecommunications Line Installer and Repairer
- Entry Level Network Cabling Specialist

5. **COURSE DESCRIPTION:** This is an Open Entry-Open Exit introductory course to the Physical layer of Networking. The program instruction involves 4 Tiers. In Tier 1, students are familiarized with the history and development of the Telecommunications Industry. Tier 1 objectives include basic terminology, function, purpose and simple troubleshooting devices. Tier 2, students will gain knowledge and skills for entry level technicians in the network cabling industry. Focus will be on the use of industry tools, cable construction techniques, troubleshooting, and repairs. Industry standards will be discussed for a variety of cables including TWISTED PAIR, UNSHIELDED TWISTED PAIR, SHIELDED TWISTED PAIR, 66/110 terminal blocks, coaxial, BNC, RG and modular jacks. Tier 3 centers on Fiber Optic telecommunication devices and instruction will include the basics of light and light transmission through fiber optic cables. Instruction will also include cable instruction, techniques of splices, closures, patch cords, cabinets and couplers found in fiber optic systems. In Tier 4, students will learn about manufacturer non-specific technology as related to the setup, maintenance and troubleshooting of telephone and key systems, including digital telephones and voicemail systems.

Tiers can be completed independently of each other and do not have to be completed concurrently. Every student will complete the module: *Connecting to Business: a training course in employability* as a supplement to the normal training.

In cooperation with C-Tech Associates, certification as "Network Cabling Specialist" will be earned upon completion of Tier 3 "Copper-Based systems" and Tier 3 "Fiber Optic-Based systems as well as certification as "Voice Communications Professional" upon completion of Tier 4. Certification is based on construction and troubleshooting techniques and a written final exam using a weighted score method. Certification is issued if the weighted score is 85% or higher.

6. HOURS:

Classroom Instruction

Tier 1 40 hours

Tier 2 50 hours

Tier 3 40 hours

Tier 4 50 hours

As needed

180 hours

Community Classroom

Tier 1 12 hours

Tier 2 24 hours

Tier 3 17 hours

Tier 4 25 hours

78 hours



7. PREREQUISITES: Basic Fine Motor Skills, ability to distinguish colors, and good eye/hand coordination are required for Tiers 1 through 4. No other prerequisites are required for entry at Tier 1. Tier 1 is a prerequisite for Tier 2. Tier 2 is a prerequisite for Tier 3.

8. REVISION DATE: November 1, 2005

9. COURSE OUTLINE:

a. CONTENT AREA SKILLS:

i. EXPECTED STUDENT OUTCOMES

ii. HOURS

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NATIONAL AND CALIFORNIA FOUNDATIONS STANDARDS

COURSE OUTLINE

KEY TO STANDARDS

- A. Academic Foundations
- B. Communications
- C. Career Planning and Management
- D. Technology
- E. Problem Solving and Critical Thinking
- F. Health, Safety, And Environmental Management
- G. Responsibility and Flexibility
- H. Ethics and Legal Responsibilities
- I. Leadership and Teamwork
- J. Technical Knowledge and Skills
- K. Demonstration and Application

CONTENT AREA SKILLS	EXPECTED STUDENT OUTCOMES	HOURS	STANDARDS
<p>TIER 1: Introduction to Telecommunications</p> <p>1. The Interactive Physical Layer: Students are introduced to the basic telecommunication systems and the physical layer components that are present in the field of telecommunications. These concepts are introduced through the use of the Interactive Telecommunications Board, (ITB). This module also provides the initial information on the DAVE-3 test set and students are familiarized with it and its use. This module also defines how the ITB can be used to simulate signal generation and testing. In addition, students will use the DAVE-3 tester to trace the systems on the Interactive Telecommunications Board</p>	<p>Student will be able to:</p> <p>a) Identify the "Physical Layer" components of the various telecommunication systems represented on the ITB.</p> <p>b) Trace the signal flow of the telecommunication systems represented on the ITB.</p> <p>c) Demonstrate knowledge of the basic functions of the DAVE-3 test set and use it to determine the continuity of test cables and the different telecommunication systems represented on the ITB.</p> <p>d) Identify how the Student Personal Optical Tester (SPOT) is used to check continuity of the Fiber Optic System on the ITB.</p>	12 hrs	<p>CL = Classroom</p> <p>CC = Comm. Class.</p>
Instruction will include:	Student will be able to:	CL	
		CC	A, B, D, J, K

<p>A, B, C, D, J, K</p>	<p>8 hrs</p>	<p>a) Define the communication process. b) Define the telecommunications process. c) Identify key developments in the history of telecommunications as it pertains to the following devices: i. Telegraph ii. Telephone iii. Radio iv. Television v. Computer Networks vi. Facsimile Machine vii. Cellular Telephone d) Identify the (Physical Layer) cabling systems used for the distribution of data, voice and video in the systems defined above. e) Identify simple block diagrams showing the telecommunication process in the above communication devices. Telecommunication system block diagram</p>	<p>2. Telecommunications: From the Beginning: Students are introduced to the history and evolution of various telecommunication systems, including telegraph, telephone, radio, television, networked computers, facsimile machines and cellular technology. Students will develop an understanding of how the telecommunications industry distributes information to the workplace and to homes.</p>
<p>A, B, D, J, K</p>	<p>4 hrs</p>	<p>a) Define the level or category associated with the different types of twisted pair cabling systems. b) Define the reasoning for the twisted pair system that includes noise reduction and cross talk elimination techniques. c) Identify 2-Pair System cabling characteristics that include pair tip and ring identification. d) Identify 4-Pair System cabling characteristics that include pair tip and ring identification. e) Define the characteristics of the twisted pair modular connecting system to include the RJ-11, and RJ-45 systems as well as associated plugs jacks, patch cords and adapters. f) Demonstrate and identify pair to pin configurations using the EIA/TIA 570 Standard. g) Define the characteristics of coaxial cable systems to include BNC and F-Type Connectors. h) Define characteristics of Fiber Optic cable systems and the ST Connector.</p>	<p>3. Transmission Media Physical Layer Components: Students will be introduced to the characteristics of the cabling systems and terminations that constitute the "Physical layer" of the telecommunications field. These systems and terminations were introduced in Module 1 and this module further defines the concepts of transmission media and the criticality of Physical Layer connections. Students are provided with information about the construction characteristics, industry standard configurations, signal transmission capability and application of each cabling system.</p>

<p>a) Identify safety precautions that insure personal protection. b) Define key points concerning Safety on a job site. c) Define safety in dealing with electrical equipment. d) Identify and explain common safety procedures when working with hazardous materials. e) Identify and explain the safety procedures and precautions that should be followed for fire prevention and safety.</p>	<p>2hr</p>	<p>B, D, F, J, K</p>
<p>a) Identify and use coaxial cable stripping tools b) Identify and use the RJ-11 stripping and crimping tool c) Safely and correctly strip and terminate a 2-Pair telephone cable with RJ-11 connectors d) Safely and correctly strip and terminate a coaxial cable with Screw on F-Type connectors e) Perform continuity checks on newly constructed cables using the DAVE-3 test set</p>	<p>4 hrs</p>	<p>B, D, E, J, K</p>
<p>4. Safety: Students will have a familiarity with general safety cautions to protect themselves the job site, in addition to knowledge of electrical hazards, hazardous equipment safety, and fire safety.</p>	<p>5. Tools, Construction Techniques And Test Equipment Utilized in Network Cabling: Students will cover some of the tools and techniques that are used by line technicians to construct cabling systems. In addition, we will construct both a 2-Pair patch cable terminated with 6P4C connectors, and we will construct a coaxial patch cable terminated with F-Type connectors. After the two cabling systems are constructed we will perform continuity testing on them the DAVE-3 test set. An introduction to techniques used to construct a cable system. Instruction will include performing a continuity test on a cable constructed by a student.</p>	

<p>a) Define the terms Testing, Troubleshooting and Preventive Maintenance.</p> <p>b) Perform operational checks on the DAVE-3 to insure its ability to test the systems of the ITB.</p> <p>c) Perform End-To-End signal testing using the DAVE-3 to test the cabling systems on the ITB.</p> <p>d) Perform selective testing of individual cabling subsystems on the ITB.</p> <p>e) Perform signal testing of the fiber optic system using the Student Personal Optical Tester (SPOT)</p> <p>f) Identify the basic characteristics of the following basic Troubleshooting Techniques.</p> <p>g) i. The Split Half Method ii. Fault isolation techniques iii. Hard Fault Troubleshooting iv. Intermittent Faults</p> <p>Demonstrate the use of Patch Cords, Adapters and Bridging Clips to simulate or to correct Physical Layer malfunctions on the Interactive Telecommunications Board.</p>	<p>6 hrs</p>	<p>6 hrs</p>	<p>a) Define Smart House and identify its component parts that include Wiring Infrastructure, Personal Computers and Smart Devices.</p> <p>b) Identify possible future developments in Wireless Systems.</p> <p>c) Identify possible future developments in Consumer Electronics.</p>	<p>6. Testing and Troubleshooting the Physical Layer: Students will be introduced to Physical Layer testing and troubleshooting using the Interactive Telecommunications Board. Students will use the DAVE-3 to test, identify and record faulty system indications. Students will also become familiar with basic signal troubleshooting techniques.</p>
<p>a) Complete all Activities and Quizzes to receive verification of accomplishment</p>	<p>2 hrs</p>	<p>2 hrs</p>	<p>7. Telecommunications: A Glimpse into the Future: Students will be introduced to some of the new technologies being developed in the Telecommunications Industry. Students are given an opportunity to speculate about future trends and assess the positive and negative impacts of some of the possible future technological developments.</p>	<p>Complete Tier 1 foundation: Introduction</p> <p>Tier 1 Complete</p>

<p>B, D, J</p>	<p>4 hrs</p>	<p>Identify all components of the ACT panel Identify all aspects of the Banner Board Identify elements in the Cable Supply DAVE-3 transmitter and receiver Identify all of the cables and test adapters in the ACT with DAVETM Training Aid Identify the types of tools located in the training aid and their function to include: i. Punchdown tool ii. Cable Strippers iii. Coaxial Cable Crimper iv. RJ45 Crimper v. Cable Cutter vi. Identify the contents of the Student Consumable Kit vii. Identify the contents of the optional tool kit</p>	<p>TIER 2: Introduction to Network Cabling - Copper-based Systems: The ACT with DAVE™ Training Aid: Students will be able to identify all of the components located in the ACT with DAVE™. They will be able to set up the ACT unit and be able to identify the functions of the DAVE-3 testers. Students are also familiarized with the tools in the ACT unit as well as their function in the cabling field.</p>
<p>A, B, D, E, J, K</p>	<p>4 hrs</p>	<p>Identify the characteristics of Twisted Pair Cables to include i. Twist Length ii. Gauge iii. Solid and Stranded Cabling Systems iv. Tip and Ring</p>	<p>9. Twisted Pair Cable Systems: Students will be able to identify and describe the characteristics, application and configuration of various cable types and terminations.</p>
<p>4 hrs</p>	<p>4 hrs</p>	<p>a) Define Plenum and Riser in regards to Copper Cabling b) Given a cabling substitution chart recommend a correct cable substitution c) Define bandwidth and bits-per-second as it pertains to twisted pair cabling systems d) Identify the color code for four pair UTP cabling e) Identify cabling configurations and uses in regards to: i. Straight Through Cable ii. Roll Over Cable iii. Cross Over Cable g) Identify the following Modular Plug and Jack pair to pin Configurations: i. T568A ii. T568B iii. USOC h) Complete a wire map of a 4-Pair UTP cable terminated in different configurations i) Define IDC as Insulation Displacement Connection j) Identify four types of IDC termination devices k) Identify IDC termination procedures</p>	<p>Identify the characteristics of Twisted Pair Cables to include i. Twist Length ii. Gauge iii. Solid and Stranded Cabling Systems iv. Tip and Ring b) Define Plenum and Riser in regards to Copper Cabling c) Given a cabling substitution chart recommend a correct cable substitution d) Define bandwidth and bits-per-second as it pertains to twisted pair cabling systems e) Identify the color code for four pair UTP cabling f) Identify cabling configurations and uses in regards to: i. Straight Through Cable ii. Roll Over Cable iii. Cross Over Cable g) Identify the following Modular Plug and Jack pair to pin Configurations: i. T568A ii. T568B iii. USOC h) Complete a wire map of a 4-Pair UTP cable terminated in different configurations i) Define IDC as Insulation Displacement Connection j) Identify four types of IDC termination devices k) Identify IDC termination procedures</p>

<p>10. Safety: Students will be able to identify and explain the safety precautions in terms of personal protection, workplace safety, and other hazards found on the job site. Students will also be familiarized with Fire Stopping and Grounding and Bonding processes and practices.</p>	
<p>a) Define Safety as it applies to the Network Cabling Specialist b) Define OSHA and its role in work place safety c) Identify and explain the safety procedures and precautions that should be followed for personnel protection to include the protection of: i. Head and Scalp ii. Eyes and Ears iii. Hands and Feet iv. Respiratory v. Skin vi. Back d) Identify and explain the safety procedures and precautions that should be followed at the work site to include: i. Special Instructions ii. Special Training iii. Restrictions iv. Permits v. Work permits vi. Lock-Out procedures vii. Access Routes viii. Locations of Safety Equipment e) Define the role of the National Electric Code as it pertains to copper cabling systems f) Identify and explain the safety procedures and precautions that should be followed to prevent electrical hazards to include: i. Function and use of Ground Fault Circuit Interrupter (G.F.C.I.) ii. Extension cords iii. Proximity and hot work iv. Insulated tools</p>	<p>i) Identify IDC termination procedures using a 110 Block m) Identify IDC termination procedures using a Krone (LSA) Block n) Identify IDC termination procedures using a BIX Block o) Identify modular patch panel configurations p) Define MAC as Moves Adds and Changes q) Identify Screened four pair UTP (SCTP) cable r) Identify Modular Jacks and Plugs s) Define termination procedures of SCTP cable on a 66 Connecting Block t) Define termination procedures of a 25 pair cable on a 66 Connecting Block u) Define termination procedures of a 25 pair cable on a 110 Connecting Block</p>
<p>4 hrs</p>	<p>4 hrs</p>
<p>A, B, D through K</p>	<p>Network Cable Technology</p>

<p>11. 4-Pair Cable systems: Students will be able to construct, test and troubleshoot 4 pair twisted pair cabling systems. Students use the ACT with DAVE™ unit to test cabling systems for shorts, opens, transposals and reversals and map pair to pin configurations.</p>	
<p>a) Identify the ACT with DAVE™ units i. Identify and define the pair layout and pin assignment illustrated on the ACT with DAVE™ Banner Board. ii. Define and correctly interpret DAVE-3 Receiver responses and pair to pin configurations for the following conditions: a. A normal configured cable b. A cable with Reversals c. A cable with an Open d. A cable with a Short e. A cable with a Split Pair f. A cable that causes Dual lighting of a DAVE-3 LED g. A cable with Transposals</p> <p>b) Test a ScTP cable using the DAVE-3 Test set c) Diagram a wire map for a terminated UTP cabling system d) Define set up and use procedures for the 3 blade cable stripper e) Define how to use the 8P8C Crimper f) Given UTP cable, plugs and tools correctly terminate and test a UTP</p>	<p>g) Define the importance of Bonding and Grounding electrical circuits and telecommunications devices h) Define the purpose of Material Safety Data Sheets when working with hazardous materials</p> <p>i) Identify and explain the safety procedures and precautions that should be followed when working with tools to include: i. Hand tools ii. Power tools</p> <p>j) Define workspace safety in regards to: i. Stability Control ii. Fall Prevention and Protection iii. Ladder Safety iv. Scaffolding v. Scissor Lifts vi. Barricades vii. Crawl Spaces</p> <p>k) Identify and explain the safety procedures and precautions that should be followed for fire prevention and safety to include: i. Location and access to fire alarms ii. Emergency exits iii. Class of fire extinguishers and types of fire</p>
<p>22 hrs</p>	
<p>6 hrs</p>	
<p>A, B, D, E, G, I, J, K</p>	

<p>Network Cable Technology</p>	<p>A, B, D, E, G, I, J, K</p>	<p>2 hrs</p>	<p>12. Troubleshooting/Punching Down of 4-Pair Cabling Systems: Students will be able to terminate, punch down and test on 66 and 110 connecting blocks, and complete the construction of jacks. Students use the ACT with DAVE™ unit to test and troubleshoot cabling systems and map pair to pin configurations. Students also perform a Tone and Trace of a UTP cabling system</p>
<p></p>	<p></p>	<p>a) Interpret and wire map the DAVE-3TM responses for multiple UTP cabling faults b) Using the ACT panel, a 66 Block adapter and bridging clips, test a 4-Pair UTP cable between a modular jack and a 66 Block c) Using the ACT panel, test a 4-Pair UTP cable between a modular jack and a 110 Block d) Using the ACT patch panel, test a 4-Pair UTP cable between a modular jack and a patch panel. e) Using the ACT panel, terminate and test a 4-Pair UTP cable on a 66 Connecting Block f) Using the ACT panel, terminate and test a 4-Pair UTP cable on a 110 Connecting Block g) Terminate and test a 4-Pair UTP cable on a modular jack h) Using the ACT panel and the DAVE-3 test set, Tone and Trace a 4-Pair UTP cable</p>	<p></p>

<p>14. Commercial Cabling Topologies and Standards: Students will be able to explain the role of codes and standards and Commercial cabling topologies. Students will be able to identify commercial cabling subsystems. Students will also be familiarized with cable labeling and equipment color code practices. They will be able to distinguish between mandatory and advisory language in codes and standards.</p>	<p>a) Define the role of codes and standards in dealing with Copper Cabling systems b) Identify the standards that pertain to copper cabling in the commercial environment c) Identify the topologies used in commercial copper cable installations d) Identify the six subsystems of a commercial cabling system as: Entrance facility, Backbone cabling, Horizontal Cabling, Telecommunications Room, Equipment Room and work area e) Identify the functions of a telecommunications room f) Define maximum cable lengths for the</p>	<p>2 hrs</p>	<p>A through K</p>
<p>13. Coaxial Cable: Students will be able to identify, terminate and test coaxial cabling systems that used in Networking and telecommunications, and understand their application.</p>	<p>a) Define common coaxial cabling applications in regards to: b) Cable Television Systems c) Cable Modems d) Digital Satellite Systems e) Local Area Networks f) Identify the component parts of a typical Coaxial Cable g) Identify the three most common types of Coaxial Cable connectors as: i. BNC ii. F-Type iii. N-Type h) Identify the tools used for installing connectors on coaxial cable i) Demonstrate the ability to set the 3 blade stripper to terminate a coaxial cable j) Identify the crimp procedure used to terminate coaxial cable k) Identify the compression procedure used to terminate coaxial cable l) Identify what the crimper eccentric adjustment is used for m) Identify the steps in coaxial cabling termination process n) Terminate and test an RG-59 coaxial cable system using F-Type connectors o) Test and troubleshoot constructed coaxial cables using the DAVE-3 test set p) Terminate an RG-59 coaxial cable system using BNC connectors q) Identify the steps to terminate quad shield coaxial cable with F-Type connectors r) Identify the component parts of a quad shielded Coaxial Cable s) Terminate and test a Quad Shield Coaxial (RG-59) cable with F-Type connectors</p>	<p>2 hrs</p>	<p>A, B, D, E, G, I, J, K</p>

<p>Network Cable Technology</p>	<p>A through K</p>	<p>2 hrs</p>	<p>2 hrs</p>	<p>various telecommunications links recommended for commercial applications Identify the main environmental hazards of copper cabling as Mechanical, Ingress, Climate, and Electromagnetic (MICE) Given a diagram of a commercial cabling system identify the backbone cable, main cross connect, intermediate cross connect, horizontal cross connect, first and second level backbone cable and the work area Define the role of the National Electric Code as it pertains to copper cabling systems Identify mandatory and advisory terms in regards to codes and standards Given blueprint symbols identify common copper components in a commercial building Define how cables should be labeled</p>	<p>15. Residential Cabling Topologies and Standards: Students are familiarized with the standards that apply to residential copper network cabling in accordance with the EIA/TIA 570 standard for both single residences and multi-tenant residences. Students will be familiarized with residential system components and topologies as well as different grades of residential cabling as set forth in residential standards, as well as structured cabling systems. Cost of parts for a residential installation will be calculated.</p>
				<p>Identify the types of cable recommended for commercial applications Identify the main environmental hazards of copper cabling as Mechanical, Ingress, Climate, and Electromagnetic (MICE) Given a diagram of a commercial cabling system identify the backbone cable, main cross connect, intermediate cross connect, horizontal cross connect, first and second level backbone cable and the work area Define the role of the National Electric Code as it pertains to copper cabling systems Identify mandatory and advisory terms in regards to codes and standards Given blueprint symbols identify common copper components in a commercial building Define how cables should be labeled</p>	
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<p>Network Cable Technology</p>	<p>A, B, D, E, F, G, H, I, J, K</p>	<p>2 hrs</p>	<p>16. Placement of Copper Cable Systems— Residential and Commercial: Students will be able to identify cable placement methods and procedures. Students will be able to identify the steps to a successful cable pull as well as the tools and devices required.</p>
<p></p>	<p>2 hrs</p>	<p>Identify the elements of a Multi-Dwelling residence to include: i. Entrance Facility ii. Main Terminal Space iii. Backbone cabling iv. Floor serving terminal v. Distribution Devices vi. Auxiliary Disconnect Outlets vii. Outlet Cabling viii. Outlets) Given a diagram of a Multi-Tenant Residence correctly label the copper cabling systems components k) Given a cabling and connector price list and a diagram of a home, calculate the cost of materials to complete a cabling job</p>	<p>a) Identify the cable pulling process as Planning, Preparation, Pulling, Terminating, and Testing b) Define how to use a pull string to begin a cable pull c) Identify distance considerations between network cables and power sources when dealing with: i. Transformers ii. Electrical service entrances iii. High voltage wiring and fixtures iv. 110 volt wiring v. Conduits d) Describe how to label cabling systems e) Identify types of cable support systems f) Identify the tools used in the placement of Copper cable to include: (Fish tapes and Rods, De-Feeders.) g) Define minimum bend radius for cable placement. h) Define how to pull cable from spools and reels i) Describe the process of pulling four or five UTP or SFTP cables at once j) Define how to pull cable from cartons k) Identify the safety precautions relative to cable pulling l) Describe the process of attaching a pulling cable to a Copper Cable m) Describe the process of pulling 25 pair n) Describe the process used to complete an installation through a vertical pull o) Describe the process used to complete an installation through a horizontal pull p) Describe the steps to pull a Copper cable into a pathway Describe how to pull a cable through</p>

<p>Network Cable Technology</p>	<p>2 hrs</p>	<p>2 hrs</p>	<p>a) Define attenuation as the loss of signal strength from one end of a cable to the other b) Identify the signal characteristics of both an analog and a digital system c) Define Insertion Loss and Return Loss d) Identify that noise in a cabling system can be either internally or externally generated e) Define that twisted cable, differential amplifiers, and good installation practices minimize the effects of noise in a cabling system f) Define that signal to noise ratio-S/N is the ratio of the signal amplitude to the amplitude of the noise g) Distinguish between Near End Cross Talk (NEXT) and Far End Cross Talk (FEXT) h) Define Wire Map i) Define Cable Length, Propagation Delay and Delay Skew as system features to be tested. j) Identify system testing as a three step process that includes: Inspection, Testing, and Documentation k) Define consolidation point and describe what it is used for Describe how to test a cable channel and a permanent link</p>	<p>17. Testing and Troubleshooting Copper-Based Cabling Systems: Students will be able to define cabling system performance parameters and have an understanding of Copper Based systems testing. Students will be familiarized with copper cabling troubleshooting methods and they will identify solutions to copper cabling faults.</p>
<p>A, B, D, E, G, I, J, K</p>	<p>2 hrs</p>	<p>2 hrs</p>	<p>q) Describe the usage of raceways a conduit r) Describe the limitations for cabling in a conduit s) Describe how to dress an outlet panel or closure t) Describe the importance of Fire Stopping u) Identify the technician's responsibility concerning fire-stopping materials v) Identify the minimum amount of cable needed to be in place after the cable has been placed in a closure or outlet w) Define how to remove an abandoned cabling system</p>	

		<p>1) Given a diagram of an overall copper cabling channel define the cabling segments and devices</p> <p>m) Describe the Split Half troubleshooting method</p> <p>n) Define that Copper Cabling system performance is based on the following: i. Cable Characteristics ii. Installation Techniques iii. Connections iv. Connecting Hardware</p> <p>o) Define safety requirements in regards to testing a cabling system</p> <p>p) Given a blueprint and price figures, cost out a typical installation.</p>	<p>18. Local Area Network</p> <p>Overview: Students are familiarized with workings of Ethernet and Token Ring local area network systems, and review the OSI model. Students also examine the role of media conversion in a network. The standards and practices of wireless networks are also covered.</p>
<p>A, B, D, E, J, K</p>	<p>2 hrs</p>	<p>a) Describe how to install a NIC card in a personal computer</p> <p>b) Identify a Local Area Network (LAN), a Wide Area Network (WAN), and a Metropolitan Area Network (MAN)</p> <p>c) Given an example of a network topology, determine if it is a Bus, Star, Token Ring</p> <p>d) Define Collision as it pertains to networking</p> <p>e) Define Ethernet and Ethernet terms to include: i. Medium ii. Node iii. Segment iv. Frame v. Protocol</p> <p>f) Define Media Access Control (MAC) as it pertains to Ethernet protocol</p> <p>g) Identify the three different parts of a standard Ethernet naming convention</p> <p>h) Define a hybrid network as one that uses both copper and fiber optic media</p> <p>i) Identify the four main reasons that hybrid networks are used as Distance, Interference, Security, and Expense</p> <p>j) Identify that the media used in a network is the first layer of the Open Systems Interconnect model</p> <p>k) Define wireless network</p> <p>l) Identify that wireless LANs solve problems of mobility and installation</p> <p>m) Given a wireless network setup, identify the purpose and function of Ad Hoc or Peer-to-Peer arrangements and access points</p> <p>n) Identify the 802.11 standard as the wireless networking standard</p> <p>o) Define the term WiFi</p> <p>p) Identify that Bluetooth is not part of the 802.11 standard</p>	

Tier 2 Complete				
<p>Complete Tier 2 Formal Examinations: Specialist Certification is based upon a weighted average of 85%.</p>	<p>Tier 2 Complete</p>	<p>a) Pass a Written Examination, Cable Construction Examination, and Diagnostics Examination to receive a Certificate "Certified Cable Specialist - Copper" awarded by C-Tech According to requirements.</p>	2 hrs	A, B, D, E, J, K
		<p>q) Identify that most wireless LAN systems use Frequency Hopping or Direct Sequence Spread Spectrum technologies</p> <p>r) Identify that security is a concern associated with wireless networks</p> <p>s) Define 3 ways a technician can increase the security of a wireless network</p>		

Network Cable Technology

<p>a) Give examples of light communication systems in the typical home or school b) Define transducer and give an example c) Identify the three main elements of an optic telecommunication system and briefly explain the function of each d) Identify the three parts of a Fiber Optic cable e) Define the purpose of the core, the cladding and the buffer in a Fiber Optic cable f) Identify key historical developments in the evolution of Fiber Optic communications systems to include i. The Photophone ii. Early light experiments iii. The Fiber Scope g) Define the key characteristics of light to include: i. Speed. ii. Frequency iii. Wavelength h) Identify that operational wavelengths of Fiber Optic devices are based on the light handling characteristics of the glass fiber. i) Define the propagation of light in Fiber Optic systems to include: i. Reflection ii. Total internal reflection iii. Refraction iv. Index of refraction j) Define attenuation as it pertains to Fiber Optics i. Describe light Scattering in Fiber ii. Describe the Absorption of light in Fiber iii. Define Micro bending and Macro Bending k) Describe attenuation in relation to wavelength l) Define Bandwidth and how it pertains to Fiber Optics m) Define dispersion to include modal and chromatic dispersion</p>	<p>2 hrs</p>	<p>2 hrs</p>	<p>TIER 3: Introduction to Fiber Optic-Based Systems: Fiber Optic Concepts: Students will be able to identify light communication systems and define key historical developments in Fiber Optic Technology. Students will have an understanding of the basics of light to include speed, wavelength and frequency. Students will also be familiarized with the propagation of light in an optical fiber as well as the limitations of optical fiber in regards to attenuation and bandwidth.</p>
<p>A, B, D, E, J, K</p>	<p>2 hrs</p>		

<p>A, B, D, E, I, J, K</p>	<p>4 hrs</p>	<p>a) Identify the structure, characteristics and types of Fiber Optic cables. i. Describe how Fiber Optic cable is manufactured (Corning Video) ii. Identify the three parts of a Fiber Optic cable iii. Describe the light propagation characteristics of both single-mode and multimode cable iv. Define cone of acceptance as it pertains to Fiber Optic cable. v. Identify the characteristics of light propagation in a Fiber Optic cable in regard to stepped index, and graded index Fiber Optic cabling systems vi. Identify the characteristics of the three main types of Fiber Optic cable systems b) Match a Single and Multimode cable with its typical application to include: i. Wavelength ii. Distance between sources and detectors c) Given a SPOT (Student Personal Optical Tester) and a Fiber Optic patch cord determine the continuity of a Fiber Optic cable d) Identify the characteristics of the two main Fiber Optic cabling systems to include applications of: i. Loose Tube ii. Tight Buffer e) Demonstrate the ability to safely strip a light guide building cable and identify its component parts f) Compare Loose Tube and Tight Buffer cabling characteristics in regards to bend radius, tensile strength, impact resistance, crush resistance and attenuation g) Identify the characteristics of ribbon cable h) Identify light guide building cable; two-fiber zip cord and patch cord i) Define the role of codes and standards in dealing with Fiber Optic cabling j) Identify both mandatory and advisory terms in regards to codes and standards k) Identify a Fiber Optic cable as conductive, non-conductive or composite as defined by the National Electrical Code l) Given the Fiber Optic color code for Fiber Optic cables identify a fiber by</p>	<p>20. Fiber Optic Cabling: Students will have an understanding of Fiber Optic cabling to include light propagation and numeral aperture of both single and multimode cabling systems. Students will be able to describe the concepts behind step index and graded index fiber. Students will gain an awareness of cabling standards and the codes that affect fiber-cabling systems to include color codes, labeling and cabling in substitution methods. Activities in this module include using the Student Personal Optical Tester (SPOT) to determine continuity in a Fiber Optic cable and a cable stripping activity in which students will become familiar with the parts of a Fiber Optic light guide building cable. Additional activities include the understanding the Fiber Optic color code and cabling substitution methods.</p>
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<p>A, B, D, E, I, J, K</p>	<p>2 hrs</p>	<p>a) Observe the process for installing Fiber Optic connectors using the anaerobic method and identify the key points and tools used. b) Identify the tools and equipment found in your Fiber Optic Termination Kit and identifies applicable safety precautions that pertain to the use of the kit. i. Identify the sections of the termination tray ii. Identify the fiber optics disposal disk iii. Identify the three Fiber Optic Patch Cords iv. Identify the fiber optic microscope and with built in</p>	<p>22. The Fiber Optic Termination Workstation: Students are familiarized with the tools and equipment that is used to terminate the Fiber Optic cables that are part of the C-Tech Fiber Optic Termination kit. Students will be familiarized with the anaerobic method of connectorization then students will remove all of the tools from the kit and identify their purpose.</p>
<p>B, D, E, G, I, J, K</p>	<p>3 hrs</p>	<p>a) Define source as it pertains to a Fiber Optic system b) Identify the operating characteristics of sources c) Identify the two primary sources used in Fiber Optic systems d) Describe the safety precautions taken when dealing with optical sources e) Describe the development of effective sources for Fiber Optic systems f) Compare the two types of sources in terms of: i. Effective range ii. Light emission patterns iii. Cost iv. Output Power v. Mean Time between failures g) Define detector as it pertains to a Fiber Optic system h) Identify the two primary types of optical detectors i) Identify operating characteristics of detectors j) Match an optical detector with its recommended source k) Match an optic detector and source with their recommended type of Fiber Optic Cable l) Identify Electro Static Discharge, ESD, and the procedures that should be followed when handling sources and detectors m) List four advantages and one disadvantage of Fiber Optic cabling systems as compared to copper cabling systems</p>	<p>21. Sources and Detectors: Students will have an understanding of the operation and characteristics of Sources and Detectors used in Fiber Optic systems. Students will be able to match sources and detectors to each other and to the fiber optic cable required. Students will be familiarized with Electro Static Discharge sensitivity when in contact with these devices. Activities in this module include working with SPOTs that are set at different wavelengths. This activity will define the concepts covered in this module and it will reinforce the importance of working with frequency matched fiber systems.</p>
<p></p>	<p>8 hrs</p>	<p>m) Identify a Fiber Optic cable type by its labeling n) Given a cabling substitution chart recommend a correct cable substitution</p>	<p></p>

	4 hrs	4 hrs	<p>a) Review Fiber Optic termination procedures for the anaerobic method of termination and identify the steps involved in the process</p> <p>b) Define anaerobic fiber termination</p> <p>c) Observe an ST connector demonstration and identify the steps to follow to correctly terminate and test the termination</p> <p>d) List the steps necessary to measure attenuation of a Fiber Optic cable using a power meter and light source</p> <p>e) State the standard attenuation values for Fiber Optic terminations</p> <p>f) State the safety procedures to follow when working with Fiber Optic cable</p> <p>g) Demonstrate the correct use of eye protection while terminating fiber</p> <p>h) Demonstrate the correct procedure for the disposal of loose fiber ends removed during cleaving</p>	<p>23. Terminating Fiber Optic Cable: students will terminate both an SC and ST Fiber Optic connector on Fiber Optic light guide building cable and Fiber Optic patch cord. Safety procedures will be covered and students will demonstrate the ability to safely terminate Fiber Optic connectors. Students will also learn to zero set the power meter and light source and determine attenuation on newly terminated cables.</p>
A, B, D, E, I, J, K	4 hrs		<p>v. Identify the buffer tube stripper</p> <p>vi. Identify the cable jacket stripper</p> <p>vii. Identify the crimp tool</p> <p>viii. Identify the polishing pad</p> <p>ix. Identify the scribe</p> <p>x. Identify the polishing pucks</p> <p>xi. Identify the scissors</p> <p>xii. Identify the screwdriver</p> <p>xiii. Identify the cable pulling jig</p> <p>xiv. Identify the four types of lapping paper used in fiber polishing during the termination process</p> <p>xv. Identify the cleaving puck</p> <p>Identify the contents of the Student Consumable Kit</p> <p>i. The Radial ST Connectors</p> <p>ii. The Radial SC Connectors</p> <p>iii. The Lapping Paper</p> <p>iv. The Light Guide Building Cable</p> <p>v. The Patch Cord</p> <p>vi. Safety Glasses</p> <p>vii. Mechanical Splices</p> <p>viii. Large Alcohol Wipes</p> <p>ix. Small Alcohol Wipes</p> <p>x. Applicator Tips</p> <p>d) Identify selected items in the instructor workstation to include</p> <p>i. Power Meter and Light Source</p> <p>ii. Visual Fault Finder</p> <p>iii. Adhesive</p> <p>iv. Primer</p> <p>v. Applicator Disposal Unit</p> <p>e) Describe how to safely use the Disposal Unit</p> <p>f) Describe safety precautions to follow when dealing with Fiber Optic chemicals</p>	

<p>A, B, D, E, I, J, K</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>a) Identify common connectors used in Fiber Optic systems i. SC Connector ii. ST Connector iii. FC Connector iv. LC Connector b) Identify the difference between simplex and duplex connectors c) Define the terms adapter and hybrid adapter in regards to Fiber Optic Cabling Connections d) Identify the standard connector color coding for both Single and Multimode connectors e) Define Small form factor in regards to Fiber Optic connectors f) Observe a small form factor connectorization and identify the four main steps in termination of the small form factor connector g) Identify two types of small form factor connectors h) Observe connectorization using the crimp and cleave method and identify the steps required i) Define Crimp and Cleave termination j) Describe mechanical splicing k) Describe fusion splicing</p>	<p>24. Fiber Optic Components: students will be able to identify and describe the purpose of the components used in Fiber Optic Cabling systems. Equipment and devices covered in this module include: Types of Fiber Optic cable connectors, fiber optic splices, splice enclosures, closures, and cabinets. Students will be able to define the purpose of these devices and their associated applications. Activities in this module include the mechanical splicing of a Fiber Optic cable and testing of the cable to insure students can identify acceptable dB limits for splices.</p>
<p>Network Cable Technology</p>			<p>i) Terminate a Fiber Optic Light Guide Building cable using the ST connector i. Select the proper connector to correspond to the type of Fiber Optic cable to be terminated ii. Prepare a Fiber Optic cable for termination iii. Demonstrate the ability to follow all applicable safety precautions while terminating Fiber Optic cables iv. Inspect newly connectorized Fiber Optic cables for continuity and measure attenuation using the power meter and light source j) Observe an SC connector demonstration and identify the steps to follow to correctly terminate and test the termination k) Terminate a Fiber Optic patch cord using the SC connector l) Follow proper procedures for Fiber Optic termination m) Demonstrate the ability to follow all applicable safety precautions while terminating Fiber Optic cables n) Inspect newly connectorized Fiber Optic cables for continuity and measure attenuation using the power meter and light source</p>	

<p>A, through K</p>	<p>2 hrs</p>	<p>a) Identify the cabling topology used in commercial fiber optic cabling. b) Define Moves, Adds, and Changes in regards to cabling. c) Identify the six subsystems of a commercial cabling system as: Entrance facility, Backbone cabling, Horizontal Cabling, Telecommunications Room, Equipment room and work area. d) Given a diagram of a Fiber Optic cabling system in a commercial building identify the backbone cable, main cross connect, intermediate cross connect, horizontal cross connect, first and second level backbone cable and the work areas. e) Identify the types of cabling recommend for commercial applications. f) Identify the blue print symbols used to identify outlets, cables, and splices. g) Define how cables should be labeled. h) Define how telecommunications equipment is color coded in an equipment room</p>	<p>Standards: Students are familiarized with the standards that apply to Fiber Optic network cabling. They will identify and define commercial LAN topologies, blueprint symbols and standard application processes. Students will be familiarized with standard terminology and accepted industry procedures.</p>
<p>Network Cable Technology</p>		<p>l) Define the need for the protection of Fiber Optic Cables and splices. m) Define the characteristics of splice closures n) Identify commonly used splice closures o) Observe an instructor led demonstration of a mechanical splice and identify the key steps involved in completing a mechanical splice p) Demonstrate the ability to safely and correctly apply a mechanical splice to a fiber optic cable q) State acceptable attenuation values for both fusion and mechanical splices. r) Using a light source and power meter, test a newly constructed mechanical splice for acceptable attenuation s) Identify the characteristics of Fiber Optic Closures and Cabinets t) Define the purpose of break out cables u) State how a Light Interface Cabinet should be dressed v) Identify the function of a. Fiber Optic cabinets b. Panels, outlets c. Faceplates</p>	

<p>A. through K. A, B, D, E, F, G, H, I, J, K</p>	<p>2 hrs</p>	<p>a) Identify the two different grades of Fiber Optic cable used in residential applications b) Define structured cable systems c) Identify Smart Home technology systems d) Identify the elements of a single residential cabling system to include: i. Gateway ii. Auxiliary Disconnect Outlet iii. Outlet Cabling iv. Outlets e) Identify the recommended Fiber Optic cable used in residential applications f) Identify the recommended cabling topology used in a residence per TIA/EIA standards g) Given a diagram of a Single-Family residence correctly label the Fiber Optic cabling components h) Define maximum cabling distances recommended for residential applications per TIA/EIA standards i) Identify the elements of Multi-Tenant residences to include: i. Entrance Facility ii. Main Terminal Space iii. Backbone cabling iv. Floor Serving Terminal v. Distribution Devices vi. Auxiliary Disconnect Outlets vii. Outlet Cabling viii. Outlets j) Given a diagram of a Multi-Tenant Residence correctly label the Fiber Optic components k) Given a cabling and connector price list and a diagram of a home, calculate the cost of materials to complete a cabling job</p>	<p>26. Residential Topologies and Standards: Students are familiarized with the standards that apply to residential Fiber Optic network cabling in accordance with the EIA/TIA 570 standard for both single residences and multi-tenant residences. Students will be familiarized with residential system components and topologies. Students will identify the different grades of residential cabling as set forth in residential standards as well as structured cabling systems. Students also calculate the cost of parts for a residential installation.</p>
<p>A, B, D, E, F, G, H, I, J, K</p>	<p>4 hrs</p>	<p>a) Identify the cable pulling process as Terminating and Testing. b) Define minimum bend radius for both cable storage and cable placement. c) After viewing a Lab Splice demonstration identify the correct procedure for testing a Fiber Optic roll of cable using splices and a light source, d) Identify the tools used in the placement of Fiber Optic cable. (Tapes, Fish and Rods, De-Reelers.) e) Identify the safety precautions relative to cable pulling. f) Given a pull string, correctly attach it to a Light Guide Building cable and prepare it for pulling.</p>	<p>27. Placement of Fiber Optic Cable: Students are familiarized with the pulling and placement of Fiber Optic cabling. Also included in this module are tool usage, cable pulling terminology, safety and considerations in Fiber Optic cable pulling. Students are also familiarized with Fire Stopping and their responsibilities concerning fire stopping when pulling Fiber Optic Cable. Students will configure a pulling jig and set it up to pull cable.</p>

<p>Network Cable Technology</p>	<p>A, B, D through K</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>a) Identify that the key considerations that effect a Fiber Optic system are: I. Fiber optic cable, II. All connectors and Splices III. Strength of source signal IV. Detector sensitivity b) Identify the correct use of a Power Meter and Light Source c) Identify the importance of using a Mandrel when checking short cable runs d) Define how to take a power and loss measurement using the Power Meter and Light Source e) Identify the passive and active parts of a Fiber Optic System f) Define Dynamic Range in regards to a Fiber Optic system. g) Calculate a Fiber Optic Loss Budget. Identify the 5 testable link segments in Fiber Optic systems h) Identify the considerations given when testing Centralized links, First and Second Level Backbones and Horizontal Links j) Identify residential testing</p>	<p>28. Testing and Troubleshooting Fiber Optic Cabling Systems: Students will be able to identify the correct steps in accordance with standards in completing Fiber Optic testing using the Power Meter and Light Source. Students will be able to bi-directionally test cabling systems and they will be able to configure cabling system for testing using the 1, 2, and 3 cable testing methods. Students will be able to describe attenuation due to cabling geometry, and mechanical factors. Students will calculate a Fiber Optic loss budget. Students will identify key considerations in maximizing system performance. Students also use Fiber Optic cable for use in testing and troubleshooting of Fiber Optic systems. Students will be able to identify correct procedures in testing Fiber Optic</p>
<p>Describe the process of attaching a pulling cable to a Fiber Optic cables strength yarns. h) Describe the process used to attach the mesh grip and swivel. i) Describe the process used to complete an installation through a vertical pull. j) Describe the process used to complete an installation through a horizontal pull. k) Describe how to pull a cable through a conduit. l) Describe the limitations for cabling in a conduit. m) Describe the steps to pull a Fiber Optic cable into a pathway. n) Describe the steps to pull a Fiber Optic cable into a ladder support system o) Identify types of cable support systems p) Describe how to dress an outlet panel or closure q) Describe the usage of optic raceways r) Describe the technician's responsibility concerning fire-stopping materials. s) Describe the importance of Fire Stopping. t) Identify the minimum amount of cable needed to be in place after the cable has been placed in a closure or outlet</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>g) Describe the process of attaching a pulling cable to a Fiber Optic cables strength yarns. h) Describe the process used to attach the mesh grip and swivel. i) Describe the process used to complete an installation through a vertical pull. j) Describe the process used to complete an installation through a horizontal pull. k) Describe how to pull a cable through a conduit. l) Describe the limitations for cabling in a conduit. m) Describe the steps to pull a Fiber Optic cable into a pathway. n) Describe the steps to pull a Fiber Optic cable into a ladder support system o) Identify types of cable support systems p) Describe how to dress an outlet panel or closure q) Describe the usage of optic raceways r) Describe the technician's responsibility concerning fire-stopping materials. s) Describe the importance of Fire Stopping. t) Identify the minimum amount of cable needed to be in place after the cable has been placed in a closure or outlet</p>	<p>g) Describe the process of attaching a pulling cable to a Fiber Optic cables strength yarns. h) Describe the process used to attach the mesh grip and swivel. i) Describe the process used to complete an installation through a vertical pull. j) Describe the process used to complete an installation through a horizontal pull. k) Describe how to pull a cable through a conduit. l) Describe the limitations for cabling in a conduit. m) Describe the steps to pull a Fiber Optic cable into a pathway. n) Describe the steps to pull a Fiber Optic cable into a ladder support system o) Identify types of cable support systems p) Describe how to dress an outlet panel or closure q) Describe the usage of optic raceways r) Describe the technician's responsibility concerning fire-stopping materials. s) Describe the importance of Fire Stopping. t) Identify the minimum amount of cable needed to be in place after the cable has been placed in a closure or outlet</p>

<p>A, B, C, D, G, H, I, J</p>	<p>2 hrs</p>	<p>a) Describe the importance of Ability, Attitude and Appearance when working as a Network Cabling Specialist b) Identify what the customer expects from a Network Cabling Specialist c) Describe the importance of communications while working as a Network Cabling Specialist d) Define the EAR communication model as: i. Empathize ii. Agree iii. Respond iv. Resolve e) Describe the basics of written communication using the bottom line method f) Identify the basics of time management g) Define the Pareto Principle h) Identify career pathways and describe duties of the five levels of Network Cabling Specialist</p>	<p>The Network Cabling Specialist: Students will have learned the basics of communications to include oral and written communication styles. Students will be familiarized with the EAR communication model, bottom line writing methods and the Pareto Principle in regards to their role as Customer Service representatives. Students will also be familiarized with entry level and career pathway progressions.</p>
<p>Network Cable Technology</p>		<p>k) Identify testing procedures as defined by standards. l) Identify testing procedures using the one, two and three cabling methods m) Define the Split-Half method of troubleshooting Fiber Optic links n) Describe the effects of cabling mismatches in regards to core size, core ellipticity and core eccentricity. o) Define the importance of correct fiber alignment. p) Define coupler alignment in regards to the PC, APC, Optiball, and Expanded beam systems. q) Identify the four items that account for connector insertion loss. r) Define the purpose of the Visual Fault Locator. s) Define the purpose of the Optical Time Domain Reflectometer (OTDR). t) Define the importance of two way testing. u) Identify testing and troubleshooting procedures in regards to the active components of a Fiber Optic System v) State the purpose of following Electro Static Discharge (ESD) precautions when dealing with sources and detectors.</p>	<p>links. Students will also be introduced to the Optical Time Domain Reflectometer and they will be able to identify when and how it is used to troubleshoot Fiber Optic systems.</p>

<p>Complete Tier 3 Formal Examinations: Specialist certification is based upon a weighted average of 85%</p>	<p>a) Pass a written examination, Cable Construction Examination and Diagnostics Examination to receive a certificate "Certified Cable Specialist - Fiber" awarded by C-Tech according to requirements.</p>	<p>2 hrs</p>	<p>A,B, D, E, J, K</p>	<p>Tier 3 Complete</p>
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<p>A, B, D, E, F, I, J, K</p>	<p>4 hrs</p>	<p>a) Demonstrate the ability to determine if a System telephone is working correctly in regards to function and cabling</p> <p>b) Identify the equipment found in the Integrated Voice and Messaging System Student Workstation to include:</p> <ol style="list-style-type: none"> i. The Integrated Voice and Messaging Unit ii. Voice Mail Module iii. Key telephone switch module iv. Sound Module v. ISVM Cabling Board vi. System telephone vii. Handsets and Cords viii. POTS set ix. Backup and Restore Card <p>c) Identify the tools located in the Key System Workstation to include</p> <ol style="list-style-type: none"> i. Cable Jacket Stripper ii. Dual Plug Crimper iii. Wire Cutter iv. Integrated Systems Toner v. Transmitter vi. Integrated Systems Receiver Unit vii. Trace Probe viii. Label Maker ix. Alligator breakout x. AC Circuit tester xi. 4 in 1 Screwdriver xii. 66/110 Punch Down Tool xiii. 66 Block Adapter (Impact) xiv. Electricians Scissors <p>d) Identify the items of the student consumable kit to include</p> <ol style="list-style-type: none"> i. Student Manual ii. Four Pair Cable Supply (solid) iii. Two Pair Cable iv. Four Pair UTP Cable (stranded) v. 103 Extension Block vi. Bridging Clips vii. Student Key and Voice Card viii. System phone overlay ix. RJ 11 and RJ45 plugs <p>e) Correctly terminate a two pair cable and connect the Key System Workstation to the System Telephone</p> <p>f) Correctly terminate a four pair UTP cable and connect the Key System Workstation to the System Telephone</p>	<p>Tier 4: Integrated Systems: Voice and Messaging: The Integrated Systems: Voice and Messaging (ISVM) Workstation: Students are familiarized with basic digital telephone operation as it pertains to determining correct system operation. Students are also familiarized with component parts and tools contained in the Integrated Voice and Messaging System Student Workstation. Students also identify the parts of the Student Consumable Kit and the Optional Tool kit. Students perform activities using cabling and tools as they connect and test the cabling used for the ISVM unit.</p>
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		<p>31. Telephone and Key System</p> <p>Theory: Students learn basic telephone theory in regards to Loop Start and Ground Start dial tone and the operation of each. Students are also familiarized with ISDN and BRI systems. This module also includes the concepts of a Key system and a PBX system and the similarities and differences of each. Also covered in this module are the concepts of Dial Tones, Touch-tones and how to obtain a low voltage license. Activities in this module include testing Enhanced Ring and programming a system phone with the students' name.</p>	<p>g) Demonstrate the ability to correctly label telephone cables</p> <p>h) Demonstrate the ability to tone and trace a telephone cable</p> <p>i) Correctly identify a correct reading on the AC Circuit tester</p> <p>j) Correctly punchdown and test a 4 pair UTP cable on a 66 block</p> <p>k) Correctly punchdown and test a 4 pair UTP cable on a 103 Extension Block</p>
A, B, D, I, J, K	4 hr	<p>a) Describe the operation of a traditional telephone system</p> <p>b) Identify a POTS (LOOP Start Dial Tone)</p> <p>c) Define Ground Start Dial Tone</p> <p>d) Define ISDN</p> <p>e) Define BRI Basic Rate Interface and 2B+D</p> <p>f) Define DSL and Packet switching</p> <p>g) Identify two types of dial tone</p> <p>h) Identify the features of a System telephone</p> <p>i) Identify the primary differences between a Key and a PBX system</p> <p>j) Define different dial tones in regards to a Central Office tone and that of a System</p> <p>k) Define Touch Tone in regards to an Integrated Voice Messaging System</p> <p>l) Given a POT set and a system telephone configure it to test dual tip and ring</p> <p>m) Define caller ID and how it is used</p> <p>n) Correctly add a name to the phone</p> <p>o) Define dual tip and ring or Enhanced Tip and Ring</p> <p>p) Define low voltage license requirements in regards to Key System Cabling</p>	

<p>A, B, D, I, J, K</p>	<p>2 hr</p>	<p>a) Identify installation considerations when dealing with a key system to include:</p> <ul style="list-style-type: none"> i. Power requirements to include a UPS ii. Acceptable weight bearing wall and/or floor iii. Cable routing to and from the key system iv. Shock/Vibration v. Humidity and Temperature vi. Dirt/Dust vii. Expansion viii. Electrical Ground ix. Hardware of Key System <p>b) Correctly configure the Integrated Voice and Messaging Board to simulate a Key system installation to include:</p> <ul style="list-style-type: none"> i. Punching down cable at the demarcation point and terminating it with Cat 5e cable at the Surge Protector ii. Terminate Cat 5e cable with RJ45 plugs iii. Configuring Cat 5e patch cables from the surge protector to the Key System iv. Identify Key System extension numbers and terminate them on 103 extension blocks with 110 type terminations <p>c) Define what a hot swap is and why it is not done with Key Systems</p> <p>d) Identify the parts and the purpose of the Control unit to include:</p> <ul style="list-style-type: none"> i. Grounding Screw ii. Contact closure iii. SMDR iv. PC Card Slots one and two v. Power LED vi. Paging Port vii. Central Office Ports and power failure ports viii. Music on hold ix. Phone Stations and Extensions x. Battery backup 	<p>32. Key Systems Components:</p> <p>Students are familiarized with key term installation. Students learn the layout of several different manufacturers in regards to expansion and set up. In this module Students use the ISVM cabling board and they wire a simulated Key system. Students are also familiarized with all of the ports and systems on the ISVM Student Workstation. Students also learn the different variations of Key system modules and configurations. Students are also introduced to paging and requirements according to the Americans Disability Act.</p>
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<p>a) Identify the four different types of Key System phones</p> <p>b) Identify the available features on Key System phones such as: i. Hold ii. Transfer iii. Conference iv. Speaker v. Intercom vi. Programmable Buttons</p> <p>c) Identify the light patterns used with the system telephones i. Steady green ii. Steady red iii. Flashing green iv. Flashing red v. Alternating green red vi. Winking green</p> <p>d) Identify System telephone ring patterns i. Ring—Ring ii. Ring—Beep iii. Ring—Beep—Beep</p> <p>e) Demonstrate the use of i. Hands Free At Intercom ii. Speaker Phone iii. Intercom</p> <p>f) Perform a telephone light and ring test</p> <p>g) Adjust the contrast on the system telephone</p>	<p>3 hr</p>	<p>2 hrs</p>	<p>A, B, D, I, J, K</p>	

<p>Adjust the volume on the system telephone Define the differences between wireless telephones and cordless telephones J) Define Station Programming K) Define System Programming I) Define Centralized Programming M) Define how to put a System phone into the Station Programming mode N) Station program a system phone and complete the following programming actions: I. Privacy II. Conference Drop III. Do Not Disturb IV. Exclusive Hold V. Save Number Redial VI. Last Number Redial VII. Background Music On/Off</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>A, B, D, I, J, K</p>	<p>34. Key System Programming: Students will be provided an understand system programming to include most of the functions of the system telephone. Students will be able to state what default settings are and will be able to reset a Key system back to factory settings. Students will also be familiarized with the steps of hunt groups in regards to how a key selects a system telephone to ring.</p>
<p>H) Identify and interpret the associated programming paperwork</p>				
<p>a) Define why a system overlay is used b) Demonstrate the use of the system phone overlay while System Programming c) Define Factory Settings or Default Setting d) Define how to enter the System Programming Mode e) Demonstrate the ability to default the ISVM unit back to Factory Settings f) Program the following features: i. System Date ii. System Time iii. Line Assignments iv. Call restrictions v. Copy Features vi. Music on Hold vii. Wake Up Call viii. Group Calling ix. Hunt Groups x. Contact Closure ports one and two xi. Define hunt group, liner hunt circular hunt and SME hunt</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>g) Program a liner, circular and SME hunt h) Identify and interpret the associated programming paperwork</p>	

<p>35. Centralized Programming: Students will be introduced to centralized programming and they will practice programming other system telephones from one location. Students will use industry standard documents to log all programming actions. Students will also learn how to configure auxiliary equipment, which are defined as fax machines and credit card scanner type devices. Students will also be familiarized with DSS/BLF configuration</p>	<p>a) Define Centralized Programming Mode: i. Automatic Line Selection ii. Privacy iii. Do Not Disturb d) Given a system planner use it to Centralize program the Key e) Define Auxiliary Equipment that is managed through a Key f) Define how a customer can share a line with an Auxiliary Device g) Identify how to configure and use a DSS/BLF</p>	<p>a) Define why Unique Line Ringing is used b) Define the benefit of using a Fax management button c) Define Fax Tone Detection and when it is used d) Define the benefit of using Forced Account Code Entry e) Define why Outside Conference Denial is used f) Define why Account Code Entry is used g) Define the purpose of Line Pooling in a Key System h) Define the benefit of Call Pickup i) Define the benefit of Call Park j) Define the benefit of Group Pickup k) Identify the purpose of Call Waiting l) Define Voice Interrupt on Busy and why it is used m) Define Voice Interrupt on Busy Talk Back and why it is used n) Define security considerations in regards to passwords o) Define Hotline and why it is used p) Define External Hotline q) Identify when a Door Phone Alert Extension would be used r) Identify when Station Lock would be used s) Identify the four benefits of Wireless phones</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>A, B, D, E, J, K</p>
<p>36. Office Management Features: Students will learn the features of Key system operation and how they are used to maximize office productivity while saving money.</p>	<p>a) Define why Unique Line Ringing is used b) Define the benefit of using a Fax management button c) Define Fax Tone Detection and when it is used d) Define the benefit of using Forced Account Code Entry e) Define why Outside Conference Denial is used f) Define why Account Code Entry is used g) Define the purpose of Line Pooling in a Key System h) Define the benefit of Call Pickup i) Define the benefit of Call Park j) Define the benefit of Group Pickup k) Identify the purpose of Call Waiting l) Define Voice Interrupt on Busy and why it is used m) Define Voice Interrupt on Busy Talk Back and why it is used n) Define security considerations in regards to passwords o) Define Hotline and why it is used p) Define External Hotline q) Identify when a Door Phone Alert Extension would be used r) Identify when Station Lock would be used s) Identify the four benefits of Wireless phones</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>A, B, D, E, J, K</p>	

<p>A through K</p>	<p>4 hrs</p>	<p>4 hrs</p>	<p>a) Using a digital display phone identify the type of Key System and the country code for the United States b) Define the two most common problems encountered by Voice Communications Professionals c) Define Cross talk and describe methods for eliminating it in the ISVM environment d) Define the role of the technician and the role of the customer in regards to Key system setup and installation e) Define two recognized methods of customer training f) Define the purpose of backing up a system and when it should be done g) Identify the steps necessary to perform a Key System Backup and Restore h) Describe the process of replacing batteries in a key system i) Define loop back testing and demonstrate the ability loop back test a key system</p>	<p>37. Key System Setup, Maintenance and Troubleshooting: Students are familiarized with basic Key maintenance and troubleshooting techniques. Cross talk elimination techniques are also stressed. Students are introduced to methods of customer training. Key system backup and restore procedures are covered as well. Students learn to test a key in the stand-alone mode using the loop back method of testing.</p>
<p>A, B, D, E, J, K</p>	<p>2 hr</p>	<p>2 hr</p>	<p>a) Describe Voice Mail b) Describe two popular and two unpopular aspects of Voice Mail c) Describe the Physical Components of a Voice Mail System d) List the responsibilities of the voice mail system administrator e) Using hunt group diagrams identify Voice Mail Hunt Group routing</p>	<p>38. Voice Mail Overview: Students are familiarized with the concepts and the programming background necessary for Voice Mail operation. Students learn the physical components of an Integrated System Voice and Messaging system. Students are also introduced to the job tasks of a voice mail administrator and they set up voice mail hunt groups.</p>
<p>A, B, D, E, J, K</p>	<p>1 hr</p>	<p>1 hr</p>	<p>a) Describe Point One of the Programming Triangle as the extensions answered by Voice Mail b) Describe Point Two of the Programming Triangle as the extensions served Voice Mail c) Describe Point Three of the Programming Triangle as the lines served by Voice Mail d) Describe the Center of the Programming Triangle as call routing and Voice Mail</p>	<p>39. Triangle Method of Programming Voice Mail: Students are familiarized with the industry standard method of programming a voice mail system</p>
<p>A, B, D, E, J, K</p>	<p>1 hr</p>	<p>1 hr</p>	<p>a) Demonstrate how to program the extensions to answer Voice Mail b) Demonstrate how to program the extensions getting Voice Mail c) Demonstrate how to program the lines being answered by Voice Mail</p>	<p>40. Program the Voice Mail: Students learn how to program the routing of voice mails by way of extensions and lines.</p>

<p>41. Create Personal Mailbox: Students set up and test system boxes</p>	<p>a) Program personal greeting b) Program a Personal operator c) Set and change a password d) Retrieve Voice Mail messages</p>	<p>1 hr</p>	<p>1 hr</p>	<p>A, B, D, E, J, K</p>
<p>42. Voice Mail Telephone Management: Students set up and manage the Voice Mail system.</p>	<p>a) Identify and program features needed to make Voice Mail productive, including: i. Do Not Disturb ii. Speed Dial to Voice Mail iii. Voice Mail Transfer iv. Record a Call v. Screen Calls vi. Night Service</p>	<p>2 hrs</p>	<p>2 hrs</p>	<p>A, B, D, E, J, K</p>
<p>43. Program First Automated Attendant: Students will populate and then program an automated voice mail system</p>	<p>a) Define Automated Attendant b) Identify the Step-by-Step Procedure of what needs to be done to program an automated attendant c) Identify a System Planner and all steps listed on it d) Program the Voice Mail on an Integrated Voice Messaging system with one Automated Attendant e) Identify and use flow charts used to program Voice Mail f) Perform a Loop Back Test on an Integrated Voice Messaging System</p>	<p>1 hr</p>	<p>1 hr</p>	<p>A, B, D, E, J, K</p>
<p>44. Program Second Automated Attendant: Students add a second Automated Attendant to the Voice Mail system.</p>	<p>a) Use a System Planner to program a second Automated Attendant b) Program additional customer changes to the system</p>	<p>1 hr</p>	<p>1 hr</p>	<p>A, B, D, E, J, K</p>
<p>45. Program Out Dial or Out Calling/Troubleshooting: Students define and program Out Calling. Students are also introduced to troubleshooting techniques in dealing with Voice Mail problems.</p>	<p>a) Define Out Calling b) Program Out Calling c) Demonstrate various techniques for troubleshooting and correcting common problems e) Identify the steps to perform a Voice Mail backup</p>	<p>1 hr</p>	<p>1 hr</p>	<p>A, B, D, E, J, K</p>
<p>46. The Voice Messaging PC Card: Students are familiarized with programming the PC card voice mail system. Students will identify that many smaller businesses rely on this system for very basic voice mail service. During this module students will learn to install the Voice Mail PC card. Students will set up and test a basic Voice mail system.</p>	<p>f) Define how to correctly and safely install the PC Messaging Card g) Define the maximum capacity of the PC Messaging Card in terms of Mailboxes and time h) Program mailboxes for four extensions i) Program general greeting j) Program personal greeting k) Program the automated attendant l) Initialize a Mailbox m) Test the integration of the Voice Messaging PC Card</p>	<p>1 hr</p>	<p>1 hr</p>	<p>A, B, D, E, J, K</p>

<p>Complete Tier 4 Formal Examinations: Specialist Certification is based upon a weighted average of 85%.</p>	<p>Tier 4 Complete</p>	<p>a) Pass a Written Examination, Key system setup examination and Voice Mail system programming to receive a Certificate "Certified Voice Communications Professional" awarded by C-Tech According to requirements.</p>		<p>A, B, D, E, J, K 2 hrs</p>	
<p>SUPPLEMENTAL ACTIVITIES: Connecting to Business: Telecommunications Employability: Students will learn how to set and achieve employment goals as well as reinforce skills needed for success in the workplace.</p>	<p>a) Describe and explain the following in terms of an effective goal setting strategy: i. The First Step ii. Long-Term, Short-term and In-Between iii. Seven Steps to Effective Goals: b) Describe and explain the importance of the following attributes from an employer's perspective: i. Ability ii. Attitude iii. Appearance c) Identify and describe the typical career path for a Cabling Specialist and the responsibilities of each position. d) Develop an effective resume. Describe and demonstrate how to use the Internet, make calls to potential employers and network to perform an effective job search. f) Describe and explain "Brand You" value-Add as the term applies to a job search. h) Describe and demonstrate through role play, an effective job interview Management i) Describe and explain effective Time j) Describe and effective oral communication k) Describe and discuss effective ways for dealing with customers both in person and on the phone. l) Describe and demonstrate effective written communication.</p>	<p>a) Describe and explain the following concepts as they apply to an effective job search for persons with criminal records: i. To Tell or Not to Tell ii. When to Start iii. Who's going to Hire Me? iv. Birth Certificates and Driver's Licenses v. Programs That Can Help vi. Work Opportunity Tax Credit vii. The Federal Bonding Program viii. For Veterans ix. State and Local Programs</p>	<p>Supple- mental as required</p>	<p>A, B, C, E, G, H, I, K 10 hours</p>	
<p>Connecting to Business: Addressing the Needs of Ex-Offenders: Where applicable, this supplement may be used to assist persons who have a criminal record in conducting an effective job search.</p>				<p>A, B, C, E, G, H, I, K</p>	



COURSE OUTLINE:

b) CAREER PERFORMANCE STANDARDS

i) EXPECTED STUDENT OUTCOMES

ii) NATIONAL AND CALIFORNIA FOUNDATION STANDARDS

COURSE OUTLINE

KEY TO STANDARDS

- L. Academic Foundations
- M. Communications
- N. Career Planning and Management
- O. Technology
- P. Problem Solving and Critical Thinking
- Q. Health, Safety, And Environmental Management
- R. Responsibility and Flexibility
- S. Ethics and Legal Responsibilities
- T. Leadership and Teamwork
- U. Technical Knowledge and Skills
- V. Demonstration and Application

STANDARDS	EXPECTED STUDENT OUTCOMES	CAREER PERFORMANCE STANDARDS
<p>Integrated in content area skills</p> <p>All Sections plus Connecting to Business: a training course in employability (see page 40)</p> <p>A through K</p>	<p>1. Understand how personal skill development, including positive attitude, honesty, self-confidence, time management, & other positive traits affect employability.</p> <ul style="list-style-type: none"> ▪ Demonstrate and understand classroom policies & procedures ▪ Define work and business ethics & demonstrate the importance of ethical standards & social responsibilities in the business environment. ▪ Discuss the laws applicable to sexual harassment & discuss tactics for handling harassment situations. ▪ Demonstrate personal skills in class and/or business environment: <ul style="list-style-type: none"> ↳ Positive attitude ↳ Self-confidence ↳ Honesty ↳ Perseverance ↳ Self-discipline ▪ Demonstrate and model personal hygiene and acceptable professional attire ▪ Prioritize tasks and meet deadlines ▪ Explain the importance of lifelong learning 	<p>1. Personal Skills</p> <p>Instruction will include:</p> <ul style="list-style-type: none"> ▪ Classroom policies & procedures ▪ Ethics ↳ Work ↳ Business ▪ Sexual harassment laws ▪ Personal skills, including positive attitude, self-confident, honesty, perseverance & self-discipline ▪ Professional appearance ▪ Time management ▪ Lifelong learning
	<p>Student will be able to:</p>	

STANDARDS	EXPECTED STUDENT OUTCOMES	CAREER PERFORMANCE STANDARDS
	<p>Student will be able to:</p>	<p>Instruction will include:</p>
<p>Integrated in content area skills All Sections plus Connecting to Business: a training course in employability (see page 40) A through K</p>	<p>2. Understand principles of effective interpersonal skills, including group dynamics, conflict resolution, and negotiation.</p> <ul style="list-style-type: none"> ▪ Identify and explain the key concepts of group dynamics ▪ Discuss and demonstrate the dynamics of conflict resolution and negotiation, and their importance within the business environment ▪ Demonstrate effective teamwork, share responsibilities, accept supervision and assume leadership roles ▪ Demonstrate cooperative working relationships and proper etiquette across gender and cultural groups 	<ul style="list-style-type: none"> ▪ Group dynamics ▪ Conflict resolution and negotiation ▪ Team work ▪ Etiquette across gender and cultural groups
<p>Integrated in content area skills All Sections plus Connecting to Business: a training course in employability (see page 40) A through K</p>	<p>3. Understand the importance of critical thinking and problem-solving skills in the workplace.</p>	<p>3. Thinking and Problem-Solving Skills</p> <ul style="list-style-type: none"> ▪ Critical and creative thinking skills ▪ Logical reasoning and problem-solving skills ▪ Numerical estimation, measurement, and calculation ▪ Identify, locate, and organize needed information and propose, evaluate, and select alternative solutions
	<ul style="list-style-type: none"> ▪ Apply critical and creative thinking skills in a work environment and implement a plan of improvement as needed ▪ Demonstrate logical reasoning and problem solving skills in a work environment ▪ Apply numerical estimation, measurement and calculation skills to business applications including the following: <ul style="list-style-type: none"> → Whole number math → Decimals & fractions → Counting & monetary functions → Use of tables & graphs ▪ Recognize problem situations; identify, locate and organize needed information, and propose, evaluate and select from alternate solutions 	

Standards	EXPECTED STUDENT OUTCOMES	CAREER PERFORMANCE STANDARDS
	<p>Student will be able to:</p>	<p>Instruction will include:</p>
<p>All Sections plus Connecting to Business: a training course in employability (see page 40) A through K</p> <p>Integrated in content area skills</p>	<p>4. Understand principles of effective communication.</p> <ul style="list-style-type: none"> ▪ Read and implement written instructions, technical manuals, written communication, and reference books ▪ Present a positive image of verbal and nonverbal communication through use of appropriate methods ▪ Demonstrate active and effective listening skills through verbal, nonverbal and written feedback ▪ Demonstrate proper etiquette in business communications, including an awareness of (languages, customs, and time zones) ▪ Demonstrate the following writing and editing skills: <ul style="list-style-type: none"> → Use correct grammar, punctuation, capitalization, vocabulary and spelling → Write, proofread and edit → Select and use appropriate forms of communication ▪ Exhibit a proficiency in the use of reference materials such as dictionary, thesaurus, telephone directory, almanac, zip code directory, and office handbooks 	<ul style="list-style-type: none"> ▪ Written communications ▪ Verbal and Nonverbal communications ▪ Active and effective listening communications ▪ Proper etiquette in business communications ▪ Writing and editing skills ▪ Use of reference material and handbooks ▪ Oral presentations
<p>All Sections plus Connecting to Business: a training course in employability (see page 40) A through K</p> <p>Integrated in content area skills</p>	<p>5. Understand occupational safety issues, including avoidance of physical hazards</p> <ul style="list-style-type: none"> ▪ Model and implement good safety practices including: <ul style="list-style-type: none"> → Avoidance and reporting of physical hazards in the work environment → Safe operation of equipment → Proper handling of hazardous materials 	<p>5. Occupational Safety</p> <ul style="list-style-type: none"> ▪ Good safety practices

Standards	EXPECTED STUDENT OUTCOMES	CAREER PERFORMANCE STANDARDS
	<p>Student will be able to:</p>	<p>Instruction will include:</p>
<p>Integrated in content area skills All Sections plus Connecting to Business: a training course in employability (see page 40) A through K</p>	<p>6. Understand career paths and strategies for obtaining employment.</p> <ul style="list-style-type: none"> ▪ Explore career opportunities and develop a career plan ▪ Identify steps for setting goals and writing personal goals and objectives ▪ Examine aptitudes related to career options; relate personal characteristics and interests to educational and occupational opportunities ▪ Develop a portfolio to include the following: <ul style="list-style-type: none"> → Letter of Introduction → Cover letter → Resume → Thank you letter → Job application → Licenses, Certificates and Awards → Transcripts → Letters of Recommendation → Work Samples 	<ul style="list-style-type: none"> ▪ Expand awareness of career opportunities ▪ Set employment goals and objectives ▪ Aptitudes, personal characteristics and interests ▪ Develop portfolio to C-TAP standards ▪ Develop interviewing techniques
<p>Integrated in content area skills All Sections plus Connecting to Business: a training course in employability (see page 40) A through K</p>	<p>7. Understand and adapt to changing technology.</p> <ul style="list-style-type: none"> ▪ Identify and demonstrate use of appropriate technology ▪ Identify and use industry specific software ▪ Demonstrate proficiency in alphanumeric keyboarding ▪ Input and retrieve information ▪ Understand the importance of lifelong learning in adapting to changing technology 	<p>7. Technology Literacy</p> <ul style="list-style-type: none"> ▪ Apply Industry specific technology ▪ Use Industry specific software ▪ Demonstrate Keyboarding ▪ Accessing information ▪ Lifelong enhancement of technology skills

10. ADDITIONAL RECOMMENDED/OPTIONAL ITEMS

a) ARTICULATION:

- Hartnell College Computer Information Systems II

b) VOCATIONAL CREDIT:

- 10 Credits

c) ACADEMIC CREDIT:

- None at this time

d) INSTRUCTIONAL STRATEGIES:

- Guided Team and Independent Work, Actual Cable Construction, Troubleshooting, Community Classroom, Guest Speakers, Field Trips to Electronics Suppliers, Cable Communications

e) INSTRUCTIONAL MATERIALS:

- Student Manuals: (C-Tech)
 - Introduction to Telecommunications
 - Introduction to Telecommunications
 - Introduction to Network Cabling: Copper-Based Systems
 - Introduction to Network Cabling: Fiber Optic Based Systems
 - Integrated Systems Voice and Messaging
 - Connecting to Business:
 - a training Course in employability Vol. 1
 - Connecting to Business: Address the needs of Ex-Offenders Vol. 1, 2

f) CERTIFICATES:

- Industry Certifications in cooperation with C-Tech Associates for earned weighted grade of 85% or higher in Tiers 2, 3 and 4.
 - Certificate of Completion = Classroom Instruction "C" or higher.
 - Certificate of Accomplishment = Classroom Instruction "A"
 - Certificate of Attendance = Attendance is 98% or higher