TELECOMMUNICATIONS ELECTRONICS TECHNICIAN - TCM

CATEGORIES LIST

(A listing of the major areas required for courses, training or study in Telecommunications Electronics)

1.0 Cables and Cabling

2.0 Analog Telephony

3.0 Equipment

4.0 Telecom Safety

5.0 Transmission Service Providers

6.0 Distribution Methods

7.0 Computer

8.0 Digital Telephony

9.0 Interfacing

10.0 Internet

11.0 Network Infrastructures and Topologies

12.0 Office Wiring

13.0 Test Equipment

14.0 Troubleshooting

15.0 Transmission Protocols

16.0 Mathematics

17.0 Optical Wiring

18.0 Wireless Telephony

TELECOMMUNICATIONS ELECTRONICS TECHNICIAN - TCM

ITEMS LIST

(A listing of the major areas required for courses, training or study in Telecommunications Electronics)

1.0 Cables and Cabling

1.1 Unshielded twisted pair (UTP)
1.2 RJ45/48 telephone connectors and fittings
1.3 CAT 5 & 5e wiring
1.4 10/100 base T
1.5 T568A / T568B standards
1.6 Cable TV wiring for data and voice
1.7 Coax types RG 58, RG 59 and RG 6
1.8 Grounding of electronics equipment
1.9 Single and multi-mode fiber optics
1.10 Connector types and terminations

2.0 Analog telephony

2.1. History of the telephone industry
2.2 Basic phone systems
2.3 POTS, DID, OPX, tie lines and WATS lines
2.4 Multiple phone lines
2.5 PBX and explain basic switching methods
2.6 Local loop
2.7 Key system units (KSU)
2.8 Central Office
2.9 Tones, loop start, ground start and wink start
2.10 CO, CPE.
2.11 Dedicated lines, metered and switched services
2.12 Broadband DSL and ISDN

3.0 Equipment

3.1 Telephone parts & components
3.2 Telephone set disassemble and reassemble
3.3 RS-232, RS-530, V.35 and USB interfaces

4.0 Telecom Safety

4.1 Safety procedures in the workplace
4.2 Safety procedures in homes and businesses
4.3 Safety procedures for outside equipment
4.4 OSHA requirements
4.5 Installer abilities required
4.6 ESD procedures in the workplace

5.0 Transmission Service Providers

5.1 LEC's—Local Exchange Carriers
5.2 CLEC's—Competitive Local Exchange Carriers
5.2 Regional Operating Companies
5.3 RBOC's—Regional Bell Operating Companies
5.3 Independent telephone company
5.4 Network control points
5.5 In-band and Common Channel Signaling (CCS) and Signaling System 7 (SS7)
5.6 T1 and T3 lines
5.7 Multiplexing

6.0 Distribution Methods

6.1 Plug and adapter wiring
6.2 Punch down blocks and tools—labeling
6.3 T carrier (DS1's)
6.4 Repeaters
6.5 Channel Banks
6.6 Common Carrier
6.7 Patch panels
6.8 Ethernet and switch hubs
6.9 Routers

7.0 Computer

7.1 Interrelationship—computers and communications technology
7.2 Modems
7.3 Worldwide numbering systems
7.4 Network control points
7.5 Databases
7.6 CTI—Computer Telephony Integration
7.7 Asynchronous Transfer Mode (ATM)

8.0 Digital Telephony

8.1 ISDN
8.2 DSL
8.3 Bundling and unbundling of telephone services
8.4 Bytes, bits, packets and frames
8.5 Caller ID
8.6 Common Carrier

9.0 Interfacing

9.1 Telephone equipment—consumer electronics interconnection problems
9.2 Electrical power surge problems
9.3 EIA, CTIA and ITU protocols and standards

10.0 Internet

10.1 Internet
10.2 TCP/IP duties and protocols
10.3 Security problems
10.4 ISP's

11.0 Network Infrastructures and Topologies

11.1 RS232 standard
11.2 Transmission protocols
11.3 LANs & WANs technology
11.4 Installation and troubleshooting networks
11.5 Sonet Ring

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ITEMS LIST

(A listing of the major areas required for courses, training or study in Telecommunications Electronics)

12.0 Office Wiring
- 12.1 Building wiring standards
- 12.2 Pre-wiring—wiring methods

13.0 Test Equipment
- 13.1 Certifying wired communications networks
- 13.2 Bit Error Rate (TBerd, etc.)
- 13.3 OTDR
- 13.4 Micro-test
- 13.5 Toners

14.0 Troubleshooting
- 14.1 Telephone test equipment
- 14.2 Troubleshooting methods and loop testing

15.0 Transmission Protocols
- 15.1 Modulation schemes

16.0 Telecom Mathematics
- 16.1 Mathematics required for telecommunications

17.0 Optical Wiring
- 17.1 Fiber disposal—eye safety
- 17.2 Optical cable types
- 17.3 Conversion process—copper to fiber
- 17.4 SONET
- 17.5 DWDM, (Dense Wave Division Multiplexing)

18.0 Wireless Telephony
- 18.1 Wired vs. Cellular networks
- 18.2 Cellular technology—architecture
- 18.3 Spread Spectrum techniques
- 18.4 TDMA and CDMA modulation
- 18.5 Paging Services technology
- 18.6 Telephone communications via satellites
- 18.7 Components of satellite uplink and downlink
- 18.8 Microwave transport

Telecommunications Electronics Technician - TCM
Competency Requirements

Telecommunications electronics technicians are expected to obtain knowledge of wired and wireless communications basic concepts which are then applicable to various types of voice, data and video systems. Once the CET has acquired these skills, abilities and knowledge, he or she will be able to enter employment in any part of the telecommunications field. With minimal training in areas unique to specific products, the CET should become a profitable and efficient part of the electronics-communications workforce.

Telecommunications Electronics Technicians must be knowledgeable and have abilities in the following technical areas:

1.0 Cables and Cabling

1.1 Describe unshielded twisted pair (UTP) - List common usage locations and capabilities
1.2 Demonstrate installation and troubleshooting of RJ45/48 telephone connectors and fittings
1.3 CAT 5 wiring—Explain the differences vs.: single twisted pair and where it is most used
1.4 10 base T-explain where it is commonly used and its frequency capabilities
1.5 Describe the T568A / T568B standards
1.6 Explain how Cable TV wiring is used for data and voice services
1.7 Explain the differences between coax types RG 58, RG 59 and RG 6
1.8 Describe required grounding of electronics equipment
1.10 Describe the differences in Single and Multi-mode fiber optics

2.0 Analog telephony

2.1. Give a brief history of the telephone industry
2.2 Explain how basic phone systems work
2.3 Define POTS, DID, OPX, tie lines and WATS lines
2.4 Explain the benefits and usage of multiple phone lines
2.5 Define PBX and explain basic switching method
2.6 Sketch a local loop map
2.7 Define Key service units
2.8 Define Central Office and list it purposes
2.9 Explain the terms and usage of tones, loop start, ground start and wink start
2.10 Define CO, CPE.
2.11 Explain the differences between dedicated lines, metered and switched services
2.12 Describe broadband DSL and ISDN

3.0 Equipment

3.1 Describe the principle parts of a telephone and explain the functions of each
3.2 Disassemble and reassemble a telephone set
3.3 Describe the differences between RS-232, RS-530, V.35 and USB interfaces

4.0 Telecom Safety

4.1 Demonstrate and practice general safety procedures in the workplace
4.2 Demonstrate and practice safety procedures in homes and businesses
4.3 Demonstrate special safety procedures required for outside equipment
4.4 Explain OSHA requirements for distribution system workers, including working at heights
4.5 Demonstrate abilities required for distribution and installation technicians
4.6 Explain proper ESD safety procedures

5.0 Transmission Service Providers

5.1 Define and explain the purposes of LEC's—Local Exchange Carriers
5.2 Explain the differences between LEC's and Regional Operating Companies
5.3 Define independent telephone company
5.4 Define network control points and define NOC
5.5 Define In-band and Common Channel Signaling (CCS) and SS7, Signaling System 7
5.6 Explain the importance of T1 and T3 lines
5.7 Explain multiplexing and its importance to today's communications systems

6.0 Distribution Methods

6.1 Show ability to install and troubleshoot plug and adapter wiring
6.2 The punch block and tools-show ability to properly perform connections and labeling
6.3 Define T carrier (DS1's)
6.4 Show why and how repeaters are used in telephone communications
6.5 Explain the usage of Channel Banks
6.6 Define Common Carrier

7.0 Computer

7.1 Describe the interrelationship between computers and communications technology
7.2 Explain how a Modem interfaces with the computer and show differences in common modems
7.3 Describe worldwide numbering systems
7.4 Define network control points
7.5 Define database
7.6 Explain CTI—Computer Telephony Integration
7.7 Explain how Asynchronous Transfer Mode (ATM) is used and list benefits

8.0 Digital Telephony

8.1 Define ISDN
8.2 Explain advantages and usage of DSL
8.3 Explain 'bundling' and 'unbundling' of telephone services
8.4 Describe the differences between bytes, packets and frames
8.5 Explain the principles of Caller ID

9.0 Interfacing

9.1 Describe the problems which are commonly encountered when interconnecting consumer electronics and telephone equipment.
9.2 Explain electrical surge potentials and ways to combat damage from them
9.3 Describe EIA, CTIA and ITU protocols and standards

10.0 Internet

10.1 Describe the Internet
10.2 Explain TCP/IP duties and protocols
10.3 Explain security problems with Internet service and list ways to improve security

11.0 Network Infrastructures and Topologies

11.1 Define RS232 and show how and where this standard is used
11.2 Describe common transmission protocols
11.3 Explain the difference between a LAN and a WAN
11.4 Show an ability to install a small business WAN system and to troubleshoot problems in it

12.0 Office Wiring

12.1 List building wiring standards as set by ANSI, EIA/TIA and NFPA (NEC)
12.2 Explain methods of pre-wiring and ways to wire existing buildings, including entry, attic and crawl space precautions and methods of 'fishing' walls and routing wiring through false ceilings.

13.0 Test Equipment

13.1 Define the job of certifying wired communications networks
13.2 Describe Bit Error Rate test equipment (TBerd, etc.); toners and OTDRs
13.3 Demonstrate proficient use of an OTDR to troubleshoot cabling problems and to verify installed cable

14.0 Troubleshooting

14.1 Demonstrate proper usage of telephone test equipment as well as common DVM's, signal tracers and sources, oscilloscopes and loop and network testing equipment
14.2 Describe "Last Good, First Bad" troubleshooting methods and loop testing

15.0 Transmission Protocols

15.1 Define Modulation schemes

16.0 Telecom Mathematics

16.1 Work math problems as required in telecommunications service and installation work

17.0 Optical Wiring

17.1 Safety-demonstrate the rules for disposal and eye safety when working with fiber optics equipment
17.2 List different parameters and reasons for choosing each type of optical cable
17.3 Describe the conversion process from copper to fiber signals
17.4 Define and explain the term SONET
17.5 Explain DWDM, Dense Wave Division Multiplexing

18.0 Wireless Telephony

18.1 Give an overview of the differences between wired telecommunications and cellular networks.
18.2 Describe the concepts and architectures of cellular telephone systems
18.3 Define Spread Spectrum broadcasting techniques
18.4 Explain TDMA and CDMA modulation
18.5 Give a description of how Paging Services operate
18.6 Explain the principles of telephone communications via satellites
18.7 Describe the major components of satellite uplink and downlink systems

Suggested Texts:

Telecommunications and Data Communications Handbook; Ray Horak; Wiley; ISBN 978-0-470-04141-3
Communications Systems and Networks, 3rd edition; Ray Horak; Wiley; ISBN 0-7645-4899-9
Webster's New World Telecom Dictionary; Ray Horak; Wiley; ISBN 978-0-471-77457-0
Voice and Data Communications Handbook, Regis Bates/Donald Gregory, McGraw-Hill ISBN 0-07-006398-6
Newton's Telecom Dictionary, 14th edition, Harry Newton, Flatiron Publishing, ISBN 1-57820-023-7
Telecommunications Distribution Methods Manual, multiple authors by BICSI, 8th ed. 800 242 7405
Essential Guide to Telecommunications; Annabel Z. Dodd
Cabling—The Complete Guide to Network Wiring; David Groth and Jim McVee; 2000; Sybex; ISBN 0-7821-2645-6; 820+ ppg; available at www.eta-i.org 800-288-3824 (ETA)

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