BCT

Broadband Communications Technician

Curriculum and Study Guide

Study Resource Key

SCTE Publications

❶ Cable Television
❷ Customer Service Essentials for Today's Technical Personnel
❸ DigiPoints, The Digital Knowledge Handbook, Volume One
❹ DigiPoints, The Digital Knowledge Handbook, Volume Two
❺ DigiPoints, The Digital Knowledge Handbook, Volume Three
❼ Expo 2002 Proceedings Manual
❽ Foundations for Delivering Quality Broadband Services
❾ From Tap to Home: The SCTE Installation Manual
❿ A Logical Approach to Broadband Service Obstacles
⓬ A Practical Guide to Broadband Network Calculations
⓭ Recommended Practices for Coaxial Cable Construction and Testing
⓮ Recommended Practices for Optical Fiber Construction and Testing
⓯ Satellite Calculations Handbook

Other Publications

① Cable Television Proof-of-Performance
② CED Magazine
③ Computer Networks
④ Data and Telecommunications Dictionary
⑥ The Essential Guide to Digital Set-top Boxes and Interactive TV
⑦ The Essential Guide to Home Networking Technologies
⑧ Fiber-Optic Communications Systems
⑨ Integrating Voice and Data Networks
⑩ Modern Cable Television Technology
⑪ NAB Engineering Handbook for Radio and Television
⑫ National Electrical Code
⑬ Broadband Return Systems for Hybrid Fiber/Coax Cable TV Networks
⑭ Understanding Cable Telephony
⑮ Video Engineering
⑯ Voice and Data Communications Handbook

Seminars

[1] Broadband Telephony
[2] Coaxial Cable in the HFC Plant
[3] Digital Basics and High-Speed Data
[4] DOCSIS™ Deployment
[5] Optical Fiber in the HFC Plant

Online Sources

3 www.microsoft.com
7 www.anixter.com
8 www.ansi.org
10 www.apple.com
11 www.askcalea.net
12 www.cable-modems.org
13 www.cabletoday.com
14 www.eia.com
16 www.eudora.com
18 www.fcc.gov
19 www.homedirector.com
21 www.howstuffworks.com
22 www.iec.org/online/tutorials
24 www.iso.ch
31 www.osha.gov
32 www.packetcable.com
35 www.scte.org
36 www.tieonline.com
38 telecom.about.com

Broadband Communications Technician (BCT) Category I—Signal Processing Centers

FACILITIES ⑩

- **HVAC**
- **Fire Protection**
- **Security/Safety**
- **Equipment/Cabinets** ⑩
- **Bonding/Grounding**
  - Grounding Grids
  - Lightning/Surge Protection
- **Powering** ⑩
  - Commercial Powering
    - Surge Protection
  - Backup Generators ⑩
  - UPS ⑩
    - Batteries
- **Layout and Cabling** ⑩
  - Combining Techniques ⑩
  - Cabling Management
  - Isolation ⑩
  - Diplexing ⑩

SIGNAL RECEPTION 1 15 ⑩ ⑪

- **Off Air** 1 ⑩ ⑪
  - Tower Structures and Requirements ⑪
    - Self-supporting Structures ⑪
    - Guyed Structures ⑪
    - Lighting Requirements ⑪
  - Pre-amplifiers 1
  - Signal Attributes ⑩
  - Antennas ⑩
    - Types ⑩
    - Arrays ⑩
    - Co-channel Elimination ⑩
- **Satellite** 15 ⑩
  - Types of Antennas 15 ⑩
    - C-band 15 ⑩
    - KU band 15 ⑩
    - Multibeam 15 ⑩
  - Alignment 15 ⑩
    - Satellite Spacing ⑩
    - Orbital Arc ⑩
  - Signal Characteristics 15
    - Transmission 15 ⑩
    - Amplification Techniques ⑩
  - Antenna Performance 15 ⑩
    - Gain 15 ⑩
    - Noise 15 ⑩
    - Satellite Antenna Optimization ⑩
- **Microwave** ⑩
  - Antenna Types
  - Signal Characteristics ⑩
    - Transmission ⑩
    - Signal Amplification ⑩
  - Transmission Line ⑩
  - Antenna Performance ⑩

CHANNEL EQUIPMENT

3 4 5 8 9 ① ③ ⑩ ⑪ 15 2 3

- **Modulation and Demodulation** 3 4 5 8 9 ① ⑩ 2 3
  - NTSC Modulators ① ⑩
    - Theory of Operation ⑩
    - Setup ① ⑩
  - NTSC Demodulators ⑩
    - Theory of Operation ⑩
    - Setup
  - FM Modulators ⑩
    - Theory of Operation ⑩
    - Setup ⑩
  - Digital Modulation 3 4 5 8 9 ⑩ 2 3
    - Formats 3 5 8 9 ⑩ 2 3
    - Modulation Techniques 3 4 8 ⑩ 3
- **Processors** ① ⑩ ⑪
  - NTSC Processors ⑩ ①
    - Theory of Operation ⑩
    - Setup ①
  - FM Processors ⑪
    - Theory of Operation ⑪
    - Setup
- **Satellite Equipment** 4 ⑩ 15
  - Receivers 4 ⑩
    - Theory of Operation ⑩
    - IRDs/IRTs 4 ⑩
  - Descrambling 4 ⑩ 15
    - Videocipher 4
    - B-MAC 15
- **Conditional Access and Signal Protection** 3 4 5 8 9 ③ ⑩
  - RF ⑩
    - Interfering Carrier Systems ⑩
    - Scrambling Systems ⑩
    - Video Inversion ⑩
  - Digital 3 4 5 8 9 ③
    - Encryption 4
    - Conditional Access 4 5 8 9
    - Flow Control Mechanisms 3 ③
- **Emergency Alert Systems** ⑩
  - Insertion Methods
    - Baseband
    - IF Override
  - Regulatory Requirements
- **Channelization** ① ⑩
  - Identification ⑩
    - EIA Numbering ⑩
  - Frequency Assignments ① ⑩
    - Standard Frequencies ① ⑩
    - HRC Frequencies ① ⑩
    - IRC Frequencies ① ⑩
  - Filters ⑩
    - Bandpass ⑩
    - Bandstop ⑩
    - High Pass ⑩
    - Low Pass ⑩
  - Signal Combining
    - Splitter Networks
    - Directional Couplers
    - Active Combiners
- **Commercial Insertion** 4 ⑩
  - Analog Insertion 4 ⑩
    - Cueing Systems ⑩
    - Performance Impairments 4
  - Digital Ad Insertion 4 ⑩
    - Cueing Systems 4 ⑩
    - Audience Segmentation 4 ⑩
    - Performance Impairments

TELEPHONY ⑨ ⑯ 1

- **PSTN** ⑯ 1
  - Network Structure
    - Central Office
    - Trunk and Local Loop
  - Organizational Structure ⑯ 1
    - Local Exchange Carriers
    - Interexchange Carriers
    - Tariffs and Fee Exchanges ⑯ 1
  - Numbering Plans ⑨ ⑯ 1
    - North American Numbering Plan ⑨ ⑯ 1
    - International Numbering Plan
    - Number Portability
    - Network Protection
  - Switching 1
    - Functions of the Local Switch
    - Call Routing
    - Feature Provisioning 1
    - Types of Switches
  - Signaling Systems
    - CCS
    - SS7
- **Constant Bit Rate**
  - Functions of the HDT 1
    - Interface to Local Switch
    - Line Concentration
    - Termination of RF Inputs
    - Termination of Connections to Digital Switch
    - RF Spectrum Management
    - Voice Line Provisioning
  - Access Techniques 1
    - TDMA 1
    - CDMA
- **IP Telephony (PacketCable™)** 32 1
  - Telephony Functions of CMTS
  - Termination of RF Inputs
  - Termination of Connections to Router/Switch
  - RF Spectrum Management
  - Voice Line Provisioning
  - Call Management Server
    - Call Agents
  - Gateways
    - Media Gateway Controller
    - Media Gateway
    - Signaling Gateway
  - Announcement Servers
  - MTAs 32 1

TESTS AND MEASUREMENTS

8 9 ① ④ ⑨ ⑩ 13 ⑭ ⑯ 1 2 38

- **Impairments** 8 9 13 2
  - Noise 8 9 13 2
    - Thermal 8 13 2
    - Impulse 8 13 2
  - Distortions 8 9 13 2
    - CSO 8 13 2
    - CTB 8 13 2
    - XMOD 8 9 2
  - Interfering Signals 8 9 13 2
    - Common Path Distortion 8 2
    - Hum Modulation 8 9 13 2
    - Ingress/Egress 8 9 13 2
  - Reflections 8 2
  - Digital ⑨ 1
    - BER ⑨ 1
    - Latency 1
    - Jitter ⑨ 1
    - Packet Loss 1
  - Analog Telephony ④ ⑯ 1
    - Far-end Crosstalk ④ ⑯
    - Near-end Crosstalk ④ ⑯
    - Frequency Hopping 1
- **Test Equipment** 9 ① ⑩ ⑭
  - RF Equipment ① ⑩
    - Spectrum Analyzer ① ⑩
    - Power Meter ⑩
    - Signal Level Meter ⑩
    - Precision Demodulators ⑩
  - Telephony Equipment 9 ⑭
    - Butt Set 9 ⑭
    - Toner 9 ⑭
    - DMM 9
    - Continuity Tester 9
- **Performance Tests** 8 9 13 2
  - C/N 8 9 13 2
    - Measurement 8 9 13 2
  - CSO 8 13 2
    - Measurement 8 13 2
  - CTB 8 13 2
    - Measurement 8 13 2
  - XMOD 8 9 2
    - Measurement 8 9 2
  - FCC Rules 8 13 2
    - Performance Requirements 8 13 2
    - Proof of Performance Tests 8 2
- **Customer Premises Telephony Troubleshooting** 9 ⑭ 1 38
  - Procedures ⑭ 38
    - Loopback Test ⑭ 38
  - Equipment 9
  - Symptoms 9 ⑭ 1
    - Poor Connection ⑭ 1
    - Wiring Faults ⑭
    - Powering ⑭ 1
    - Interference/Ingress 9 1
    - Upstream 1
  - Remote Diagnostics 1

Broadband Communications Technician (BCT) Category II—Video and Audio Signals and Systems

ANALOG VIDEO

Fundamental Concepts
- Interlace Scanning
  - Fields
  - Frame
- Aspect Ratio
- Polarity of Picture
- White Peak
- Viewing Distance

NTSC Components
- Synchronization and Timing
  - Vertical Blanking Interval
  - Horizontal Blanking Interval
- Picture Components
  - Blanking Level
  - Reference Black
  - Luminance
  - Reference White
- Color Components
  - Chrominance
  - Sync Burst

Other Video Formats
- PAL
- SECAM

Video Processing Equipment
- Time Base Correctors
- Frame Store/Frame Synchronizer
- Distribution Amplifiers

ANALOG AUDIO

Fundamental Concepts
- Loudness
- Octave
- Phase
- Sound Pressure
- Balanced/Unbalanced
- Stereo
- BTSC
  - Monaural Channel
  - Stereo Channel
  - SAP Channel
  - Professional Channel
  - Performance Objectives
  - Pilot
- FM Stereo
  - L+R
  - L-R
- Dolby AC3

Audio Processing
- Unity Gain
- Equalization
- Headroom
- Compression and Expansion

Standards
- Impedance
- Level
- RS-297

ANALOG TESTS AND MEASUREMENTS

Equipment
- Oscilloscope
  - Graticule
  - Termination
- Waveform Monitor
  - Graticule
  - Termination
- Vectorscope
  - Graticule
- Digital Multimeters
- Signal Generators

Video Tests
- Types of Tests
  - Video Gain
  - Signal-to-Noise Ratio
  - Carrier-to-Noise Ratio
- Test Signals
  - Color Bars
  - Field Square Wave
  - Ramp Signal
  - Multipulse
  - Composite Test Signal
  - Combination Test Signal
- Performance Standards and References
  - EIA-250C
  - NTC-7
  - RS-170A
  - FCC Rules
  - Measurements and References

Audio Tests
- Insertion Gain
- Gain vs. Frequency Distortion
- Channel Separation
- Signal-to-Noise
  - Weighted
  - Unweighted
- Level and Relative Loudness
  - Vu Meter
  - PPM
  - Persistence Meter

Distortions
- Video
  - Linear Distortions
  - Non-linear Distortions
  - Effects of Impairment
- Audio
  - Distortions
  - Crosstalk
  - Frequency-based Distortion
  - Noise
  - ICPM

DIGITAL VIDEO AND AUDIO

Basics of Digital
- Binary System
  - Terms
  - Numbering Systems
  - Coding of Information
  - Line Codes
- Structure of Messages
  - Frames
  - Packets
  - OSI Model

Analog-to-Digital Conversion
- Conversion Steps
  - Sampling
  - Quantization
  - Encoding
- Compression Formats
  - MPEG
  - Lossy vs. Lossless Compression

Digital Video
- Digital Video Processing
  - Multiplexing/Demultiplexing
- Digital Satellite
  - IRT/IRDs
  - HITS
  - Cherry Picker
- Vertical Blanking Interval
  - Data
  - Structure
- ATV Formats
  - Improved NTSC
  - Extended Definition
  - Full HDTV
  - Advanced Analog

Digital Audio
- Formats
  - MP-3
  - Dolby 5.1
  - Dolby AC-3
  - Musicam 5.1
- Compression
- Processing
  - Pre/De-emphasis
  - A/D Conversion
- Multiplexing
  - Multiplexers
  - Demultiplexers

Digital Video Services
- Narrowcast Services
  - VOD
  - NVOD
  - SVOD
  - PPV
- Interactive TV
  - On-Screen Guides
  - Video Gaming
  - Service Impairments
- Server Management
  - Centralized Servers
  - Decentralized Servers
  - Server Equipment

DIGITAL TESTS AND MEASUREMENTS

Error Detection and Correction
- Error Checking
  - Process
  - Techniques
- FEC

Digital Performance Metrics
- BER
- MER

Digital Impairments
- Baseband Impairments
  - Sampling Error
  - Quantizing Error
- Line Impairments
  - S/N
  - Jitter
  - Latency
  - Packet Loss
- RF Impairments
  - C/N
  - Interference
  - Satellite
- Power Per Hertz

Test Equipment
- QAM Analyzers
  - Theory of Operation
  - Use of
- Spectrum Analyzers
  - Theory of Operation
  - Use of
- Protocol Analyzers
  - Theory of Operation
  - Use of
- SLMs with Digital Options or Plug-Ins
  - Theory of Operation
  - Use of
  - Types of Digital Options

Broadband Communications Technician (BCT) Category III—Transportation Systems

FIBER OPTIC THEORY
Fundamentals of Optics
- Properties of Light
  - Wavelength
  - Reflection
  - Refraction
- Propagation of Light

Optical Fiber and Cables
- Types
  - Single Mode
  - Multi-mode
- Physical Properties
  - Core
  - Cladding
  - Color Code
  - Mode Field Diameter
  - Cables
  - Index of Refraction
- Losses
  - Intrinsic
  - Extrinsic

Transmit and Receive Equipment
- Lasers
  - Types
  - Performance Characteristics
  - Classes
  - Safety
- Receivers/Nodes
  - Detectors
- Amplifiers
  - RF Launch Amplifiers
  - EDFA's
- Regenerators
  - Defined

Hardware
- Connectorization
  - Types
  - Pig-tails
  - Defects
- Patch Panels
- Optical Couplers

OPTICAL TRANSPORT SYSTEMS
Topologies
- Bus
- Star
- Ring
- Self-Healing Ring

Architectures
- SONET
  - Hierarchy
- Proprietary
- Gigabit Ethernet (GigE)
  - Advantages
  - 10GigE/10Gbase
- FTTx
  - FTTC
  - FTTH
- Passive Optical Networks (PONs)
  - Defined

Transmission Techniques
- Modulation Schemes
  - AM
  - Digital
- Multiplexing
  - DWDM
  - CWDM
  - WDM
- Return Techniques
  - Digital
  - Frequency Stacking
  - Setup

LINK PERFORMANCE
Rules and Regulations
- FCC
  - Proofs
  - CLI
  - Public Files

Operating Principles
- Link Budget
  - Losses
  - Calculations
- Input/Output Levels
  - Voltage/Current/Power
  - RF Input to Lasers
  - Optical Input to Photodetectors
  - RF Output of Optical Receivers
- Component Contributions to Noise and Distortions
  - C/N
  - Distortions

Performance Metrics
- BER

TROUBLESHOOTING AND MAINTENANCE
Test Equipment
- Spectrum Analyzers
  - RF
  - Optical
- Sweep Equipment
  - Operation
  - Testing
- TDR
  - Operation
  - Testing
- Optical Power Meter
  - Operation
  - Testing
- OTDR
  - Operation
  - Testing
- Power Meter/Light Source
- Identifiers
- Visual Fault Indicator

Troubleshooting
- Transmitters
  - Cooling Circuit
  - OMI
- Receivers
  - Optical Input
  - RF Output
  - Troubleshooting Process
- Return
  - Monitoring
  - Testing
  - Sweeping
- Optical Fibers
- Optical Couplers
  - Performance Characteristics
- Patch Panels

Maintenance
- Types of Maintenance
  - Preventive
  - Demand
- DWDM
  - C/N
  - Crosstalk
- Status Monitoring
  - Forward
  - Return
  - Transponders

Construction
- Aerial
  - Lashing/Overlashing
  - Pulling Tension
  - Clearances
  - Fold-back Loops
- Underground
  - Cable Locates
  - Boring
  - Mid-Point Pulling
- Weather Protection
  - Enclosures
- Emergency Restoration
  - Restoration Kit
  - Splicing

ALTERNATIVE TRANSPORT SYSTEMS
Microwave Systems
- Equipment
  - Transmitter
  - Tower
  - Receiver
  - Waveguide
  - Frequencies
- Test Instruments
- Antennas and Alignment
  - Radio Horizon
- Types
  - AML
  - FML
- Advantages
- Rules and Regulations
  - Towers
  - Frequencies
  - Operation

Super Trunks
- FM
  - Bandwidth
  - Advantages
  - Operation Principles
- Parallel Hybrid
  - Advantages
  - Operation Principles
- Feedforward
  - Advantages

PSTN
- Multiplexing
  - Frequency Division
  - Time Division
  - Code Division
- Transmission Methods
  - Asynchronous
  - Synchronous
- Error Conditions
- Traffic Engineering
  - CCS and Erlang Calculations
  - High Day Busy Hour
- Remote Terminals
  - Subscriber Loop Carriers
  - Digital Loop Carriers
  - Next Generation Digital Loop Carriers
- PSTN Interface Options
  - T1
  - ISDN
  - GR-303

Broadband Communications Technician (BCT) Category IV—Distribution Systems

SYSTEM ARCHITECTURES 8 10 12 13 ⑩ 2

- **Design Principles** 8 10 12 13 ⑩ 2
  - Mapping 8 10
    - Symbols 8
    - Types of Maps 8
  - Powering 12 13 2
    - Standby 12 2
    - Powering Topologies 12 13 2
    - Sources 12 2
    - Grids 12
  - RF Principles 8 12 2
    - Levels 12
    - Power/Voltage Addition 12 2
    - Amplifier Cascades 8 2
- **HFC Architectures** 8 ⑩ 2
  - Tree and Branch 8 ⑩ 2
    - Trunk 8 2
    - Feeder 8 2
    - Spacing ⑩ 2
  - Star/Hub 8 2
  - Two-way 8
    - Sub-split 8
    - Mid-split 8
    - High-split 8
    - Tri-split

DISTRIBUTION COMPONENTS 8 12 13 ⑩ 2

- **Actives** 8 12 13 ⑩ 2
  - Amplifiers 8 2
    - Operating Parameters 8
    - Types of Amplifiers 8 2
    - Application of Amplifiers 8 2
    - Specification Sheets 8
    - Internal Design 8 2
  - Alignment 8 13 2
    - Manual 8 13 2
    - AGC/ASC 8 13 2
    - Reverse 8 13 2
  - Calculations 8 12 13 ⑩ 2
    - Ohm's Law 12 2
    - Decibel Theory 12 2
    - Noise/Distortions 8 2
    - Return Loss ⑩
    - Reverse 8 13
  - Plug In Devices 8 12 2
    - Diplex Filters 8 2
    - Pads/Equalizers 8 2
    - Trim Devices 2
    - Feedermakers 8 2
    - Fusing 8 12
  - Nodes 8 ⑩ 2
    - Forward ⑩ 2
    - Reverse ⑩ 2
- **Passives** 8 2
  - RF and AC Properties 8 2
    - Fusing/Shunts 8
    - Return Loss 8 2
  - Devices 8 2
    - Line Splitters 8 2
    - Directional Couplers 8 2
    - Power Inserters 8 2
    - Directional Taps 8 2
- **Coaxial Cable** 8 13 2 3
  - Connectors 8 13
    - Cable Prep 8 13
    - Types 8 13
    - Connectorization 8 13
  - Properties 8 13 2 3
    - Impedance 8 2
    - Velocity of Propagation 8 13
    - Inductance 2
    - Capacitance 2
    - Attenuation 8 13 2 3
    - Shielding 8
    - DC Loop Resistance 8 2
  - Handling 8 13
    - Bending Radius 8
    - Lashing 13
    - Environmental Damage 8
  - Return Loss 8 13 2
    - Structural Return Loss 8 13 2
    - Impedance Mismatches 8 13 2
  - Components 8 13 2
    - Center Conductor 8 2
    - Dielectric 8 2
    - Jacket 8
    - Flooding Compound 8 13

SIGNAL TYPES 3 5 8 9 13 2 3

- **ANALOG** 8 13 2
  - NTSC 8 2
    - Components 8
    - Bandwidth 8
    - Transmission 8 2
  - Pilots 8 13 2
  - Modulation Schemes 8 2
    - AM 8 2
    - FM 8 2
    - PM 8 2
- **Digital** 3 5 8 9 2 3
  - Components 3 5 8 9 3
  - Modulation Schemes 8 2 3
    - FSK 8 2 3
    - QPSK 8 2
    - QAM 8 2
- **Frequency Spectrum** 8
  - Analog Forward/Reverse 8
    - Bandwidth 8
    - Channel Allocation/Frequencies 8
  - Digital Forward/Reverse 8
- **Analog Impairments** 8 9 13 2
  - Noise 8 9 2 13
    - Thermal 8 13 2
    - Impulse 8 13 2
  - Distortions 8 9 2 13
    - CSO 8 13 2
    - CTB 8 13 2
    - XMOD 8 9 2
  - Interfering Signals 8 9 13 2
    - Common Path Distortions 8 2
    - Hum Modulation 8 9 13 2
    - Ingress/Egress 8 9 13 2
  - Reflections 8 2
- **Digital Impairments** 3 4 ⑩ 3

MAINTENANCE AND TROUBLESHOOTING 1 4 8 9 10 13 ⑩ 2 3

- **Sweeping** 13 2
  - Use of Sweep Systems 13 2
    - Techniques 13 2
    - Forward and Return 13 2
    - Injection Points 2
  - Types of Sweep Systems 13 2
    - Low Level 13 2
    - High Level 13 2
    - Carrier 13 2
- **FCC Rules** 8 13 2
  - Performance Requirements 8 13 2
  - Proof of Performance Tests 8 2
- **Return Path** 13
- **Test Equipment** 4 8 9 13 ⑩ 2 3
  - Analog 8 9 13 ⑩ 2
    - Spectrum Analyzer ⑩ 2
    - SLM 8 9 13
    - Leakage Detector 8 9
    - DMM 8 9
  - Digital 4 8 2 3
    - QAM Analyzer 4 3
    - BERT 8 2
  - Locators 8
  - TDRs 8 13
  - RF Bridge 13
- **Status Monitoring** 8
- **Troubleshooting Techniques** 1 10 8
  - Intrusive 8
  - Non-intrusive 8 10
  - Half-split 10
  - Outages 8 10

SAFETY AND CONSTRUCTION 1 8 9 12 13

- **Field Safety** 8 9 12
  - Personal Protective Equipment 8 9
    - Hard Hat 8 9
    - Body Belt 8 9
    - Safety Strap 8 9
    - Safety Glasses 8 9
    - Hot Gloves 8 9
    - Fall Arrest Systems 8
  - Equipment Use 8 9 12
    - Tools 8 9
    - Battery Handling 12
  - Ladder Safety 8 9
    - Inspection 9
    - Types of 9
    - Handling 9
    - Use 8 9
  - Pole Climbing 8 9
    - Pole Inspection 8 9
    - Voltage Probes 9
    - Climbing Technique 8 9
    - Gaffs/Hooks 8
  - Vehicle Operation 8 9
    - Traffic Management 9
    - Aerial Lifts 8
    - Trucks/Vans 8 9
    - Daily Inspection 8 9
- **Construction** 1 8 13
  - Lashing/Overlashing 1 13
  - Clearances 8 13
    - On Poles 8 13
    - Over Roadways 8 13
    - Between Conductors 8 13
  - Expansion Loops 8 13
  - Restoration 13
  - Bonding 13

Broadband Communications Technician (BCT) Category V—High Speed Data, Networking and Architecture

FUNDAMENTALS OF DIGITAL

- **Coding**
  - Data Codes
    - ASCII
    - EBCDIC
  - Line Coding
    - Non-Return to Zero
    - Bipolar
    - Manchester Coding
- **Data Frames**
  - Structure of Frames
    - MPEG Frames
  - Error Management
    - Error Control
- **Access Techniques**
  - TDMA
  - CDMA
- **Transmission**
  - Asynchronous
  - Synchronous
  - Bisynchronous
  - Multiplexing
    - Time Based
    - Frequency Based
  - Modulation Techniques
    - One-bit Modulation
    - Multibit Modulation
    - Advanced Modulation Techniques (DOCSIS 2.0)

COMPUTER TECHNOLOGY

- **Software**
  - Operating Systems
    - DOS
    - Windows
    - UNIX/LINUX
    - Macintosh
  - Uses of Software
    - Applications
    - User Files
    - Drivers
    - ER/O
- **Hardware**
  - CPU/Motherboard
    - x86
    - 680x0
    - Interrupt Requests
    - Architecture
  - Expansion Bus
    - ISA
    - PCI
    - PCMCIA
  - Memory
    - RAM
    - ROM
    - CMOS
  - Storage Devices/Media
    - Hard Drive
    - Floppy Drive
    - Zip Drives
    - CD
    - DVD
- **Input/Output**
  - Serial Interface
    - EIA-232
    - USB
    - InfraRed
    - NIC
  - Parallel Interface
    - SCSI
    - IDE/EIDE
    - 1294 Parallel Port
  - Peripheral Devices
    - Input
    - Output
    - Input and Output
  - Application Configuration
    - Browsers
    - E-mail
    - Integrated Monitoring and Repair Applications

NETWORKING FUNDAMENTALS

- **Topologies**
  - Bus
  - Ring
  - Star
  - Tree and Branch
- **Protocols**
  - OSI Model
  - IEEE 802.x
    - Frame Structure
  - TCP/IP
    - IP
    - ARP
    - ICMP
    - TCP
    - UDP
- **LANs and WANs**
  - Routing Protocols
    - BGP
    - IGRP
    - IP Multicast
    - NLSP
    - RSVP
    - RIP
    - SMRP
    - MPLS
  - Internetworking
    - Equipment
  - Connection Techniques
    - VPN
    - PPTP
    - PPPoE
  - Transmission Media
    - Twisted Pair
    - Optical Fiber
    - Coaxial Cable
    - Wireless
- **Networking Standards**
  - Standards Organizations
    - EIA
    - ISO
    - SCTE
  - In-home Networks
    - Wire Based
    - Wireless

DOCSIS NETWORKS

- **DOCSIS Specifications**
  - Transmission
    - Upstream
    - Downstream
    - Network Side Interface
  - Provisioning
    - Provisioning Protocols
  - Traffic Management
    - Bandwidth Allocation
    - QoS
    - CoS
  - PMD Sublayer
    - Downstream RF
    - Upstream RF
    - RF Combining/Splitting
- **ISP Connections**
  - Provisioning Data Services
    - Single ISP
    - Multiple ISPs
  - Protocols
    - ATM
    - T1/T3
    - SONET
  - NAPs
- **Security**
  - Conditional Access
  - Baseline Privacy
  - BPI+

TEST AND MAINTENANCE

- **Test Equipment**
  - Spectrum Analyzers
  - Protocol Analyzers
  - QAM Analyzers
    - Constellation Evaluation
- **Performance Metrics**
  - BER
  - MER
  - EVM
- **Impairments and Mitigation**
  - Impairment Sources
    - Ingress
    - Noise
    - Distortions
    - Transmission Impairments
  - Frequency Hopping
  - Interleaving
    - Byte
    - Bit
- **Measurement Techniques**
  - Transmission Channel
    - Amplitude
    - Carrier-to-Noise
    - Carrier-to-Interference
  - Data Tools
    - SNMP
    - CMTS
    - OSS
- **Traffic Management**

Broadband Communications Technician (BCT) Category VI—Terminal Devices

CONSUMER EQUIPMENT AND INTERFACES

5 8 9 4 7 9 10 16 1 7 8 11 18 21 31 36

Customer Premises Equipment 5 8 9 7 10
- Video Terminal Devices — 5 8 9 7
  - VCR 8 9
  - TV Receiver 8 9
  - DVD 5 8 9
  - PVR 7
  - Digital Monitors 8
  - Video Switches
- Equipment Interface Configuration — 9 10
  - Recording Alternative 9 10
- Navigation Devices/Interface — 5 8 9 10
  - Remote Controls 5 10
  - Parental Control 5
  - IR Blaster 8 9 10

Aural Terminal Devices — 8 9 10
- BTSC — 8
- Home Theater — 8 9 10
  - Dolby AC3 8 10
- FM Receivers

Telephony — 4 9 16 1
- Telephone Components — 4 9 16 1
  - Ringer 16
  - Handset 16
  - Hook Switch 16 1
  - Dial Pad 16
  - Multiline Devices 4 9 16
- Cordless Phones — 4 21
  - Frequencies of Operation 4 21
  - Modulation Techniques 21
- Other Devices — 21
  - Alarm Service Equipment (Line Seizing) 21
  - External Caller ID Services 21
- Safety and Regulatory — 12 16 11 18 31 1
  - OSHA 31
  - FCC 18
  - CALEA 11
  - E911
  - Modified Final Judgement (MFJ) 16
  - Demarcation Point 1
  - National Electrical Code (NEC) 12
  - Telecommunications Act of 1996 16 18
- Wiring Standards — 9 14 16 7 8 36
  - Wiring Codes 7 8 36
  - Cable and Connectors 9 14 16

SET-TOP TERMINALS

3 4 5 8 9 6 7 10

Basic Terminal Components (Operation) — 4 8 9 6
- Analog Converters — 8 9
  - Tuner 8
  - Output Interfaces 8 9
- Digital Terminals — 4 8 9 6
  - Tuner 4 9
  - CPU/Clock 4 6
  - Storage 4 6
  - Demodulator 4 6
  - Demultiplexing 4 6
  - Output Interfaces 4 8 9
  - Decoder 4 6

Regulatory
- FCC
- Independent Testing Laboratories
- NEC

Types of Set-top Terminals 3 4 5 8 9 7 10
- Analog Terminals — 8 9
  - Analog/Non-addressable 8 9
  - Addressable Converter 8 9
- Digital Terminals — 8 4 5
  - Features/Functions 4 8
  - Digital Communications 4 5 8
- Next Generation Set-top Terminals 3 4 5 7
  - OpenCable 4 5
  - DOCSIS-Based Video Terminals 4
  - Set-Top Operating Systems 4 7
  - Protocol Layers 3
- Addressable Systems — 5 8
  - Controllers 5 8
- Terminals — 8 10
  - Address Schemes 8 10
  - Location of Data Stream 8 10

Conditional Access Techniques — 4 8 9 6
- Analog — 8 9
  - Scrambling
  - Video Inversion
  - Channel Authorization
  - Traps 8 9
- Digital — 4 8 9
  - Encryption/Decryption 4
- Smart Cards — 4 6
  - Defined 4 6
  - CPU 4 6
  - RAM 6
  - ROM 6
  - EEPROM 6

SERVICES

3 4 5 8 9 2 3 6 7 10 1 3 32

Video — 4 5 8 9 2 6 10
- Analog
  - IPPV
  - PPV
- Standard Definition Television
- HDTV — 4 5 8
  - Aspect Ratio 4 5 8
  - Scanning Systems 5 8
- Interactive TV — 4 8 9 2
  - VOD 4
  - SVOD 2
  - NVOD 4 9
  - Web TV 8 9
- Set-top Applications — 5 6 10
  - Navigation Aids 5 6 10
  - T-commerce

Telephony — 1 32
- Circuit Switched Telephony — 1
  - NIU/NID 1
  - Provisioning 1
- IP Telephony — 1 32
  - Packet Switching 1
  - PacketCable™ 1 32
- Powering — 1
  - Twisted Pair Powering (AC) 1
  - Coaxial Powering 1
  - Batteries 1
  - Network Power vs. Home Power 1

Data — 3 5 4 8 3 7 10 3
- Modems — 3 4 3
  - Dial-up Modems 3 4 3
  - DOCSIS Telco Return 4
- DOCSIS CM — 4 10 3
  - Provisioning 4 3
  - RF Performance 4 10 3
- CPE Interface — 4 5 7 10 3
  - Ethernet 4 3
  - USB 4 10
  - Wireless 5 7
  - PCI 10 3
- Application Protocols — 3
  - HTTP 3
  - FTP 3

TROUBLESHOOTING AND MAINTENANCE

3 4 8 9 13 10 14 1 2 3 38

Analog — 8 9 13 2
- Signal Impairments — 8 9 13 2
  - Noise 8 9 13 2
  - Intermodulation 8 13 2
  - Cross Modulation 8 9 2
  - Ingress 8 9 13 2
  - Ghosting 8 9
  - Co-channel 8 9
- Performance Criteria — 2
  - FCC Part 76 Rules 2
  - NCTA Best Practices

Digital — 3 4 8 10 3
- Signal Impairments — 3 4 10 3
  - Channel Noise 3 3
  - Jitter/Latency 3 3
  - Interfering Carriers 3 4
  - Reflections 3 10
  - Packet Loss
- Performance Criteria — 3 4 8 3
  - Channel Characterization 3 4
  - Error Correction 3 8 3

Set-top Terminals — 4
- Self-Diagnostics — 4
  - Power On 4

Telephony — 9 14 1 38
- Test Equipment — 9 14
  - Butt Set 9 14
  - Toner 9 14
  - Continuity Tester 9
- Customer Premises Troubleshooting 14 1 38
  - Procedures 14 38
  - Symptoms 14 1
  - Remote Diagnostics 1

Test Equipment — 3 4 8 9 2 3
- Analog Equipment — 8 9
  - SLM 8 9
  - Test TV 8 9
  - VOM/DMM 8 9
  - Signal Leakage Detection 8 9
  - System Analyzers
- Digital Equipment — 3 4 8 2 3
  - QAM Analyzers 4 3
  - BER Testers 3 8 2
  - Protocol Analyzers 3

CUSTOMER SERVICE

2 9

Professionalism — 2 9
- On the Job — 2 9
  - Conduct
  - Job Performance
  - Customer Property
- Personal Appearance — 2 9
  - Grooming
  - Attitude
  - Interpersonal Skills
  - Clothing
- Off the Job — 9
  - Driving in Company Vehicle
  - Stores and Restaurants in Uniform
- Stress Management — 2

Customer Relations — 2 9
- Customer Retention 9
  - Retaining Customers 9
  - Internal vs. External Customers
- Effective Communication — 2 9
  - Listening
  - Clarity of Speech
  - Empathy
  - Probing
  - Telephone Etiquette
  - After-hours Calls
- Conflict Resolution — 2 9
- Problem Resolution — 9
  - Customer Compensations

Society of Cable Telecommunications Engineers

140 Philips Road
Exton, PA 19341-1318
800-542-5040
www.scte.org