

1255 W 15th Street, Suite 440 Plano, TX 75075 Tel: (972)-633-5100 Toll Free: 1-8777-RF-MCPS Fax: (972)-633-5106 www.mcpsinc.com

Certification & Training on Transmission & Transport Network

Course Duration (25 Days)

Objective:

After completing this course, the audience will be able to:

- Understand Basic Concepts
- Describe transmission types
- Define Networks & Network Models
- Explain optical & microwave transmission

Who Should Attend?

This is beginner level course and suitable for professionals & students who have little or no understanding of Transmission systems.

Course Content

1). Introduction to Telecommunication (2 Days)

Overview

- What is transmission?
- History
- Evolution
- Transmission types
- Challenges
- Usage in networks
- Components of a Transmission System











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Modulation Schemes

- AM systems
- FM systems
- Digital Wireless systems
- Line codes
- ASK, FSK, PSK, MSK, QPSK, QAM modulation schemes presentation
- Modulation techniques over fading channels

Antenna System Considerations; Transmission Lines

- Antenna classifications •
- Antenna types •
- Standard antennas
- High performance antennas
- Transmission lines basics
- Antenna electrical characteristics (Gain, Antenna Lobes, Beam width, • Antenna Polarization, VSWR)

Transmission basics

- Multiplexing •
- Media and Media Characteristics, •
 - Copper
 - Microwave
 - **Optical fiber**
- **PDH** Fundamentals •
 - PCM CODEC •

SDH Basics

- Introduction to SDH
- STM-1 Frame Structure •
- RSOH, MSOH and payload •









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2). Microwave Radio Systems (3 Days)

INTRODUCTION TO WIRELESS RADIO COMMUNICATIONS

- Wireless systems design challenges
- The wireless channel
- Propagation models
- Large scale propagation
- Small scale propagation
- Rayleigh model
- Wireless multipath channels
- Spatial channel models and antennas
- Space-Frequency Diversity

RADIO PROPAGATION

- Electromagnetic Waves
- Radio Wave Propagation
- Refraction
- K-Factor
- Multipath Propagation
- Fading
- Formation Of a Duct
- Diffraction
- Reflection and scattering
- Absorption
- Rain Attenuation

MICROWAVE ANTENNA

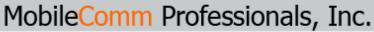
- Antenna Gain
- VSWR
- Side and Back lobe Levels
- Beam Width
- Antenna Characteristics EIRP and ERP
- Antenna Characteristics Polarization
- Cross Polarization
- Passive Repeater
- Plane Reflectors
- Back to back Repeater
- Mechanical Stability
- Antenna Datasheet











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ANTENNA SYSTEM CONSIDERATIONS

- Antenna classifications
- Antenna types
- Standard antennas
- High performance antennas
- Extra high performance antennas
- Transmission lines basics
- Antenna electrical characteristics (Gain, Antenna Lobes, Beam width, Antenna Polarization, VSWR)
- Antenna system accessories (Antenna Dehydrators, Antenna Grounding, Antenna Fields)

ANTENNA INSTALLATIONS

- Feeder cables
- Safety regulations
- Mounting connectors
- Sealing connectors
- Antenna spacing and direction requirements
- Site Installation planning and procedures
- Site Installation documentation
- Earthing and lightning protection
- Roxtec installation
- Antenna system testing
- Practical exercises

DIGITAL MAP AND TOOLS OVERVIEW

- Prediction Tools
- Tasks
- Prediction Tool Database
- Digital Maps
- Geographical Databases
- Vector Data (Linear)
- Altitude
- Clutter (Land use)
- Resolution / Precision
- Map Coordinates Geodesy











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- Map Coordinates Projection
- Projection Systems

PERFORMANCE AND QUALITY OBJECTIVES

- Degradation on quality
- The ITU standards
- Performance Objectives
- Availability Objectives
- Circuit Classification
- Performance Predictions
- Reliability
- Calculation of Unavailability

3). Transmission Planning (3 Days)

TRANSMISSION NETWORKS

- Short haul microwave networks
- Long haul microwave networks

TRANSMISSION RATES HIERARCHY

- PCM basics
- PDH network
- SDH network
- ATM basics

NETWORK TOPOLOGIES

Tandem configurations

- Star configurations
- Mesh configurations
- Star-Mesh configurations
- Mixed networks
- Transmission networks for Cellular
- GSM: PCM over Optical; PDH, SDH
- GPRS: IP over Ethernet and Frame Relay
- UMTS: Frames over ATM
- LTE: IP based traffic, the MBPN network









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BRIEF INTRODUCTION TO WIRELESS RADIO COMMUNICATIONS

- Wireless systems design challenges
- The wireless channel
- Propagation models
- Large scale propagation
- Small scale propagation
- Rayleigh model
- Ricean model
- Nakagami model
- Wireless multipath channels
- Spatial channel models and antennas
- Space-Frequency Diversity

MODULATION SCHEMES

- AM systems
- FM systems
- Digital Wireless systems
- Line codes
- ASK, FSK, PSK, MSK, QPSK, QAM modulation schemes presentation
- Modulation techniques over fading channels

KEY RADIO FUNDAMENTALS

- Equalization principles
- Fundamental principles of channel coding
- Error correction & error detection principles
- Introduction to Forward Error Correction Coding (FEC)
- Block coding
- Convolutional coding
- Interleaving
- Diversity principles
- Multiple Access Techniques
- FDMA / TDMA
- Direct sequence spread spectrum principles
- Automatic Transmission Power Control (ATPC)
- Errorless Vs. Hitless Receiver Switching











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TRANSMITTER RECEIVER CHARACTERISTICS

- System Gain
- Dispersive Fade Margin
- Radio Thermal Noise
- Signal to Noise ratio S/N
- Receiver sensitivity
- Modulation and S/N
- Design principles

MW RADIO PLANNING

- Propagation and prediction methods
- Frequency planning and interference calculations
- Far interference planning principles
- Radio spectrum and channel arrangements

TOOLS FOR PLANNING

- Planning with ATPC
- TEMS link planner tool
- Planning examples case studies

4). Frequency Planning and Optimization (2 Days)

EXECUTIVE SUMMARY

- What is interference?
- Frequency spectrum and microwave bands
- Channel plans
- Frequency planning
- High/low sites
- Interference calculations
- Nodal interference
- Over-shoot interference

LINK CALCULATIONS

- Choosing antenna heights
- -clearance rules
- Choosing antenna size
- -power budget
- -fade margin
- Outage prediction











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- -rain fading
- -multipath fading

GRAPHIC METHOD FOR PATH-LENGTH OPTIMIZATION

- Optimization of maximum path lengths
- Optimization antenna size
- Optimization of output power
- Determine values of Q&A parameters for a given path length

Q&A RECOMMENDATIONS FOR MICROWAVE PLANNING Q&A CALCULATIONS

- Influence of "path-type parameters" on the calculations
- Antenna separation
- Space-diversity aspects

RAIN ATTENUATION MODELS

5). SDH Basic (4 Days)

EXECUTIVE SUMMARY

- Optical Networks
- Fiber Optic Fundamentals
- Access, metro, long hual networks
- SONET/SDH Overview
- Overview, Architectures and Services
- SDH in Enterprise Networks & LANs
- Convergence of Services
- Overview of SDH Structure & Formats
- Overview of SDH Products & Features
- Overview of SDH Networking

OVERVIEW OF FIBER OPTICS COMMUNICATIONS

- Fiber optic transmission
- Optical fibers structure
- Optical amplifiers
- Light sources and transmitters
- Photodiodes and receivers
- Optical communication systems
- Optical components









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SONET/SDH ARCHITECTURES & SERVICES

- Evolving CPE/ILEC/IXCs Infrastructure & Services
- Inter-Office & Core Networking with SONET/SDH
- SONET/SDH in the Feeder Section
- Loop Section & the Last Mile
- ADSL (Twisted Pair)
- HFC (Coax)
- Strategies for DWDM &SDH in the 21st Century

WHAT ARE THE BENEFITS OF SONET/SDH?

- Pointers, MUX/ DEMUX
- Reduced Back-to-Back Multiplexing
- Optical Interconnect
- Multipoint Configurations
- Convergence, ATM, Video, and SDH
- Grooming
- Reduced Cabling and Elimination of DSX Panels
- Enhanced OAM&P
- Enhanced Performance Monitoring

SYNCHRONOUS DIGITAL HIERARCHY (SDH)

- Basic Rates
- Frame Structure
- Overhead Bytes
- STM-4, STM-16 and STM-64
- Tributary Units (TUs)
- SONET and SDH Compatibility

SDH OVERHEAD

- Regenerator Section Overhead
- Multiplex Section Overhead
- Higher-Order Path Overhead (VC-4/VC-3)
- Lower-Order Path Overhead (VC-2/VC-1)
- SDH Anomalies, Defects, Failures, and Alarms
- SDH Error Performance Monitoring
- SDH Pointers
- Payload Pointers
- Positive Pointer Justification
- Negative Pointer Justification
- SDH Multiplexing











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- SDH Tributary Multiplexing
- Tributary Unit Group
- TU Multi-frame
- TU Payload Pointer
- Automatic Protection Switching
- Multiplex Section Protection, K1/K2 Bytes
- 1+1 Protection
- 1:N Protection

SDH NETWORK ARCHITECTURE

- Technical Advantages
- Redundancy
- Layers & Functions
- Network path, line, and section
- Multiplexing Frame Structures/Formats
- Ring Configurations (terminals, drops, inserts)
- Network Synchronization (timing, modes, pointers, issues)
- Applications & Services

6). Optical Transport Networking (OTN) (3 Days)

Introduction

- The World Today—Growth and Limits
- Traffic Streams & Technical Limitations
- Facts about Fiber Optics
- Light and Light Propagation
 - Attenuation and Optical Windows
 - Dispersion
 - Optical Interfaces
 - Backscattering Measurement Using OTDR
- LASER—In the Focus of Interest
- Overview of Important LASER Types
- Tunable LASERs and their Application
- Optical Amplifiers—The Power of Light
- Application Examples











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Optical Transmission—High-Speed Technologies

- High-Speed in LANs and WANs
- Gigabit and 10 Gigabit Ethernet
- SDH with 10 and 40 Gbps
- DWDM—Principle and Technology
- Important Advantages
- Setup of a WDM Mux
- Channel Separation with DWDM
- DWDM Measurements
- DWDM—Practical Application
- Connection to Routers
- Data Communications in the Campus Area
- DWDM in the LAN
- DWDM in the MAN
- Pros and Cons—Disadvantages of WDM
- The World of Optical Fibers
- Optical Fiber Types of the Metro and WAN Area
- The New Generation: Hollow Fiber
- Network Optimization with Optical Fibers

Optical Switching

- Optical Add/Drop Multiplexers (OADM)
- Application of OADMs
- Configurable OADMs
- Optical Cross-Connects
- Application Options
- Schematic Setup of Optical Cross-Connects
- Optical Switches—Various Solutions
 - MEMS—Technical Data
 - Thermo-Optical Switches
 - The Bubble Switch
 - Liquid Crystal Switches
 - Optical Routers
- Optical Transport Networks (OTN) and Digital Wrapper

Optical Networks—Wavelengths all over the World

- Optical Networks in Practical Application
- DWDM Networks
- Transparent Optical Networks—Wavelength Path Routing
- The Future—Virtual Wavelength Path Routing
- MPLS and Optical Networks



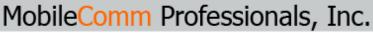






Wireless Engineering

Service



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- Optical Protection Concepts
- Dedicated Protection
- Shared Protection
- Unidirectional and Bidirectional Rings
- MS Shared Protection
- All-Optical Protection Mechanisms

7). Ethernet Overview (3 Days)

INTRODUCTION

- 100BASE-T
- 10-Gigabit Ethernet
- Objective of 10G Ethernet
- IEEE 802.3 Higher Speed Study Group (HSSG)
- MAC Client server interface.
- IEEE 802 Functional Requirements
- 10Gb/s at MAC/PLS service interface
- What is the 10 Gigabit Ethernet Alliance (10 GEA)
- IEEE 802.3ae Task Force

WHY 10G ETHERNET?

- Architecture
- MAC Layer
- Physical Layer
- 10Gibagit Ethernet in LAN, MAN & WAN
- Advantages and Disadvantages
- Future market of 10G Ethernet

HOW DOES 10 GIGABIT ETHERNET DIFFER FROM PREVIOUS VERSIONS OF ETHERNET?

- Differences between 10 Gigabit Ethernet and other speeds of Ethernet.
- Long-haul (40+ km) optical transceiver
- physical medium dependent (PMD) interface for single mode fiber
- LAN physical layer (PHY) or wide area network (WAN PHY)
- Building metropolitan area networks (MANs)
- WAN PHY option
- 10 Gigabit Ethernet transported across existing SONET (synchronous optical network) OC-192c
- SDH (synchronous digital hierarchy) VC-4-64c infrastructures
- Advantages and Disadvantages











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8). TCP/IP Basic (3 Days)

Introduction to Data Networking

- LAN and WAN
- Network Topology
- Access Methods
- Types of Connection
- Circuit and Packet Switching
- Transfer Modes

Physical Layer Fundamentals

- Physical Layer Overview
- Networking Components on Physical Layer
- Transmission Media
- Physical Structure

Data Link Layer Fundamentals

- Data Link Layer Overview
- Networking Components on Data Link Layer
- Ethernet
- Asynchronous Transfer Mode (ATM)
- Frame Relay

Network Layer Fundamentals

- Network Layer Overview
- Networking Components on Network Layer
- Introduction of the Internet Protocol (IP)
- The Address Resolution Protocol Family
- Routing
- Internet Control Message Protocol (ICMP)

Transport Layer Fundamentals

- Transport Layer Overview
- Transmission Control Protocol (TCP)
- User Datagram Protocol (UDP)
- TCP/UDP in GPRS/UMTS and OAM networks

Holiday for Test Preparation.....(2 Days) Course Assessment through written test & mock interview







