COURSE NUMBER: CE3430

COURSE TITLE: Network Cabling

COURSE DESCRIPTION:

This course will provide the learner with the necessary skills to design and implement high performance cabling systems. The performance level of the system determines the type of cabling and hardware to be used, the rules to be followed and the type of testing and documentation required to certify performance and trouble-shoot the installation.

This course focuses on the physical layer of the OSI Network Model and includes the electrical and mechanical aspects of interfacing to the transmission medium and the impact on performance they may have. This includes analysis of copper cabling, fibre optics, connectors and interconnection hardware, electrical code requirements for installation, performance certification, and documentation best practices.

PREREQUISITES: CE1210 – Basic Communications Networks I

CO-REQUISITES: None

CREDIT VALUE: Four (4)

COURSE HOURS PER WEEK: Three (3)

LAB HOURS PER WEEK: Three (3)

SUGGESTED TEXT:

Sterling, D.J., & Baxter, L. (2006). *Premises cabling* (3rd ed.). New York, NY: Delmar Publishing. ISBN-10: 1401898203; ISBN-13: 9781401898205

LEARNING RESOURCES: To be determined by instructor

MAJOR TOPICS:

1.0 Introduction to the TIA/EIA/ISO/ITU Standards
2.0 Copper Cables
3.0 Fibre Optics
4.0 Connections and Interconnection Hardware
5.0 Certifying, Testing, Documenting, and Troubleshooting Installations

LEARNING OBJECTIVES:

The expected learning outcomes are that the learner will be able to:

1.0 Introduction to the TIA/EIA/ISO/ITU Standards

1.1 Establish the need for standards in cabling Systems
1.2 Explain the purpose of industry standards
1.3 Identify the current standards for information transport system
1.4 Synthesize why bandwidth requirements dictate network cabling types and proper installation for reliable operation
1.5 Specify minimum requirements for telecommunications cabling within an office environment based on network type and topology
1.6 Analyse approved media types and connectors according to category rating
1.7 Apply the six sub-systems of a structured cabling system and the physical requirements for each
1.8 Apply appropriate documentation and labelling standards to an information transport system

2.0 Copper Cables

2.1 Analyse properties of copper cabling which limit performance such as noise, crosstalk, impedance, and attenuation
2.2 Evaluate coaxial cables based on characteristic impedance, propagation velocity and delay, and terminations
2.3 Evaluate the various categories of twisted pair cables in terms of frequency, distance power loss, and attenuation-to-crosstalk ratio
2.4 Specify a cable's duty and flammability rating according to electrical code, i.e., plenum, riser, or general purpose

3.0 Fibre Optics

3.1 Compare the many advantages that optical fibre as a communications medium has over other types in terms of security, noise immunity, bandwidth, safety, loss, and cost, etc.
3.2 Analyse the properties of light: energy, propagation velocity, electromagnetic spectrum
3.3 Analyse the laws of reflection and refraction and how total internal reflection and continuous refraction is achieved through different refractive indices
3.4 Evaluate how light is absorbed and scattered in a medium: Rayleigh and Mie scatter; Fresnel reflection
3.5 Identify the physical construction of an optical fibre, core/cladding and buffer type (tight or loose), their usage (indoor or outdoor)
3.6 Analyse optical fibre characteristics in terms of numerical aperture/acceptance angle, loss windows and wavelength, bandwidth/attenuation length product
3.7 Compare multimode and single mode fibre in terms of core size, attenuation,

bandwidth, communication distance, dispersion effects (intermodal/intramodal), and numerical aperture

3.8 Analyse factors which contribute to added losses in fibre optics including bending loss, misalignment loss, and mismatched fibre

3.9 Evaluate differing optical cable construction types: single, duplex, breakout fan-out, fibre bundle, ribbon, indoor and outdoor, direct buried or aerial construction, conductive/non-conductive, and hybrid

3.10 Evaluate optical sources, such as surface emitters, edge emitters and laser diode, in terms of bandwidth, spectral width, coupling losses, beam pattern, and output power

3.11 Evaluate optical detectors, such as P-N, PIN, and Avalanche Photodiode, in terms of detectability, noise, and bandwidth

3.12 Analyse an optical communication link for bandwidth and rise time budget, power budget and margin, dynamic range, S-N Ratio, and bit error rate

4.0 Connections and Interconnection Hardware

4.1 Specify pin assignments and colour coding for eight-position modular jack (RJ45), coaxial/twinaxial cable, and multi-fibre cable

4.2 Install RJ45, coaxial, twinaxial, and fibre optic ST-type connections

4.3 Evaluate and apply baluns and media converters to network applications

4.4 Perform optical fibre mechanical and fusion splicing

4.5 Implement type 66 and 110 cross connects, RJ45, and optical patch panels

4.6 Specify cable installation requirements in terms of minimum bend radius, tensile loading, clamping tension, conduit fill ratio, electrical code restrictions, grounding, and surge protection

4.7 Implement horizontal and backbone cabling configurations utilizing copper cables, multimode optical fibre, patch panels, cross connects, splice closures, media connection, and baluns

4.8 Demonstrate the safe use of tools in the assembly of network cables

4.9 Demonstrate the correct procedure for working with chemicals used in the assembly of network cables to ensure user safety

4.10 Assess a work area for safety hazards prior to performing cable assembly and installation

4.11 Develop a procedure for safe network cable assembly and installation

5.0 Certifying, Testing, Documenting, and Troubleshooting Installations

5.1 Evaluate the TSB-67 standard for installed links and channels

5.2 Differentiate between verification, validation, and certification of an information transport system

5.3 Perform tests on twisted pair and coaxial cable using a LAN cable tester and signal injector to determine wire-map, length, near-end crosstalk, attenuation, attenuation-to-crosstalk ratio, impedance, capacitance, and noise

5.4 Perform fibre continuity tests, link certification using an optical source and power meter, and overall link attenuation using an optical time domain reflectometer

5.5 Perform troubleshooting on network installations using LAN cable testers, optical power meters, and OTDR, to determine fault location and areas of uncharacteristic attenuation
5.6 Demonstrate the correct operation of network test equipment to ensure user safety
5.7 Specify documentation requirements to ensure proper performance of the cabling system for acceptance, compliance, and troubleshooting

EVALUATION:

Laboratories and/or Project	30%
Test (s)	30%
Final Examination	40%

DATE DEVELOPED: **DATE REVIEWED:**

REVISION NUMBER: 4 **DATE REVISED:** March 2014

Note to instructor: Check PIRS to ensure this outline is the most current version.