ITT Technical Institute

NT1310

Physical Networking

Onsite Course

SYLLABUS

Credit hours: 4.5

Contact/Instructional hours: 56 (34 Theory Hours, 22 Lab Hours)
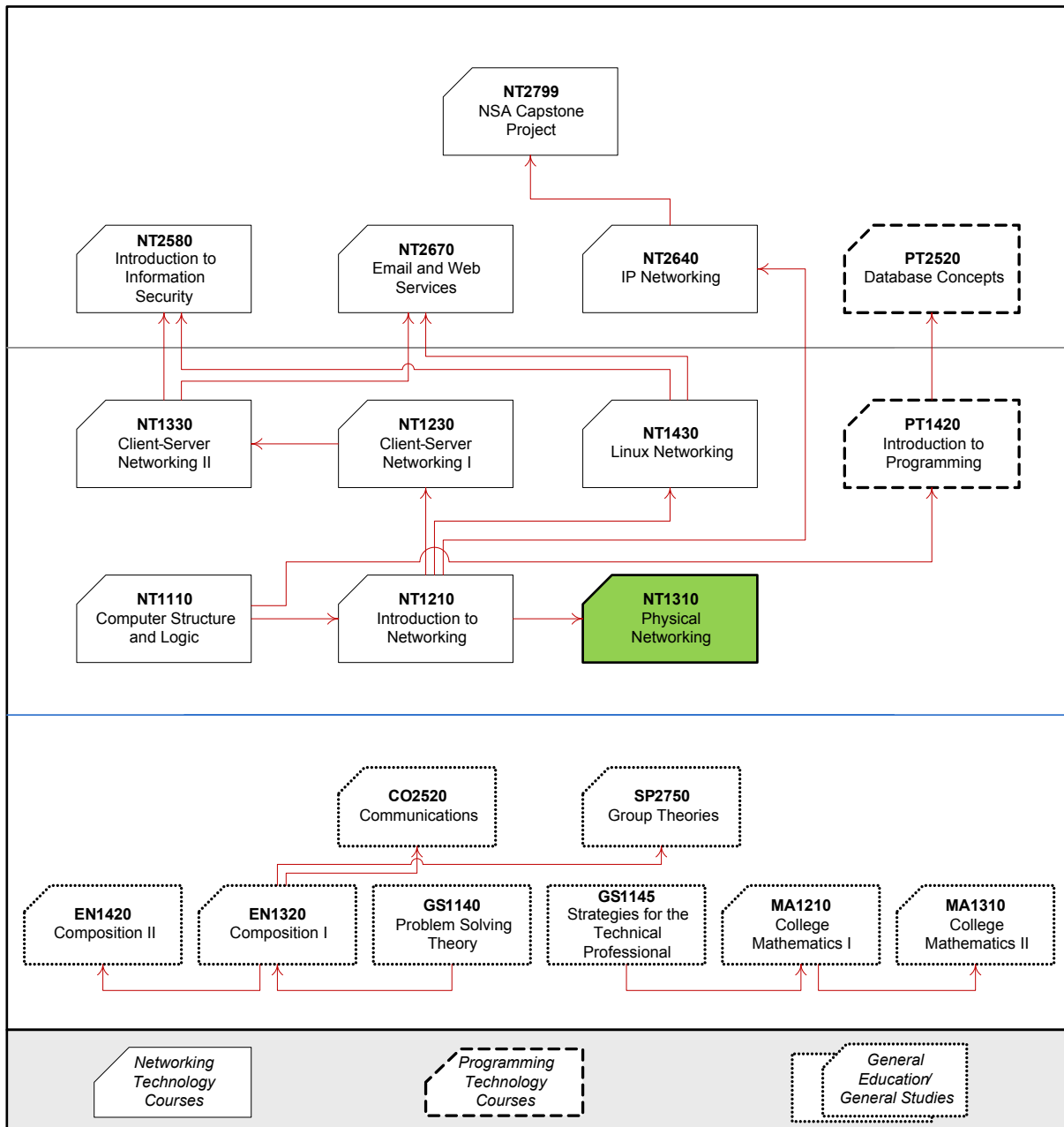
Prerequisite(s) and/or Corequisite(s):

Prerequisites: NT1210 Introduction to Networking or equivalent

Course Description:

This course examines industry standards and practices involving the physical components of networking technologies (such as wiring standards and practices, various media and interconnection components), networking devices and their specifications and functions. Students will practice designing physical network solutions based on appropriate capacity planning and implementing various installation, testing and troubleshooting techniques for a computer network.

Where Does This Course Belong?

NT2799
NSA Capstone Project

NT2580
Introduction to Information Security

NT2670
Email and Web Services

NT2640
IP Networking

PT2520
Database Concepts

NT1330
Client-Server Networking II

NT1230
Client-Server Networking I

NT1430
Linux Networking

PT1420
Introduction to Programming

NT1110
Computer Structure and Logic

NT1210
Introduction to Networking

NT1310
Physical Networking

CO2520
Communications

SP2750
Group Theories

EN1420
Composition II

EN1320
Composition I

GS1140
Problem Solving Theory

GS1145
Strategies for the Technical Professional

MA1210
College Mathematics I

MA1310
College Mathematics II

Networking Technology Courses

Programming Technology Courses

General Education/ General Studies

NOTE: *Refer to the catalog for the state-specific course and program information, if applicable.*

Course Summary

Major Instructional Areas

1. Telecommunications
2. Cabling Specifications and Constraints
3. Cabling Tools and Media
4. Network Equipment for Wired and Wireless Networks
5. Cable Testing
6. Fiber Optics and Light Principles
7. Fiber-Optic Cables, Splicing and Connectors
8. Fiber-Optic Light Sources, Detectors and Receivers
9. Fiber-Optic Considerations and Testing

Course Objectives

1. Distinguish between bandwidth, frequency, and data rate in a data network
2. Explain the importance of codes, standards, and specifications.
3. Compare and contrast network topologies
4. Describe the characteristics of different copper cables
5. Explain the purpose of network tools
6. Compare and contrast fiber-optic and copper transmission
7. Differentiate between twisted-pair cable connectors, coaxial cable connectors, and fiber-optic cable connectors
8. Construct a network based on specifications using repeaters, hubs, bridges, switches, servers, and routers
9. Demonstrate how to test copper and fiber-optic networks
10. Explain how fiber-optic transmission utilizes the basic principles of light for transmission
11. Evaluate the optical fiber characteristics that affect data rates, including dispersion, attenuation, and bending
12. Compare different fiber-optic light sources
13. Explain the passive components used in fiber-optic networking, including couplers, optical switches, optical attenuators, optical isolators, optical amplifiers, and optical filters
14. Explain how to install, test and repair fiber-optic cables and networks.
15. Analyze telephone networks and network topology.
16. Contrast telecommunications services.
17. Complete the SPE project.

Learning Materials and References

Required Resources

Complete Textbook Package	New to this Course	Carried over from Previous Course(s)	Required for Subsequent Course(s)
Oliviero, A. and Woodward, B. (2009). *Cabling: The complete guide to copper and fiber-optic networking,* (4th ed.) Hoboken, NJ: John Wiley and Sons, Inc. [Custom Update Edition]	■		■
Oliviero, A. and Woodward, B. (2012) Telecommunications Appendix, (1st ed.) Hoboken, NJ: John Wiley and Sons, Inc.	■		■

Technology Requirements

Each class should have:

- Four wiring racks

- Four sets of cabling instruments and hand tools

- Expendable materials

Recommended Resources

ITT Tech Virtual Library

Log on to the ITT Tech Virtual Library at http://www.library.itt-tech.edu/ to access online books, journals, and other reference resources selected to support ITT Tech curricula.

Books

You may click "Books" or use the "Search" function on the home page to find the following books.

Books24x7

- Dean, Tamara. CompTIA Network+ 2009 in Depth. Boston, MA: Cengage Learning, 2009.
- Heldman, William, and Lona Cram. IT Project+ Study Guide. 2nd ed. (Exam PKO-002) Alameda, CA: Sybex, 2004.

Ebrary

- Barnett, David, David Groth, and Jim McBee. Cabling: The Complete Guide to Network Wiring. 3rd ed. Alameda, CA: Sybex, 2004.

- Fuller, Ron (Contributor), Tim Blakenship (Contributor), and Robert Padjen (Contributor). Building a Cisco Wireless LAN. Rockland, MA: Syngress Publishing, 2002.
- Gilster, Ron, and Helen Heneveld. HTI+ Home Technology Integration and CEDIA Installer I All-in-One Exam Guide. Emeryville, CA: McGraw-Hill Osborne, 2004.
- Ross, John. Book of Wireless: A Painless Guide to Wi-Fi and Broadband Wireless. 2nd ed. San Francisco, CA: No Starch Press, 2008.
- Trulove, James. LAN Wiring. Blacklick, OH: McGraw-Hill Professional Publishing, 2005.
- Wetteroth, Debbra. OSI Reference Model for Telecommunications. Blacklick, OH: McGraw-Hill Professional Publishing, 2001.

Gale Virtual Reference Collection

- Green, James (Ed.). Structured Cabling Systems. 5th ed. Irwin Handbook of Telecommunications.

Periodicals

You may click "Periodicals" or use the "Search" function on the home page to find the following periodicals.

ProQuest Computing

- "MRV Communications, Inc.; MRV Debuts Next-Gen 10G Media Converter for Network Cabling Flexibility and Distance Extension up to 100 km." Anonymous. Network Business Weekly. Atlanta: Jan 25, 2010. p. 7.
- "SIEMON: New Siemon white paper on delivering video over the structured cabling network." Anonymous. M2 Presswire. Coventry: Oct 29, 2009.

Reference

You may click "Reference" or use the "Search" function on the home page to find the following reference resources.

Additional reference resources> Project Management

- Microsoft Project

Additional reference resources> Grammar, Writing & Style

- APA Formatting and Style Guide
- APA Style
- Basics of APA Style Tutorial
- Dr. Grammar

School Of Study

You may click "School Of Study" or use the "Search" function on the home page to find the following resources.

School of Information Technology> Recommended Links

- PC MAGAZINE

- PC WORLD

Other References

The following resources may be found **outside** of the ITT Tech Virtual Library, whether online or in hard copy.

Web sites

- Wiley Student Companion Site (Cabling Animations)

    Wiley offers a Student Companion Site for the course's required text. Log on to: http://bcs.wiley.com/he-bcs/Books?action=index&itemId=0470477075&bcsId=5638

    Or you can log on to www.wiley.com, then type the text isbn (0470477075) in the search bar on the upper right hand side of the web page and click the search button. You will then be taken to a screen with the text cover image and title listed. Click on the "Visit the Companion Sites" link under the text title and then click on the "Student Companion Site" link from the drop down menu.

    Note: To access the media, download the Animations zip file and then extract the files from the zip.

    (This site is not password protected)

- Cabling Business Magazine: This is the Web site of the cabling business magazine.
  www.cablingbusiness.com/ (accessed March 24, 2010)
- Cabling Installation and Maintenance: This Web site provides information on how to install and maintain cabling systems.
  http://www.cablinginstall.com/index.html (accessed March 24, 2010)
- Data Communications Cabling FAQ: This Web site provides information sources, standards, implementation methods and definitions for data communications cabling.
  www.faqs.org/faqs/LANs/cabling-faq/ (accessed March 24, 2010)
- ethermanage.com: This Web site provides valuable information on Ethernet LAN systems.
  www.ethermanage.com/ethernet/ (accessed March 24, 2010)
- IEEE Standards Association: This is the home page of the IEEE 802 workgroup on standards.
  http://standards.ieee.org/getieee802/ (accessed March 24, 2010)
- IHS Standards Store: This Web site is a source of information for various electronic and electrical equipments and products.
  http://global.ihs.com/ (accessed March 24, 2010)
- Microsoft Office Online: This Web site provides useful tips and tricks for using Microsoft Visio 2003.
  http://office.microsoft.com/en-us/visio/FX100649221033.aspx?CTT=96&Origin=CL100636311033 (accessed March 24, 2010)
- National Electrical Code: This Web site provides information about important electrical code terms for contractors, electricians, engineers, inspectors, instructors, safety specialists, and other electrically related individuals.
  http://www.mikeholt.com/index.php?id=homegeneral (accessed March 24, 2010)

- Premises Networks: This Web site provides marketplace to search for network-related equipments.
  http://www.premisesnetworks.com/?VNETCOOKIE=NO (accessed March 24, 2010)
- Protocols.com: This Web site provides information on various data communication protocols.
  www.protocols.com/ (accessed March 24, 2010)
- TechFest Networking: This Web page provides information on networking concepts.
  www.techfest.com/networking/ (accessed March 24, 2010)
- Whatis.com: This Web site is a computer dictionary for computer and information technology (IT)-related terms.
  http://whatis.techtarget.com/ (accessed March 24, 2010)
- Wiring.com: This Web site provides important information on wired and wireless networks.
  www.wiring.com/ (accessed March 24, 2010)

Following is a list of vendors and manufacturers of the cabling field:

- Anixter: www.anixter.com/AXECOM/US.NSF/HomePage (accessed March 24, 2010)
- Erico International Corporation: www.erico.com/ (accessed March 24, 2010)
- Fluke Networks: www.flukenetworks.com/fnet/en-us (accessed March 24, 2010)
- IDEAL Industries, Inc.: www.idealindustries.com/ (accessed March 24, 2010)
- Labor Saving Devices, Inc.: www.lsdinc.com/content/main (accessed March 24, 2010)
- MilesTek: www.milestek.com/ (accessed March 24, 2010)
- Ortronics: www.ortronics.com/ (accessed March 24, 2010)
- Panduit: http://www.panduit.com/index.htm (accessed March 24, 2010)
- Siemon: www.siemon.com/ (accessed March 24, 2010)
- Superior Essex: www.superioressex.com/ (accessed March 24, 2010)

All links to Web references outside of the ITT Tech Virtual Library are always subject to change without prior notice.

NOTE: All links are subject to change without prior notice.

Information Search

Use the following keywords to search for additional online resources that may be used for supporting your work on the course assignments:

-
- Telecommunications circuits
- Network media
- Twisted pair
- Fiber optics
- Testing instruments for network wiring
- Wiring standards

Course Plan

Suggested Learning Approach

In this course, you will be studying individually and within a group of your peers. As you work on the course deliverables, you are encouraged to share ideas with your peers and instructor, work collaboratively on projects and team assignments, raise critical questions, and provide constructive feedback.

Use the following advice to receive maximum learning benefits from your participation in this course:

DO	DON'T
- Do take a proactive learning approach - Do share your thoughts on critical issues and potential problem solutions - Do plan your course work in advance - Do explore a variety of learning resources in addition to the textbook - Do offer relevant examples from your experience - Do make an effort to understand different points of view - Do connect concepts explored in this course to real-life professional situations and your own experiences	- Don't assume there is only one correct answer to a question - Don't be afraid to share your perspective on the issues analyzed in the course - Don't be negative about the points of view that are different from yours - Don't underestimate the impact of collaboration on your learning - Don't limit your course experience to reading the textbook - Don't postpone your work on the course deliverables – work on small assignment components every day

Course Outline

Unit 1: Introduction to Telecommunications and Network Topology

Upon completion of this unit, students are expected to:
- Demonstrate an understanding of the history of telecommunications.
- Identify the main structures that comprise a telephone network.
- Explain what is involved in an interfacing with the local exchange.
- Explain what is involved in long distance and ocean networks.
- Compare voice and data communication.
- Explain how data travels long distances in a real world example.
- Demonstrate an understanding of fixed line and cellular networks.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Oliviero/Woodward Telecommunications Appendix "Introduction to Telecommunications" and "Network Topology"	Assignment	Unit 1. Assignment 1. Voice vs. Data	2%
	Exercise	Unit 1. Exercise 1. Local Exchange	2%
	Lab	Unit 1. Lab 1. Data on Fixed Line vs. Cellular Debate	3%

Unit 2: Exploring Cable TV, Internet Systems and Other Telecommunications Services

Upon completion of this unit, students are expected to:
- Describe cable TV systems.
- Compare the various service provider types.
- Identify the different telecommunication services offered today.
- Explain the importance and necessity of cloud computing.
- Compare service provider types.
- Describe telecommunication services and their value.
- Compare the similarities and differences between cloud vendors.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Oliviero/Woodward Telecommunications Appendix "Exploring Cable TV and Internet Systems" and "Telecommunications Services"	Assignment	Unit 2. Assignment 1. Service Provider Types	2%
	Exercise	Unit 2. Exercise 1. Triple Play Marketing	2%
	Lab	Unit 2. Lab 1. Cloud Computing Research	2%

Unit 3: Cabling Specifications and Constraints

Upon completion of this unit, the students are expected to:

- Compare and contrast twisted-pair, coaxial and fiber-optic cables.
- Explain the purpose of standards and specification groups.
- Explain bandwidth, frequency, signal attenuation, noise, and crosstalk.
- Compare and contrast Ethernet cables.
- Describe the purpose of the FCC and NEC.
- Define important specification terms.
- Describe the hierarchical star, bus, and ring network topologies.
- Identify examples of codes, standards, and specifications.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
Oliviero/Woodward, Chapters 1-4	Exercise	Unit 3. Exercise 1. Specifications - Definitions	2%
	Assignment	Unit 3. Assignment 1. Network Topology Paper	2%
	Lab	Unit 3. Lab 1. Building a New Structure - NFPA Codes	3%

Unit 4: Cabling Tools and Media

Upon completion of this unit, the students are expected to:

- Describe the equipment and cables found in a standard telecommunications room.
- Explain the purpose of different cabling tools.
- Describe installation procedures for copper cabling.
- Describe installation procedures for fiber optic cabling.
- Compare and contrast copper and fiber optic cabling.
- Define copper and fiber optic cabling terms.
- Choose the type of cabling, tools, and testing to be used in a new building

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Oliviera/Woodward, Chapters 5-8	Assignment	Unit 4. Assignment 1. Copper vs. Fiber	2%
	Exercise	Unit 4. Exercise 1. Cabling - Definitions	2%
	Lab	Unit 4. Lab 1. New Building - Tools and Wiring	2%

Unit 5: Network Equipment for Wired and Wireless Networks

Upon completion of this unit, the students are expected to:

- Describe the different wall plates and boxes used to wire a room.
- Contrast the different connectors available for cabling.
- Describe the components of a data network.
- Contrast the wireless technologies
- Demonstrate an understanding of cabling, standards, networks and other topics from the first half of the course.
- Describe the factors and tools that are important in a cable installation.
- Choose a network plan for a new building.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
Oliviera/Woodward Chapter #	Assignment	Unit 5. Assignment 1. Cabling Factors and Tools Discussion	2%
	Lab	Unit 5. Lab 1. New Building – Wired and Wireless†	3%

† **Candidate for the ePortfolio**

Unit 6: Cable Testing and Case Studies

Upon completion of this unit, the students are expected to:

- Explain how to test a cable installation.
- Explain how to add a connector to a fiber cable.
- Identify the information that belongs in a request for proposal.
- Identify positive and negative situations in a cable installation.
- Contrast cable testers and their usages.
- Add connectors to twisted-pair and coaxial cables.
- Describe the requirements for a new building in RFP format.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Oliviera/Woodward Chapter #	Assignment	Unit 6. Assignment 1. Cable Testers	2%
	Exercise	Unit 6. Exercise 1. Connector Installations	2%
	Lab	Unit 6. Lab 1. Building a New Structure – RFP	2%
	Exam	Unit 6. Midterm Exam	12%

Unit 7: Fiber Optics and Light Principles

Upon completion of this unit, the students are expected to:

- Illustrate the history of fiber-optic development.
- Explain the electromagnetic spectrum, refraction and reflection.
- Describe performance affecting factors in optical fibers.
- Explain safety practices and regulations in optic work.
- Define terms dealing with fiber optics.
- Demonstrate an understanding of reflection, refraction and signal degradation in fiber-optic transmission.
- Choose safety and emergency plans for a new building installation.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Oliviera/Woodward Chapter #	Exercise	Unit 7. Exercise 1. Fiber Optics - Definitions	2%
	Assignment	Unit 7. Assignment 1. Refraction, Reflection and Optics	2%
	Lab	Unit 7. Lab 1. New Building – Safety Plan	3%

Unit 8: Fiber-Optic Cables, Splicing and Connectors

Upon completion of this unit, the students are expected to:

- Show the differences between components of a fiber optic cable.
- Identify the different intrinsic and extrinsic factors affecting splice performance.
- Explain the correct way to perform a mechanical splice.
- Compare different tools and their usages when adding a connector to a fiber optic cable.
- Explain the factors that can affect performance on splices and connectors on fiber-optic cables.
- Demonstrate the difference between mechanical and fusion splices.
- Add a connector to a fiber optic cable.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Oliviera/Woodward Chapter #	Assignment	Unit 8. Assignment 1. Splicing and Connection Performance	2%
	Exercise	Unit 8. Exercise 1. Mechanical Splice of Fiber-Optic Cable	2%
	Lab	Unit 8. Lab 1. Fiber Optic Connector Assembly	2%

Unit 9: Fiber-Optic Light Sources, Detectors and Receivers

Upon completion of this unit, the students are expected to:

- Compare LED and laser transmitters.
- Understand the components of fiber-optic receivers and how they work.
- Identify the components and multiplexers in a passive optical network.
- Understand the different "Fiber to the X" configurations.
- Define terms dealing with light sources and components.
- Explain the differences between LED and laser transmitters.
- Demonstrate what hardware and safety procedures are necessary to install an optical network in a new building.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
Oliviera/Woodward Chapter #	Exercise	Unit 9. Exercise 1. Light Sources and Components – Definitions	2%
	Assignment	Unit 9. Assignment 1. Transmitters	2%
	Lab	Unit 9. Lab 1. New Building – Optical Network	3%

Unit 10: Fiber-Optic Considerations and Testing

Upon completion of this unit, the students are expected to:

- Identify the different tools needed for performing a cable installation.
- Explain the information that should go into fiber-optic system design.
- Identify the tools needed to properly test a cable installation.
- Describe the process for troubleshooting fiber installations.
- Compare the different cable installation techniques and when each is important.
- Test fiber-optic cables.
- Identify a plan to test and troubleshoot an existing fiber installation.

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
	Grading Category	Activity/Deliverable Title	Grade Allocation (% of all graded work)
Oliviera/Woodward Chapter #	Assignment	Unit 10. Assignment 1. Fiber-Optic Installation	2%
	Exercise	Unit 10. Exercise 1. Testing Your Fiber-Optic Cables	2%
	Lab	Unit 10. Lab 1. Building a New Structure – Problem Analysis	2%

READING ASSIGNMENT	GRADED ACTIVITIES / DELIVERABLES		
Unit 11: Review and Final Exam			
	Grading Category	**Activity/Deliverable Title**	**Grade Allocation** (% of all graded work)
Oliviera/Woodward Review All Chapters	Exam	Final Examination	20%
	Project	SPE Project	5%

Note: Your instructor may add a few learning activities that will change the grade allocation for each assignment in a category. The overall category percentages will not change.

Evaluation and Grading

Evaluation Criteria

The graded assignments will be evaluated using the following weighted categories:

Category	Weight
Assignment	20%
Exercise	18%
Lab	25%
SPE Project	5%
Exam	32%
TOTAL	**100%**

Grade Conversion

The final grades will be calculated from the percentages earned in the course, as follows:

Grade	Percentage	Credit
A	90–100%	4.0
B+	85–89%	3.5
B	80–84%	3.0
C+	75–79%	2.5
C	70–74%	2.0
D+	65–69%	1.5
D	60–64%	1.0
F	<60%	0.0

Academic Integrity

All students must comply with the policies that regulate all forms of academic dishonesty, or academic misconduct, including plagiarism, self-plagiarism, fabrication, deception, cheating, and sabotage. For more information on the academic honesty policies, refer to the Student Handbook and the Course Catalog.

(End of Syllabus)