NETWORKING FUNDAMENTALS
COURSE CODE: 5310

PROGRAM DESCRIPTION: Students in the Networking program will perform networking tasks commonly performed by systems administrators, network administrators, network engineers and related careers. Students manage hardware and software network components including IP configuration, setting up wireless and wired networks, managing networks, basic network security, software updates, hardware upgrades and network protocols. Students will learn about configuring and maintaining networks in home and corporate environments. Upon completion of the two courses, students will be prepared to earn nationally-recognized industry certifications.

OBJECTIVE: Given the essential classroom and work-based learning experiences, the student will be able to perform the following core competencies.

COURSE CREDITS: 1 Carnegie unit (120 hours), 2 (240 hours)
3 (360 hours), 4 (480 hours)

PREREQUISITE(S): None

COMPUTER ACCESS REQUIRED: 1 Computer per student with Internet access

RECOMMENDED GRADE LEVELS: 9-12

RECOMMENDED MAXIMUM ENROLLMENT: 20

CERTIFICATIONS: Cisco Certified Network Associate
CompTIA Network +
TestOut Network Pro
MTA Networking Fundamentals

RESOURCES: Instructional Materials

A. SAFETY

Proficient professionals know the academic subject matter, including safety as required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Review school safety policies and procedures.
2. Review classroom safety rules and procedures.
3. Review safety procedures for using equipment in the classroom.
4. Identify major causes of work-related accidents in office environments.
5. Demonstrate safety skills in an office/work environment.

B. STUDENT ORGANIZATIONS

Proficient professionals know the academic subject matter, including professional development, required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Identify the purpose and goals of a Career and Technology Student Organization (CTSO).
2. Explain how CTSOs are integral parts of specific clusters, majors, and/or courses.
3. Explain the benefits and responsibilities of being a member of a CTSO.
4. List leadership opportunities that are available to students through participation in CTSO conferences, competitions, community service, philanthropy, and other activities.
5. Explain how participation in CTSOs can promote lifelong benefits in other professional and civic organizations.

C. TECHNOLOGY KNOWLEDGE

Proficient professionals know the academic subject matter, including the ethical use of technology as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate proficiency and skills associated with the use of technologies that are common to a specific occupation.
2. Identify proper netiquette when using e-mail, social media, and other technologies for communication purposes.
3. Identify potential abuse and unethical uses of laptops, tablets, computers, and/or networks.
4. Explain the consequences of social, illegal, and unethical uses of technology (e.g., piracy; cyberbullying, illegal downloading; licensing infringement; inappropriate uses of software, hardware, and mobile devices in the work environment).
5. Discuss legal issues and the terms of use related to copyright laws, fair use laws, Creative Commons, and ethics pertaining to downloading of images, photographs, documents, video, sounds, music, trademarks, and other elements for personal use.
6. Describe ethical and legal practices of safeguarding the confidentiality of business-related information.
7. Describe possible threats to a laptop, tablet, computer, and/or network and methods of avoiding attacks.

D. PERSONAL QUALITIES AND EMPLOYABILITY SKILLS

Proficient professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate punctuality.
2. Demonstrate self-representation.
3. Demonstrate work ethic.
4. Demonstrate respect.

5. Demonstrate time management.
6. Demonstrate integrity.
7. Demonstrate leadership.
8. Demonstrate teamwork and collaboration.
9. Demonstrate conflict resolution.
10. Demonstrate perseverance.
11. Demonstrate commitment.
12. Demonstrate a healthy view of competition.
13. Demonstrate a global perspective.
14. Demonstrate health and fitness.
15. Demonstrate self-direction.
16. Demonstrate lifelong learning.

E. PROFESSIONAL KNOWLEDGE

Proficient professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate effective speaking and listening skills.
2. Demonstrate effective reading and writing skills.
3. Demonstrate mathematical reasoning.
4. Demonstrate job-specific mathematics skills.
5. Demonstrate critical-thinking and problem-solving skills.
6. Demonstrate creativity and resourcefulness.
7. Demonstrate an understanding of business ethics.
8. Demonstrate confidentiality.
9. Demonstrate an understanding of workplace structures, organizations, systems, and climates.
10. Demonstrate diversity awareness.
11. Demonstrate job acquisition and advancement skills.
12. Demonstrate task management skills.
13. Demonstrate customer-service skills.

LEVEL 1

F. INTRODUCTION TO NETWORKING

Proficient networking professionals demonstrate knowledge introductory networking concepts, as needed in their role. The following accountability criteria are considered essential for students in the Networking program of study.

1. Differentiate the functions and applications of various network topologies.
   a. Mesh
   b. Bus
   c. Ring

d. Star
e. Hybrid
f. Point-to-point
g. Point-to-multipoint
h. Client-server
i. Peer-to-peer.

2. Explain the functions and applications of various network devices:
   a. Router
   b. Bridge
   c. Switch
   d. Hub
   e. Multilayer switch
   f. Firewall
   g. Access point (wireless/wired)
   h. Content filter
   i. Modems
3. Differentiate between common network infrastructures, e.g., LAN, WAN, WLAN, PAN, MAN.
4. Identify networking media between devices, e.g., copper, fiber-optic, wireless.

G. OPEN SYSTEMS INTERCONNECTION MODEL (OSI)

Proficient networking professionals demonstrate knowledge of the devices, applications, protocols, and services at their appropriate OSI layers used in networking as needed in their role. The following accountability criteria are considered essential for students in the Networking program of study.

1. Analyze functions at the different OSI layers.
   Layer 1 – Physical
   Layer 2 – Data link
   Layer 3 – Network
   Layer 4 – Transport
   Layer 5 – Session
   Layer 6 – Presentation
   Layer 7 – Application
2. Analyze devices at the different OSI layers.
   Hubs
   Repeaters
   Network Interface Cards
   Media
   Bridges
   Switches
   Routers
   Firewalls
3. Differentiate between protocols based upon appropriate functions and layers.
4. Identify the applications and services at the different OSI layers, e.g., email, host

configuration, file transfer, web services, network services and management, transport, and control.

H. NETWORK OPERATING SYSTEMS

Proficient networking professionals demonstrate knowledge of various network operating systems as needed in their role. The following accountability criteria are considered essential for students in the Networking program of study.

1. Differentiate various operating systems used in networking.
2. Explain how major operating systems use hardware and networking protocols, e.g., traffic, collision domains.

I. WIRED NETWORKING

Proficient networking professionals demonstrate how to configure and implement a cabled network as needed in their role. The following accountability criteria are considered essential for students in the Networking program of study.

1. Differentiate wiring pattern standards EIA/TIA 568A/568B.
2. Compare and contrast appropriate Ethernet standards. e.g., 10BaseX, IEEE 802.3.
3. Differentiate internet access technologies, e.g., DSL, cable, broadband, dial-up, and satellite. (See IEEE 802.7)
4. Deploy an appropriate cabling solution using copper connectors, copper cables, fiber connectors, fiber cables, media converters, and tools.

J. WIRELESS NETWORKING

Proficient networking professionals demonstrate how to configure and implement a wireless network as needed in their role. The following accountability criteria are considered essential for students in the Networking program of study.

1. Differentiate various wireless technologies, e.g., infrared, radio waves, satellite, microwave.
2. Differentiate wireless standards (See IEEE).
3. Determine configuration settings of wireless hardware equipment, software, and security.
4. Given a scenario, implement the appropriate wireless technologies and configurations.

K. TCP/IP FUNDAMENTALS

Proficient networking professionals demonstrate knowledge of the applications, protocols, and services at their appropriate TCP/IP layers used in networking as needed in their role. The following accountability criteria are considered essential for students in the Networking program of study.

1. Analyze functions at the different TCP/IP layers.
   a. Network Access
   b. Internet

c. Transport
d. Application

2. Differentiate between protocols based upon appropriate functions and layers.
3. Identify the applications and services at the different TCP/IP layers, e.g., email, host configuration, file transfer, web services, and transport.
4. Differentiate TCP/IPv4 vs. TCP/IPv6.

L. NETWORK ADDRESSING

Proficient networking professionals demonstrate knowledge of networking addressing needed in their role. The following accountability criteria are considered essential for students in the Networking program of study.

1. Examine and classify IP addressing schemes, e.g., IPv4, IPv6, classful address ranges, and subnet mask.
2. Examine and classify MAC addressing schemes.
3. Configure IP address on client/server hardware and software.
4. Configure MAC address on client/server hardware and software.

LEVEL 2

F. NETWORK ARCHITECTURE

Proficient networking professionals demonstrate knowledge of network architecture. The following accountability criteria are considered essential for students in the Networking program of study.

1. Explain the functions and applications of various network devices.
2. Compare and contrast the use of networking services and applications.
3. Install and configure the following networking services/applications.
4. Explain the characteristics and benefits of various WAN technologies.
5. Install and properly terminate various cable types and connectors using appropriate tools.
6. Differentiate between common network topologies.
7. Differentiate between network infrastructure implementation.
8. Given a scenario, implement and configure the appropriate addressing schema.
9. Explain the basics of routing concepts and protocols.
10. Identify the basics elements of unified communication technologies.
11. Compare and contrast technologies that support cloud and virtualization.
12. Given a set of requirements, implement a basic network.

G. NETWORK OPERATIONS

Proficient networking professionals demonstrate knowledge of network operations. The following accountability criteria are considered essential for students in the Networking program of study.

1. Given a scenario, use appropriate monitoring tools.
2. Given a scenario, analyze metrics and reports from monitoring and tracking performance tools.
3. Given a scenario, use appropriate resources to support configuration management.
4. Explain the importance of implementing network segmentation.
5. Given a scenario, install and apply patches and updates.
6. Given a scenario, configure a switch using proper features.
7. Install and configure wireless LAN infrastructure and implementation the appropriate technologies in support of wireless capable devices.

H. NETWORK SECURITY

Proficient networking professionals demonstrate knowledge of network security. The following accountability criteria are considered essential for students in the Networking program of study.

1. Compare and contrast risk related concepts.
2. Compare and contrast common network vulnerabilities and threats.
3. Given a scenario, implement network hardening techniques.
4. Compare and contrast physical security controls.
5. Given a scenario, install and configure a basic firewall.
6. Explain the purpose of various network access control models.
7. Summarize basic forensic concepts.

I. TROUBLESHOOTING

Proficient networking professionals demonstrate knowledge of network troubleshooting. The following accountability criteria are considered essential for students in the Networking program of study.

1. Given a scenario, implement the following network troubleshooting methodology.
2. Given a scenario, analyze and interpret the output of troubleshooting tools.
3. Given a scenario, troubleshoot and resolve a common wireless issues.
4. Given a scenario, troubleshoot and resolve common copper cable issues.
5. Given a scenario, troubleshoot and resolve common fiber cable issues.
6. Given a scenario, troubleshoot and resolve common network issues.
7. Given a scenario, troubleshoot and resolve common security issues.
8. Given a scenario, troubleshoot and resolve common WAN issues.

J. INDUSTRY STANDARDS, PRACTICES, AND NETWORK THEORY

Proficient networking professionals demonstrate knowledge of industry standards, practices, and network theory. The following accountability criteria are considered essential for students in the Networking program of study.

1. Analyze a scenario and determine the corresponding OSI layer.

2. Explain the basics of network theory and concepts.
3. Given a scenario, deploy the appropriate wireless standard.
4. Given a scenario, deploy the appropriate wired connectivity standard.
5. Given a scenario, implement the appropriate policies or procedures.
6. Summarize safety practices.
7. Given a scenario, install and configure equipment in the appropriate location using best practices.
8. Explain the basics of change management procedures.
9. Compare and contrast ports and protocols.
10. Given a scenario, configure and apply the appropriate ports and protocols.

Course Materials and Resources

Course Academic Standards and Indicators

SC Computer Science Academic Standards and Process Standards