Network Fundamentals

Course Credit	1.0
Grade Levels	9-12
Prerequisites	Information Technology Fundamentals OR Programming Foundations

Network Fundamentals introduces the architecture, structure, functions, components, and models of the Internet and other computer networks. The course allows students to examine devices, equipment, topologies, communication protocols, and virtual and cloud technologies and to simulate networks in order to explore properties, settings, and capabilities. Routing and switching protocols will be explored as well as various connectivity media. Additional topics include network management, security, and troubleshooting.

Career and Technical Student Organizations are integral, co-curricular components of each career and technical education course. These organizations enhance classroom instruction while helping students develop leadership abilities, expand workplace readiness skills, and access opportunities for personal and professional growth. Students in the Information Technology cluster affiliate with SkillsUSA and/or TSA.

Foundational standards, shown in the table below, are an important part of every course. Through these standards, students learn and apply safety concepts, explore career opportunities and requirements, practice the skills needed to succeed in the workplace, develop leadership qualities and take advantage of the opportunities afforded by Career and Technical Student Organizations (CTSOs), and learn and practice essential digital literacy skills. The foundational standards are to be incorporated throughout the course.

Each foundational standard completes the stem *"**Students will**…"*

Foundational Standards	1. Incorporate safety procedures in handling, operating, and maintaining tools and machinery; handling materials; utilizing personal protective equipment; maintaining a safe work area; and handling hazardous materials and forces. 2. Demonstrate effective workplace and employability skills, including communication, awareness of diversity, positive work ethic, problem-solving, time management, and teamwork. 3. Explore the range of careers available in the field and investigate their educational requirements, and demonstrate job-seeking skills including resume-writing and interviewing. 4. Advocate and practice safe, legal, responsible, and ethical use of information and technology tools specific to the industry pathway. 5. Participate in a Career and Technical Student Organization (CTSO) to increase knowledge and skills and to enhance leadership and teamwork. 6. Use technology to collaborate with peers and/or experts to create digital artifacts that can be published online for a target audience. 7. Formulate new ideas, solve problems, or create products through the design and engineering process by utilizing testing, prototypes, and user feedback.

NETWORK FUNDAMENTALS
CONTENT STANDARDS

Each content standard completes the stem *"**Students will**…"*
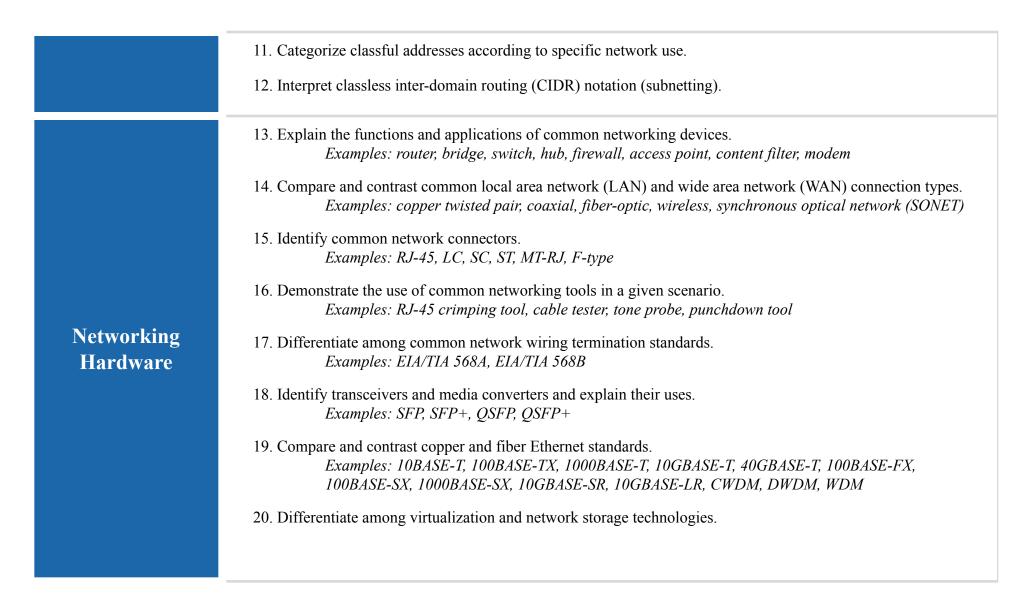

Networking Concepts	1. Compare and contrast the functions and applications of common physical and logical network topologies.
	    Examples: mesh, bus, ring, star, hybrid
	
	2. Differentiate among common network infrastructures.
	    ExamplesWas : LAN, WAN, WLAN, PAN, MAN, CAN, SAN, SDWAN
	
	3. Identify and formulate binary, decimal, and hexadecimal numbers.
	4. Compare and contrast the layers of the Open Systems Interconnect (OSI) model and the Transport Control Protocol/Internet Protocol (TCP/IP) model.
	    a. Illustrate encapsulation and decapsulation within layers of a standard network model.
	        Examples: Ethernet header, Internet protocol (IP) header, transmission control protocol (TCP) header, user datagram protocol (UDP) header, maximum transmission unit (MTU)
	
	5. Compare and contrast the services and applications used to perform basic network operations.
	
	6. Differentiate among network categories, technologies, and topologies.
	
	7. Explain the purpose of routing and switching and their associated technologies and protocols.
	    Examples: dynamic routing, bandwidth management, virtual local area network (VLAN), spanning tree protocol
	
	8. Summarize the purpose of common TCP/IP protocols.
	
	9. Differentiate between public and private IP addressing schemes.
	
	10. Compare and contrast IPv4 and IPv6 addressing features, methods, and characteristics.
	    Examples: APIPA, EUI-64, multicast, unicast, anycast, broadcast, link local, loopback, default gateway

11. Categorize classful addresses according to specific network use.

12. Interpret classless inter-domain routing (CIDR) notation (subnetting).

Networking Hardware

13. Explain the functions and applications of common networking devices.
    Examples: router, bridge, switch, hub, firewall, access point, content filter, modem

14. Compare and contrast common local area network (LAN) and wide area network (WAN) connection types.
    Examples: copper twisted pair, coaxial, fiber-optic, wireless, synchronous optical network (SONET)

15. Identify common network connectors.
    Examples: RJ-45, LC, SC, ST, MT-RJ, F-type

16. Demonstrate the use of common networking tools in a given scenario.
    Examples: RJ-45 crimping tool, cable tester, tone probe, punchdown tool

17. Differentiate among common network wiring termination standards.
    Examples: EIA/TIA 568A, EIA/TIA 568B

18. Identify transceivers and media converters and explain their uses.
    Examples: SFP, SFP+, QSFP, QSFP+

19. Compare and contrast copper and fiber Ethernet standards.
    Examples: 10BASE-T, 100BASE-TX, 1000BASE-T, 10GBASE-T, 40GBASE-T, 100BASE-FX, 100BASE-SX, 1000BASE-SX, 10GBASE-SR, 10GBASE-LR, CWDM, DWDM, WDM

20. Differentiate among virtualization and network storage technologies.

Network Management	21. Interpret and explain technical network documents and text. 22. Interpret network documentation and diagrams. 23. Compare and contrast business continuity and disaster recovery concepts based on current industry practices. *Examples: policies, procedures* 24. Explain common scanning, monitoring, and patching processes and summarize their expected outputs.

Wireless Networking	25. Compare and contrast media access control techniques used in networks.
	
	26. Configure a router with basic settings.
	
	27. Differentiate among common wireless communication methods.
	    Examples: infrared, radio waves, satellite, microwave
	
	28. Describe wireless networking industry standards.
	    Examples: IEEE 802.11ac, 802.11ax

Network Security	29. Explain common security concepts.
	    Examples: awareness, risk assessment, ethics
	
	30. Compare and contrast common types of attacks.
	    Examples: malware, phishing, SQL injection attack, cross-site scripting (XSS), denial of service (DoS), session hijacking, man-in-the-middle attacks
	
	31. Apply network hardening techniques in a given scenario.
	    Examples: reduce attack surface, limit access, change passwords frequently, patch management

32. Analyze remote access methods and associated security consequences.
    Examples: site-to-site VPN, virtual network computing (VNC), remote desktop connection

33. Identify risks and vulnerabilities related to physical security within a network.
    Examples: personnel access and risks, hardware access, data access and availability
    a. Investigate and report on current best practices for mitigating physical security threats to the network.

Network Troubleshooting

34. Utilize common network troubleshooting methodologies to resolve issues within a network in a given scenario.

35. Utilize network software tools and commands to troubleshoot network issues.
    Examples: ping, netstat, arp, nbtstat, hostname, tracert, ipconfig, ifconfig, nslookup

36. Troubleshoot common wireless connectivity issues.