

North Dakota Information Technology Education

Content Standards

Approved and Adopted 2015



North Dakota Department of Career and Technical Education

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This set of standards was sent electronically to all North Dakota IT teachers for comment.
After two months of comments and edits, the final document has been approved.

Career and Technical Education Standards Introduction

Mission

The mission of the State Board for Career and Technical Education (CTE) is to work with others to provide all North Dakota citizens with the technical skills, knowledge, and attitudes necessary for successful performance in a globally competitive workplace.

Vision

The State Board for Career and Technical Education (CTE) is committed to providing career awareness, work readiness skills, occupational preparation, and retraining of workers throughout the state. Career and technical education will span all educational levels, providing youth with exploration opportunities and the foundation skills needed to enter the world of work while providing adults with skills needed to enter, re-enter, or advance in the workforce.

Goal

North Dakota Career and Technical Education's goal is to create a competitive and knowledgeable work force. This is accomplished through a variety of educational program areas that are organized to prepare students for careers in their chosen fields, to take leadership roles, and balance their multiple roles in life. CTE programs prepare students with the knowledge and skills to make informed career choices, to integrate and apply academic concepts, to prepare for successful participation in a global society, and to engage in lifelong learning.

Standards Development Process

Standards development is a multi-phase process. Existing and/or industry standards are the basis for the North Dakota Program Standards. A team of expert secondary and postsecondary teachers, business and industry representatives, and the state program supervisor draft the standards document. Once the document is finalized, the State Board for Career and Technical Education approves and adopts the standards.

Course Frameworks are also developed by the writing team. A framework includes a brief overview of the course content, topical units of study, and identifies the standards recommended for inclusion within the course. The frameworks are tailored to prepare young people for the opportunities in North Dakota. School Districts will use the frameworks as a guide for developing curriculum that reflects local needs.

Key Principles of Career and Technical Education

We believe that Career Technical Education:

1. Draws its curricula, standards, and organizing principles from the workplace.

The workplace provides the context, objectives, and organizing constructs for instruction and assessment. The workplace also defines the standards of performance necessary, including those required for academic, technical, and employability skills.

2. Is a critical and integral component of the total educational system, offering career-oriented benefits for all students.

CTE classes offer educational benefits to students pursuing careers requiring specific technical skills as well as providing a strong foundation for those pursuing a traditional four-year (or more) degree.

3. Is a critical and integral component of the workforce development system, providing the essential foundation for a thriving economy.

Preparation of a well-prepared, qualified workforce requires solid academics, good work ethics, and specific technical skills as well as the ability to communicate, work with others, solve problems, and use information. CTE contributes directly to this preparation by providing a curriculum tied to specific workplace requirements.

4. Maintains high levels of excellence supported through identification of academic and workplace standards, measurement of performance (accountability), and high expectations for participant success.

Career Technical Education is committed to continuous improvement, attention to industry certification, and the development of highly qualified teachers.

5. Is robust and flexible enough to respond to the needs of the multiple educational environments, customers, and levels of specialization.

CTE involves a large and complex delivery system that (1) integrates career exploration, (2) provides effective tools for organizing all curricula, (3) facilitates the teaching and use of technology, (4) is integrated into the total learning experience, (5) enhances the learning of academic subjects, (6) teaches broad occupational skills, (7) includes all aspects of the industry, (8) teaches how to balance family and work responsibilities, (9) provides job-specific training, (10) is offered at multiple levels of the educational continuum, and (11) is delivered through a variety of educational environments.

Table of Contents

Publication Availability.....	2
State Board Members.....	3
State Standards Writing Team.....	4
Introduction to CTE Standards.....	5
Principles of Career and Technical Education.....	6
Table of Contents.....	7
Information Technology.....	8
Network Systems.....	12
Information Support and Services.....	20
Programming and Software Development.....	29
Web and Digital Communications.....	37
Career Ready Practices.....	47

Standard 1	Information Technology	
Topic 1.1	Demonstrate knowledge of organization's offerings and of customers' importance to the organization.	
Student Competencies		
	1.1.1	Identify organization's products and services (including own strengths as an agent of the company).
	1.1.2	Recognize the importance of all customers to the business.
Topic 1.2	Summarize the process of IT product/service design.	
Student Competencies		
	1.2.1	Test products for reliability.
	1.2.2	Initiate predictive maintenance procedures.
	1.2.3	Document a Quality Assurance (QA) program (includes creating a plan and evaluating effectiveness of the program).
Topic 1.3	Identify and implement new products/services.	
Student Competencies		
	1.3.1	Plan for products/services using reliability factors.
	1.3.2	Create products/services using reliability factors.
	1.3.3	Test new products/services for reliability.
	1.3.4	Maintain the reliability of new products/services.
Topic 1.4	Summarize the importance of cross-functional teams in achieving IT project goals.	
Student Competencies		
	1.4.1	Consider the benefits of using a cross-functional team in policy and procedure development.
	1.4.2	Identify desired group and team behavior in an IT context.
	1.4.3	Explain technical concepts to various audiences in non-technical terms.
	1.4.4	Describe strategies for maximizing productivity in a high tech environment.
Topic 1.5	Explain legal issues faced by IT professionals.	
Student Competencies		
	1.5.1	Demonstrate knowledge of the legal issues that face IT professionals.
	1.5.2	Identify issues and trends affecting computers and information privacy.
	1.5.3	Explain legal issues involved in a company security policy.

	1.5.4	Identify legal issues involved concerning a security breach.
	1.5.5	Summarize the rights and responsibilities of IT workers.
	1.5.6	Identify ethical issues common to the IT field.
Topic 1.6	Demonstrate understanding of the impact of IT on businesses.	
Student Competencies		
	1.6.1	Demonstrate knowledge of how both PCs and larger computer systems impact people and are used in business/industry/government and other institutions.
	1.6.2	Demonstrate knowledge of the impact of computers on career pathways in business/industry (e.g., how computers have eliminated and created jobs).
	1.6.3	Demonstrate knowledge of the impact of computers on access to information and information exchange worldwide.
	1.6.4	Demonstrate knowledge of ethical issues that have surfaced in the information age.
Topic 1.7	Identify new IT technologies.	
Student Competencies		
	1.7.1	Identify new technologies relevant to information technology.
	1.7.2	Assess the importance of new technologies to future developments and to future knowledge worker productivity.
	1.7.3	Identify new and emerging drivers and inhibitors of information technology change.
	1.7.4	Assess the potential importance and impact of new IT technologies in the future.
Topic 1.8	Explain the need for regular backup procedures.	
Student Competencies		
	1.8.1	Recognize the need for regular backup procedures.
Topic 1.9	Configure, perform and maintain backup procedures.	
Student Competencies		
	1.9.1	Load backup software.
	1.9.2	Load compression drive backup software.
	1.9.3	Install surge suppression protection.
	1.9.4	Identify battery backup equipment.
	1.9.5	Maintain battery backup system.
	1.9.6	Identify hot and warm site backup concepts.

Topic 1.10	Assess security threats.	
Student Competencies		
	1.10.1	Describe potential security threats to information systems
	1.10.2	Identify the range of security needs and the problems that can occur due to security lapses.
	1.10.3	Maximize threat reduction.
	1.10.4	Assess exposure to security issues.
	1.10.5	Implement countermeasures.
	1.10.6	Ensure compliance with security rules, regulations, and codes.
	1.10.7	Demonstrate knowledge of virus protection strategy.
	1.10.8	Implement security procedures in accordance with business ethics.
	1.10.9	Develop plans to address secure threats.
	1.10.10	Document security procedures.
Topic 1.11	Implement plans to address security procedures.	
Student Competencies		
	1.11.1	Maintain confidentiality.
	1.11.2	Load virus detection and protection software.
	1.11.3	Identify sources of virus infections.
	1.11.4	Remove viruses.
	1.11.5	Report viruses in compliance with company standards.
	1.11.6	Implement backup and recovery procedures.
	1.11.7	Follow disaster plan.
	1.11.8	Provide for user authentication and restricted access (e.g., assign passwords, access level).
Topic 1.12	Summarize the elements of a quality management system.	
Student Competencies		
	1.12.1	Demonstrate knowledge of the control devices used in functional areas (e.g., SPC, equipment).
	1.12.2	Demonstrate knowledge of the relationship among organizational structures, policies, procedures, and quality assurance.
	1.12.3	Identify internal and external customers.
	1.12.4	Differentiate between prevention and detection.
	1.12.5	Differentiate between variable and attribute data.

	1.12.6	Identify types of control charts.
	1.12.7	Demonstrate knowledge of how statistical techniques are used to control quality (e.g., SPC, DOE, CR).
Topic 1.13	Explain the terminology, role, and benefits of quality within an organization.	
Student Competencies		
	1.13.1	Demonstrate knowledge of quality management terminology.
	1.13.2	Identify the role of quality within the organization.
	1.13.3	Identify the features and benefits of quality planning.
Topic 1.14	Describe the role of computer forensic investigators.	
Student Competencies		
	1.14.1	Define computer forensics.
	1.14.2	List some of the basic skills and knowledge a computer forensics specialist should possess.
	1.14.3	Identify the circumstances under which computer forensics evidence is typically used, who typically uses such evidence, and how it is used.
Topic 1.15	Demonstrate the effective use of basic computer applications relating to forensics investigations.	
Student Competencies		
	1.15.1	Identify and attempt to retrieve possible evidence that may exist on a computer system.
	1.15.2	List what should and should not be done with the computer and evidence during an investigation.
Topic 1.16	Identify criminal activity in relationship to cybercrime, the Internet, and Internet trafficking.	
Student Competencies		
	1.16.1	List common internet crimes.
	1.16.2	List some prevention actions related to cybercrime.
	1.16.3	Describe techniques to identify criminal activity.
	1.16.4	Identify how one files a complaint if a cybercrime is suspected or has occurred.
Topic 1.17	Demonstrate knowledge of the hardware components associated with information systems.	
Topic 1.18	Compare key functions and applications of software and determine maintenance strategies for computer systems.	

Standard 2	Information Support and Services	
Topic 2.1	Employ effective listening and questioning skills when working with client.	
Student Competencies		
	2.1.1	Identify support needs.
	2.1.2	Respond to user questions.
	2.1.3	Apply information and data analysis techniques.
	2.1.4	Identify skill level needs and available resources.
	2.1.5	Define scope of work to meet customer needs.
	2.1.6	Evaluate present data and system configuration.
	2.1.7	Formulate a support plan/confirm plan with client.
Topic 2.2	Employ customer service principles/scientific method when working with consumers.	
Student Competencies		
	2.2.1	Respond to user questions and question customer.
	2.2.2	Provide troubleshooting/research of hardware/software.
	2.2.3	Analyze symptoms of problem and use diagnostic skills.
	2.2.4	Perform technical functions required by customer/user.
	2.2.5	Employ appropriate hardware and software tools to perform task in the most cost-effective manner.
	2.2.6	Employ effective problem-solving skills in performing support, maintenance and/or repair.
	2.2.7	Utilize effective field note techniques in documentation of technical support provided.
Topic 2.3	Evaluate and follow-up on customer service provided.	
Student Competencies		
	2.3.1	When appropriate, follows up support session for evaluation.
	2.3.2	Employs evaluative tools (software/recordings) to check work.
	2.3.3	Understands steps to take to create improvement plan when needed.
	2.3.4	Communicate evaluation and feedback to customer.
Topic 2.4	Perform configuration management activities.	
Student Competencies		
	2.4.1	Demonstrate knowledge of identification and control functions.
	2.4.2	Demonstrate knowledge of version management and interface control.

	2.4.3	Select appropriate tools for configuration management.
	2.4.4	Determine standards to be applied (e.g., international, industry, military).
	2.4.5	Specify baseline and software life-cycle phases.
	2.4.6	Assess the impact of changes that affect interfaces.
Topic 2.5	Evaluate application software packages.	
Student Competencies		
	2.5.1	Perform work flow analysis to determine user needs.
	2.5.2	Evaluate appropriateness of software for specific projects.
	2.5.3	Prepare a cost-benefit analysis for a software package.
	2.5.4	Document results of the software evaluation.
	2.5.5	Perform a software configuration audit.
	2.5.6	Perform a physical configuration audit.
	2.5.7	Develop a method for evaluation.
	2.5.8	Test the functionality of proposed software configuration.
Topic 2.6	Identify the purpose of computer components (e.g. current and new technologies as they arrive).	
Student Competencies		
	2.6.1	Explain the purpose of computer components and how they work together as a system.
	2.6.2	Demonstrate knowledge of the CPU (e.g., Intel, AMD, etc.) and sockets.
	2.6.3	Demonstrate knowledge of Chipsets/BIOS and their drivers.
	2.6.4	Demonstrate knowledge of motherboard/CPU (e.g., North/Southbridge, L1/L2, multi-core, bus, 32/64 bit, form-factor, slots, etc.).
	2.6.5	Demonstrate knowledge of memory modules (e.g., RIMM, Dimm, SDRAM, DDR, DDR2, etc.).
	2.6.6	Demonstrate knowledge of hard drive setup and troubleshooting.
	2.6.7	Demonstrate knowledge of hard drive technologies (e.g., IDE, EIDE, SATA, SCSI, etc.).
	2.6.8	Demonstrate knowledge of I/O ports (e.g., serial, parallel, USB, PS/2, Firewire, HDMI, etc.).
	2.6.9	Demonstrate knowledge of modem/NIC ports and troubleshooting their problems.
	2.6.10	Demonstrate knowledge of video cards and slots (e.g., VGA, XGA, VESA, SLI, PCI ExpressX16, etc.).
	2.6.11	Demonstrate knowledge of INPUT devices (e.g., keyboard, mouse, touchpad, cameras, scanners, midis, barcode scanners, etc.).
	2.6.12	Demonstrate knowledge of OUTPUT devices (e.g., printers, CRTs, LCD monitors, network devices).

	2.6.13	Demonstrate knowledge of PDAs, phones and other portable devices and how they connect to and share data with computers.
	2.6.14	Demonstrate knowledge of power and power supplies and how associated problems can be solved.
	2.6.15	Demonstrate knowledge of peculiar features and problems of notebooks, PDAs and other portable devices.
Topic 2.7	Demonstrate knowledge to build or install computer system.	
Student Competencies		
	2.7.1	Identify primary PC components and the functions of each.
	2.7.2	Demonstrate knowledge of how hardware components interact and how conflicts arise.
	2.7.3	Access needed information using manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts, device drivers).
	2.7.4	Secure supplies and resources.
	2.7.5	Demonstrate knowledge of error messages and symptoms of hardware failures.
	2.7.6	Install mainboard (with memory/CPU).
	2.7.7	Connect peripherals and expansion cards to/in mainboard.
	2.7.8	Install drives (e.g., HDD, FDD, CD, CDR) both EIDE and SATA.
	2.7.9	Employ appropriate safety precautions for the worker and hardware when working with PC.
	2.7.10	Configure hardware system.
	2.7.11	Verify system operation.
	2.7.12	Check OS operations, updates and Service Packs.
	2.7.13	Document system installation activities.
	2.7.14	Backup system and configuration.
	2.7.15	Test all applications.
	2.7.16	Restore system and configuration.
	2.7.17	Transfer system settings and files from old system to new.
Topic 2.8	Demonstrate ability to couple troubleshooting skills with hardware knowledge to solve client problems.	
Student Competencies		
	2.8.1	Know startup sequence and beep codes.
	2.8.2	Identify priorities and interrupts at system level.
	2.8.3	Demonstrate ability to couple memory upgrades with motherboard (RAM chips, different types).

	2.8.4	Test system using diagnostic tools/software.
	2.8.5	Identify problems in the operating system and related hardware.
	2.8.6	Differentiate between hardware and software failure.
	2.8.7	Update flash memory (BIOS).
	2.8.8	Demonstrate hard drive maintenance procedures (defragment, scan, clear caches, etc.).
	2.8.9	Gather information on problem from user.
	2.8.10	Conduct appropriate diagnostic tests.
	2.8.11	Repair/replace malfunctioning hardware.
	2.8.12	Reinstall software as needed.
	2.8.13	Demonstrate backup and recovery.
	2.8.14	Restore system to various states (safe modes, previous date, etc.).
Topic 2.9	Demonstrate knowledge of Operating System components in the building and deployment of computer systems.	
Student Competencies		
	2.9.1	Identify differences between O/Ss (Windows/Linux/Mac/DOS).
	2.9.2	Demonstrate knowledge of components of O/S (explorer, Control panel, etc.).
	2.9.3	Demonstrate knowledge of startup sequence of O/Ss.
Topic 2.10	Demonstrate knowledge of Operating System components in the repair and maintenance of computer systems.	
Student Competencies		
	2.10.1	Connect stations to each other and to Internet.
	2.10.2	Connect stations to peripheral devices, especially printers.
	2.10.3	Protect stations from viruses, malwares, adwares, security breaches, etc.
	2.10.4	Test integrity and drivers of all devices recognized by O/S.
	2.10.5	Recover from system errors.
	2.10.6	Upgrade from one generation of O/S to the next.
	2.10.7	Install new hardware (drives, cards, etc.) on O/S.
Topic 2.11	Describe basic network classifications, topologies and network operating systems (NOS).	
Student Competencies		
	2.11.1	Interpret basic networking terminology.
	2.11.2	Differentiate between LANs, MANs and WANs.
	2.11.3	Demonstrate knowledge of how to turn LANs into MANs and WANs.

	2.11.4	Identify the basic point-to-point/broadcast network topologies (e.g., routers, switches, wireless technologies, star, ring, bus, tree, network, irregular).
Topic 2.12	Demonstrate the use of networking concepts in the support and maintenance of the computers on the network.	
Student Competencies		
	2.12.1	Demonstrate knowledge of the characteristics and uses of network components (e.g., hub, switches, routers, wireless routers, firewall).
	2.12.2	Differentiate between a physical and logical topology.
	2.12.3	Demonstrate knowledge of LAN transmission methods, standards, and protocols.
Topic 2.13	Initiate a system project.	
Student Competencies		
	2.13.1	Identify the phases in a system project.
	2.13.2	Select basic fact-gathering techniques to be used.
	2.13.3	Define the scope of the systems project.
	2.13.4	Conduct a preliminary investigation.
Topic 2.14	Evaluate applications within the information system.	
Student Competencies		
	2.14.1	Design a framework for evaluating information system functions.
	2.14.2	Design a framework for evaluating individual applications.
	2.14.3	Recommend new features or enhancements to existing tools.
Topic 2.15	Describe the life cycle of an information system.	
Student Competencies		
	2.15.1	Research the concept of information system life cycles.
Topic 2.16	Manage backup and recovery, both on- and off-site.	
Student Competencies		
	2.16.1	Implement backup procedures in accordance with a regular schedule.
	2.16.2	Implement recovery procedures as needed.
Topic 2.17	Troubleshoot problems.	
Student Competencies		
	2.17.1	Demonstrate knowledge of basic troubleshooting steps.
	2.17.2	Minimize impact of problems on productivity (e.g., minimize downtime).

Topic 2.18	Evaluate problem-solving processes and outcomes.	
Student Competencies		
	2.18.1	Evaluate problem-solving outcomes to determine whether the problem was solved as intended.
	2.18.2	Evaluate whether the process was applied in an efficient and responsible manner.
	2.18.3	Assess the validity and usefulness of the outcomes.
	2.18.4	Determine needed follow-up actions.
Topic 2.19	Perform general system administration tasks.	
Student Competencies		
	2.19.1	Facilitate the delivery of technical services.
	2.19.2	Set up/maintain user accounts on multiple systems.
	2.19.3	Participate in the evaluation, analysis, and recommendation of technical computing products.
	2.19.4	Document performance problems.
	2.19.5	Prepare required reports.
	2.19.6	Maintain technical industry knowledge.
Topic 2.20	Employ sound technical writing skills including keyboarding and handwriting.	
Student Competencies		
	2.20.1	Define/prioritize communication needs.
	2.20.2	Specify project objectives.
	2.20.3	Determine the size and specifics of the work to be completed.
	2.20.4	Estimate time, materials, and capabilities needed to complete assignment.
	2.20.5	Evaluate strengths and weaknesses of completed project.
Topic 2.21	Employ technical research to both evaluate applications and systems as well as find drivers and solutions.	
Student Competencies		
	2.21.1	Identify target audience.
	2.21.2	Define research questions.
	2.21.3	Determine priorities for the information that should be gathered.
	2.21.4	Identify potential sources of information.
	2.21.5	Target audience/user group as a key information source.
	2.21.6	Identify subject-matter experts.
	2.21.7	Evaluate potential sources of information based on established criteria (e.g., affordability, relevance).

	2.21.8	Conduct interviews with selected human information sources.
	2.21.9	Gather information from selected print and electronic sources.
	2.21.10	Determine the accuracy and completeness of the information gathered.
Topic 2.22	Design technical documentation.	
Student Competencies		
	2.22.1	Define purpose of documentation.
	2.22.2	Specify standards for documentation, including critical success criteria.
	2.22.3	Identify delivery options.
	2.22.4	Evaluate cost-effectiveness of each delivery option.
	2.22.5	Select tools appropriate for task purpose.
	2.22.6	Plan information flow.
	2.22.7	Select writing style and tone appropriate for given documentation.
	2.22.8	Determine level of detail needed.
	2.22.9	Identify visuals appropriate for given documentation.
	2.22.10	Provide feedback on design to development team/individual.
Topic 2.23	Write technical reports and effective field notes.	
Student Competencies		
	2.23.1	Determine audience of product.
	2.23.2	Access needed information using standard references and sources.
	2.23.3	Identify type of report needed.
	2.23.4	Compile relevant data.
	2.23.5	Analyze data.
	2.23.6	Organize data into charts and graphs.
	2.23.7	Draw conclusions from data analysis.
	2.23.8	Outline report.
	2.23.9	Draft report.
	2.23.10	Edit report (e.g., check spelling, grammar, punctuation, sentence structure, accuracy of content).
	2.23.11	Review report with peers.
	2.23.12	Revise report as needed based on peer feedback.
	2.23.13	Proofread revised report.

	2.23.14	Present reports.
Topic 2.24	Evaluate tools for quality characteristics.	
Student Competencies		
	2.24.1	Demonstrate knowledge of the characteristics and functions of available quality tools.
	2.24.2	Select quality tool(s) appropriate to situation.
Topic 2.25	Apply quality cost implications to a project.	
Student Competencies		
	2.25.1	Establish cost/quality objectives.
	2.25.2	Classify costs (e.g., direct and indirect, fixed and variable, methods and standards).
	2.25.3	Classify quality costs (e.g., prevention, evaluation, pre-delivery failure, post-delivery failure).
	2.25.4	Interpret quality cost reports.
	2.25.5	Establish guidelines for liability prevention.
	2.25.6	Identify safety terms of product.
	2.25.7	Identify safety responsibility within organization.

Standard 3	Network Systems	
Topic 3.1	Conduct needs analysis.	
	Student Competencies	
	3.1.1	Collect information on system objectives from users.
	3.1.2	Develop workflow analysis to determine user needs.
	3.1.3	Analyze existing procedures.
	3.1.4	Define business objectives to be achieved by the application.
	3.1.5	Determine necessary user applications (e.g., web access, email).
	3.1.6	Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, and work flowcharts).
Topic 3.2	Develop networking requirements specifications.	
	Student Competencies	
	3.2.1	Demonstrate knowledge of the use, structure, and contents of a requirements specification document.
	3.2.2	Define system and software requirements.
	3.2.3	Develop informal and formal specifications.
	3.2.4	Evaluate installation requirements.
	3.2.5	Solve conflicting requirements.
	3.2.6	Review and verify specifications with customer.
Topic 3.3	Analyze requirements/specifications using current IT approaches.	
	Student Competencies	
	3.3.1	Analyze facilities' bandwidth requirements.
	3.3.2	Demonstrate knowledge of how to use software methodologies to analyze a real-world problem.
	3.3.3	Identify site and system constraints.
Topic 3.4	Collect data to identify customer/organizational requirements.	
	Student Competencies	
	3.4.1	Identify customer/stakeholders.
	3.4.2	Develop functional requirements/specifications for high-level systems.
	3.4.3	Identify security requirements.

	3.4.4	Identify time, technology, and resource constraints.
	3.4.5	Identify physical requirements for system implementation.
	3.4.6	Identify system requirements for various types of installations.
	3.4.7	Identify new application requirements within the system.
	3.4.8	Identify environment requirements, conditions, and limitations.
	3.4.9	Determine required service level.
	3.4.10	Collect information using interviewing strategies.
	3.4.11	Identify input and output requirements.
	3.4.12	Develop specifications using questioning techniques.
	3.4.13	Identify hardware, networking, and software system functional requirements.
	3.4.14	Demonstrate knowledge of nonfunctional requirements (e.g., integrity response time, reliability, support, and documentation).
Topic 3.5	Analyze the computer site environment.	
Student Competencies		
	3.5.1	Identify power and power supplies.
	3.5.2	Define power conversion.
	3.5.3	Identify structural capacities and electrical wiring codes.
	3.5.4	Analyze facilities' capacity planning.
	3.5.5	Evaluate the potential effects of emerging technologies on information system software/hardware.
Topic 3.6	Analyze network security systems.	
Student Competencies		
	3.6.1	Identify security requirements and the need for data protection.
	3.6.2	Identify specific access levels that need to be accommodated.
	3.6.3	Match security system design to identified security requirements.
	3.6.4	Develop security plan.
Topic 3.7	Evaluate the correctness and effectiveness of implementing the network system.	
Student Competencies		
	3.7.1	Employ the use of prototyping to evaluate network system functionality.
	3.7.2	Identify problems.
	3.7.3	Recommend new features or enhancements to network system.

Topic 3.8	Demonstrate knowledge of the basics of network architecture.	
Student Competencies		
	3.8.1	Demonstrate knowledge of the characteristics and uses of network components.
	3.8.2	Differentiate between a physical and logical topology.
	3.8.3	Demonstrate a basic knowledge of OSI modeling.
	3.8.4	Demonstrate knowledge of LAN transmission protocols, methods, and standards.
	3.8.5	Demonstrate knowledge of various frame types and formats.
	3.8.6	Differentiate processes, services, and protocols.
Topic 3.9	Demonstrate knowledge of basic network classifications and topologies.	
Student Competencies		
	3.9.1	Differentiate between LANs and WANs.
	3.9.2	Differentiate between point-to-point and point-to-multipoint network topologies.
	3.9.3	Demonstrate knowledge of packet-switching techniques.
	3.9.4	Identify basic physical and logical topologies.
	3.9.5	Demonstrate knowledge of characteristics of connection-oriented and connectionless networks.
	3.9.6	Identify emerging networks.
	3.9.7	Investigate emerging technologies.
	3.9.8	Demonstrate knowledge of electronic communications.
	3.9.9	Demonstrate knowledge of basic telephony.
	3.9.10	Demonstrate knowledge of Voice over IP (VoIP) concepts.
	3.9.11	Explain convergence issues, including codec choice, jitter, wander, and connecting analog telephone adapter equipment.
	3.9.12	Describe common VoIP protocols, including Session Initiation Protocol (SIP), H.323, and Megaco/H.248.
	3.9.13	Explain the benefits of implementing convergence.
Topic 3.10	Implement common network computing platforms.	
Student Competencies		
	3.10.1	Identify how the four components of a network operating system support network operations.
	3.10.2	Select a LAN/WAN technology that meets defined set of requirements.

Topic 3.11	Implement appropriate LAN physical media.	
Student Competencies		
	3.11.1	Demonstrate knowledge of the reasons for installing a network.
	3.11.2	Demonstrate knowledge of local-area network (LAN) trends and issues.
	3.11.3	Relate the evolution of networks.
	3.11.4	Analyze current trends and development in LANs.
Topic 3.12	Characterize network connectivity basis and transmission line applications.	
Student Competencies		
	3.12.1	Demonstrate knowledge of the principles and operation of wire and wireless systems.
	3.12.2	Demonstrate knowledge of the principles and operation of fiber optics, analog and digital circuits.
Topic 3.13	Demonstrate knowledge of communication standards for networks.	
Student Competencies		
	3.13.1	Demonstrate knowledge of the open system interconnection (OSI) standard (ISO Standard 7498).
	3.13.2	Identify standard high-speed networks.
	3.13.3	Demonstrate knowledge of the TCP/IP protocol suite.
Topic 3.14	Use WAN systems in network development.	
Student Competencies		
	3.14.1	Demonstrate knowledge of the conversion of analog speech to digital.
	3.14.2	Relate voice, data concepts, and video to delivery of video services.
	3.14.3	Select primary and backup data circuits.
	3.14.4	Evaluate analog and digital transmission for cost, performance, and reliability.
	3.14.5	Demonstrate knowledge of firewall implementation between trusted network and WAN.
	3.14.6	Configure a Virtual Private Network (VPN) to form the infrastructure of the WAN.
	3.14.7	Demonstrate knowledge of interconnecting LANs using WAN services.
Topic 3.15	Implement network security systems.	
Student Competencies		
	3.15.1	Demonstrate knowledge security requirements and the need for data protection.
	3.15.2	Demonstrate the knowledge of access levels that need to be accommodated.
	3.15.3	Implement security plan.

	3.15.4	Demonstrate knowledge of the role that routers, firewalls, intrusion detection systems, and VPNs play in security.
Topic 3.16	Characterize the use of Network Operating Systems.	
Student Competencies		
	3.16.1	Demonstrate knowledge of the general characteristics of network operating systems.
	3.16.2	Demonstrate knowledge of network operating systems.
	3.16.3	Demonstrate knowledge about the difference between stand-alone, peer-to-peer, and client-server networks and software.
Topic 3.17	Install a network infrastructure.	
Student Competencies		
	3.17.1	Evaluate installation requirements.
	3.17.2	Install information system application programs in accordance with requirements.
	3.17.3	Install appropriate operating system hardware and software and peripherals.
	3.17.4	Identify differences between stand-alone and network applications/operating systems.
	3.17.5	Access needed technical information using software help facilities.
	3.17.6	Install structured cabling.
	3.17.7	Ensure that all multi-user aspects of the application function are operational.
Topic 3.18	Configure and install a network operating system.	
Student Competencies		
	3.18.1	Demonstrate knowledge of network operating system to configure.
	3.18.2	Load software with minimum disruption of process flow.
	3.18.3	Resolve compatibility issues.
	3.18.4	Convert data between different software packages and between software and the OS version.
	3.18.5	Import/export data between different software packages.
	3.18.6	Configure software appropriately for system and user application.
	3.18.7	Add capability to a software system by recording macros and storing them in the system's library.
	3.18.8	Customize a general-purpose software package (e.g., DBMS) to provide specific functionality beyond the default setting.
	3.18.9	Assemble necessary components to complement information system design.

	3.18.10	Install LAN Management software.
Topic 3.19	Monitor network performance including information management and infrastructure.	
Student Competencies		
	3.19.1	Support network operating center (NOC).
	3.19.2	Monitor system status and performance.
	3.19.3	Conduct post-implementation evaluation.
	3.19.4	Identify abnormal system performance.
	3.19.5	Create a baseline of system/network performance.
	3.19.6	Identify required service level.
	3.19.7	Identify system alerts.
	3.19.8	Identify security problems.
	3.19.9	Identify environmental problems.
	3.19.10	Perform remote monitoring.
Topic 3.20	Demonstrate knowledge of disaster recovery and business continuance.	
Student Competencies		
	3.20.1	Differentiate between disaster recovery and business continuance.
	3.20.2	Identify the steps in a disaster recovery plan and a business resumption plan.
	3.20.3	Identify methods for avoiding common computer system disasters.
	3.20.4	Identify common backup devices.
	3.20.5	Identify the criteria for selecting a backup system.
	3.20.6	Compare/contrast streaming file-by-file backup systems.
	3.20.7	Establish process for archiving files.
	3.20.8	Develop a disaster recovery plan.
	3.20.9	Develop a business resumption plan.
	3.20.10	Conduct backup of system.
	3.20.11	Conduct system restore.
Topic 3.21	Perform network system administration tasks.	
Student Competencies		
	3.21.1	Identify principles governing software acquisition and upgrades.
	3.21.2	Manage inventory and assets.

	3.21.3	Retrieve/analyze historical data for trends analysis.
	3.21.4	Perform administration functions using LAN manager software.
	3.21.5	Respond appropriately to system messages.
	3.21.6	Choose and implement an appropriate routing protocol.
	3.21.7	Develop a logical device naming convention.
	3.21.8	Define traffic priorities.
Topic 3.22	Identify various methods of technical support used to maintain and support a network system.	
Student Competencies		
	3.22.1	Identify support requirements.
	3.22.2	Apply information and data analysis techniques.
	3.22.3	Identify skill level needs of support personnel.
	3.22.4	Define scope of work to meet customer needs.
	3.22.5	Identify resources and risks.
	3.22.6	Evaluate present data and system configuration.
	3.22.7	Formulate a support plan.
Topic 3.23	Perform technical support duties.	
Student Competencies		
	3.23.1	Respond to user questions.
	3.23.2	Communicate and document technical support provided.
	3.23.3	Perform technical functions required by customer/user.
	3.23.4	Employ technical and computer tools to perform task in the most cost-effective manner.
	3.23.5	Manage working relationships with customer within support boundaries.
	3.23.6	Analyze the balance of resources against customer/user needs.
	3.23.7	Manage multiple customer requirements.
	3.23.8	Discuss and evaluate application and system development reviews.
Topic 3.24	Apply software upgrades, service packs, and patches.	
Student Competencies		
	3.24.1	Analyze operational problems.
	3.24.2	Install and configure Internet software packages.

	3.24.3	Upgrade network system software.
Topic 3.25	Perform standard computer backup procedures.	
Student Competencies		
	3.25.1	Identify the different types of backups (differential, complete, incremental).
	3.25.2	Recognize the need for regular backup procedures.
	3.25.3	Develop backup process and load appropriate backup software.
	3.25.4	Perform restore operation using backup software.
	3.25.5	Identify battery backup equipment.
	3.25.6	Maintain battery backup system.
	3.25.7	Install surge suppression protection.
Topic 3.26	Perform network system maintenance.	
Student Competencies		
	3.26.1	Demonstrate knowledge of the basic elements of network maintenance.
	3.26.2	Identify available diagnostic tools used for system maintenance.
	3.26.3	Identify maintenance procedures and processes.
	3.26.4	Identify problems using diagnostic tools.
	3.26.5	Respond to system messages.
	3.26.6	Document network system malfunction(s).
	3.26.7	Fix recoverable problems.
	3.26.8	Perform preventive maintenance procedures on computer and peripheral devices.
	3.26.9	Restore system.
	3.26.10	Identify new or replacement networking components needed.
	3.26.11	Establish a preventive maintenance plan.
	3.26.12	Create maintenance plan for regular integrity checks.
	3.26.13	Identify maintenance procedures and processes.
	3.26.14	Evaluate maintenance processes and outcomes.
	3.26.15	Select most appropriate solution.
	3.26.16	Implement selected solution.

	3.26.17	Minimize impact of problems on productivity (e.g., minimize downtime).
Topic 3.27	Troubleshoot network system problems.	
Student Competencies		
	3.27.1	Demonstrate knowledge of basic troubleshooting steps.
	3.27.2	Identify available diagnostic tools used for system maintenance.
	3.27.3	Perform appropriate analysis to identify problem cause.
	3.27.4	Develop resolution plan and identify possible solutions.
	3.27.5	Identify and test possible solutions.
	3.27.6	Identify criticality of problem.
	3.27.7	Identify problems using diagnostic tools.
	3.27.8	Document results and solutions.
Topic 3.28	Troubleshoot data communications.	
Student Competencies		
	3.28.1	Isolate system faults in various types of networks, cables, data modems, and carrier systems.
	3.28.2	Determine hardware communication faults utilizing diagnostic tools.
	3.28.3	Identify network problems utilizing network management tools.

Standard 4	Programming and Software Development	
Topic 4.1	Gather data to identify customer requirements.	
Student Competencies		
	4.1.1	Demonstrate knowledge of nonfunctional requirements (e.g., security, integrity response time, reliability, support, and documentation).
	4.1.2	Clarify specifications using questioning techniques.
	4.1.3	Gather information using interviewing strategies.
	4.1.4	Identify input and output requirements.
	4.1.5	Identify system processing requirements.
	4.1.6	Identify hardware, networking, and software system functional requirements.
Topic 4.2	Conduct needs analysis.	
Student Competencies		
	4.2.1	Gather information on problems from users.
	4.2.2	Perform workflow analysis to determine user needs.
	4.2.3	Analyze existing procedures.
	4.2.4	Define business problem to be solved by the application.
Topic 4.3	Use available reference tools as appropriate.	
Student Competencies		
	4.3.1	Access needed information using company and manufacturers' references.
	4.3.2	Review collected information with customer.
Topic 4.4	Analyze requirements/specifications using current approaches.	
Student Competencies		
	4.4.1	Demonstrate knowledge of how to use software methodologies to analyze a real-world problem.
	4.4.2	Identify constraints.
	4.4.3	Demonstrate knowledge of modeling and analyzing functional and data requirements.
Topic 4.5	Develop software requirements and specifications.	
Student Competencies		
	4.5.1	Demonstrate knowledge of the use, structure, and contents of a requirements specification document.
	4.5.2	Define system and software requirements.

	4.5.3	Define informal and formal specifications.
	4.5.4	Resolve conflicting requirements.
	4.5.5	Review and verify specifications with customer.
Topic 4.6	Utilize interpersonal skills necessary to work on a software development team.	
Student Competencies		
	4.6.1	Identify resources and risks.
	4.6.2	Demonstrate knowledge of cross-functional team structures and team members' roles.
Topic 4.7	Define scope of work for the programming project.	
Student Competencies		
	4.7.1	Define scope of work to meet customer needs.
	4.7.2	Demonstrate knowledge of the key functions and subsystems of the software product.
	4.7.3	Demonstrate knowledge of software development process and issues.
	4.7.4	Demonstrate knowledge of the system life-cycle approach.
Topic 4.8	Design project plan.	
Student Competencies		
	4.8.1	Demonstrate knowledge of project budgeting, scheduling, and control issues related to software development.
	4.8.2	Demonstrate knowledge of software development methodology.
	4.8.3	Develop implementation plan.
Topic 4.9	Identify the potential importance and impact of new IT technologies.	
Student Competencies		
	4.9.1	Identify new technologies relevant to information technology.
	4.9.2	Assess the importance of new technologies to future developments.
	4.9.3	Identify system processing requirements.
	4.9.4	Identify data communication trends and major current issues.
Topic 4.10	Assess the potential importance and impact of new IT technologies and emerging classes of software.	
Student Competencies		
	4.10.1	Identify new and emerging classes of software and IT technologies.
	4.10.2	Determine compatibility of hardware and software.

Topic 4.11	Summarize elements and types of information processing.	
	Student Competencies	
	4.11.1	Identify the elements of the information processing cycle.
	4.11.2	Identify required hardware.
Topic 4.12	Explain measurement techniques for increased productivity due to information systems implementation.	
	Student Competencies	
	4.12.1	Identify metrics for measurements.
	4.12.2	Measure increases in productivity realized by the implementation of information systems.
	4.12.3	Identify new and emerging drivers and inhibitors of information technology change.
Topic 4.13	Employ tools in developing software applications.	
	Student Competencies	
	4.13.1	Demonstrate knowledge of software development environment.
	4.13.2	Use prototyping techniques.
	4.13.3	Use appropriate configuration management tools.
	4.13.4	Use appropriate issues tracking tools.
	4.13.5	Demonstrate knowledge of reuse and components.
Topic 4.14	Demonstrate use of computer-aided software engineering (CASE) tools.	
	Student Competencies	
	4.14.1	Use appropriate requirement analysis tools.
	4.14.2	Use appropriate modeling and analysis tools.
	4.14.3	Use requirement tracking tools.
	4.14.4	Demonstrate knowledge of software reuse, design pattern, and components.
Topic 4.15	Apply language-specific programming tools/techniques.	
	Student Competencies	
	4.15.1	Develop programs using appropriate language.
	4.15.2	Use appropriate development environment for the selected language.
	4.15.3	Use user interface development tools.
Topic 4.16	Describe software development processes and methodology.	
	Student Competencies	
	4.16.1	Identify the use of program design tools in a software development process.

	4.16.2	Identify roles of team members/customers in the software development process.
	4.16.3	Identify current information life cycle models.
	4.16.4	Create design specifications for a computer application.
	4.16.5	Describe trade-offs involved in design choices.
	4.16.6	Summarize the use of the principles of effective information management, information organization, and information-retrieval skills when designing a software application.
	4.16.7	Demonstrate knowledge of the information system life cycle.
	4.16.8	Demonstrate knowledge of system analysis issues related to design, testing, implementation, and maintenance.
	4.16.9	Record and analyze the process.
Topic 4.17	Explain computing/networking hardware and software architecture.	
Student Competencies		
	4.17.1	Explain the importance of performance, security and resilience of networks.
	4.17.2	Describe communication protocol for exchanging information via networks.
	4.17.3	Describe properties of communication protocols.
	4.17.4	Describe the choice of networks based on their physical or organizational purpose and how usage and security differ between these types of networks.
	4.17.5	Identify the organizational scope of different types of networks.
	4.17.6	Identify the hardware required for different types of networks.
Topic 4.18	Explain programming language concepts.	
Student Competencies		
	4.18.1	Demonstrate knowledge of the hardware-software connections.
	4.18.2	Demonstrate knowledge of the concepts of data and procedural representations.
	4.18.3	Demonstrate knowledge of the basic principles for analyzing a programming language.
	4.18.4	Demonstrate knowledge of the basics of structured, object-oriented language.
	4.18.5	Demonstrate knowledge of how a programming language can support multitasking and exception-handling.
Topic 4.19	Summarize program development methodology.	
Student Competencies		
	4.19.1	Demonstrate knowledge of how to resolve program implementation issues.

	4.19.2	Demonstrate knowledge of software development issues.
	4.19.3	Demonstrate knowledge of code analysis issues related to design, testing, implementation, and maintenance.
	4.19.4	Demonstrate knowledge of how to design and implement programs in a top-down manner.
	4.19.5	Demonstrate knowledge of how to translate algorithmic and modular designs to develop a program.
	4.19.6	Demonstrate knowledge of structured/modular programming.
	4.19.7	Demonstrate knowledge of how programming control structures are used to verify correctness.
	4.19.8	Use code development tools (e.g. debugger, integrated development environments).
Topic 4.20	Demonstrate proficiency in developing an application using an appropriate programming language.	
Student Competencies		
	4.20.1	Describe the range of languages used in software development.
	4.20.2	Demonstrate knowledge of current key programming languages and the environment in which they are used.
	4.20.3	Translate data structure and program design into code in an appropriate language.
	4.20.4	Demonstrate knowledge of key constructs and commands specific to a language.
Topic 4.21	Explain basic software systems implementation.	
Student Competencies		
	4.21.1	Use appropriate programming language.
	4.21.2	Analyze and prepare logic using program flowchart.
	4.21.3	Analyze and prepare logic using at least one alternative to flowcharting, such as pseudo-coding.
	4.21.4	Review design.
	4.21.5	Compile and debug code.
	4.21.6	Prepare code documentation.
	4.21.7	Prepare unit testing plan.
	4.21.8	Conduct unit testing and bug fixes.
Topic 4.22	Develop software requirements/specifications.	
Student Competencies		
	4.22.1	Access needed information using company and manufacturers' references.
	4.22.2	Divide design specifications into logical process blocks.
	4.22.3	Identify parameters.

	4.22.4	Follow specifications or drawings.
	4.22.5	Record process utilizing flowcharts and/or step-by-step documentation.
	4.22.6	Record data.
Topic 4.23	Resolve problems with integration.	
Student Competencies		
	4.23.1	Identify unexpected results.
	4.23.2	Review and revise code.
Topic 4.24	Develop a software test plan.	
Student Competencies		
	4.24.1	Access needed information using appropriate reference materials.
	4.24.2	Define test procedures.
	4.24.3	Analyze requirement and design specifications.
	4.24.4	Development test cases using requirements and design specification.
Topic 4.25	Perform testing and validation.	
Student Competencies		
	4.25.1	Perform integration testing.
	4.25.2	Perform regression testing.
	4.25.3	Help with user-acceptance test.
	4.25.4	Validate user documentation.
	4.25.5	Document test results.
	4.25.6	Document errors discovered.
	4.25.7	Perform defect tracking.
Topic 4.26	Develop software testing audit trails.	
Student Competencies		
	4.26.1	Record error correction procedures and actions.
	4.26.2	Record results from error corrections and actions.
Topic 4.27	Summarize software quality assurance (QA) procedures.	
Student Competencies		
	4.27.1	Demonstrate knowledge of Software QA process.
	4.27.2	Demonstrate knowledge of the standards/requirements for Software QA.

	4.27.3	Develop team relationships to support Software QA tasks.
Topic 4.28	Perform software quality assurance tasks to produce a quality software product.	
Student Competencies		
	4.28.1	Identify standards and issues related to I/O programming and design of I/O interfaces.
	4.28.2	Use customer satisfaction in determining product characteristics.
	4.28.3	Recognize the relationship between dependability, functionality, ease of use, etc.
	4.28.4	Conduct code walkthrough and/or inspection.
	4.28.5	Follow established procedures for testing, identifying problems, and tracking resolutions.
Topic 4.29	Analyze software technical support needs.	
Student Competencies		
	4.29.1	Identify maintenance and support requirements.
	4.29.2	Apply information and data analysis techniques.
	4.29.3	Define scope of work to meet customer support needs.
Topic 4.30	Perform customer service.	
Student Competencies		
	4.30.1	Access needed information using appropriate reference materials.
	4.30.2	Provide help to first line user-support personnel to answer user questions.
	4.30.3	Provide troubleshooting for software.
	4.30.4	Perform system-tuning functions.
	4.30.5	Diagnose problems within system.
	4.30.6	Perform technical functions required by customer/user.
	4.30.7	Communicate and document technical support provided.
Topic 4.31	Perform software maintenance activities.	
Student Competencies		
	4.31.1	Utilize organizational procedures to communicate and document maintenance tasks.
	4.31.2	Identify and analyze problem(s).
	4.31.3	Analyze and propose solutions.
	4.31.4	Implement solutions in code and documentation.
	4.31.5	Release software and documentation updates according to procedures.

Topic 4.32	Explain database development processes.	
Student Competencies		
	4.32.1	Identify appropriate database type based on customer requirements, availability of software and hardware resources, and distribution specifications, etc.
	4.32.2	Apply information and data analysis specifications to create a database model using techniques such as Entity Relationship Diagramming.
	4.32.3	Analyze and normalize the developed database model looking for and resolving potential problems.
	4.32.4	Analyze the security needs for the database.
Topic 4.33	Create, populate, and maintain a database.	
Student Competencies		
	4.33.1	Create a database from model specifications using both program code and Graphic User Interface (GUI) processes when provided by the database software.
	4.33.2	Verify that all possible security safeguards are in place.
	4.33.3	Populate the database created with test data.
	4.33.4	Perform database queries to analyze database functionality and diagnose problems.
	4.33.5	Perform database troubleshooting and system-tuning functions.
	4.33.6	Perform technical functions required by customer/user.
	4.33.7	Communicate and document technical support provided.
	4.33.8	Perform standard maintenance on the database.
	4.33.9	Release software and documentation updates according to procedures.
Topic 4.34	Perform database interfacing with web applications.	
Student Competencies		
	4.34.1	Develop scripts and forms that permit access via websites to the database.
	4.34.2	Identify and analyze potential security problems for web access to the database.
	4.34.3	Propose security solutions to web-based security problems.
	4.34.4	Implement solutions in code and documentation.

Standard 5	Web and Digital Communications	
Topic 5.1	Collect and evaluate data to identify customer requirements.	
	Student Competencies	
	5.1.1	Collect information using interviewing strategies.
	5.1.2	Analyze and determine client's needs and expected outcomes.
	5.1.3	Conduct feasibility analysis of data collected.
Topic 5.2	Collect requirements data from customers and competing web sites.	
	Student Competencies	
	5.2.1	Determine purpose of the digital communication project.
	5.2.2	Determine the target audience.
	5.2.3	Determine the digital communication elements to be used.
	5.2.4	Determine clients' privacy policy and expectations.
	5.2.5	Conduct a project analysis.
Topic 5.3	Participate in development of web/digital product with clients and team members.	
	Student Competencies	
	5.3.1	Manage the change control process.
	5.3.2	Identify and track critical milestones.
	5.3.3	Report project status.
	5.3.4	Identify optimal strategies for successful interactions with clients and team members.
	5.3.5	Apply for approval of a web site plan.
	5.3.6	Communicate technical concepts from web design to non-technical audiences.
Topic 5.4	Analyze usability and accessibility as it pertains to customer needs.	
	Student Competencies	
	5.4.1	Demonstrate knowledge of WAI priorities.
	5.4.2	Demonstrate knowledge of web metrics and governance (policies and stylebooks).
	5.4.3	Demonstrate knowledge of cultural implications on design and deployment of digital communication products.
	5.4.4	Engage in user testing throughout the design and development process.

Topic 5.5	Prepare functional specifications.	
Student Competencies		
	5.5.1	Develop flowchart/navigational blueprints.
	5.5.2	Develop storyboards.
	5.5.3	Determine delivery platform(s).
	5.5.4	Design system architecture.
	5.5.5	Design user interface.
	5.5.6	Design navigational schema.
Topic 5.6	Prepare visual design specifications.	
Student Competencies		
	5.6.1	Apply principles of design (color theory and schemes, proximity, alignment, repetition, web graphics, optimization, typography).
	5.6.2	Identify technical constraints.
	5.6.3	Create sample design showing placement of buttons/navigational graphics and suggested color scheme.
Topic 5.7	Create final project plan.	
Student Competencies		
	5.7.1	Identify and obtain tools and resources to do the job.
	5.7.2	Identify and evaluate risks.
	5.7.3	Develop detailed task list.
	5.7.4	Identify critical milestones.
	5.7.5	Identify interdependencies.
Topic 5.8	Define scope of work to meet customer requirements.	
Student Competencies		
	5.8.1	Develop a design brief.
	5.8.2	Determine the target audience requirements (such as web accessibility)
	5.8.3	Identify available media and content sources.
	5.8.4	Develop timeline for completion.
	5.8.5	Determine staffing resources, both internal and external, that are required to complete the project.
	5.8.6	Develop preliminary project budget.
	5.8.7	Write document with all appropriate information.

	5.8.8	Obtain client approval on scope of work.
Topic 5.9	Select and use appropriate software tools.	
Student Competencies		
	5.9.1	Demonstrate proficiency in the use of digital imaging, digital video techniques, and equipment.
	5.9.2	Demonstrate knowledge of available graphics, video, motion graphics, web software programs.
	5.9.3	Demonstrate knowledge of available project management and collaborative tools.
	5.9.4	Demonstrate knowledge of integrated development environments (such as Visual Studio, Dreamweaver, Flash, Waterproof, etc.).
	5.9.5	Manipulate images, video, and motion graphics.
	5.9.6	Demonstrate knowledge of the basic principles of motion graphics.
	5.9.7	Identify how different user agents (browsers, devices) affect the digital communication product.
Topic 5.10	Implement functional design criteria.	
Student Competencies		
	5.10.1	Identify, utilize, and create reusable components.
	5.10.2	Create and produce content.
	5.10.3	Create and refine design concepts.
Topic 5.11	Create product visual design.	
Student Competencies		
	5.11.1	Apply principles and elements of design.
	5.11.2	Apply color theory to select appropriate colors.
	5.11.3	Create and/or implement the look and feel of the product.
	5.11.4	Create graphical images and/or video elements.
	5.11.5	Apply knowledge of typography.
	5.11.6	Enhance digital communication presentation using a photographic process.
	5.11.7	Alter digitized images using an image manipulation program.
	5.11.8	Alter digitized video using a video manipulation program.
	5.11.9	Evaluate visual appeal.
Topic 5.12	Employ basic motion graphic programming knowledge.	
Student Competencies		
	5.12.1	Demonstrate knowledge of key frames and frames.

	5.12.2	Demonstrate knowledge of the impact that deployment device has on design and production needs.
	5.12.3	Demonstrate knowledge of animation techniques.
	5.12.4	Demonstrate knowledge of motion graphic security.
	5.12.5	Demonstrate that motion graphic meets the validation process and is compatible across multiple browsers or devices.
Topic 5.13	Use basic web development skills.	
Student Competencies		
	5.13.1	Demonstrate knowledge of HTML, XHTML, and CSS.
	5.13.2	Demonstrate knowledge of version control and documentation.
	5.13.3	Demonstrate knowledge of basic web application security.
	5.13.4	Demonstrate that website meets the validation process and is compatible across multiple browsers and devices.
	5.13.5	Explain importance of web standards.
Topic 5.14	Summarize Internet architecture elements.	
Student Competencies		
	5.14.1	Demonstrate knowledge of transfer protocols (FTP, WebDav).
	5.14.2	Demonstrate knowledge of Internet standards bodies.
	5.14.3	Identify cross-platform issues.
	5.14.4	Keep up-to-date with new and emerging trends related to the Internet.
	5.14.5	Demonstrate knowledge of Web 2.0.
Topic 5.15	Employ basic web programming knowledge.	
Student Competencies		
	5.15.1	Demonstrate knowledge of the purpose of web content delivery enablers (e.g., CGI, API, SSI).
	5.15.2	Demonstrate knowledge of how to interface client/server.
	5.15.3	Demonstrate knowledge of client-side processing and its advantages/disadvantages.
	5.15.4	Identify security issues related to server-side processing.
	5.15.5	Identify standard scripting languages (e.g., JavaScript, .NET frameworks, PHP, ActiveX,).
	5.15.6	Demonstrate knowledge of XML/XSL.
	5.15.7	Demonstrate knowledge of quality assurance.
	5.15.8	Demonstrate knowledge of the uses and advantages/disadvantages of various scripting languages.

	5.15.9	Demonstrate knowledge of how to use a scripting language to program a site.
Topic 5.16	Employ web administration skills to maintain a web application.	
Student Competencies		
	5.16.1	Demonstrate knowledge of how to use advanced communication protocols.
	5.16.2	Compare the advantages and disadvantages of running your own server vs. using a server provider.
	5.16.3	Identify hardware requirements for a server.
	5.16.4	Identify server software options.
	5.16.5	Evaluate server providers.
	5.16.6	Establish a domain name.
	5.16.7	Comply with TCP/IP (Transfer Control Protocol/Internet Protocol).
	5.16.8	Upload files to the server.
	5.16.9	Publicize the site (e.g., submit announcements to major search engines).
	5.16.10	Explain the importance of ethical behaviors and legal issues.
	5.16.11	Collect/analyze usage statistics.
	5.16.12	Utilize back-up and restore software features.
	5.16.13	Document server environment to include specifications, passwords, and software versions.
Topic 5.17	Produce a digital communication product as member of a development team.	
Student Competencies		
	5.17.1	Define the role of individual team members.
	5.17.2	Develop a conceptual model for the digital communication project.
	5.17.3	Select the media elements (e.g., sound, video, graphics, text, motion graphics) to be used.
	5.17.4	Integrate media elements.
	5.17.5	Select the publication process to be used.
	5.17.6	Select the distribution method to be used.
	5.17.7	Explain the impact that publication processes and distribution methods have on product development.
Topic 5.18	List and employ functional design terms and criteria.	
Student Competencies		
	5.18.1	Identify, utilize, and create reusable components.
	5.18.2	Create and produce content.
	5.18.3	Create and refine design concepts.

Topic 5.19	Create product visual design.	
Student Competencies		
	5.19.1	Apply principles and elements of design.
	5.19.2	Apply color theory to select appropriate colors.
	5.19.3	Create and/or implement the look and feel of the product.
	5.19.4	Create graphical images and video.
	5.19.5	Apply knowledge of typography.
	5.19.6	Enhance digital communication presentation using a photographic process.
	5.19.7	Alter digitized images using an image manipulation program.
	5.19.8	Alter digitized video using a video manipulation program.
	5.19.9	Evaluate visual appeal.
Topic 5.20	Acquire and produce content for a digital communication product.	
Student Competencies		
	5.20.1	Produce or acquire graphics content.
	5.20.2	Produce or acquire motion graphics content.
	5.20.3	Produce or acquire audio content.
	5.20.4	Produce or acquire video content.
Topic 5.21	Employ web development knowledge.	
Student Competencies		
	5.21.1	Demonstrate knowledge of the purpose of web content delivery enablers (e.g., CGI, API, SSI).
	5.21.2	Demonstrate knowledge of how to interface client/server.
	5.21.3	Demonstrate knowledge of client-side processing and its advantages/disadvantages.
	5.21.4	Identify security issues related to server-side processing.
	5.21.5	Identify standard scripting languages (e.g., JavaScript, .NET frameworks, PHP, ActiveX).
	5.21.6	Demonstrate knowledge of XML/XSL.
	5.21.7	Demonstrate knowledge of quality assurance.
	5.21.8	Demonstrate knowledge of the uses and advantages/disadvantages of various scripting languages.
	5.21.9	Demonstrate knowledge of how to use a scripting language to program a site.

Topic 5.22	Employ web programming knowledge.	
	Student Competencies	
	5.22.1	Demonstrate knowledge of key frames and frames.
	5.22.2	Demonstrate knowledge of the impact deployment device has on design and production needs.
	5.22.3	Demonstrate knowledge of animation techniques.
	5.22.4	Demonstrate knowledge of motion graphic security.
	5.22.5	Demonstrate that motion graphic meets the validation process and is compatible across multiple browsers or devices.
Topic 5.23	Employ basic motion graphic programming knowledge.	
	Student Competencies	
	5.23.1	Integrate the use of photographic special effects into interactive media presentations.
	5.23.2	Integrate photographically derived images with hand-drawn graphic images.
Topic 5.24	Describe search engine management (SEM) and search engine optimization (SEO).	
	Student Competencies	
	5.24.1	Measure current traffic on site.
	5.24.2	Determine and measure traffic sources.
	5.24.3	Determine that search engines can easily index web pages.
	5.24.4	Ensure code is W3C-compliant.
	5.24.5	Develop and implement a legal statement, privacy statement, and site map.
Topic 5.25	Integrate media elements.	
	Student Competencies	
	5.25.1	Determine needed media elements for site.
	5.25.2	Implement appropriate media elements for site.
Topic 5.26	Identify the use of Web 2.0 components of service-oriented architecture, rich internet applications, and social networking on site.	
	Student Competencies	
	5.26.1	Develop social networking policies.
	5.26.2	Determine key people to develop policies.
	5.26.3	Develop social networking guidelines.
	5.26.4	Determine type of platform for rich internet applications for site.

	5.26.5	Develop design and distribution method.
	5.26.6	Determine cost of application.
	5.26.7	Develop security solutions for application.
Topic 5.27	Develop a test plan for the digital communication product.	
Student Competencies		
	5.27.1	Perform usability tests.
	5.27.2	Assess product effectiveness.
	5.27.3	Test product for reliability.
	5.27.4	Plan and coordinate customer acceptance testing.
Topic 5.28	Implement a test plan and resolution process for product problems for the digital communication product.	
Student Competencies		
	5.28.1	Define the problem.
	5.28.2	Identify/test possible solutions.
	5.28.3	Develop resolution plan.
	5.28.4	Implement solution.
	5.28.5	Evaluate problem-solving processes and outcomes.
Topic 5.29	Summarize digital communication quality assurance measures.	
Student Competencies		
	5.29.1	Demonstrate knowledge of the quality assurance (QA) process.
	5.29.2	Demonstrate knowledge of the standards/requirements for QA.
	5.29.3	Develop team relationships to support quality assurance tasks.
Topic 5.30	Perform quality assurance tasks to produce a quality product.	
Student Competencies		
	5.30.1	Use customer satisfaction in determining product characteristics (e.g., cost, user-friendliness).
	5.30.2	Recognize the relationship between dependability, functionality, ease of use, etc.
	5.30.3	Follow established procedures for testing, identifying problems, and tracking resolutions.
Topic 5.31	Analyze software technical support needs.	
Student Competencies		
	5.31.1	Identify maintenance and support requirements.
	5.31.2	Apply information and data analysis techniques.

	5.31.3	Define scope of work to meet customer support needs.
Topic 5.32	Employ customer service techniques and strategies.	
Student Competencies		
	5.32.1	Access needed information using appropriate reference materials.
	5.32.2	Provide help to first line user-support personnel to answer user questions.
	5.32.3	Provide troubleshooting for digital communication products.
	5.32.4	Provide troubleshooting for hardware.
	5.32.5	Perform system-tuning function.
	5.32.6	Diagnose problems within system.
	5.32.7	Perform technical functions required by customer/user.
	5.32.8	Communicate and document technical support provided.
Topic 5.33	Perform product maintenance activities.	
Student Competencies		
	5.33.1	Follow organizational procedures in communication and document maintenance tasks.
	5.33.2	Identify and analyze problem.
	5.33.3	Analyze and propose solutions.
	5.33.4	Implement solutions in code and documentation.
	5.33.5	Release software and documentation updates according to procedures.
Topic 5.34	Explain the concept of intellectual property.	
Student Competencies		
	5.34.1	Identify and discuss appropriate state intellectual property laws.
	5.34.2	Identify and discuss national intellectual property laws.
	5.34.3	Identify any intellectual property issues in created web pages.
Topic 5.35	Differentiate between copyright and trademarks.	
Student Competencies		
	5.35.1	Discuss the difference between copyright and trademarks.
	5.35.2	Discuss any copyright issues in web page being designed and how they will be managed.
	5.35.3	Discuss any trademark issues in web page being designed and how they will be managed.

Topic 5.36	Describe the function of a non-disclosure agreement (NDA).	
Student Competencies		
	5.36.1	Discuss what a non-disclosure agreement (NDA) is.
	5.36.2	Identify who will be included in the NDA for the developed web page(s).
	5.36.3	Identify and discuss what will be included in the NDA.
	5.36.4	Determine the length of time the agreement will be in effect.

Career Ready Practices

1. Act as a Responsible and Contributing Citizen and Employee

Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them, think about the near-term and long-term consequences of their actions, and seek to act in ways that contribute to the betterment of their teams, families, community, and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

2. Apply Appropriate Academic and Technical Skills

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications and make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

3. Attend to Personal Health and Financial Well-Being

Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice health diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

4. Communicate Clearly, Effectively, and with Reason

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice and organization and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

5. Consider the environmental, social, and economic impacts of decisions

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organizations and the environment. They are aware of and utilize new technologies, understandings, procedures, materials and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and profitability of the organization.

6. Demonstrate creativity and innovation

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

7. Employ valid and reliable research strategies

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices, or inform strategies. They use a reliable research process to search for new information and evaluate the validity of sources when considering the use and adoption of external information or practices. They use an informed process to test new ideas, information, and practices in their workplace situation.

8. Utilize critical thinking to make sense of problems and persevere in solving them

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur, quickly take action to address the problem, thoughtfully investigate the root cause of the problem prior to introducing solutions, and carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

9. Model integrity, ethical leadership, and effective management

Career-ready individuals consistently act in ways that align to personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they apply insights into human behavior to change others' actions, attitudes, and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

10. Plan education and career path aligned to personal goals

Career-ready individuals take personal ownership of their own educational and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience, and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the educational and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

11. Use technology to enhance productivity

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology, being proficient with ubiquitous technology applications. They understand the inherent risks, personal and organizational, of technology applications, and they take actions to prevent or mitigate these risks.

12. Work productively in teams while using cultural/global competence

Career-ready individuals positively contribute to every team whether formal or informal. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.