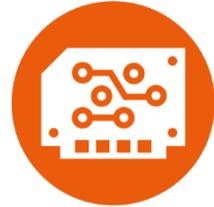




### Information Technology Career Cluster (IT)

1. Demonstrate effective professional communication skills and practices that enable positive customer relationships.
2. Use product or service design processes and guidelines to produce a quality information technology (IT) product or service.
3. Demonstrate the use of cross-functional teams in achieving IT project goals.
4. Demonstrate positive cyber citizenry by applying industry-accepted ethical practices and behaviors.
5. Explain the implications of IT on business development.
6. Describe trends in emerging and evolving computer technologies and their influence on IT practices.
7. Perform standard computer backup and restore procedures to protect IT information.
8. Recognize and analyze potential IT security threats to develop and maintain security requirements.
9. Describe quality assurance practices and methods employed in producing and providing quality IT products and services.
10. Describe the use of computer forensics to prevent and solve information technology crimes and security breaches.
11. Demonstrate knowledge of the hardware components associated with information systems.
12. Compare key functions and applications of software and determine maintenance strategies for computer systems.



### Cybersecurity Career Pathway (IT-NET)

1. Analyze customer or organizational network system needs and requirements.
2. Analyze wired and wireless network systems to determine if they meet specifications (e.g., IEEE, power, security).
3. Design a network system using technologies, tools and standards.
4. Perform network system installation and configuration.
5. Perform network administration, monitoring and support to maintain a network system.

### Programming Career Pathway (IT-PRG)

1. Analyze customer software needs and requirements.
2. Demonstrate the use of industry-standard strategies and project planning to meet customer specifications.
3. Analyze system and software requirements to ensure maximum operating efficiency.
4. Demonstrate the effective use of software development tools to develop software applications.
5. Apply an appropriate software development process to design a software application.
6. Program a computer application using the appropriate programming language.
7. Demonstrate software testing procedures to ensure quality products.
8. Perform quality assurance tasks as part of the software development cycle.
9. Perform software maintenance and customer support functions.
10. Design, create and maintain a database.



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### Digital Design and Communications Career Pathway (IT-WD)

1. Analyze customer requirements to design and develop a web or digital communication product.
2. Apply the design and development process to produce user-focused web and digital communications solutions.
3. Write product specifications that define the scope of work aligned to customer requirements.
4. Demonstrate the effective use of tools for digital communication production, development and project management.
5. Develop, administer and maintain web applications.
6. Design, create and publish a digital communication product based on customer needs.
7. Evaluate the functionality of a digital communication product using industry accepted techniques and metrics.
8. Implement quality assurance processes to deliver quality digital communication products and services.
9. Perform maintenance and customer support functions for digital communication products.
10. Comply with intellectual property laws, copyright laws and ethical practices when creating web/digital communications.





### Information Technology Career Cluster (IT)

IT 	Standard	Performance Elements	Sample Indicators
IT 01	Demonstrate effective professional communication skills and practices that enable positive customer relationships.	1. Demonstrate knowledge of organization's offerings and of customers' importance to the organization.	<ul style="list-style-type: none"> <li>Identify organization's products and services (including own strengths as an agent of the company).</li> <li>Recognize the importance of all customers to the business.</li> </ul>
IT 02	Use product or service design processes and guidelines to produce a quality information technology (IT) product or service.	1. Summarize the process of IT product/service design.	<ul style="list-style-type: none"> <li>Test products for reliability.</li> <li>Initiate predictive maintenance procedures.</li> <li>Document a Quality Assurance (QA) program (includes creating a plan and evaluating effectiveness of the program).</li> </ul>
		2. Identify and implement new products/services.	<ul style="list-style-type: none"> <li>Plan for products/services using reliability factors.</li> <li>Create products/services using reliability factors.</li> <li>Test new products/services for reliability.</li> <li>Maintain the reliability of new products/services.</li> </ul>
IT 03	Demonstrate the use of cross-functional teams in achieving IT project goals.	1. Summarize the importance of cross-functional teams in achieving IT project goals.	<ul style="list-style-type: none"> <li>Consider the benefits of using a cross-functional team in policy and procedure development.</li> <li>Identify desired group and team behavior in an IT context.</li> <li>Explain technical concepts to various audiences in non-technical terms.</li> <li>Describe strategies for maximizing productivity in a high tech environment.</li> </ul>
IT 04	Demonstrate positive cyber citizenry by applying industry accepted ethical practices and behaviors.	1. Explain legal issues faced by IT professionals.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of the legal issues that face IT professionals.</li> <li>Identify issues and trends affecting computers and information privacy.</li> <li>Explain legal issues involved in a company security policy.</li> <li>Identify legal issues involved concerning a security breach.</li> <li>Summarize the rights and responsibilities of IT workers.</li> <li>Identify ethical issues common to the IT field.</li> </ul>



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IT 	Standard	Performance Elements	Sample Indicators
IT 05	Explain the implications of IT on business development.	1. Demonstrate understanding of the impact of IT on businesses.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of how both PCs and larger computer systems impact people and are used in business/industry/government and other institutions.</li> <li>• Demonstrate knowledge of the impact of computers on career pathways in business/industry (e.g., how computers have eliminated and created jobs).</li> <li>• Demonstrate knowledge of the impact of computers on access to information and information exchange worldwide.</li> <li>• Demonstrate knowledge of ethical issues that have surfaced in the information age.</li> </ul>
IT 06	Describe trends in emerging and evolving computer technologies and their influence on IT practices.	1. Identify new IT technologies.	<ul style="list-style-type: none"> <li>• Identify new technologies relevant to information technology.</li> <li>• Assess the importance of new technologies to future developments and to future knowledge worker productivity.</li> <li>• Identify new and emerging drivers and inhibitors of information technology change.</li> <li>• Assess the potential importance and impact of new IT technologies in the future.</li> </ul>
IT 07	Perform standard computer backup and restore procedures to protect IT information.	1. Explain the need for regular backup procedures.	<ul style="list-style-type: none"> <li>• Recognize the need for regular backup procedures.</li> </ul>
		2. Configure, perform and maintain backup procedures.	<ul style="list-style-type: none"> <li>• Load backup software.</li> <li>• Load compression drive backup software.</li> <li>• Install surge suppression protection.</li> <li>• Identify battery backup equipment.</li> <li>• Maintain battery backup system.</li> <li>• Identify hot and warm site backup concepts.</li> </ul>
IT 08	Recognize and analyze potential IT security threats to develop and maintain security requirements.	1. Assess security threats.	<ul style="list-style-type: none"> <li>• Describe potential security threats to information systems.</li> <li>• Identify the range of security needs and the problems that can occur due to security lapses.</li> <li>• Maximize threat reduction.</li> <li>• Assess exposure to security issues.</li> <li>• Implement countermeasures.</li> <li>• Ensure compliance with security rules, regulations and codes.</li> <li>• Demonstrate knowledge of virus protection strategy.</li> <li>• Implement security procedures in accordance with business ethics.</li> <li>• Develop plans to address secure threats.</li> <li>• Document security procedures.</li> </ul>



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IT 	Standard	Performance Elements	Sample Indicators
		2. Implement plans to address security procedures.	<ul style="list-style-type: none"> <li>• Maintain confidentiality.</li> <li>• Load virus detection and protection software.</li> <li>• Identify sources of virus infections.</li> <li>• Remove viruses.</li> <li>• Report viruses in compliance with company standards.</li> <li>• Implement backup and recovery procedures.</li> <li>• Follow disaster plan.</li> <li>• Provide for user authentication and restricted access (e.g., assign passwords, access level).</li> </ul>
IT 09	Describe quality assurance practices and methods employed in producing and providing quality IT products and services.	1. Explain the history and standards of key quality management initiatives.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the historical evolution of quality assurance/total quality management (e.g., Deming, ISO 9000).</li> <li>• Demonstrate knowledge of changes brought about by quality leaders in the world.</li> <li>• Demonstrate knowledge of the ISO 9000 process.</li> <li>• Demonstrate knowledge of the standards/requirements for the Baldrige award.</li> <li>• Demonstrate knowledge of successful efforts by industry to improve quality and/or reduce costs.</li> </ul>
		2. Summarize the elements of a quality management system.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the control devices used in functional areas (e.g., SPC, equipment).</li> <li>• Demonstrate knowledge of the relationship among organizational structures, policies, procedures and quality assurance.</li> <li>• Identify internal and external customers.</li> <li>• Differentiate between prevention and detection.</li> <li>• Differentiate between variable and attribute data.</li> <li>• Identify types of control charts.</li> <li>• Demonstrate knowledge of how statistical techniques are used to control quality (e.g., SPC, DOE, CR).</li> </ul>
		3. Explain the terminology, role and benefits of quality within an organization.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of quality management terminology.</li> <li>• Identify the role of quality within the organization.</li> <li>• Identify the features and benefits of quality planning.</li> </ul>



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IT 	Standard	Performance Elements	Sample Indicators
IT 10	Describe the use of computer forensics to prevent and solve information technology crimes and security breaches.	1. Describe the role of computer forensic investigators.	<ul style="list-style-type: none"> <li>Define computer forensics.</li> <li>List some of the basic skills and knowledge a computer forensics specialist should possess.</li> <li>Identify the circumstances under which computer forensics evidence is typically used, who typically uses such evidence and how it is used.</li> </ul>
		2. Demonstrate the effective use of basic computer applications relating to forensics investigations	<ul style="list-style-type: none"> <li>Identify and attempt to retrieve possible evidence that may exist on a computer system.</li> <li>List what should and should not be done with the computer and evidence during an investigation.</li> </ul>
		3. Identify criminal activity in relationship to cybercrime, the Internet and Internet trafficking.	<ul style="list-style-type: none"> <li>List common internet crimes.</li> <li>List some prevention actions related to cybercrime.</li> <li>Describe techniques to identify criminal activity.</li> <li>Identify how one files a complaint if a cybercrime is suspected or has occurred.</li> </ul>
IT 11	Demonstrate knowledge of the hardware components associated with information systems.	1. (none available at this time)	<ul style="list-style-type: none"> <li>No Sample Indicators.</li> </ul>
IT 12	Compare key functions and applications of software and determine maintenance strategies for computer systems.	1. (none available at this time)	<ul style="list-style-type: none"> <li>No Sample Indicators.</li> </ul>



**Cybersecurity Career Pathway (IT-NET)**

<p>IT-NET</p> 	Standard	Performance Elements	Sample Indicators
<p>IT-NET 1</p>	<p>Analyze customer or organizational network system needs and requirements.</p>	<p>1. Conduct needs analysis.</p>	<ul style="list-style-type: none"> <li>• Collect information on system objectives from users.</li> <li>• Develop workflow analysis to determine user needs.</li> <li>• Analyze existing procedures.</li> <li>• Define business objectives to be achieved by the application.</li> <li>• Determine necessary user applications (e.g., web access, email).</li> <li>• Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, and work flowcharts).</li> </ul>
		<p>2. Develop networking requirements specifications.</p>	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the use, structure and contents of a requirements specification document.</li> <li>• Define system and software requirements.</li> <li>• Develop informal and formal specifications.</li> <li>• Evaluate installation requirements.</li> <li>• Solve conflicting requirements.</li> <li>• Review and verify specifications with customer.</li> </ul>
		<p>3. Analyze requirements/ specifications using current IT approaches.</p>	<ul style="list-style-type: none"> <li>• Analyze facilities' bandwidth requirements.</li> <li>• Demonstrate knowledge of how to use software methodologies to analyze a real-world problem.</li> <li>• Identify site and system constraints.</li> </ul>
		<p>4. Collect data to identify customer/organizational requirements.</p>	<ul style="list-style-type: none"> <li>• Identify customer/stakeholders.</li> <li>• Develop functional requirements/specifications for high-level systems.</li> <li>• Identify security requirements.</li> <li>• Identify time, technology and resource constraints.</li> <li>• Identify physical requirements for system implementation.</li> <li>• Identify system requirements for various types of installations.</li> <li>• Identify new application requirements within the system.</li> <li>• Identify environment requirements, conditions and limitations.</li> <li>• Determine required service level.</li> <li>• Collect information using interviewing strategies.</li> <li>• Identify input and output requirements.</li> <li>• Develop specifications using questioning techniques.</li> <li>• Identify hardware, networking and software system functional requirements.</li> <li>• Demonstrate knowledge of nonfunctional requirements (e.g., integrity response time, reliability, support and documentation).</li> </ul>
<p>IT-NET 2</p>	<p>Analyze wired and wireless network systems</p>	<p>1. Analyze the computer site environment.</p>	<ul style="list-style-type: none"> <li>• Identify power and power supplies.</li> <li>• Define power conversion.</li> <li>• Identify structural capacities and electrical wiring codes.</li> </ul>



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IT-NET 	Standard	Performance Elements	Sample Indicators
	to determine if they meet specifications (e.g., IEEE, power, security).		<ul style="list-style-type: none"> <li>Analyze facilities' capacity planning.</li> <li>Evaluate the potential effects of emerging technologies on information system software/hardware.</li> </ul>
		2. Analyze network security systems.	<ul style="list-style-type: none"> <li>Identify security requirements and the need for data protection.</li> <li>Identify specific access levels that need to be accommodated.</li> <li>Match security system design to identified security requirements.</li> <li>Develop security plan.</li> </ul>
		3. Evaluate the correctness and effectiveness of implementing the network system.	<ul style="list-style-type: none"> <li>Employ the use of prototyping to evaluate network system functionality.</li> <li>Identify problems.</li> <li>Recommend new features or enhancements to network system.</li> </ul>
IT-NET 3	Design a network system using technologies, tools and standards.	1. Demonstrate knowledge of the basics of network architecture.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of the characteristics and uses of network components.</li> <li>Differentiate between a physical and logical topology.</li> <li>Demonstrate a basic knowledge of OSI modeling.</li> <li>Demonstrate knowledge of LAN transmission protocols, methods and standards.</li> <li>Demonstrate knowledge of various frame types and formats.</li> <li>Differentiate processes, services and protocols.</li> </ul>
		2. Demonstrate knowledge of basic network classifications and topologies.	<ul style="list-style-type: none"> <li>Differentiate between LANs and WANs.</li> <li>Differentiate between point-to-point and point-to-multipoint network topologies.</li> <li>Demonstrate knowledge of packet-switching techniques.</li> <li>Identify basic physical and logical topologies.</li> <li>Demonstrate knowledge of characteristics of connection-oriented and connectionless networks.</li> <li>Identify emerging networks.</li> <li>Investigate emerging technologies.</li> <li>Demonstrate knowledge of electronic communications.</li> <li>Demonstrate knowledge of basic telephony.</li> <li>Demonstrate knowledge of Voice over IP (VoIP) concepts.</li> <li>Explain convergence issues, including codec choice, jitter, wander and connecting analog telephone adapter equipment.</li> <li>Describe common VoIP protocols, including Session Initiation Protocol (SIP), H.323 and Megaco/H.248.</li> <li>Explain the benefits of implementing convergence.</li> </ul>
		3. Implement common network computing platforms.	<ul style="list-style-type: none"> <li>Identify how the four components of a network operating system support network operations.</li> <li>Select a LAN/WAN technology that meets defined set of requirements.</li> </ul>



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IT-NET 	Standard	Performance Elements	Sample Indicators
		4. Implement appropriate LAN physical media.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the reasons for installing a network.</li> <li>• Demonstrate knowledge of local-area network (LAN) trends and issues.</li> <li>• Relate the evolution of networks.</li> <li>• Analyze current trends and development in LANs.</li> </ul>
		5. Characterize network connectivity basis and transmission line applications.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the principles and operation of wire and wireless systems.</li> <li>• Demonstrate knowledge of the principles and operation of fiber optics, analog and digital circuits.</li> </ul>
		6. Demonstrate knowledge of communication standards for networks.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the open system interconnection (OSI) standard (ISO Standard 7498).</li> <li>• Identify standard high-speed networks.</li> <li>• Demonstrate knowledge of the TCP/IP protocol suite.</li> </ul>
		7. Use WAN systems in network development.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the conversion of analog speech to digital.</li> <li>• Relate voice, data concepts and video to delivery of video services.</li> <li>• Select primary and backup data circuits.</li> <li>• Evaluate analog and digital transmission for cost, performance and reliability.</li> <li>• Demonstrate knowledge of firewall implementation between trusted network and WAN.</li> <li>• Configure a Virtual Private Network (VPN) to form the infrastructure of the WAN.</li> <li>• Demonstrate knowledge of interconnecting LANs using WAN services.</li> </ul>
		8. Implement network security systems.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge security requirements and the need for data protection.</li> <li>• Demonstrate the knowledge of access levels that need to be accommodated.</li> <li>• Implement security plan.</li> <li>• Demonstrate knowledge of the role that routers, firewalls, intrusion detection systems and VPNs play in security.</li> </ul>
		9. Characterize the use of Network Operating Systems.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the general characteristics of network operating systems.</li> <li>• Demonstrate knowledge of network operating systems.</li> <li>• Demonstrate knowledge about the difference between stand-alone, peer-to-peer and client-server networks and software.</li> </ul>
IT-NET 4	Perform network system installation and configuration.	1. Install a network infrastructure.	<ul style="list-style-type: none"> <li>• Evaluate installation requirements.</li> <li>• Install information system application programs in accordance with requirements.</li> <li>• Install appropriate operating system hardware and software and peripherals.</li> <li>• Identify differences between stand-alone and network applications/operating systems.</li> </ul>



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IT-NET 	Standard	Performance Elements	Sample Indicators
			<ul style="list-style-type: none"> <li>• Access needed technical information using software help facilities.</li> <li>• Install structured cabling.</li> <li>• Ensure that all multi-user aspects of the application function are operational.</li> </ul>
		2. Configure and install a network operating system.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of network operating system to configure.</li> <li>• Load software with minimum disruption of process flow.</li> <li>• Resolve compatibility issues.</li> <li>• Convert data between different software packages and between software and the OS version.</li> <li>• Import/export data between different software packages.</li> <li>• Configure software appropriately for system and user application.</li> <li>• Add capability to a software system by recording macros and storing them in the system's library.</li> <li>• Customize a general-purpose software package (e.g., DBMS) to provide specific functionality beyond the default setting.</li> <li>• Assemble necessary components to complement information system design.</li> <li>• Install LAN Management software.</li> </ul>
IT-NET 5	Perform network administration, monitoring and support to maintain a network system.	1. Monitor network performance including information management and infrastructure.	<ul style="list-style-type: none"> <li>• Support network operating center (NOC).</li> <li>• Monitor system status and performance.</li> <li>• Conduct post-implementation evaluation.</li> <li>• Identify abnormal system performance.</li> <li>• Create a baseline of system/network performance.</li> <li>• Identify required service level.</li> <li>• Identify system alerts.</li> <li>• Identify security problems.</li> <li>• Identify environmental problems.</li> <li>• Perform remote monitoring.</li> </ul>
		2. Demonstrate knowledge of disaster recovery and business continuance.	<ul style="list-style-type: none"> <li>• Differentiate between disaster recovery and business continuance.</li> <li>• Identify the steps in a disaster recovery plan and a business resumption plan.</li> <li>• Identify methods for avoiding common computer system disasters.</li> <li>• Identify common backup devices.</li> <li>• Identify the criteria for selecting a backup system.</li> <li>• Compare/contrast streaming file-by-file backup systems.</li> <li>• Establish process for archiving files.</li> <li>• Develop a disaster recovery plan.</li> <li>• Develop a business resumption plan.</li> <li>• Conduct backup of system.</li> </ul>



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IT-NET 	Standard	Performance Elements	Sample Indicators
			<ul style="list-style-type: none"> <li>• Conduct system restore.</li> </ul>
		3. Perform network system administration tasks.	<ul style="list-style-type: none"> <li>• Identify principles governing software acquisition and upgrades.</li> <li>• Manage inventory and assets.</li> <li>• Retrieve/analyze historical data for trends analysis.</li> <li>• Perform administration functions using LAN manager software.</li> <li>• Respond appropriately to system messages.</li> <li>• Choose and implement an appropriate routing protocol.</li> <li>• Develop a logical device naming convention.</li> <li>• Define traffic priorities.</li> </ul>
		4. Identify various methods of technical support used to maintain and support a network system.	<ul style="list-style-type: none"> <li>• Identify support requirements.</li> <li>• Apply information and data analysis techniques.</li> <li>• Identify skill level needs of support personnel.</li> <li>• Define scope of work to meet customer needs.</li> <li>• Identify resources and risks.</li> <li>• Evaluate present data and system configuration.</li> <li>• Formulate a support plan.</li> </ul>
		5. Perform technical support duties.	<ul style="list-style-type: none"> <li>• Respond to user questions.</li> <li>• Communicate and document technical support.</li> <li>• Perform technical functions required by customer/user.</li> <li>• Employ technical and computer tools to perform task in the most cost-effective manner.</li> <li>• Manage working relationships with customer within support boundaries.</li> <li>• Analyze the balance of resources against customer/user needs.</li> <li>• Manage multiple customer requirements.</li> <li>• Discuss and evaluate application and system development reviews.</li> </ul>
		6. Apply software upgrades, service packs and patches.	<ul style="list-style-type: none"> <li>• Analyze operational problems.</li> <li>• Install and configure Internet software packages.</li> <li>• Upgrade network system software.</li> </ul>
		7. Perform standard computer backup procedures.	<ul style="list-style-type: none"> <li>• Identify the different types of backups (differential, complete, incremental).</li> <li>• Recognize the need for regular backup procedures.</li> <li>• Develop backup process and load appropriate backup software.</li> <li>• Perform restore operation using backup software.</li> <li>• Identify battery backup equipment.</li> <li>• Maintain battery backup system.</li> <li>• Install surge suppression protection.</li> </ul>
		8. Perform network system maintenance.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the basic elements of network maintenance.</li> <li>• Identify available diagnostic tools used for system maintenance.</li> </ul>



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IT-NET 	Standard	Performance Elements	Sample Indicators
			<ul style="list-style-type: none"> <li>• Identify maintenance procedures and processes.</li> <li>• Identify problems using diagnostic tools.</li> <li>• Respond to system messages.</li> <li>• Document network system malfunction(s).</li> <li>• Fix recoverable problems.</li> <li>• Perform preventive maintenance procedures on computer and peripheral devices.</li> <li>• Restore system.</li> <li>• Identify new or replacement networking components needed.</li> <li>• Establish a preventive maintenance plan.</li> <li>• Create maintenance plan for regular integrity checks.</li> <li>• Identify maintenance procedures and processes.</li> <li>• Evaluate maintenance processes and outcomes.</li> <li>• Select most appropriate solution.</li> <li>• Implement selected solution.</li> <li>• Minimize impact of problems on productivity (e.g., minimize downtime).</li> </ul>
		9. Troubleshoot network system problems.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of basic troubleshooting steps.</li> <li>• Identify available diagnostic tools used for system maintenance.</li> <li>• Perform appropriate analysis to identify problem cause.</li> <li>• Develop resolution plan and identify possible solutions.</li> <li>• Identify and test possible solutions.</li> <li>• Identify criticality of problem.</li> <li>• Identify problems using diagnostic tools.</li> <li>• Document results and solutions.</li> </ul>
		10. Troubleshoot data communications.	<ul style="list-style-type: none"> <li>• Isolate system faults in various types of networks, cables, data modems and carrier systems.</li> <li>• Determine hardware communication faults utilizing diagnostic tools.</li> <li>• Identify network problems utilizing network management tools.</li> </ul>



**Programming Career Pathway (IT-PRG)**

 IT-PRG	Standard	Performance Elements	Sample Indicators
IT-PRG 01	Analyze customer software needs and requirements.	1. Gather data to identify customer requirements.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of nonfunctional requirements (e.g., security, integrity response time, reliability, support and documentation).</li> <li>• Clarify specifications using questioning techniques.</li> <li>• Gather information using interviewing strategies.</li> <li>• Identify input and output requirements.</li> <li>• Identify system processing requirements.</li> <li>• Identify hardware, networking and software system functional requirements.</li> </ul>
		2. Conduct needs analysis.	<ul style="list-style-type: none"> <li>• Gather information on problems from users.</li> <li>• Perform workflow analysis to determine user needs.</li> <li>• Analyze existing procedures.</li> <li>• Define business problem to be solved by the application.</li> </ul>
		3. Use available reference tools as appropriate.	<ul style="list-style-type: none"> <li>• Access needed information using company and manufacturers' references.</li> <li>• Review collected information with customer.</li> </ul>
		4. Analyze requirements/specifications using current approaches.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of how to use software methodologies to analyze a real-world problem.</li> <li>• Identify constraints.</li> <li>• Demonstrate knowledge of modeling and analyzing functional and data requirements.</li> </ul>
		5. Develop software requirements and specifications.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the use, structure and contents of a requirements specification document.</li> <li>• Define system and software requirements.</li> <li>• Define informal and formal specifications.</li> <li>• Resolve conflicting requirements.</li> <li>• Review and verify specifications with customer.</li> </ul>
IT-PRG 02	Demonstrate the use of industry standard strategies and project planning to meet customer specifications.	1. Utilize interpersonal skills necessary to work on a software development team.	<ul style="list-style-type: none"> <li>• Identify resources and risks.</li> <li>• Demonstrate knowledge of cross-functional team structures and team members' roles.</li> </ul>
		2. Define scope of work for the programming project.	<ul style="list-style-type: none"> <li>• Define scope of work to meet customer needs.</li> <li>• Demonstrate knowledge of the key functions and subsystems of the software product.</li> <li>• Demonstrate knowledge of software development process and issues.</li> <li>• Demonstrate knowledge of the system life-cycle approach.</li> </ul>
		3. Design project plan.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of project budgeting, scheduling and control issues related to software development.</li> <li>• Demonstrate knowledge of software development methodology.</li> <li>• Develop implementation plan.</li> </ul>



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IT-PRG 	Standard	Performance Elements	Sample Indicators
IT-PRG 03	Analyze system and software requirements to ensure maximum operating efficiency.	1. Identify the potential importance and impact of new IT technologies.	<ul style="list-style-type: none"> <li>Identify new technologies relevant to IT.</li> <li>Assess the importance of new technologies to future developments.</li> <li>Identify system processing requirements.</li> <li>Identify data communication trends and major current issues.</li> </ul>
		2. Assess the potential importance and impact of new IT technologies and emerging classes of software.	<ul style="list-style-type: none"> <li>Identify new and emerging classes of software and IT technologies.</li> <li>Determine compatibility of hardware and software.</li> </ul>
		3. Summarize elements and types of information processing.	<ul style="list-style-type: none"> <li>Identify the elements of the information processing cycle.</li> <li>Identify required hardware.</li> </ul>
		4. Explain measurement techniques for increased productivity due to information systems implementation.	<ul style="list-style-type: none"> <li>Identify metrics for measurements.</li> <li>Measure increases in productivity realized by the implementation of information systems.</li> <li>Identify new and emerging drivers and inhibitors of information technology change.</li> </ul>
IT-PRG 04	Demonstrate the effective use of software development tools to develop software applications.	1. Employ tools in developing software applications.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of software development environment.</li> <li>Use prototyping techniques.</li> <li>Use appropriate configuration management tools.</li> <li>Use appropriate issues tracking tools.</li> <li>Demonstrate knowledge of reuse and components.</li> </ul>
		2. Demonstrate use of computer-aided software engineering (CASE) tools.	<ul style="list-style-type: none"> <li>Use appropriate requirement analysis tools.</li> <li>Use appropriate modeling and analysis tools.</li> <li>Use requirement tracking tools.</li> <li>Demonstrate knowledge of software reuse, design pattern and components.</li> </ul>
		3. Apply language-specific programming tools/techniques.	<ul style="list-style-type: none"> <li>Develop programs using appropriate language.</li> <li>Use appropriate development environment for the selected language.</li> <li>Use user interface development tools.</li> </ul>
IT-PRG 05	Apply an appropriate software development process to design a software application.	1. Describe software development processes and methodology.	<ul style="list-style-type: none"> <li>Identify the use of program design tools in a software development process.</li> <li>Identify roles of team members/customers in the software development process.</li> <li>Identify current information life cycle models.</li> <li>Create design specifications for a computer application.</li> <li>Describe trade-offs involved in design choices.</li> <li>Summarize the use of the principles of effective information management, information organization and information-retrieval skills when designing a software application.</li> </ul>



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IT-PRG 	Standard	Performance Elements	Sample Indicators
			<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the information system life cycle.</li> <li>• Demonstrate knowledge of system analysis issues related to design, testing, implementation and maintenance.</li> <li>• Record and analyze the process.</li> </ul>
		2. Explain computing/networking hardware and software architecture.	<ul style="list-style-type: none"> <li>• Explain the importance of performance, security and resilience of networks.</li> <li>• Describe communication protocol for exchanging information via networks.</li> <li>• Describe properties of communication protocols.</li> <li>• Describe the choice of networks based on their physical or organizational purpose and how usage and security differ between these types of networks.</li> <li>• Identify the organizational scope of different types of networks.</li> <li>• Identify the hardware required for different types of networks.</li> </ul>
IT-PRG 06	Program a computer application using the appropriate programming language.	1. Explain programming language concepts.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the hardware-software connections.</li> <li>• Demonstrate knowledge of the concepts of data and procedural representations.</li> <li>• Demonstrate knowledge of the basic principles for analyzing a programming language.</li> <li>• Demonstrate knowledge of the basics of structured, object-oriented language.</li> <li>• Demonstrate knowledge of how a programming language can support multitasking and exception-handling.</li> </ul>
		2. Summarize program development methodology.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of how to resolve program implementation issues.</li> <li>• Demonstrate knowledge of software development issues.</li> <li>• Demonstrate knowledge of code analysis issues related to design, testing, implementation and maintenance.</li> <li>• Demonstrate knowledge of how to design and implement programs in a top-down manner.</li> <li>• Demonstrate knowledge of how to translate algorithmic and modular designs to develop a program.</li> <li>• Demonstrate knowledge of structured/modular programming.</li> <li>• Demonstrate knowledge of how programming control structures are used to verify correctness.</li> <li>• Use code development tools (e.g. debugger, integrated development environments).</li> </ul>
		3. Demonstrate proficiency in developing an	<ul style="list-style-type: none"> <li>• Describe the range of languages used in software development.</li> <li>• Demonstrate knowledge of current key programming</li> </ul>



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IT-PRG 	Standard	Performance Elements	Sample Indicators
		application using an appropriate programming language.	languages and the environment in which they are used. <ul style="list-style-type: none"> <li>• Translate data structure and program design into code in an appropriate language.</li> <li>• Demonstrate knowledge of key constructs and commands specific to a language.</li> </ul>
		4. Explain basic software systems implementation.	<ul style="list-style-type: none"> <li>• Use appropriate programming language.</li> <li>• Analyze and prepare logic using program flowchart.</li> <li>• Analyze and prepare logic using at least one alternative to flowcharting, such as pseudo-coding.</li> <li>• Review design.</li> <li>• Compile and debug code.</li> <li>• Prepare code documentation.</li> <li>• Prepare unit testing plan.</li> <li>• Conduct unit testing and bug fixes.</li> </ul>
		5. Develop software requirements and/or specifications.	<ul style="list-style-type: none"> <li>• Access needed information using company and manufacturers' references.</li> <li>• Divide design specifications into logical process blocks.</li> <li>• Identify parameters.</li> <li>• Follow specifications or drawings.</li> <li>• Record process utilizing flowcharts and/or step-by-step documentation.</li> <li>• Record data.</li> </ul>
		6. Resolve problems with integration.	<ul style="list-style-type: none"> <li>• Identify unexpected results.</li> <li>• Review and revise code.</li> </ul>
IT-PRG 07	Demonstrate software testing procedures to ensure quality products.	1. Develop a software test plan.	<ul style="list-style-type: none"> <li>• Access needed information using appropriate reference materials.</li> <li>• Define test procedures.</li> <li>• Analyze requirement and design specifications.</li> <li>• Development test cases using requirements and design specification.</li> </ul>
		2. Perform testing and validation.	<ul style="list-style-type: none"> <li>• Perform integration testing.</li> <li>• Perform regression testing.</li> <li>• Help with user-acceptance test.</li> <li>• Validate user documentation.</li> <li>• Document test results.</li> <li>• Document errors discovered.</li> <li>• Perform defect tracking.</li> </ul>
		3. Develop software testing audit trails.	<ul style="list-style-type: none"> <li>• Record error correction procedures and actions.</li> <li>• Record results from error corrections and actions.</li> </ul>



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IT-PRG 	Standard	Performance Elements	Sample Indicators
IT-PRG 08	Perform quality assurance tasks as part of the software development cycle.	1. Summarize software quality assurance (QA) procedures.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of Software QA process.</li> <li>• Demonstrate knowledge of the standards/requirements for Software QA.</li> <li>• Develop team relationships to support Software QA tasks.</li> </ul>
		2. Perform software quality assurance tasks to produce a quality software product.	<ul style="list-style-type: none"> <li>• Identify standards and issues related to I/O programming and design of I/O interfaces.</li> <li>• Use customer satisfaction in determining product characteristics.</li> <li>• Recognize the relationship between dependability, functionality, ease of use, etc.</li> <li>• Conduct code walkthrough and/or inspection.</li> <li>• Follow established procedures for testing, identifying problems and tracking resolutions.</li> </ul>
IT-PRG 09	Perform software maintenance and customer support functions.	1. Analyze software technical support needs.	<ul style="list-style-type: none"> <li>• Identify maintenance and support requirements.</li> <li>• Apply information and data analysis techniques.</li> <li>• Define scope of work to meet customer support needs.</li> </ul>
		2. Perform customer service.	<ul style="list-style-type: none"> <li>• Access needed information using appropriate reference materials.</li> <li>• Provide help to first line user-support personnel to answer user questions.</li> <li>• Provide troubleshooting for software.</li> <li>• Perform system-tuning functions.</li> <li>• Diagnose problems within system.</li> <li>• Perform technical functions required by customer/user.</li> <li>• Communicate and document technical support provided.</li> </ul>
		3. Perform software maintenance activities.	<ul style="list-style-type: none"> <li>• Utilize organizational procedures to communicate and document maintenance tasks.</li> <li>• Identify and analyze problem(s).</li> <li>• Analyze and propose solutions.</li> <li>• Implement solutions in code and documentation.</li> <li>• Release software and documentation updates according to procedures.</li> </ul>



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IT-PRG 	Standard	Performance Elements	Sample Indicators
IT-PRG 10	Design, create and maintain a database.	1. Explain database development processes.	<ul style="list-style-type: none"> <li>• Identify appropriate database type based on customer requirements, availability of software and hardware resources and distribution specifications, etc.</li> <li>• Apply information and data analysis specifications to create a database model using techniques such as Entity Relationship Diagramming.</li> <li>• Analyze and normalize the developed database model looking for and resolving potential problems.</li> <li>• Analyze the security needs for the database.</li> </ul>
		2. Create, populate and maintain a database.	<ul style="list-style-type: none"> <li>• Create a database from model specifications using both program code and Graphic User Interface (GUI) processes when provided by the database software.</li> <li>• Verify that all possible security safeguards are in place.</li> <li>• Populate the database created with test data.</li> <li>• Perform database queries to analyze database functionality and diagnose problems.</li> <li>• Perform database troubleshooting and system-tuning functions.</li> <li>• Perform technical functions required by customer/user.</li> <li>• Communicate and document technical support provided.</li> <li>• Perform standard maintenance on the database.</li> <li>• Release software and documentation updates according to procedures.</li> </ul>
		3. Perform database interfacing with web applications.	<ul style="list-style-type: none"> <li>• Develop scripts and forms that permit access via websites to the database.</li> <li>• Identify and analyze potential security problems for web access to the database.</li> <li>• Propose security solutions to web-based security problems.</li> <li>• Implement solutions in code and documentation.</li> </ul>



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## Digital Design and Communications Career Pathway (IT-WD)

IT-WD 	Standard	Performance Elements	Sample Indicators
IT-WD 01	Analyze customer requirements to design and develop a Web or digital communication product.	1. Collect and evaluate data to identify customer requirements.	<ul style="list-style-type: none"> <li>Collect information using interviewing strategies.</li> <li>Analyze and determine client's needs and expected outcomes.</li> <li>Conduct feasibility analysis of data collected.</li> </ul>
		2. Collect requirements data from customers and competing web sites.	<ul style="list-style-type: none"> <li>Determine purpose of the digital communication project.</li> <li>Determine the target audience.</li> <li>Determine the digital communication elements to be used.</li> <li>Determine clients' privacy policy and expectations.</li> <li>Conduct a project analysis.</li> </ul>
		3. Participate in development of web/digital product with clients and team members.	<ul style="list-style-type: none"> <li>Manage the change control process.</li> <li>Identify and track critical milestones.</li> <li>Report project status.</li> <li>Identify optimal strategies for successful interactions with clients and team members.</li> <li>Apply for approval of a web site plan.</li> <li>Communicate technical concepts from web design to non-technical audiences.</li> </ul>
IT-WD 02	Apply the design and development process to produce user-focused Web and digital communications solutions.	1. Analyze usability and accessibility as it pertains to customer needs.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of WAI priorities.</li> <li>Demonstrate knowledge of web metrics and governance (policies and stylebooks).</li> <li>Demonstrate knowledge of cultural implications on design and deployment of digital communication products.</li> <li>Engage in user testing throughout the design and development process.</li> </ul>
IT-WD 03	Write product specifications that define the scope of work aligned to customer requirements.	1. Prepare functional specifications.	<ul style="list-style-type: none"> <li>Develop flowchart/navigational blueprints.</li> <li>Develop storyboards.</li> <li>Determine delivery platform(s).</li> <li>Design system architecture.</li> <li>Design user interface.</li> <li>Design navigational schema.</li> </ul>
		2. Prepare visual design specifications.	<ul style="list-style-type: none"> <li>Apply principles of design (color theory and schemes, proximity, alignment, repetition, web graphics, optimization, typography).</li> <li>Identify technical constraints.</li> <li>Create sample design showing placement of buttons/navigational graphics and suggested color scheme.</li> </ul>
		3. Create final project plan.	<ul style="list-style-type: none"> <li>Identify and obtain tools and resources to do the job.</li> <li>Identify and evaluate risks.</li> <li>Develop detailed task list.</li> <li>Identify critical milestones.</li> <li>Identify interdependencies.</li> </ul>



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IT-WD 	Standard	Performance Elements	Sample Indicators
		4. Define scope of work to meet customer requirements.	<ul style="list-style-type: none"> <li>• Develop a design brief.</li> <li>• Determine the target audience requirements (such as web accessibility).</li> <li>• Identify available media and content sources.</li> <li>• Develop timeline for completion.</li> <li>• Determine staffing resources, both internal and external, that are required to complete the project.</li> <li>• Develop preliminary project budget.</li> <li>• Write document with all appropriate information.</li> <li>• Obtain client approval on scope of work.</li> </ul>
IT-WD 04	Demonstrate the effective use of tools for digital communication production, development and project management.	1. Select and use appropriate software tools.	<ul style="list-style-type: none"> <li>• Demonstrate proficiency in the use of digital imaging, digital video techniques and equipment.</li> <li>• Demonstrate knowledge of available graphics, video, motion graphics, web software programs.</li> <li>• Demonstrate knowledge of available project management and collaborative tools.</li> <li>• Demonstrate knowledge of integrated development environments (such as Visual Studio, Dreamweaver, Flash, Waterproof, etc.).</li> <li>• Manipulate images, video and motion graphics.</li> <li>• Demonstrate knowledge of the basic principles of motion graphics.</li> <li>• Identify how different user agents (browsers, devices) affect the digital communication product.</li> </ul>
IT-WD 05	Develop, administer and maintain Web applications.	1. Implement functional design criteria.	<ul style="list-style-type: none"> <li>• Identify, utilize and create reusable components.</li> <li>• Create and produce content.</li> <li>• Create and refine design concepts.</li> </ul>
		2. Create product visual design.	<ul style="list-style-type: none"> <li>• Apply principles and elements of design.</li> <li>• Apply color theory to select appropriate colors.</li> <li>• Create and/or implement the look and feel of the product.</li> <li>• Create graphical images and/or video elements.</li> <li>• Apply knowledge of typography.</li> <li>• Enhance digital communication presentation using a photographic process.</li> <li>• Alter digitized images using an image manipulation program.</li> <li>• Alter digitized video using a video manipulation program.</li> <li>• Evaluate visual appeal.</li> </ul>
		3. Employ basic motion graphic programming knowledge.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of key frames and frames.</li> <li>• Demonstrate knowledge of the impact that deployment device has on design and production needs.</li> <li>• Demonstrate knowledge of animation techniques.</li> <li>• Demonstrate knowledge of motion graphic security.</li> </ul>



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IT-WD 	Standard	Performance Elements	Sample Indicators
			<ul style="list-style-type: none"> <li>Demonstrate that motion graphic meets the validation process and is compatible across multiple browsers or devices.</li> </ul>
		4. Use basic web development skills.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of HTML, XHTML and CSS.</li> <li>Demonstrate knowledge of version control and documentation.</li> <li>Demonstrate knowledge of basic web application security.</li> <li>Demonstrate that website meets the validation process and is compatible across multiple browsers and devices.</li> <li>Explain importance of web standards.</li> </ul>
		5. Summarize Internet architecture elements.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of transfer protocols (FTP, WebDav).</li> <li>Demonstrate knowledge of Internet standards bodies.</li> <li>Identify cross-platform issues.</li> <li>Keep up-to-date with new and emerging trends related to the Internet.</li> <li>Demonstrate knowledge of Web 2.0.</li> </ul>
		6. Employ basic web programming knowledge.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of the purpose of web content delivery enablers (e.g., CGI, API, SSI).</li> <li>Demonstrate knowledge of how to interface client/server.</li> <li>Demonstrate knowledge of client-side processing and its advantages/disadvantages.</li> <li>Identify security issues related to server-side processing.</li> <li>Identify standard scripting languages (e.g., JavaScript, .NET frameworks, PHP, ActiveX).</li> <li>Demonstrate knowledge of XML/XSL.</li> <li>Demonstrate knowledge of quality assurance.</li> <li>Demonstrate knowledge of the uses and advantages/disadvantages of various scripting languages.</li> <li>Demonstrate knowledge of how to use a scripting language to program a site.</li> </ul>
		7. Employ web administration skills to maintain a web application.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of how to use advanced communication protocols.</li> <li>Compare the advantages and disadvantages of running your own server vs. using a server provider.</li> <li>Identify hardware requirements for a server.</li> <li>Identify server software options.</li> <li>Evaluate server providers.</li> <li>Establish a domain name.</li> <li>Comply with TCP/IP (Transfer Control Protocol/Internet Protocol).</li> <li>Upload files to the server.</li> </ul>



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IT-WD 	Standard	Performance Elements	Sample Indicators
			<ul style="list-style-type: none"> <li>Publicize the site (e.g., submit announcements to major search engines).</li> <li>Explain the importance of ethical behaviors and legal issues.</li> <li>Collect/analyze usage statistics.</li> <li>Utilize back-up and restore software features.</li> <li>Document server environment to include specifications, passwords and software versions.</li> </ul>
IT-WD 06	Design, create and publish a digital communication product based on customer needs.	1. Produce a digital communication product as member of a development team.	<ul style="list-style-type: none"> <li>Define the role of individual team members.</li> <li>Develop a conceptual model for the digital communication project.</li> <li>Select the media elements (e.g., sound, video, graphics, text, motion graphics) to be used.</li> <li>Integrate media elements.</li> <li>Select the publication process to be used.</li> <li>Select the distribution method to be used.</li> <li>Explain the impact that publication processes and distribution methods have on product development.</li> </ul>
		2. List and employ functional design terms and criteria.	<ul style="list-style-type: none"> <li>Identify, utilize and create reusable components.</li> <li>Create and produce content.</li> <li>Create and refine design concepts.</li> </ul>
		3. Create product visual design.	<ul style="list-style-type: none"> <li>Apply principles and elements of design.</li> <li>Apply color theory to select appropriate colors.</li> <li>Create and/or implement the look and feel of the product.</li> <li>Create graphical images and video.</li> <li>Apply knowledge of typography.</li> <li>Enhance digital communication presentation using a photographic process.</li> <li>Alter digitized images using an image manipulation program.</li> <li>Alter digitized video using a video manipulation program.</li> <li>Evaluate visual appeal.</li> </ul>
		4. Acquire and produce content for a digital communication product.	<ul style="list-style-type: none"> <li>Produce or acquire graphics content.</li> <li>Produce or acquire motion graphics content.</li> <li>Produce or acquire audio content.</li> <li>Produce or acquire video content.</li> </ul>
		5. Employ web development knowledge.	<ul style="list-style-type: none"> <li>Demonstrate knowledge of the purpose of web content delivery enablers (e.g., CGI, API, and SSI).</li> <li>Demonstrate knowledge of how to interface client/server.</li> <li>Demonstrate knowledge of client-side processing and its advantages/disadvantages.</li> <li>Identify security issues related to server-side processing.</li> <li>Identify standard scripting languages (e.g., JavaScript, .NET frameworks, PHP, ActiveX).</li> </ul>



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IT-WD 	Standard	Performance Elements	Sample Indicators
			<ul style="list-style-type: none"> <li>• Demonstrate knowledge of XML/XSL.</li> <li>• Demonstrate knowledge of quality assurance.</li> <li>• Demonstrate knowledge of the uses and advantages/disadvantages of various scripting languages.</li> <li>• Demonstrate knowledge of how to use a scripting language to program a site.</li> </ul>
		6. Employ web programming knowledge.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of key frames and frames.</li> <li>• Demonstrate knowledge of the impact deployment device has on design and production needs.</li> <li>• Demonstrate knowledge of animation techniques.</li> <li>• Demonstrate knowledge of motion graphic security.</li> <li>• Demonstrate that motion graphic meets the validation process and is compatible across multiple browsers or devices.</li> </ul>
		7. Employ basic motion graphic programming knowledge.	<ul style="list-style-type: none"> <li>• Integrate the use of photographic special effects into interactive media presentations.</li> <li>• Integrate photographically derived images with hand-drawn graphic images.</li> </ul>
		8. Describe search engine management (SEM) and search engine optimization (SEO).	<ul style="list-style-type: none"> <li>• Measure current traffic on site.</li> <li>• Determine and measure traffic sources.</li> <li>• Determine that search engines can easily index web pages.</li> <li>• Ensure code is W3C-compliant.</li> <li>• Develop and implement a legal statement, privacy statement and site map.</li> </ul>
		9. Integrate media elements.	<ul style="list-style-type: none"> <li>• Determine needed media elements for site.</li> <li>• Implement appropriate media elements for site.</li> </ul>
		10. Identify the use of Web 2.0 components of service-oriented architecture, rich internet applications and social networking on site.	<ul style="list-style-type: none"> <li>• Develop social networking policies.</li> <li>• Determine key people to develop policies.</li> <li>• Develop social networking guidelines.</li> <li>• Determine type of platform for rich internet applications for site.</li> <li>• Develop design and distribution method.</li> <li>• Determine cost of application.</li> <li>• Develop security solutions for application.</li> </ul>
IT-WD 07	Evaluate the functionality of a digital communication product using industry accepted techniques and metrics.	1. Develop a test plan for the digital communication product.	<ul style="list-style-type: none"> <li>• Perform usability tests.</li> <li>• Assess product effectiveness.</li> <li>• Test product for reliability.</li> <li>• Plan and coordinate customer acceptance testing.</li> </ul>
		2. Implement a test plan and resolution process for product problems for the digital communication product.	<ul style="list-style-type: none"> <li>• Define the problem.</li> <li>• Identify/test possible solutions.</li> <li>• Develop resolution plan.</li> <li>• Implement solution.</li> <li>• Evaluate problem-solving processes and outcomes.</li> </ul>



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IT-WD 	Standard	Performance Elements	Sample Indicators
IT-WD 08	Implement quality assurance processes to deliver quality digital communication products and services.	1. Summarize digital communication quality assurance measures.	<ul style="list-style-type: none"> <li>• Demonstrate knowledge of the quality assurance (QA) process.</li> <li>• Demonstrate knowledge of the standards/requirements for QA.</li> <li>• Develop team relationships to support quality assurance tasks.</li> </ul>
		2. Perform quality assurance tasks to produce a quality product.	<ul style="list-style-type: none"> <li>• Use customer satisfaction in determining product characteristics (e.g., cost, user-friendliness).</li> <li>• Recognize the relationship between dependability, functionality, ease of use, etc.</li> <li>• Follow established procedures for testing, identifying problems and tracking resolutions.</li> </ul>
IT-WD 09	Perform maintenance and customer support functions for digital communication products.	1. Analyze software technical support needs.	<ul style="list-style-type: none"> <li>• Identify maintenance and support requirements.</li> <li>• Apply information and data analysis techniques.</li> <li>• Define scope of work to meet customer support needs.</li> </ul>
		2. Employ customer service techniques and strategies.	<ul style="list-style-type: none"> <li>• Access needed information using appropriate reference materials.</li> <li>• Provide help to first line user-support personnel to answer user questions.</li> <li>• Provide troubleshooting for digital communication products.</li> <li>• Provide troubleshooting for hardware.</li> <li>• Perform system-tuning function.</li> <li>• Diagnose problems within system.</li> <li>• Perform technical functions required by customer/user.</li> <li>• Communicate and document technical support provided.</li> </ul>
		3. Perform product maintenance activities.	<ul style="list-style-type: none"> <li>• Follow organizational procedures in communication and document maintenance tasks.</li> <li>• Identify and analyze problem.</li> <li>• Analyze and propose solutions.</li> <li>• Implement solutions in code and documentation.</li> <li>• Release software and documentation updates according to procedures.</li> </ul>



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IT-WD 	Standard	Performance Elements	Sample Indicators
IT-WD 10	Comply with intellectual property laws, copyright laws and ethical practices when creating Web/digital communications.	1. Explain the concept of intellectual property.	<ul style="list-style-type: none"> <li>• Identify and discuss appropriate state intellectual property laws.</li> <li>• Identify and discuss national intellectual property laws.</li> <li>• Identify any intellectual property issues in created web pages.</li> </ul>
		2. Differentiate between copyright and trademarks.	<ul style="list-style-type: none"> <li>• Discuss the difference between copyright and trademarks.</li> <li>• Discuss any copyright issues in web page being designed and how they will be managed.</li> <li>• Discuss any trademark issues in web page being designed and how they will be managed.</li> </ul>
		3. Describe the function of a non-disclosure agreement (NDA).	<ul style="list-style-type: none"> <li>• Discuss what a non-disclosure agreement (NDA) is.</li> <li>• Identify who will be included in the NDA for the developed web page(s).</li> <li>• Identify and discuss what will be included in the NDA.</li> <li>• Determine the length of time the agreement will be in effect.</li> </ul>