Information Technology Career Cluster

1. Demonstrate effective professional communication skills and practices that enable positive customer relationships.

IT 1.1: Explain Demonstrate knowledge of organization's offerings and of customers' importance to the organization.

Sample Indicators:

- *Identify organization's products and services (including own strengths as an agent of the company).*
- *Recognize the importance of all customers to the business.*

2. Use product or service design processes and guidelines to produce a quality information technology (IT) product or service.

IT 2.1: Summarize the process of IT product/service design.

Sample Indicators:

- *Test products for reliability.*
- *Initiate predictive maintenance procedures.*
- *Document a Quality Assurance (QA) program (includes creating a plan and evaluating effectiveness of the program).*

IT 2.2: Identify and implement new products/services.

Sample Indicators:

- *Plan for products/services using reliability factors.*
- *Create products/services using reliability factors.*
- *Test new products/services for reliability.*
- *Maintain the reliability of new products/services.*

3. Demonstrate the use of cross-functional teams in achieving IT project goals.

IT 3.1: Summarize the importance of cross-functional teams in achieving IT project goals.

Sample Indicators:

- *Consider the benefits of using a cross-functional team in policy and procedure development.*
- *Identify desired group and team behavior in an IT context.*
- *Explain technical concepts to various audiences in non-technical terms.*
- *Describe strategies for maximizing productivity in a high tech environment.*

4. Demonstrate positive cyber citizenry by applying industry accepted ethical practices and behaviors.

IT 4.1: Explain legal issues faced by IT professionals.
Sample Indicators:

- *Demonstrate knowledge of the legal issues that face IT professionals.*
- *Identify issues and trends affecting computers and information privacy.*
- *Explain legal issues involved in a company security policy.*
- *Identify legal issues involved concerning a security breach.*
- *Summarize the rights and responsibilities of IT workers.*
- *Identify ethical issues common to the IT field.*

5. Explain the implications of IT on business development.

IT 5.1: Demonstrate understanding of the impact of IT on businesses.
Sample Indicators:

- *Demonstrate knowledge of how both PCs and larger computer systems impact people and are used in business/industry/government and other institutions.*
- *Demonstrate knowledge of the impact of computers on career pathways in business/industry (e.g., how computers have eliminated and created jobs).*
- *Demonstrate knowledge of the impact of computers on access to information and information exchange worldwide.*
- *Demonstrate knowledge of ethical issues that have surfaced in the information age.*

6. Describe trends in emerging and evolving computer technologies and their influence on IT practices.

IT 6.1: Identify new IT technologies.
Sample Indicators:

- *Identify new technologies relevant to information technology.*
- *Assess the importance of new technologies to future developments and to future knowledge worker productivity.*
- *Identify new and emerging drivers and inhibitors of information technology change.*
- *Assess the potential importance and impact of new IT technologies in the future.*

7. Perform standard computer backup and restore procedures to protect IT information.

IT 7.1: Explain the need for regular backup procedures.
Sample Indicators:

- *Recognize the need for regular backup procedures.*

IT 7.1: Configure, perform and maintain backup procedures.
Sample Indicators:

- *Load backup software.*
- *Load compression drive backup software.*
- *Install surge suppression protection.*
- *Identify battery backup equipment.*
- *Maintain battery backup system.*
- *Identify hot and warm site backup concepts.*

8. Recognize and analyze potential IT security threats to develop and maintain security requirements.

IT 8.1: Assess security threats.
Sample Indicators:

- *Describe potential security threats to information systems*
- *Identify the range of security needs and the problems that can occur due to security lapses.*
- *Maximize threat reduction.*
- *Assess exposure to security issues.*
- *Implement countermeasures.*
- *Ensure compliance with security rules, regulations, and codes.*
- *Demonstrate knowledge of virus protection strategy.*
- *Implement security procedures in accordance with business ethics.*
- *Develop plans to address secure threats.*
- *Document security procedures.*

IT 8.2: Implement plans to address security procedures.
Sample Indicators:

- *Maintain confidentiality.*
- *Load virus detection and protection software.*
- *Identify sources of virus infections.*
- *Remove viruses.*
- *Report viruses in compliance with company standards.*
- *Implement backup and recovery procedures.*
- *Follow disaster plan.*
- *Provide for user authentication and restricted access (e.g., assign passwords, access level).*

9. Describe quality assurance practices and methods employed in producing and providing quality IT products and services.

IT 9.1: Explain the history and standards of key quality management initiatives.
Sample Indicators:

- *Demonstrate knowledge of the historical evolution of quality assurance/total quality management (e.g., Deming, ISO 9000).*
- *Demonstrate knowledge of changes brought about by quality leaders in the world.*
- *Demonstrate knowledge of the ISO 9000 process.*
- *Demonstrate knowledge of the standards/requirements for the Baldridge award.*
- *Demonstrate knowledge of successful efforts by industry to improve quality and/or reduce costs.*

IT 9.2: Summarize the elements of a quality management system.
Sample Indicators:

- *Demonstrate knowledge of the control devices used in functional areas (e.g., SPC, equipment).*
- *Demonstrate knowledge of the relationship among organizational structures, policies, procedures, and quality assurance.*
- *Identify internal and external customers.*
- *Differentiate between prevention and detection.*
- *Differentiate between variable and attribute data.*
- *Identify types of control charts.*
- *Demonstrate knowledge of how statistical techniques are used to control quality (e.g., SPC, DOE, CR).*

IT 9.3: Explain the terminology, role, and benefits of quality within an organization.
Sample Indicators:

- *Demonstrate knowledge of quality management terminology.*
- *Identify the role of quality within the organization.*
- *Identify the features and benefits of quality planning.*

10. Describe the use of computer forensics to prevent and solve information technology crimes and security breaches.

IT 10.1: Describe the role of computer forensic investigators.
Sample Indicators:

- *Define computer forensics.*
- *List some of the basic skills and knowledge a computer forensics specialist should possess.*
- *Identify the circumstances under which computer forensics evidence is typically used, who typically uses such evidence and how it is used.*

IT 10.2: Demonstrate the effective use of basic computer applications relating to forensics investigations
Sample Indicators:

- *Identify and attempt to retrieve possible evidence that may exist on a computer system.*
- *List what should and should not be done with the computer and evidence during an investigation.*

IT 10.3: Identify criminal activity in relationship to cyber crime, the Internet, and Internet trafficking.
Sample Indicators:

- *List common internet crimes.*
- *List some prevention actions related to cyber crime.*
- *Describe techniques to identify criminal activity.*
- *Identify how one files a complaint if a cyber crime is suspected or has occurred.*

11. Demonstrate knowledge of the hardware components associated with information systems.

IT 11.1: Identify criminal activity in relationship to cyber crime, the Internet, and Internet trafficking.
Sample Indicators:

- *No Sample Indicators.*

12. Demonstrate knowledge of the hardware components associated with information systems.

IT 11.2: Compare key functions and applications of software and determine maintenance strategies for computer systems.
Sample Indicators:

- *No Sample Indicators.*

Information Support & Services Career Pathways (IT-SUP)

1. Provide technology support to maintain service.

IT-SUP 1.1: Employ effective listening and questioning skills when working with client.
Sample Indicators:

- *Identify support needs.*
- *Respond to user questions.*
- *Apply information and data analysis techniques.*
- *Identify skill level needs and available resources.*
- *Define scope of work to meet customer needs.*
- *Evaluate present data and system configuration.*
- *Formulate a support plan/confirm plan with client.*

IT-SUP 1.2: Employ customer service principles/scientific method when working with consumers.

Sample Indicators:

- *Respond to user questions and question customer.*
- *Provide troubleshooting/research of hardware/software.*
- *Analyze symptoms of problem and use diagnostic skills.*
- *Perform technical functions required by customer/user.*
- *Employ appropriate hardware and software tools to perform task in the most cost-effective manner.*
- *Employ effective problem-solving skills in performing support, maintenance and/or repair.*
- *Utilize effective field note techniques in documentation of technical support provided*

IT-SUP 1.3: Evaluate and follow-up on customer service provided.
Sample Indicators:

- *When appropriate, follows up support session for evaluation.*
- *Employs evaluative tools (software/recordings) to check work.*
- *Understands steps to take to create improvement plan when needed.*
- *Communicate evaluation and feedback to customer.*

2. Manage operating systems and software applications, including maintenance of upgrades, patches and service packs.

IT-SUP 2.1: Perform configuration management activities.
Sample Indicators:

- *Demonstrate knowledge of identification and control functions.*
- *Demonstrate knowledge of version management and interface control.*
- *Select appropriate tools for configuration management.*
- *Determine standards to be applied (e.g., international, industry, military).*
- *Specify baseline and software life-cycle phases.*
- *Assess the impact of changes that affect interfaces.*

IT-SUP 2.2: Evaluate application software packages.
Sample Indicators:

- *Perform work flow analysis to determine user needs.*
- *Evaluate appropriateness of software for specific projects.*
- *Prepare a cost-benefit analysis for a software package.*
- *Document results of the software evaluation.*
- *Perform a software configuration audit.*
- *Perform a physical configuration audit.*
- *Develop a method for evaluation.*
- *Test the functionality of proposed software configuration.*

3. Apply appropriate troubleshooting techniques in resolving computer hardware, software and configuration problems.

IT-SUP 3.1: Identify the purpose of computer components (e.g. current and new technologies as they arrive).

Sample Indicators:

- *Explain the purpose of computer components and how they work together as a system.*
- *Demonstrate knowledge of the CPU (e.g., Intel, AMD, etc.) and sockets.*
- *Demonstrate knowledge of Chipsets/BIOS and their drivers.*
- *Demonstrate knowledge of motherboard/CPU (e.g., North/Southbridge, L1/L2, multi-core, bus, 32/64 bit, form-factor, slots, etc.).*
- *Demonstrate knowledge of memory modules (e.g., RIMM, Dimm, SDRAM, DDR, DDR2, etc.).*
- *Demonstrate knowledge of hard drive setup and troubleshooting.*
- *Demonstrate knowledge of hard drive technologies (e.g., IDE, EIDE, SATA, SCSI, etc.).*
- *Demonstrate knowledge of I/O ports (e.g., serial, parallel, USB, PS/2, Firewire, HDMI, etc.).*
- *Demonstrate knowledge of modem/NIC ports and troubleshooting their problems.*
- *Demonstrate knowledge of video cards and slots (e.g., VGA, XVGA, VESA, SLI, PCI ExpressX16, etc.).*
- *Demonstrate knowledge of INPUT devices (e.g., keyboard, mouse, touchpad, cameras, scanners, midis, barcode scanners, etc.).*
- *Demonstrate knowledge of OUTPUT devices (e.g., printers, CRTs, LCD monitors, network devices).*
- *Demonstrate knowledge of PDAs, phones and other portable devices and how they connect to and share data with computers.*
- *Demonstrate knowledge of power and power supplies and how associated problems can be solved.*
- *Demonstrate knowledge of peculiar features and problems of notebooks, PDAs and other portable devices.*

IT-SUP 3.2: Demonstrate knowledge to build or install computer system.

Sample Indicators:

- *Identify primary PC components and the functions of each.*
- *Demonstrate knowledge of how hardware components interact and how conflicts arise.*
- *Access needed information using manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts, device drivers).*
- *Secure supplies and resources.*
- *Demonstrate knowledge of error messages and symptoms of hardware failures.*
- *Install mainboard (with memory/CPU).*

- *Connect peripherals and expansion cards to/in mainboard.*
- *Install drives (e.g., HDD, FDD, CD, CDR) both EIDE and SATA.*
- *Employ appropriate safety precautions for the worker and hardware when working with PC.*
- *Configure hardware system.*
- *Verify system operation.*
- *Check OS operations, updates and Service Packs.*
- *Document system installation activities.*
- *Backup system and configuration.*
- *Test all applications.*
- *Restore system and configuration.*
- *Transfer system settings and files from old system to new.*

IT-SUP 3.3: Demonstrate ability to couple troubleshooting skills with hardware knowledge to solve client problems.
Sample Indicators:

- *Know startup sequence and beep codes.*
- *Identify priorities and interrupts at system level.*
- *Demonstrate ability to couple memory upgrades with motherboard (RAM chips, different types).*
- *Test system using diagnostic tools/software.*
- *Identify problems in the operating system and related hardware.*
- *Differentiate between hardware and software failure.*
- *Update flash memory (BIOS).*
- *Demonstrate hard drive maintenance procedures (defragment, scan, clear caches, etc.).*
- *Gather information on problem from user.*
- *Conduct appropriate diagnostic tests.*
- *Repair/replace malfunctioning hardware.*
- *Reinstall software as needed.*
- *Demonstrate backup and recovery.*
- *Restore system to various states (safe modes, previous date, etc.).*

4. Perform installation, configuration and maintenance of operating systems.

IT-SUP 4.1: Demonstrate knowledge of Operating System components in the building and deployment of computer systems.
Sample Indicators:

- *Identify differences between O/Ss (Windows/Linux/Mac/DOS).*
- *Demonstrate knowledge of components of O/S (explorer, Control panel, etc.).*
- *Demonstrate knowledge of startup sequence of O/Ss.*

IT-SUP 4.2: Demonstrate knowledge of Operating System components in the repair and maintenance of computer systems.
Sample Indicators:

- *Connect stations to each other and to Internet.*
- *Connect stations to peripheral devices, especially printers.*
- *Protect stations from viruses, malwares, adwares, security breaches, etc.*
- *Test integrity and drivers of all devices recognized by O/S.*
- *Recover from system errors.*
- *Upgrade from one generation of O/S to the next.*
- *Install new hardware (drives, cards, etc.) on O/S.*

5. Demonstrate the use of networking concepts to develop a network.

IT-SUP 5.1: Describe basic network classifications, topologies and network operating systems (NOS).
Sample Indicators:

- *Interpret basic networking terminology.*
- *Differentiate between LANs, MANs and WANs.*
- *Demonstrate knowledge of how to turn LANs into MANs and WANs.*
- *Identify the basic point-to-point/broadcast network topologies (e.g., routers, switches, wireless technologies, star, ring, bus, tree, network irregular).*

IT-SUP 5.2: Demonstrate the use of networking concepts in the support and maintenance of the computers on the network.
Sample Indicators:

- *Demonstrate knowledge of the characteristics and uses of network components (e.g., hub, switches, routers, wireless routers, firewall).*
- *Differentiate between a physical and logical topology.*
- *Demonstrate knowledge of LAN transmission methods, standards and protocols.*

6. Evaluate the effectiveness of an information system.

IT-SUP 6.1: Initiate a system project.
Sample Indicators:

- *Identify the phases in a system project.*
- *Select basic fact-gathering techniques to be used.*
- *Define the scope of the systems project.*
- *Conduct a preliminary investigation.*

IT-SUP 6.1: Evaluate applications within the information system.
Sample Indicators:

- *Design a framework for evaluating information system functions.*

- *Design a framework for evaluating individual applications.*
- *Recommend new features or enhancements to existing tools.*

7. Employ system installation and maintenance skills to set-up and maintain an information system.

IT-SUP 7.1: Describe the life cycle of an information system.
Sample Indicators:

- *Research the concept of information system life cycles.*

IT-SUP 7.2: Manage backup and recovery, both on- and off-site.
Sample Indicators:

- *Implement backup procedures in accordance with a regular schedule.*
- *Implement recovery procedures as needed.*

IT-SUP 7.3: Troubleshoot problems.
Sample Indicators:

- *Demonstrate knowledge of basic troubleshooting steps.*
- *Minimize impact of problems on productivity (e.g., minimize downtime).*

IT-SUP 7.4: Evaluate problem-solving processes and outcomes.
Sample Indicators:

- *Evaluate problem-solving outcomes to determine whether the problem was solved as intended.*
- *Evaluate whether the process was applied in an efficient and responsible manner.*
- *Assess the validity and usefulness of the outcomes.*
- *Determine needed follow-up actions.*

8. Employ system administration and control skills to monitor the performance of an information system.

IT-SUP 8.1: Perform general system administration tasks.
Sample Indicators:

- *Facilitate the delivery of technical services.*
- *Set up/maintain user accounts on multiple systems.*
- ** Participate in the evaluation, analysis, and recommendation of technical computing products.*
- *Document performance problems.*
- *Prepare required reports.*

- *Maintain technical industry knowledge.*

9. Employ technical writing and documentation skills in support of an information system.

IT-SUP 9.1: Employ sound technical writing skills including keyboarding and handwriting.
Sample Indicators:

- *Define/prioritize communication needs.*
- *Specify project objectives.*
- *Determine the size and specifics of the work to be completed.*
- *Estimate time, materials, and capabilities needed to complete assignment.*
- *Evaluate strengths and weaknesses of completed project.*

IT-SUP 9.2: Employ technical research to both evaluate applications and systems as well as find drivers and solutions.
Sample Indicators:

- *Identify target audience.*
- *Define research questions.*
- *Determine priorities for the information that should be gathered.*
- *Identify potential sources of information.*
- *Target audience/user group as a key information source.*
- *Identify subject-matter experts.*
- *Evaluate potential sources of information based on established criteria (e.g., affordability, relevance).*
- *Conduct interviews with selected human information sources.*
- *Gather information from selected print and electronic sources.*
- *Determine the accuracy and completeness of the information gathered.*

IT-SUP 9.3: Design technical documentation.
Sample Indicators:

- *Define purpose of documentation.*
- *Specify standards for documentation, including critical success criteria.*
- *Identify delivery options.*
- *Evaluate cost-effectiveness of each delivery option.*
- *Select tools appropriate for task purpose.*
- *Plan information flow.*
- *Select writing style and tone appropriate for given documentation.*
- *Determine level of detail needed.*
- *Identify visuals appropriate for given documentation.*
- *Provide feedback on design to development team/individual.*

IT-SUP 9.4: Write technical reports and effective field notes.

Sample Indicators:

- *Determine audience of product.*
- *Access needed information using standard references and sources.*
- *Identify type of report needed.*
- *Compile relevant data.*
- *Analyze data.*
- *Organize data into charts and graphs.*
- *Draw conclusions from data analysis.*
- *Outline report.*
- *Draft report.*
- *Edit report (e.g., check spelling, grammar, punctuation, sentence structure, accuracy of content).*
- *Review report with peers.*
- *Revise report as needed based on peer feedback.*
- *Proofread revised report.*
- *Present reports*

10. . Apply quality assurance processes to maximize information system operation.

IT-SUP 10.1: Evaluate tools for quality characteristics.
Sample Indicators:

- *Demonstrate knowledge of the characteristics and functions of available quality tools.*
- *Select quality tool(s) appropriate to situation.*

IT-SUP 10.2: Apply quality cost implications to a project.
Sample Indicators:

- *Establish cost/quality objectives.*
- *Classify costs (e.g., direct and indirect, fixed and variable, methods and standards).*
- *Classify quality costs (e.g., prevention, evaluation, pre-delivery failure, post-delivery failure).*
- *Interpret quality cost reports.*
- *Establish guidelines for liability prevention.*
- *Identify safety terms of product.*
- *Identify safety responsibility within organization.*

Network Systems Career Pathways (IT-NET)

1. Analyze customer or organizational network system needs and requirements.

IT-NET 1.1: Conduct needs analysis.
Sample Indicators:

- *Collect information on system objectives from users.*

- *Develop workflow analysis to determine user needs.*
- *Analyze existing procedures.*
- *Define business objectives to be achieved by the application.*
- *Determine necessary user applications (e.g., web access, email).*
- *Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts).*

IT-NET 1.2: Develop networking requirements specifications.
Sample Indicators:

- *Demonstrate knowledge of the use, structure, and contents of a requirements specification document.*
- *Define system and software requirements.*
- *Develop informal and formal specifications.*
- *Evaluate installation requirements.*
- *Solve conflicting requirements.*
- *Review and verify specifications with customer.*

IT-NET 1.3: Analyze requirements/specifications using current IT approaches.
Sample Indicators:

- *Analyze facilities' bandwidth requirements.*
- *Demonstrate knowledge of how to use software methodologies to analyze a real-world problem.*
- *Identify site and system constraints.*

IT-NET 1.4: Collect data to identify customer/organizational requirements.
Sample Indicators:

- *Identify customer/stakeholders.*
- *Develop functional requirements/specifications for high-level systems.*
- *Identify security requirements.*
- *Identify time, technology, and resource constraints.*
- *Identify physical requirements for system implementation.*
- *Identify system requirements for various types of installations.*
- *Identify new application requirements within the system.*
- *Identify environment requirements, conditions, and limitations.*
- *Determine required service level.*
- *Collect information using interviewing strategies.*
- *Identify input and output requirements.*
- *Develop specifications using questioning techniques.*
- *Identify hardware, networking, and software system functional requirements.*
- *Demonstrate knowledge of nonfunctional requirements (e.g., integrity response time, reliability, support, and documentation).*

2. Analyze wired and wireless network systems to determine if they meet specifications (e.g., IEEE, power, security)

IT-NET 2.1: Analyze the computer site environment.
Sample Indicators:

- *Identify power and power supplies.*
- *Define power conversion.*
- *Identify structural capacities and electrical wiring codes.*
- *Analyze facilities' capacity planning.*
- *Evaluate the potential effects of emerging technologies on information system software/hardware.*

IT-NET 2.2: Analyze network security systems.
Sample Indicators:

- *Identify security requirements and the need for data protection.*
- *Identify specific access levels that need to be accommodated.*
- *Match security system design to identified security requirements.*
- *Develop security plan.*

IT-NET 2.3: Evaluate the correctness and effectiveness of implementing the network system.
Sample Indicators:

- *Employ the use of prototyping to evaluate network system functionality.*
- *Identify problems.*
- *Recommend new features or enhancements to network system.*

3. Design a network system using technologies, tools and standards.

IT-NET 3.1: Demonstrate knowledge of the basics of network architecture.
Sample Indicators:

- *Demonstrate knowledge of the characteristics and uses of network components.*
- *Differentiate between a physical and logical topology.*
- *Demonstrate a basic knowledge of OSI modeling.*
- *Demonstrate knowledge of LAN transmission protocols, methods, and standards.*
- *Demonstrate knowledge of various frame types and formats.*
- *Differentiate processes, services, and protocols.*

IT-NET 3.2: Demonstrate knowledge of basic network classifications and topologies.
Sample Indicators:

- *Differentiate between LANs and WANs.*
- *Differentiate between point-to-point and point-to-multipoint network topologies.*
- *Demonstrate knowledge of packet-switching techniques.*

- *Identify basic physical and logical topologies.*
- *Demonstrate knowledge of characteristics of connection-oriented and connectionless networks.*
- *Identify emerging networks.*
- *Investigate emerging technologies.*
- *Demonstrate knowledge of electronic communications.*
- *Demonstrate knowledge of basic telephony.*
- *Demonstrate knowledge of Voice over IP (VoIP) concepts.*
- *Explain convergence issues, including codec choice, jitter, wander, and connecting analog telephone adapter equipment.*
- *Describe common VoIP protocols, including Session Initiation Protocol (SIP), H.323, and Megaco/H.248.*
- *Explain the benefits of implementing convergence.*

IT-NET 3.3: Implement common network computing platforms.
Sample Indicators:

- *Identify how the four components of a network operating system support network operations.*
- *Select a LAN/WAN technology that meets defined set of requirements.*

IT-NET 3.4: Implement appropriate LAN physical media.
Sample Indicators:

- *Demonstrate knowledge of the reasons for installing a network.*
- *Demonstrate knowledge of local-area network (LAN) trends and issues.*
- *Relate the evolution of networks.*
- *Analyze current trends and development in LANs.*

IT-NET 3.5: Characterize network connectivity basis and transmission line applications.
Sample Indicators:

- *Demonstrate knowledge of the principles and operation of wire and wireless systems.*
- *Demonstrate knowledge of the principles and operation of fiber optics, analog and digital circuits.*

IT-NET 3.6: Demonstrate knowledge of communication standards for networks.
Sample Indicators:

- *Demonstrate knowledge of the open system interconnection (OSI) standard (ISO Standard 7498).*
- *Identify standard high-speed networks.*
- *Demonstrate knowledge of the TCP/IP protocol suite.*

IT-NET 3.7: Use WAN systems in network development.
Sample Indicators:

- *Demonstrate knowledge of the conversion of analog speech to digital.*

- *Relate voice, data concepts, and video to delivery of video services.*
- *Select primary and backup data circuits.*
- *Evaluate analog and digital transmission for cost, performance, and reliability.*
- *Demonstrate knowledge of firewall implementation between trusted network and WAN.*
- *Configure a Virtual Private Network (VPN) to form the infrastructure of the WAN.*
- *Demonstrate knowledge of interconnecting LANs using WAN services.*

IT-NET 3.8: Implement network security systems.
Sample Indicators:

- *Demonstrate knowledge security requirements and the need for data protection.*
- *Demonstrate the knowledge of access levels that need to be accommodated.*
- *Implement security plan.*
- *Demonstrate knowledge of the role that routers, firewalls, intrusion detection systems, and VPNs play in security.*

IT-NET 3.9: Characterize the use of Network Operating Systems.
Sample Indicators:

- *Demonstrate knowledge of the general characteristics of network operating systems.*
- *Demonstrate knowledge of network operating systems.*
- *Demonstrate knowledge about the difference between stand-alone, peer-to-peer, and client-server networks and software.*

4. Perform network system installation and configuration.

IT-NET 4.1: Install a network infrastructure.
Sample Indicators:

- *Evaluate installation requirements.*
- *Install information system application programs in accordance with requirements.*
- *Install appropriate operating system hardware and software and peripherals.*
- *Identify differences between stand-alone and network applications/operating systems.*
- *Access needed technical information using software help facilities.*
- *Install structured cabling.*
- *Ensure that all multi-user aspects of the application function are operational.*

IT-NET 4.2: Configure and install a network operating system.
Sample Indicators:

- *Demonstrate knowledge of network operating system to configure.*
- *Load software with minimum disruption of process flow.*
- *Resolve compatibility issues.*
- *Convert data between different software packages and between software and the OS version.*

- *Import/export data between different software packages.*
- *Configure software appropriately for system and user application.*
- *Add capability to a software system by recording macros and storing them in the system's library.*
- *Customize a general-purpose software package (e.g., DBMS) to provide specific functionality beyond the default setting.*
- *Assemble necessary components to complement information system design.*
- *Install LAN Management software.*

5. Perform network administration, monitoring and support to maintain a network system.

IT-NET 5.1: Monitor network performance including information management and infrastructure.
Sample Indicators:

- *Support network operating center (NOC).*
- *Monitor system status and performance.*
- *Conduct post-implementation evaluation.*
- *Identify abnormal system performance.*
- *Create a baseline of system/network performance.*
- *Identify required service level.*
- *Identify system alerts.*
- *Identify security problems.*
- *Identify environmental problems.*
- *Perform remote monitoring.*

IT-NET 5.2: Demonstrate knowledge of disaster recovery and business continuance.
Sample Indicators:

- *Differentiate between disaster recovery and business continuance.*
- *Identify the steps in a disaster recovery plan and a business resumption plan.*
- *Identify methods for avoiding common computer system disasters.*
- *Identify common backup devices.*
- *Identify the criteria for selecting a backup system.*
- *Compare/contrast streaming file-by-file backup systems.*
- *Establish process for archiving files.*
- *Develop a disaster recovery plan.*
- *Develop a business resumption plan.*
- *Conduct backup of system.*
- *Conduct system restore.*

IT-NET 5.3: Perform network system administration tasks.
Sample Indicators:

- *Identify principles governing software acquisition and upgrades.*

- *Manage inventory and assets.*
- *Retrieve/analyze historical data for trends analysis.*
- *Perform administration functions using LAN manager software.*
- *Respond appropriately to system messages.*
- *Choose and implement an appropriate routing protocol.*
- *Develop a logical device naming convention.*
- *Define traffic priorities.*

IT-NET 5.4: Identify various methods of technical support used to maintain and support a network system.
Sample Indicators:

- *Identify support requirements.*
- *Apply information and data analysis techniques.*
- *Identify skill level needs of support personnel.*
- *Define scope of work to meet customer needs.*
- *Identify resources and risks.*
- *Evaluate present data and system configuration.*
- *Formulate a support plan.*

IT-NET 5.5: Perform technical support duties.
Sample Indicators:

- *Respond to user questions.*
- *Communicate and document technical support provided.*
- *Perform technical functions required by customer/user.*
- *Employ technical and computer tools to perform task in the most cost-effective manner.*
- *Manage working relationships with customer within support boundaries.*
- *Analyze the balance of resources against customer/user needs.*
- *Manage multiple customer requirements.*
- *Discuss and evaluate application and system development reviews.*

IT-NET 5.6: Apply software upgrades, service packs, and patches.
Sample Indicators:

- *Analyze operational problems.*
- *Install and configure Internet software packages.*
- *Upgrade network system software.*

IT-NET 5.7: Perform standard computer backup procedures.
Sample Indicators:

- *Identify the different types of backups (differential, complete, incremental).*
- *Recognize the need for regular backup procedures.*

- *Develop backup process and load appropriate backup software.*
- *Perform restore operation using backup software.*
- *Identify battery backup equipment.*
- *Maintain battery backup system.*
- *Install surge suppression protection.*

IT-NET 5.8: Perform network system maintenance.
Sample Indicators:

- *Demonstrate knowledge of the basic elements of network maintenance.*
- *Identify available diagnostic tools used for system maintenance.*
- *Identify maintenance procedures and processes.*
- *Identify problems using diagnostic tools.*
- *Respond to system messages.*
- *Document network system malfunction(s).*
- *Fix recoverable problems.*
- *Perform preventive maintenance procedures on computer and peripheral devices.*
- *Restore system.*
- *Identify new or replacement networking components needed.*
- *Establish a preventive maintenance plan.*
- *Create maintenance plan for regular integrity checks.*
- *Identify maintenance procedures and processes.*
- *Evaluate maintenance processes and outcomes.*
- *Select most appropriate solution.*
- *Implement selected solution.*
- *Minimize impact of problems on productivity (e.g., minimize downtime).*

IT-NET 5.9: Troubleshoot network system problems.
Sample Indicators:

- *Demonstrate knowledge of basic troubleshooting steps.*
- *Identify available diagnostic tools used for system maintenance.*
- *Perform appropriate analysis to identify problem cause.*
- *Develop resolution plan and identify possible solutions.*
- *Identify and test possible solutions.*
- *Identify criticality of problem.*
- *Identify problems using diagnostic tools.*
- *Document results and solutions.*

IT-NET 5.10: Troubleshoot network system problems.
Sample Indicators:

- *Isolate system faults in various types of networks, cables, data modems, and carrier systems.*
- *Determine hardware communication faults utilizing diagnostic tools.*

- *Identify network problems utilizing network management tools.*

Programming & Software Development Career Pathways (IT-PRG)

1. Analyze customer software needs and requirements.

IT-PRG 1.1: Gather data to identify customer requirements.
Sample Indicators:
- *Demonstrate knowledge of nonfunctional requirements (e.g., security, integrity response time, reliability, support and documentation).*
- *Clarify specifications using questioning techniques.*
- *Gather information using interviewing strategies.*
- *Identify input and output requirements.*
- *Identify system processing requirements.*
- *Identify hardware, networking, and software system functional requirements.*

IT-PRG 1.2: Conduct needs analysis.
Sample Indicators:
- *Gather information on problems from users.*
- *Perform workflow analysis to determine user needs.*
- *Analyze existing procedures.*
- *Define business problem to be solved by the application.*

IT-PRG 1.3: Use available reference tools as appropriate.
Sample Indicators:
- *Access needed information using company and manufacturers' references.*
- *Review collected information with customer.*

IT-PRG 1.4: Analyze requirements/specifications using current approaches.
Sample Indicators:
- *Demonstrate knowledge of how to use software methodologies to analyze a real-world problem.*
- *Identify constraints.*
- *Demonstrate knowledge of modeling and analyzing functional and data requirements.*

IT-PRG 1.6: Develop software requirements and specifications.
Sample Indicators:
- *Demonstrate knowledge of the use, structure, and contents of a requirements specification document.*
- *Define system and software requirements.*
- *Define informal and formal specifications.*
- *Resolve conflicting requirements.*

- *Review and verify specifications with customer.*

2. Demonstrate the use of industry standard strategies and project planning to meet customer specifications.

IT-PRG 2.1: Utilize interpersonal skills necessary to work on a software development team.
Sample Indicators:

- *Identify resources and risks.*
- *Demonstrate knowledge of cross-functional team structures and team members' roles.*

IT-PRG 2.2: Define scope of work for the programming project.
Sample Indicators:

- *Define scope of work to meet customer needs.*
- *Demonstrate knowledge of the key functions and subsystems of the software product.*
- *Demonstrate knowledge of software development process and issues.*
- *Demonstrate knowledge of the system life-cycle approach.*

IT-PRG 2.3: Design project plan.
Sample Indicators:

- *Demonstrate knowledge of project budgeting, scheduling, and control issues related to software development.*
- *Demonstrate knowledge of software development methodology.*
- *Develop implementation plan.*

3. Analyze system and software requirements to ensure maximum operating efficiency.

IT-PRG 3.1: Identify the potential importance and impact of new IT technologies.
Sample Indicators:

- *Identify new technologies relevant to information technology.*
- *Assess the importance of new technologies to future developments.*
- *Identify system processing requirements.*
- *Identify data communication trends and major current issues.*

IT-PRG 3.2: Assess the potential importance and impact of new IT technologies and emerging classes of software.
Sample Indicators:

- *Identify new and emerging classes of software and IT technologies.*
- *Determine compatibility of hardware and software.*

IT-PRG 3.3: Summarize elements and types of information processing.

Sample Indicators:

- *Identify the elements of the information processing cycle.*
- *Identify required hardware.*

IT-PRG 3.4: Explain measurement techniques for increased productivity due to information systems implementation.
Sample Indicators:

- *Identify metrics for measurements.*
- *Measure increases in productivity realized by the implementation of information systems.*
- *Identify new and emerging drivers and inhibitors of information technology change.*

4. Demonstrate the effective use of software development tools to develop software applications.

IT-PRG 4.1: Employ tools in developing software applications.
Sample Indicators:

- *Demonstrate knowledge of software development environment.*
- *Use prototyping techniques.*
- *Use appropriate configuration management tools.*
- *Use appropriate issues tracking tools.*
- *Demonstrate knowledge of reuse and components.*

IT-PRG 4.2: Demonstrate use of computer-aided software engineering (CASE) tools.
Sample Indicators:

- *Use appropriate requirement analysis tools.*
- *Use appropriate modeling and analysis tools.*
- *Use requirement tracking tools.*
- *Demonstrate knowledge of software reuse, design pattern, and components.*

IT-PRG 4.3: Apply language-specific programming tools/techniques.
Sample Indicators:

- *Develop programs using appropriate language.*
- *Use appropriate development environment for the selected language.*
- *Use user interface development tools.*

5. Apply an appropriate software development process to design a software application.

IT-PRG 5.1: Describe software development processes and methodology.
Sample Indicators:

- *Identify the use of program design tools in a software development process.*
- *Identify roles of team members/customers in the software development process.*

- *Identify current information life cycle models.*
- *Create design specifications for a computer application.*
- *Describe trade-offs involved in design choices.*
- *Summarize the use of the principles of effective information management, information organization, and information-retrieval skills when designing a software application.*
- *Demonstrate knowledge of the information system life cycle.*
- *Demonstrate knowledge of system analysis issues related to design, testing, implementation, and maintenance.*
- *Record and analyze the process.*

IT-PRG 5.2: Explain computing/networking hardware and software architecture.
Sample Indicators:

- *Explain the importance of performance, security and resilience of networks.*
- *Describe communication protocol for exchanging information via networks.*
- *Describe properties of communication protocols*
- *Describe the choice of networks based on their physical or organizational purpose and how usage and security differ between these types of networks.*
- *Identify the organizational scope of different types of networks.*
- *Identify the hardware required for different types of networks.*

6. Program a computer application using the appropriate programming language.

IT-PRG 6.1: Explain programming language concepts.
Sample Indicators:

- *Demonstrate knowledge of the hardware-software connections.*
- *Demonstrate knowledge of the concepts of data and procedural representations.*
- *Demonstrate knowledge of the basic principles for analyzing a programming language.*
- *Demonstrate knowledge of the basics of structured, object-oriented language.*
- *Demonstrate knowledge of how a programming language can support multitasking and exception-handling.*

IT-PRG 6.2: Summarize program development methodology.
Sample Indicators:

- *Demonstrate knowledge of how to resolve program implementation issues.*
- *Demonstrate knowledge of software development issues.*
- *Demonstrate knowledge of code analysis issues related to design, testing, implementation, and maintenance.*
- *Demonstrate knowledge of how to design and implement programs in a top-down manner.*
- *Demonstrate knowledge of how to translate algorithmic and modular designs to develop a program.*
- *Demonstrate knowledge of structured/modular programming.*

- *Demonstrate knowledge of how programming control structures are used to verify correctness.*
- *Use code development tools (e.g. debugger, integrated development environments).*

IT-PRG 6.3: Demonstrate proficiency in developing an application using an appropriate programming language.
Sample Indicators:

- *Describe the range of languages used in software development.*
- *Demonstrate knowledge of current key programming languages and the environment in which they are used.*
- *Translate data structure and program design into code in an appropriate language.*
- *Demonstrate knowledge of key constructs and commands specific to a language.*

IT-PRG 6.4: Explain basic software systems implementation.
Sample Indicators:

- *Use appropriate programming language.*
- *Analyze and prepare logic using program flowchart.*
- *Analyze and prepare logic using at least one alternative to flowcharting, such as pseudo-coding.*
- *Review design.*
- *Compile and debug code.*
- *Prepare code documentation.*
- *Prepare unit testing plan.*
- *Conduct unit testing and bug fixes.*

IT-PRG 6.5: Develop software requirements/specifications.
Sample Indicators:

- *Access needed information using company and manufacturers' references.*
- *Divide design specifications into logical process blocks.*
- *Identify parameters.*
- *Follow specifications or drawings.*
- *Record process utilizing flowcharts and/or step-by-step documentation.*
- *Record data.*

IT-PRG 6.6: Resolve problems with integration.
Sample Indicators:

- *Identify unexpected results.*
- *Review and revise code.*

7. Demonstrate software testing procedures to ensure quality products.

IT-PRG 7.1: Develop a software test plan.
Sample Indicators:

- *Access needed information using appropriate reference materials.*
- *Define test procedures.*
- *Analyze requirement and design specifications.*
- *Development test cases using requirements and design specification.*

IT-PRG 7.2: Perform testing and validation.
Sample Indicators:

- *Perform integration testing.*
- *Perform regression testing.*
- *Help with user-acceptance test.*
- *Validate user documentation.*
- *Document test results.*
- *Document errors discovered.*
- *Perform defect tracking.*

IT-PRG 7.3: Develop software testing audit trails.
Sample Indicators:

- *Record error correction procedures and actions.*
- *Record results from error corrections and actions.*

8. Perform quality assurance tasks as part of the software development cycle.

IT-PRG 8.1: Summarize software quality assurance (QA) procedures.
Sample Indicators:

- *Demonstrate knowledge of Software QA process.*
- *Demonstrate knowledge of the standards/requirements for Software QA.*
- *Develop team relationships to support Software QA tasks.*

IT-PRG 8.2: Perform software quality assurance tasks to produce a quality software product.
Sample Indicators:

- *Identify standards and issues related to I/O programming and design of I/O interfaces.*
- *Use customer satisfaction in determining product characteristics.*
- *Recognize the relationship between dependability, functionality, ease of use, etc.*
- *Conduct code walkthrough and/or inspection.*
- *Follow established procedures for testing, identifying problems, and tracking resolutions.*

9. Perform software maintenance and customer support functions.

IT-PRG 9.1: Analyze software technical support needs.
Sample Indicators:

- *Identify maintenance and support requirements.*
- *Apply information and data analysis techniques.*
- *Define scope of work to meet customer support needs.*

IT-PRG 9.2: Perform customer service.
Sample Indicators:

- *Access needed information using appropriate reference materials.*
- *Provide help to first line user-support personnel to answer user questions.*
- *Provide troubleshooting for software.*
- *Perform system-tuning functions.*
- *Diagnose problems within system.*
- *Perform technical functions required by customer/user.*
- *Communicate and document technical support provided.*

IT-PRG 9.3: Perform software maintenance activities.
Sample Indicators:

- *Utilize organizational procedures to communicate and document maintenance tasks.*
- *Identify and analyze problem(s).*
- *Analyze and propose solutions.*
- *Implement solutions in code and documentation.*
- *Release software and documentation updates according to procedures.*

10. Design, create and maintain a database.

IT-PRG 10.1: Explain database development processes.
Sample Indicators:

- *Identify appropriate database type based on customer requirements, availability of software and hardware resources, and distribution specifications, etc.*
- *Apply information and data analysis specifications to create a database model using techniques such as Entity Relationship Diagramming.*
- *Analyze and normalize the developed database model looking for and resolving potential problems.*
- *Analyze the security needs for the database.*

IT-PRG 10.2: Create, populate, and maintain a database.
Sample Indicators:

- *Create a database from model specifications using both program code and Graphic User Interface (GUI) processes when provided by the database software.*
- *Verify that all possible security safeguards are in place.*

- *Populate the database created with test data.*
- *Perform database queries to analyze database functionality and diagnose problems.*
- *Perform database troubleshooting and system-tuning functions.*
- *Perform technical functions required by customer/user.*
- *Communicate and document technical support provided.*
- *Perform standard maintenance on the database.*
- *Release software and documentation updates according to procedures.*

IT-PRG 10.3: Perform database interfacing with web applications.
Sample Indicators:

- *Develop scripts and forms that permit access via websites to the database.*
- *Identify and analyze potential security problems for web access to the database.*
- *Propose security solutions to web-based security problems.*
- *Implement solutions in code and documentation.*

Web and Digital Communications Career Pathways (IT-WD)

1. Analyze customer requirements to design and develop a web or digital communication product.

IT-WD 1.1: Collect and evaluate data to identify customer requirements.
Sample Indicators:

- *Collect information using interviewing strategies.*
- *Analyze and determine client's needs and expected outcomes.*
- *Conduct feasibility analysis of data collected.*

IT-WD 1.2: Collect requirements data from customers and competing web sites.
Sample Indicators:

- *Determine purpose of the digital communication project.*
- *Determine the target audience.*
- *Determine the digital communication elements to be used.*
- *Determine clients' privacy policy and expectations.*
- *Conduct a project analysis.*

IT-WD 1.3: Participate in development of web/digital product with clients and team members.
Sample Indicators:

- *Manage the change control process.*
- *Identify and track critical milestones.*
- *Report project status.*
- *Identify optimal strategies for successful interactions with clients and team members.*

- *Apply for approval of a web site plan.*
- *Communicate technical concepts from web design to non-technical audiences.*

2. Apply the design and development process to produce user-focused web and digital communications solutions.

IT-WD 2.1: Analyze usability and accessibility as it pertains to customer needs.
Sample Indicators:

- *Demonstrate knowledge of WAI priorities.*
- *Demonstrate knowledge of web metrics and governance (policies and stylebooks).*
- *Demonstrate knowledge of cultural implications on design and deployment of digital communication products.*
- *Engage in user testing throughout the design and development process.*

3. Write product specifications that define the scope of work aligned to customer requirements.

IT-WD 3.1: Prepare functional specifications.
Sample Indicators:

- *Develop flowchart/navigational blueprints.*
- *Develop storyboards.*
- *Determine delivery platform(s).*
- *Design system architecture.*
- *Design user interface.*
- *Design navigational schema.*

IT-WD 3.2: Prepare visual design specifications.
Sample Indicators:

- *Apply principles of design (color theory and schemes, proximity, alignment, repetition, web graphics, optimization, typography).*
- *Identify technical constraints.*
- *Create sample design showing placement of buttons/navigational graphics and suggested color scheme.*

IT-WD 3.3: Create final project plan.
Sample Indicators:

- *Identify and obtain tools and resources to do the job.*
- *Identify and evaluate risks.*
- *Develop detailed task list.*

- *Identify critical milestones.*
- *Identify interdependencies.*

IT-WD 3.4: Define scope of work to meet customer requirements.
Sample Indicators:

- *Develop a design brief.*
- *Determine the target audience requirements (such as web accessibility)*
- *Identify available media and content sources.*
- *Develop timeline for completion.*
- *Determine staffing resources, both internal and external, that are required to complete the project.*
- *Develop preliminary project budget.*
- *Write document with all appropriate information.*
- *Obtain client approval on scope of work.*

4. Demonstrate the effective use of tools for digital communication production, development and project management.

IT-WD 4.1: Select and use appropriate software tools.
Sample Indicators:

- *Demonstrate proficiency in the use of digital imaging, digital video techniques, and equipment.*
- *Demonstrate knowledge of available graphics, video, motion graphics, web software programs.*
- *Demonstrate knowledge of available project management and collaborative tools.*
- *Demonstrate knowledge of integrated development environments (such as Visual Studio, Dreamweaver, Flash, Waterproof, etc.).*
- *Manipulate images, video, and motion graphics.*
- *Demonstrate knowledge of the basic principles of motion graphics.*
- *Identify how different user agents (browsers, devices) affect the digital communication product.*

5. Develop, administer and maintain web applications.

IT-WD 5.1: Implement functional design criteria.
Sample Indicators:

- *Identify, utilize, and create reusable components.*
- *Create and produce content.*
- *Create and refine design concepts.*

IT-WD 5.2: Create product visual design.
Sample Indicators:

- *Apply principles and elements of design.*

- *Apply color theory to select appropriate colors.*
- *Create and/or implement the look and feel of the product.*
- *Create graphical images and/or video elements.*
- *Apply knowledge of typography.*
- *Enhance digital communication presentation using a photographic process.*
- *Alter digitized images using an image manipulation program.*
- *Alter digitized video using a video manipulation program.*
- *Evaluate visual appeal.*

IT-WD 5.3: Employ basic motion graphic programming knowledge.
Sample Indicators:

- *Demonstrate knowledge of key frames and frames.*
- *Demonstrate knowledge of the impact that deployment device has on design and production needs.*
- *Demonstrate knowledge of animation techniques.*
- *Demonstrate knowledge of motion graphic security.*
- *Demonstrate that motion graphic meets the validation process and is compatible across multiple browsers or devices.*

IT-WD 5.4: Use basic web development skills.
Sample Indicators:

- *Demonstrate knowledge of HTML, XHTML, and CSS.*
- *Demonstrate knowledge of version control and documentation.*
- *Demonstrate knowledge of basic web application security.*
- *Demonstrate that website meets the validation process and is compatible across multiple browsers and devices.*
- *Explain importance of web standards.*

IT-WD 5.5: Summarize Internet architecture elements.
Sample Indicators:

- *Demonstrate knowledge of transfer protocols (FTP, WebDav).*
- *Demonstrate knowledge of Internet standards bodies.*
- *Identify cross-platform issues.*
- *Keep up-to-date with new and emerging trends related to the Internet.*
- *Demonstrate knowledge of Web 2.0.*

IT-WD 5.6: Employ basic web programming knowledge.
Sample Indicators:

- *Demonstrate knowledge of the purpose of web content delivery enablers (e.g., CGI, API, SSI).*
- *Demonstrate knowledge of how to interface client/server.*

- *Demonstrate knowledge of client-side processing and its advantages/disadvantages.*
- *Identify security issues related to server-side processing.*
- *Identify standard scripting languages (e.g., JavaScript, .NET frameworks, PHP, ActiveX,).*
- *Demonstrate knowledge of XML/XSL.*
- *Demonstrate knowledge of quality assurance.*
- *Demonstrate knowledge of the uses and advantages/disadvantages of various scripting languages.*
- *Demonstrate knowledge of how to use a scripting language to program a site.*

IT-WD 5.7: Employ web administration skills to maintain a web application.
Sample Indicators:

- *Demonstrate knowledge of how to use advanced communication protocols.*
- *Compare the advantages and disadvantages of running your own server vs. using a server provider.*
- *Identify hardware requirements for a server.*
- *Identify server software options.*
- *Evaluate server providers.*
- *Establish a domain name.*
- *Comply with TCP/IP (Transfer Control Protocol/Internet Protocol).*
- *Upload files to the server.*
- *Publicize the site (e.g., submit announcements to major search engines).*
- *Explain the importance of ethical behaviors and legal issues.*
- *Collect/analyze usage statistics.*
- *Utilize back-up and restore software features.*
- *Document server environment to include specifications, passwords, and software versions.*

6. Design, create and publish a digital communication product based on customer needs.

IT-WD 6.1: Produce a digital communication product as member of a development team.
Sample Indicators:

- *Define the role of individual team members.*
- *Develop a conceptual model for the digital communication project.*
- *Select the media elements (e.g., sound, video, graphics, text, motion graphics) to be used.*
- *Integrate media elements.*
- *Select the publication process to be used.*
- *Select the distribution method to be used.*
- *Explain the impact that publication processes and distribution methods have on product development.*

IT-WD 6.2: List and employ functional design terms and criteria.

Sample Indicators:

- *Identify, utilize, and create reusable components.*
- *Create and produce content.*
- *Create and refine design concepts.*

IT-WD 6.3: Create product visual design.
Sample Indicators:

- *Apply principles and elements of design.*
- *Apply color theory to select appropriate colors.*
- *Create and/or implement the look and feel of the product.*
- *Create graphical images and video.*
- *Apply knowledge of typography.*
- *Enhance digital communication presentation using a photographic process.*
- *Alter digitized images using an image manipulation program.*
- *Alter digitized video using a video manipulation program.*
- *Evaluate visual appeal.*

IT-WD 6.4: Acquire and produce content for a digital communication product.
Sample Indicators:

- *Produce or acquire graphics content.*
- *Produce or acquire motion graphics content.*
- *Produce or acquire audio content.*
- *Produce or acquire video content.*

IT-WD 6.5: Employ web development knowledge.
Sample Indicators:

- *Demonstrate knowledge of the purpose of web content delivery enablers (e.g., CGI, API, SSI).*
- *Demonstrate knowledge of how to interface client/server.*
- *Demonstrate knowledge of client-side processing and its advantages/disadvantages.*
- *Identify security issues related to server-side processing.*
- *Identify standard scripting languages (e.g., JavaScript, .NET frameworks, PHP, ActiveX).*
- *Demonstrate knowledge of XML/XSL.*
- *Demonstrate knowledge of quality assurance.*
- *Demonstrate knowledge of the uses and advantages/disadvantages of various scripting languages.*
- *Demonstrate knowledge of how to use a scripting language to program a site.*

IT-WD 6.6: Employ web programming knowledge.
Sample Indicators:

- *Demonstrate knowledge of key frames and frames.*
- *Demonstrate knowledge of the impact deployment device has on design and production needs.*

- *Demonstrate knowledge of animation techniques.*
- *Demonstrate knowledge of motion graphic security.*
- *Demonstrate that motion graphic meets the validation process and is compatible across multiple browsers or devices.*

IT-WD 6.7: Employ basic motion graphic programming knowledge.
Sample Indicators:

- *Integrate the use of photographic special effects into interactive media presentations.*
- *Integrate photographically derived images with hand-drawn graphic images.*

IT-WD 6.8: Describe search engine management (SEM) and search engine optimization (SEO).
Sample Indicators:

- *Measure current traffic on site.*
- *Determine and measure traffic sources.*
- *Determine that search engines can easily index web pages.*
- *Ensure code is W3C-compliant.*
- *Develop and implement a legal statement, privacy statement, and site map.*

IT-WD 6.9: Integrate media elements.
Sample Indicators:

- *Determine needed media elements for site.*
- *Implement appropriate media elements for site.*

IT-WD 6.10: Identify the use of Web 2.0 components of service-oriented architecture, rich internet applications, and social networking on site.
Sample Indicators:

- *Develop social networking policies.*
- *Determine key people to develop policies.*
- *Develop social networking guidelines.*
- *Determine type of platform for rich internet applications for site.*
- *Develop design and distribution method.*
- *Determine cost of application.*
- *Develop security solutions for application.*

7. Evaluate the functionality of a digital communication product using industry accepted techniques and metrics.

IT-WD 7.1: Develop a test plan for the digital communication product.
Sample Indicators:

- *Perform usability tests.*
- *Assess product effectiveness.*

- *Test product for reliability.*
- *Plan and coordinate customer acceptance testing.*

IT-WD 7.2: Implement a test plan and resolution process for product problems for the digital communication product.
Sample Indicators:

- *Define the problem.*
- *Identify/test possible solutions.*
- *Develop resolution plan.*
- *Implement solution.*
- *Evaluate problem-solving processes and outcomes.*

8. Implement quality assurance processes to deliver quality digital communication products and services.

IT-WD 8.1: Summarize digital communication quality assurance measures.
Sample Indicators:

- *Demonstrate knowledge of the quality assurance (QA) process.*
- *Demonstrate knowledge of the standards/requirements for QA.*
- *Develop team relationships to support quality assurance tasks.*

IT-WD 8.2: Perform quality assurance tasks to produce a quality product.
Sample Indicators:

- *Use customer satisfaction in determining product characteristics (e.g., cost, user-friendliness).*
- *Recognize the relationship between dependability, functionality, ease of use, etc.*
- *Follow established procedures for testing,*

9. Perform maintenance and customer support functions for digital communication products.

IT-WD 9.1: Analyze software technical support needs.
Sample Indicators:

- *Identify maintenance and support requirements.*
- *Apply information and data analysis techniques.*
- *Define scope of work to meet customer support needs.*

IT-WD 9.2: Employ customer service techniques and strategies.
Sample Indicators:

- *Access needed information using appropriate reference materials.*
- *Provide help to first line user-support personnel to answer user questions.*
- *Provide troubleshooting for digital communication products.*

- *Provide troubleshooting for hardware.*
- *Perform system-tuning function.*
- *Diagnose problems within system.*
- *Perform technical functions required by customer/user.*
- *Communicate and document technical support provided.*

IT-WD 9.3: Perform product maintenance activities.
Sample Indicators:

- *Follow organizational procedures in communication and document maintenance tasks.*
- *Identify and analyze problem.*
- *Analyze and propose solutions.*
- *Implement solutions in code and documentation.*
- *Release software and documentation updates according to procedures.*

10. Comply with intellectual property laws, copyright laws and ethical practices when creating web/digital communications.

IT-WD 10.1: Explain the concept of intellectual property.
Sample Indicators:

- *Identify and discuss appropriate state intellectual property laws.*
- *Identify and discuss national intellectual property laws.*
- *Identify any intellectual property issues in created web pages.*

IT-WD 10.2: Differentiate between copyright and trademarks.
Sample Indicators:

- *Discuss the difference between copyright and trademarks.*
- *Discuss any copyright issues in web page being designed and how they will be managed.*
- *Discuss any trademark issues in web page being designed and how they will be managed.*

IT-WD 10.3: Describe the function of a non-disclosure agreement (NDA).
Sample Indicators:

- *Discuss what a non-disclosure agreement (NDA) is.*
- *Identify who will be included in the NDA for the developed web page(s).*
- *Identify and discuss what will be included in the NDA.*
- *Determine the length of time the agreement will be in effect.*