Career Field	Information Technology	**Page 1**
Strand	1. Business Operations/21st Century Skills	
Description	Learners apply principles of economics, business management, marketing, and employability in an entrepreneur, manager, and employee role to the leadership, planning, developing, and analyzing of business enterprises related to the career field.	

Outcome	1.1. Information Management and Technology: Demonstrate current and emerging strategies and technologies used to collect, analyze, record, and share information in business operations.					
Competencies	1.1.1. Use evidence-based research to explain how technology influences labor, efficiency, availability, and dissemination of information. 1.1.2. Use office equipment to locate, retrieve, and distribute information (e.g., phone, radio equipment, fax machine, scanner, public address systems, information technology tools). 1.1.3. Select and use software applications to record, analyze, and present information (e.g., word processing, electronic mail, spreadsheet, databases, presentation, Internet search engines). 1.1.4. Demonstrate compliance with security rules, regulations, and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to industry pathway. 1.1.5. Identify system hardware specific to industry pathway. 1.1.6. Use information technology tools to maintain and monitor business records. 1.1.7. Use electronic sources to access business and technical information. 1.1.8. Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.2. Business Ethics and Law: Analyze how professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms contribute to continuous improvement in organizational performance and regulatory compliance.
Competencies	1.2.1. Analyze how forms of ownership, business management, and environmental management systems (e.g., health, safety) contribute to continuous improvement in organizational performance and regulatory compliance. 1.2.2. Follow protocols and practices necessary to maintain a clean and healthy work environment.

Career Field	Information Technology	**Page 2**
Strand	1. Business Operations/21st Century Skills	
Description	Learners apply principles of economics, business management, marketing, and employability in an entrepreneur, manager, and employee role to the leadership, planning, developing, and analyzing of business enterprises related to the career field.	

	1.2.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice). 1.2.4. Access and implement compliance measures (e.g., quality assurance information, material safety data sheets [MSDSs], safety data sheets [SDSs], product safety data sheets [PSDSs], U.S. Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization. 1.2.5. Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their overall impact on organizational performance. 1.2.6. Identify the legislation that regulates standards for workplace safety, harassment, labor, and employment, and the consequences of noncompliance for both employee and employer (e.g., employment interview, testing, laws affecting minors, Americans with Disabilities Act, Occupational Safety and Health Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission). 1.2.7. Use copyright, intellectual property, and computer laws and regulations to cite proprietary information appropriately (e.g., computer hacking, software piracy, source code, software license, copyright law, Internet, e-mail). 1.2.8. Explain the relationship between business ethics and consumer confidence and impact of business ethics on the techniques used to build customer relationships. 1.2.9. Resolve issues relating to any potential conflicts of interest (e.g., personal gain, project bidding) between personal and organizational ethics.					
Pathways	X	Information Support and Services		X	Programming and Software Dev	
	X	Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.3. Business Leadership and Communications: Process, maintain, evaluate, and disseminate information in a business to enhance decision-making processes and develop leadership and team building to promote collaboration.
Competencies	1.3.1 Extract relevant, valid information from materials and cite sources of information.

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	1.3.2 Deliver formal and informal presentations that demonstrate organization and delivery skills. 1.3.3 Apply active listening skills and speak effectively to clarify information and contribute to group discussions and meetings. 1.3.4 Use negotiation and conflict resolution skills to reach solutions. 1.3.5 Communicate directions in an organized manner appropriate for the intended audience and purpose. 1.3.6 Use consensus-building techniques, including parliamentary procedure, to make decisions and to compile a summary of meeting minutes, conclusions, and next steps. 1.3.7 Identify strengths and weaknesses of leaders and leadership styles and the relationships between leaders and team members to enhance team building and leadership techniques. 1.3.8 Identify issues involving digital and/or electronic communications (e.g., lack of body language, lack of verbal cues, potential for forwarding information). 1.3.9 Use interpersonal skills to provide group leadership and promote collaboration. 1.3.10 Write business letters, job applications, and résumés using conventional style that contribute to the readability and impact of the document. 1.3.11 Use technical writing skills to complete forms and reports pertinent to the career field.					
Pathways	X	Information Support and Services		X	Programming and Software Dev	
	X	Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.4. Operations Management: Plan, organize, and monitor an organization or department to maximize contribution to organizational goals and objectives.
Competencies	1.4.1. Select and organize resources to develop a product or a service to be rendered. 1.4.2. Analyze the performance of an enterprise and reallocate resources to achieve organizational goals. 1.4.3. Identify the characteristics of a business plan. 1.4.4. Identify the organizational structures of businesses.

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Career Field	Information Technology	Page 4
Strand	1. Business Operations/21st Century Skills	
Description	Learners apply principles of economics, business management, marketing, and employability in an entrepreneur, manager, and employee role to the leadership, planning, developing, and analyzing of business enterprises related to the career field.	

	1.4.5. Document and adjust business activities to realign with established goals. 1.4.6. Use inventory and control systems to purchase materials, supplies, and equipment (e.g., Last In, First Out [LIFO]; First In, First Out [FIFO]; Just in Time [JIT]). 1.4.7. Collect information and feedback to help assess the organization's strategic planning and policymaking processes. 1.4.8. Discuss alternative actions to take when goals are not met for a specific reason (e.g., changing goals, changing strategies). 1.4.9. Identify routine activities for maintaining business facilities and equipment. 1.4.10. Follow requirements for purchase requisitions. 1.4.11. Explain the value of seeking diverse opinion from all stakeholders. 1.4.12. Develop a budget and allocation processes.					
Pathways	X	Information Support and Services		X	Programming and Software Dev	
	X	Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.5. Financial Management: Use financial tools, strategies, and systems to develop, monitor, and control the use of financial resources to ensure personal and business financial well-being.
Competencies	1.5.1. Interpret financial documents (e.g., budgets, income statements, balance sheets) to forecast future resources and budgetary needs (e.g., capital, human, financial, time). 1.5.2. Identify how involuntary and voluntary deductions (e.g., taxes, retirement, insurance, employment benefits) affect take-home pay. 1.5.3. Use investment strategies and options (e.g., buy, lease, finance, risk, Return on Investment [ROI]) to achieve increased net worth. 1.5.4. Identify sources of capital and explain considerations in selecting among them. 1.5.5. Analyze the factors that determine the cost of credit in order to select optimum credit sources (e.g., the advantages and disadvantages of borrowing from different types of credit providers and sources for short-, intermediate-, and long-term credit). 1.5.6. Develop a risk management plan to protect against potential loss of personal

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Career Field	Information Technology	Page 5
Strand	1. Business Operations/21st Century Skills	
Description	Learners apply principles of economics, business management, marketing, and employability in an entrepreneur, manager, and employee role to the leadership, planning, developing, and analyzing of business enterprises related to the career field.	

	or business assets or income. 1.5.7. Determine the cost of doing business (e.g., personnel, depreciation, materials, freight, quality). 1.5.8. Identify depreciation schedules used to determine property values. 1.5.9. Solve problems that involve discounts, markups, commissions, and profit and compute simple and compound interest. 1.5.10. Use forms of financial exchange (e.g., cash, credit, and debit) to achieve short- and long-term financial goals. 1.5.11. Describe sources of income (e.g., wages/salaries, interest, rent, dividends, transfer payments). 1.5.12. Analyze personal financial needs and develop goals and a personal budget to meet those needs (e.g., college, retirement, wills, insurance).					
Pathways	X	Information Support and Services		X	Programming and Software Dev	
	X	Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.6. Entrepreneurship/Entrepreneurs: Analyze the environment in which business operates and the economic factors and opportunities associated with self-employment.
Competencies	1.6.1. Describe the advantages and disadvantages of the four types of business ownership (i.e., individual proprietorships, partnerships, corporations, and cooperatives). 1.6.2. Explain the role of profit as the incentive to entrepreneurs in a market economy. 1.6.3. Identify the factors that contribute to the success and failure of entrepreneurial ventures. 1.6.4. Assess the roles of social, nonprofit, and for-profit businesses. 1.6.5. Describe life cycles of an entrepreneurial business and an entrepreneur. 1.6.6. Create a list of personal strengths, weaknesses, skills, and abilities needed to be successful as an entrepreneur. 1.6.7. Identify the advantages and disadvantages of becoming an entrepreneur. 1.6.8. Explain pathways used to become an entrepreneur. 1.6.9. Conduct self-assessment to determine entrepreneurial potential.

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Career Field	Information Technology	**Page 6**
Strand	1. Business Operations/21st Century Skills	
Description	Learners apply principles of economics, business management, marketing, and employability in an entrepreneur, manager, and employee role to the leadership, planning, developing, and analyzing of business enterprises related to the career field.	

	1.6.10. Describe techniques for obtaining experience (e.g., apprenticeship, co-operative [co-op] education, work placement, internship) related to an entrepreneurial objective. 1.6.11. Identify resources and assistance available to entrepreneurs (e.g., Small Business Administration, mentors, information resources, educational opportunities).					
Pathways	X	Information Support and Services		X	Programming and Software Dev	
	X	Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.7. Employability Skills: Develop career awareness and employability skills needed for gaining and maintaining employment in multicultural business settings.
Competencies	1.7.1. Identify the personal qualifications, aptitudes, and skills necessary to succeed in careers. 1.7.2. Identify the scope of career opportunities and identify the requirements for education, training, and licensure. 1.7.3. Develop a career plan that reflects career interests, pathways, and secondary and postsecondary options. 1.7.4. Describe the role and function of professional organizations, industry associations, and organized labor and use networking techniques to develop professional relationships. 1.7.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, résumé writing, interviewing skills, portfolio development). 1.7.6. Explain the importance of work ethic, accountability, and responsibility and demonstrate associated behaviors in fulfilling personal, community, and workplace roles. 1.7.7. Apply problem solving and critical thinking skills to work-related issues when making decisions and formulating solutions. 1.7.8. Manage personal emotions, behavior, and appearance to maintain professionalism. 1.7.9. Use constructive feedback to improve work habits. 1.7.10. Adapt coping skills to prevent and/or resolve workplace conflicts.

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Career Field	Information Technology	**Page 7**
Strand	1. Business Operations/21st Century Skills	
Description	Learners apply principles of economics, business management, marketing, and employability in an entrepreneur, manager, and employee role to the leadership, planning, developing, and analyzing of business enterprises related to the career field.	

	1.7.11. Recognize and demonstrate respect for different cultural beliefs and practices.					
Pathways	X	Information Support and Services		X	Programming and Software Dev	
	X	Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.8. Sales and Marketing Management: Create, communicate, and deliver value to customers while managing product, pricing, place, promotion, packaging, positioning, and customer relationships.
Competencies	1.8.1. Analyze market conditions and define the features and functions of a product or service to determine the product's or service's optimal marketing position. 1.8.2. Discuss the importance of correct pricing to support a product's or service's positioning in the marketing mix and to achieve the financial goals of the company. 1.8.3. Describe the importance of distribution chains to sell a product (e.g., intensive, selective, exclusive). 1.8.4. Use promotional techniques to maximize sales revenues (e.g., advertising, sales promotion, publicity, public relations, creating new sales channels, creating new products). 1.8.5. Use product management (e.g., product mix, positioning, branding) to maximize sales revenues, market share, and profit margins. 1.8.6. Determine how a product or service is made available (i.e., market placement) to the consumer and how that affects utility and cost (i.e., possible consequences of price increases or decreases). 1.8.7. Identify the roles of marketing and sales and identify how they contribute to a company's image. 1.8.8. Compare and contrast the advantages and disadvantages of carrying cost and Just in Time (JIT) production systems and the effects of monitoring inventory (e.g., perishable, shrinkage, insurance) on profitability. 1.8.9. Demonstrate personal selling steps (e.g., prospecting, sales presentation, closing) used to make a successful sale and the techniques used to approach potential customers and overcome their objections. 1.8.10. Demonstrate methods for assessing the factors that influence a potential

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	customer or client to purchase a product or service. 1.8.11. Monitor client expectations by using measurement tools (e.g., online marketing, email marketing, direct mailer marketing) to ensure product/ or service satisfaction.					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.9. Principles of Business Economics: Examine and employ economic principles and concepts to accomplish organizational goals and objectives.					
Competencies	1.9.1. Explain the process by which competition among buyers and sellers determines a market price. 1.9.2. Discuss the economic principles that guide the location of industry and the distribution of transportation and retail facilities. 1.9.3. Identify the effects of changes in supply or demand on the relative scarcity, price, and quantity of products. 1.9.4. Identify the difference between monetary and nonmonetary incentives and explain how changes in incentives cause changes in behavior.					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	1.10. Principles of International Business: Evaluate how international opportunities, including new technologies, competition, and the global economy, impact business decision-making.
Competencies	1.10.1. Develop cultural intelligence (CQ). 1.10.2. Identify social and cultural factors that influence consumer and buyer behavior and the marketing of goods and services. 1.10.3. Analyze how the quality, quantity, and price of goods and services are affected by domestic and international competition in a market economy. 1.10.4. Compare business protocol among countries and describe how a negotiation

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	process may be affected by cultural differences. 1.10.5. Analyze factors that affect currency and exchange rates. 1.10.6. Describe how laws and regulations influence international trade. 1.10.7. Discuss the impact of globalization on local, state, national economies.						
Pathways	X	Information Support and Services			X	Programming and Software Dev	
	X	Network Systems			X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply	

Career Field	Information Technology
Strand	2. IT Fundamentals
Description	Learners apply fundamental principles of IT, including the history of IT and its impact on society, common industry terms, systems theory, information storage and retrieval, database management, and computer hardware, software and peripheral device configuration and installation. This base of knowledge and skills may be applied across the career field.

Outcome	2.1. Security, Risks, and Safeguards: Describe the need for security and explain security risks and security safeguards.					
Competencies	2.1.1. Explain the need for confidentiality, integrity, and availability (CIA) of information. 2.1.2. Describe authentication, authorization, and auditing. 2.1.3. Describe multilevel security. 2.1.4. Identify security risks and describe associated safeguards and methodologies (e.g., auditing). 2.1.5. Describe major threats to computer systems (e.g., internal threats, viruses, worms, spyware, malware, ransomware, spoofing, hacking). 2.1.6. Describe the components of the physical environment (e.g., wiring closets, server rooms) and physical security systems. 2.1.7. Describe the need for security in networking. 2.1.8. Describe the need for security in application development. 2.1.9. Track and catalogue physical assets. 2.1.10. Describe computer forensics, its importance in information security and cybersecurity, and its relevance to law enforcement. 2.1.11. Identify the need for personal security in digital information and describe how personal information can be safeguarded. 2.1.12. Practice information security per job requirements. 2.1.13. Describe privacy security compliance on systems (e.g., Health Insurance Portability and Accountability Act [HIPAA], Payment Card Industry [PCI], Sarbanes-Oxley Act [SOX], Americans with Disabilities Act [ADA]).					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	2.2. Networking Fundamentals: Apply networking fundamentals to infrastructure systems.
Competencies	2.2.1. Differentiate between Local Area Networks (LANs), Wide Area Networks (WANs), Wireless Local Area Networks (WLANs), and Near Field

Career Field	Information Technology
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	Communication (NFC). 2.2.2. Select the basic point-to-point (PTP) and point-to-multipoint (PTMP) network topologies (e.g., star, ring, tree, network, mesh, irregular) and broadband and baseband transmission methods. 2.2.3. Select network storage techniques (e.g., fiber channel, Internet Small Computer System Interface [iSCSI], Internet Protocol [IP], Fiber Channel over Ethernet [FCoE], Serial Attached SCSI [SAS], Network File Systems [NFS], Network Attached Storage /Server Message Blocks [NAS/SMB], Redundant Array of Inexpensive Disks [RAID]). 2.2.4. Differentiate between the Internet, intranets, and extranets. 2.2.5. Identify and apply Transmission Control Protocol and Internet Protocol (TCP/IP; Internet Protocol Version 4 [IPv4], Internet Protocol Version 6 [IPv6]) applications and services (e.g., rlogin, Simple Mail Transfer Protocol [SMTP], Telecommunications Network [Telnet], File Transfer Protocol [FTP], Domain Name System [DNS], Network File System [NFS], Voice over Internet Protocol [VoIP], Internet Control Message Protocol [ICMP]). 2.2.6. Differentiate between cable types (e.g., fiber optic, twisted pair, coaxial) and interfaces. 2.2.7. Identify the top-level domains (e.g., .gov, .com, .edu). 2.2.8. Describe the characteristics and uses of networks, network devices, and components (e.g., hubs, switches, routers, firewalls).					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	2.3. Data Encoding: Explain and describe data encoding basics.			
Competencies	2.3.1. Identify and explain coding information and representation of characters (e.g., American Standard Code for Information Interchange (ASCII), Extended Binary Coded Decimal Interchange Code (EBCDIC), Unicode). 2.3.2. Convert between numbering systems (e.g., binary, hexadecimal, decimal).			
Pathways	X	Information Support and Services	X	Programming and Software Dev

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Career Field	Information Technology
Strand	2. IT Fundamentals
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	X	Network Systems		X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply	

Outcome	2.4. Emerging Technologies: Identify trending technologies, their fundamental architecture, and their value in the marketplace.						
Competencies	2.4.1. Investigate the scope and the impact of mobile computing environments on society. 2.4.2. Describe the differences, advantages, and limitations of cloud computing (e.g., public cloud, private cloud, hybrid cloud) and on-premises computing. 2.4.3. Utilize cloud computing applications (e.g. services, applications, virtual environments).						
Pathways	X	Information Support and Services		X	Programming and Software Dev		
	X	Network Systems		X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply	

Outcome	2.5. Operating Systems: Maintain operating systems (OSs).						
Competencies	2.5.1. Compare and contrast OSs for computer hardware (e.g. personal computers, servers, mainframes, and mobile devices). 2.5.2. Describe virtual machines and why they are used. 2.5.3. Identify the properties of open and proprietary systems. 2.5.4. Maintain file structures in an OS. 2.5.5. Use system utilities to maintain an OS. 2.5.6. Describe OS interfaces (e.g., command line, Graphic User Interface [GUI]). 2.5.7. Install and test updates and patches to OSs.						
Pathways	X	Information Support and Services		X	Programming and Software Dev		
	X	Network Systems		X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply	

Outcome	2.6. Installation and Configuration: Install and configure hardware and software.

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Career Field	Information Technology
Strand	2. IT Fundamentals
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Competencies	2.6.1. Comply with license agreements for software and hardware and describe the consequences of noncompliance. 2.6.2. Identify hardware requirements for software applications. 2.6.3. Verify software compatibility and troubleshoot any software incompatibility. 2.6.4. Install and test new software and software upgrades on stand-alone, mobile, and networked systems. 2.6.5. Preserve, convert, or migrate existing data files to new format. 2.6.6. Determine compatibility of software and hardware and resolve any conflicts. 2.6.7. Install and test hardware peripherals. 2.6.8. Document the installation and configuration of hardware and software.					
Pathways	X	Information Support and Services		X	Programming and Software Dev	
	X	Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	2.7. Web Architecture: Explain the fundamentals of delivering information and applications using web architecture.			
Competencies	2.7.1. Describe methods of securely transmitting data. 2.7.2. Describe ways to present data (e.g., mobile applications, desktop applications, web applications). 2.7.3. Differentiate between a client and a server. 2.7.4. Identify how the use of different browsers and devices affects the look of a webpage. 2.7.5. Explain the relationship between data transmission volumes, bandwidth, and latency. 2.7.6. Describe the characteristics and use of browser plug-ins. 2.7.7. Compare the advantages and disadvantages of running an in-house server or using a service provider. 2.7.8. Describe the difference between static and dynamic sites and the reasons for using each.			
Pathways	X	Information Support and Services	X	Programming and Software Dev
	X	Network Systems	X	Interactive Media

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Career Field	Information Technology
Strand	2. IT Fundamentals
Description	Learners apply fundamental principles of IT, including the history of IT and its impact on society, common industry terms, systems theory, information storage and retrieval, database management, and computer hardware, software and peripheral device configuration and installation. This base of knowledge and skills may be applied across the career field.

Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	2.8. Databases: Describe the fundamentals of databases.					
Competencies	2.8.1. Identify emerging database technology (e.g., Not only Structured Query Language [NoSQL], New Structured Query Language [NewSQL], graph databases). 2.8.2. Identify the purpose and uses of a database. 2.8.3. Compare and contrast databases (e.g., flat file, hierarchical, relational). 2.8.4. Describe the elements of a database (e.g., table, record/row, field, relationships, transactions). 2.8.5. Describe the elements of a database user interface (e.g., form, queries, filters, reports). 2.8.6. Describe the uses of a Database Management System (DBMS). 2.8.7. Describe how data can be stored in and extracted from a database. 2.8.8. Explain the importance of data integrity and security. 2.8.9. Differentiate between a front-end interface and a back-end database.					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	2.9. Project Concept Proposal: Develop a project concept proposal.			
Competencies	2.9.1. Identify and incorporate branding strategies. 2.9.2. Determine the scope and purpose of the project. 2.9.3. Determine the target audience, client needs, expected outcomes, objectives, budget. 2.9.4. Develop a conceptual model and design brief for the project. 2.9.5. Develop a timeline, communication plan, task breakdown, costs (e.g., equipment, labor), deliverables, and responsibilities for completion. 2.9.6. Develop and present a comprehensive proposal to stakeholders.			
Pathways	X	Information Support and Services	X	Programming and Software Dev

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Career Field	Information Technology
Strand	2. IT Fundamentals
Description	Learners apply fundamental principles of IT, including the history of IT and its impact on society, common industry terms, systems theory, information storage and retrieval, database management, and computer hardware, software and peripheral device configuration and installation. This base of knowledge and skills may be applied across the career field.

	X	Network Systems			X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent				Does not apply

Outcome	2.10. Equipment: Select, operate, and maintain equipment.							
Competencies	2.10.1. Identify hardware platforms, configurations, and support models. 2.10.2. Identify processor, memory, and storage requirements. 2.10.3. Identify architecture requirements. 2.10.4. Identify software application requirements. 2.10.5. Prepare and operate equipment per project design specifications. 2.10.6. Monitor equipment operation and troubleshoot issues and problems. 2.10.7. Backup, archive, and manage data. 2.10.8. Prepare equipment for storage or decommissioning. 2.10.9. Perform routine maintenance per manufacturer specifications.							
Pathways	X	Information Support and Services			X	Programming and Software Dev		
	X	Network Systems			X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent				Does not apply

Outcome	2.11. Troubleshooting: Select and apply troubleshooting methodologies for problem solving.			
Competencies	2.11.1. Identify the problem. 2.11.2. Select troubleshooting methodology (e.g. top down, bottom up, follow the path, spot the differences). 2.11.3. Investigate symptoms based on the selected methodology. 2.11.4. Gather and analyze data about the problem. 2.11.5. Design a solution. 2.11.6. Test a solution. 2.11.7. Implement a solution. 2.11.8. Document the problem and the verified solution.			
Pathways	X	Information Support and Services	X	Programming and Software Dev
	X	Network Systems	X	Interactive Media

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Career Field	Information Technology
Strand	2. IT Fundamentals
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Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	2.12. Performance Tests and Acceptance Plans: Develop performance tests and acceptance plans.					
Competencies	2.12.1. Create a written procedure agreed by the stakeholders and project team for determining the acceptability of the project deliverables. 2.12.2. Develop a test system that accurately mimics external interfaces. 2.12.3. Develop test cases that are realistic, that compare with expected performance, and that include targeted platforms and device types. 2.12.4. Develop, perform, and document usability and testing integration. 2.12.5. Make corrections indicated by test results. 2.12.6. Seek stakeholder acceptance upon successful completion of the test plan.					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	2.13. Rollout and Handoff: Plan rollout and facilitate handoff to customer.					
Competencies	2.13.1. Include overall project goals and timelines in the rollout plan. 2.13.2. Communicate rollout plans to key stakeholders in a timely manner. 2.13.3. Conduct final review and approvals according to company standards. 2.13.4. Identify support staff, training needs, and contingency plans in the rollout plan. 2.13.5. Test delivered application to assure that it is fully functional for the customer or user and meets all requirements. 2.13.6. Deliver support and training materials.					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

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Career Field	Information Technology
Strand	3. Information Security
Description	Learners apply principles of information security to implement and maintain security compliance and network security. Learners select components and mechanisms required for a multilayer defense structure and evaluate and minimize security risks to wired and wireless networks and devices.

Outcome	3.1. Components of Information Security: Describe the components associated with information security systems.					
Competencies	3.1.1. Differentiate between authentication and authorization. 3.1.2. Compare and contrast authentication techniques (e.g. single factor, multifactor, passwords, biometrics, certificates, Radio Frequency Identification [RFID] cards). 3.1.3. Compare and contrast methods of achieving information assurance and integrity and confidentiality (e.g. digital signatures, digital certifications, hashing algorithms, encryption). 3.1.4. Describe Virtual Private Networks (VPNs) using tunneling protocols (e.g., Layer 2 Tunneling Protocol [L2TP], Secure Socket Tunneling Protocol [SSTP], Point-to-Point Tunneling Protocol [PPTP]) and encrypting techniques). 3.1.5. Discuss the role of certificate authorities (CAs) and Public Key Infrastructure (PKI).					
Pathways	X	Information Support and Services		X	Programming and Software Dev	
	X	Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	3.2. General Security Compliance: Implement and maintain general security compliance.
Competencies	3.2.1. Identify and implement data and application security. 3.2.2. Implement backup and verification procedures (e.g., tape, disk, cloud). 3.2.3. Describe and assign permissions (e.g., read-only, read-write). 3.2.4. Provide user authentication (e.g., assign and reset user accounts and passwords). 3.2.5. Install, test, implement, and update virus and malware detection and protection software. 3.2.6. Identify sources of virus and malware infection and remove viruses and malware. 3.2.7. Provide documentation, training, and support to users on established security procedures. 3.2.8. Identify the need for disaster recovery policies and procedures.

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Career Field	Information Technology
Strand	3. Information Security
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Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	3.3. Network Security: Implement and maintain network security.					
Competencies	3.3.1. Describe network security policies (e.g., acceptable use policy). 3.3.1. Identify security appliances and describe the role of each in a networked environment. 3.3.2. Devise account administration functions to support network security. 3.3.3. Describe Access Control Lists (ACLs) and explain why they are used. 3.3.4. Assess risks based on vulnerability of the organization, likelihood of risk, and impact on the organization. 3.3.5. Describe patch management and its purposes. 3.3.6. Train users in network security procedures.					
Pathways	X	Information Support and Services		Programming and Software Dev		
	X	Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	3.4. Multilayer Defense Structure: Explain information technology mechanisms as they apply to a multilayer defense structure.					
Competencies	3.4.1. Describe available systems for intrusion prevention, detection, and mitigation. 3.4.2. Review system log files to identify security risks. 3.4.3. Compare and contrast network analysis software (e.g., network analyzer) and hardware tools to identify security risks and vulnerabilities. 3.4.4. Identify the components of human security (e.g., social engineering) and techniques to mitigate human security threats (e.g., policies, procedures, training).					
Pathways	X	Information Support and Services		Programming and Software Dev		
	X	Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

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Career Field	Information Technology
Strand	3. Information Security
Description	Learners apply principles of information security to implement and maintain security compliance and network security. Learners select components and mechanisms required for a multilayer defense structure and evaluate and minimize security risks to wired and wireless networks and devices.

Outcome	3.5. Wireless Security: Implement secure wireless networks.					
Competencies	3.5.1. Describe wireless security risks (e.g., unauthorized access) and how to mitigate them. 3.5.2. Compare and contrast methods of increasing the security of wireless networks and devices (e.g., Media Access Control [MAC] address filtering, Wired Equivalent Privacy [WEP], Wi-Fi Protected Access [WPA], 802.1x, Remote Authentication Dial In User Service [RADIUS]). 3.5.3. Identify security enhancements provided by Institute of Electrical and Electronics Engineers (IEEE) 802.11(x). 3.5.4. Describe practices and policies for preventing and detecting installation of rogue networks. 3.5.5. Describe security practices and policies for personal devices. 3.5.6. Implement and test the security of a wireless network.					
Pathways	X	Information Support and Services		Programming and Software Dev		
	X	Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

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Career Field	Information Technology
Strand	4. Infrastructure Systems
Description	Learners apply principles of networking and infrastructure related to the installation, administration, and maintenance of computer networks and components. Knowledge and skills may be applied to network connectivity, cabling, protocols, architecture, classification, topologies, operating systems, Open Systems Interconnection (OSI) standards, data encoding, Quality of Service (QoS), Internet Protocol (IP) addressing, and wide area network (WAN) design.

Outcome	4.1. Network Infrastructure: Build a multinode network.					
Competencies	4.1.1. Determine the basic point-to-point (PTP) and point-to-multipoint (PTMP) network topologies (e.g., star, ring, tree, mesh, hybrid) and identify broadband and baseband (e.g., Ethernet) transmission methods and standards. 4.1.2. Explain packet-switching techniques. 4.1.3. Compare the characteristics of connection-oriented and connectionless protocols and select protocols based on given criteria. 4.1.4. Identify standard and emerging network technologies (e.g., broadband, satellite nets, optic nets, Integrated Services Digital Network [ISDN], Switched Multimegabit Data Service [SMDS], Asynchronous Transfer Mode [ATM], T1, T3, Synchronous Optical Network [SONET], interplanetary Internet, Long-Term Evolution [LTE], High Speed Packet Access [HSPA]). 4.1.5. Describe how Unified Communication (UC) integrates voice, data, and video communications. 4.1.6. Configure and build a network.					
Pathways	X	Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.2. Open Systems Interconnection: Describe the Open Systems Interconnection (OSI) standard (International Organization for Standardization [ISO] Standard 7498).
Competencies	4.2.1. Identify the benefits of using a layered network model. 4.2.2. Compare OSI stack positions and their relationships to one another. 4.2.3. Compare the seven layers of the OSI stack to the four layers of the Transmission Control Protocol/Internet Protocol (TCP/IP) stack. 4.2.4. Compare the basics of TCP/IP layers, components, and functions. 4.2.5. Describe actions to be performed at each of the OSI physical layers. 4.2.6. Explain how the OSI layers relate to the elements of network

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	communication.					
Pathways	X	Information Support and Services		Programming and Software Dev		
	X	Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.3. Network Media: Select, assemble, terminate, and test media.					
Competencies	4.3.1. Identify the criteria used in selecting media (e.g., physical properties, transmission technologies, transmission span, bandwidth, topology, security, noise immunity, installation considerations, cost). 4.3.2. Differentiate between media types (e.g., coaxial, twisted pair, fiber optic) and interfaces. 4.3.3. Compare and contrast media categories (e.g., single mode, multimode, CAT5, CAT5E, CAT6+). 4.3.4. Describe types of media connectors (e.g., Bayonet Neill-Concelman [BNC], Registered Jack [RJ]-45, LC, ST) and grounding techniques. 4.3.5. Identify media standards (e.g., American National Standards Institute [ANSI], Electronic Industries Alliance/Telecommunications Industry Association [EIA/TIA]-568, EIA/TIA-568A and 568B). 4.3.6. Identify the advantages and disadvantages of cabling systems. 4.3.7. Describe typical problems associated with cable installation. 4.3.8. Assemble and test Ethernet cable (e.g., straight-through, crossover, loopback).					
Pathways	X	Information Support and Services		Programming and Software Dev		
	X	Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.4. Wireless Communications: Explain wireless communications.
Competencies	4.4.1. Compare and contrast wireless standards in common use (e.g., Institute of Electrical and Electronics Engineers [IEEE] 802.11, Bluetooth, Worldwide

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Career Field	Information Technology
Strand	4. Infrastructure Systems
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	Interoperability for Microwave Access [WiMAX], Radio Frequency Identification [RFID], Near Field Communication [NFC]). 4.4.2. Compare and contrast characteristics of wireless signals (e.g., reflection, diffraction, scattering, fading). 4.4.3. Differentiate media access methods used by wireless. 4.4.4. Describe appropriate applications of wireless technologies to specific communication scenarios.					
Pathways	X	Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.5. Wireless Network Solutions: Design and implement wireless network solutions.					
Competencies	4.5.1. Compare and contrast secure wireless solutions operating in ad-hoc mode and infrastructure mode. 4.5.2. Describe the frequency ranges and associated rules in the wireless spectrum as managed by the Federal Communication Commission (FCC). 4.5.3. Describe the Service Set Identifier (SSID) as used in wireless communications. 4.5.4. Select and install access points, wireless Network Interface Cards (NICs), antennas, and other hardware and software components to provide a wireless networking solution as determined by a site and customer survey. 4.5.5. Troubleshoot Wireless Local Area Networks (WLANs) using system logs, vendor-provided utilities, and diagnostic tools. 4.5.6. Secure the wireless network.					
Pathways	X	Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.6. Network Protocols: Compare and contrast network protocols.
Competencies	4.6.1. Explain network protocols (e.g., Transmission Control Protocol/Internet

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	Protocol [TCP/IP], User Datagram Protocol (UDP), Internet Protocol Version 4 [IPv4], Internet Protocol Version 6 [IPv6]). 4.6.2. Identify the advantages and disadvantages of well-known protocols (e.g., Domain Name System [DNS], File Transfer Protocol [FTP], Secure Hypertext Transfer Protocol [HTTPS], Telecommunications Network [Telnet], Dynamic Host Configuration Protocol [DHCP], Remote Desktop Protocol [RDP]) and associated port numbers. 4.6.3. Explain the purposes of encapsulation and decapsulation and their relationship to the Open Systems Interconnection (OSI) model. 4.6.4. Explain the difference between User Datagram Protocol (UDP) and TCP. 4.6.5. Identify TCP and UDP conventional ports (e.g., Simple Mail Transfer Protocol [SMTP], Telnet, Hypertext Transfer Protocol [HTTP], FTP). 4.6.6. Explain TCP/IP protocol details (e.g., Internet addresses, Address Resolution Protocol [ARP], Reverse Address Resolution Protocol [RARP], IP datagram format, routing IP datagrams, TCP segment format, IPv4, IPv6). 4.6.7. Describe a Virtual Private Network (VPN) and identify associated protocols (e.g., Layer 2 Tunneling Protocol [L2TP], Point-to-Point Tunneling Protocol [PPTP]). 4.6.8. Capture and analyze data packets.					
Pathways	X	Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.7. Transmission Control Protocol/Internet Protocol (TCP/IP): Describe IP addressing schemes and create subnet masks.
Competencies	4.7.1. Explain Fully Qualified Domain Names (FQDNs) and how they are used. 4.7.2. Explain the IP addressing scheme and how it is used. 4.7.3. Identify Class A, B, and C reserved (i.e., private) address ranges and why they are used. 4.7.4. Identify the class of network to which a given address belongs.

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	4.7.5. Differentiate between default subnet masks and custom subnet masks. 4.7.6. Explain the relationship between an IP address and its associated subnet mask. 4.7.7. Identify the differences between classful and classless addressing schemes. 4.7.8. Identify multicasting addresses and explain why they are used. 4.7.9. Create custom subnet masks to meet network design requirements. 4.7.10. Compare and contrast Internet Protocol Version 4 (IPv4) and Internet Protocol Version 6 (IPv6).					
Pathways		Information Support and Services				Programming and Software Dev
	X	Network Systems				Interactive Media
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.8. Network Architecture: Describe network architecture.					
Competencies	4.8.1. Describe media-access protocols (e.g., Carrier Sense Multiple Access with Collision Detection [CSMA/CD], Carrier Sense Multiple Access with Collision Avoidance [CSMA/CA]). 4.8.2. Identify the components of and relationships within the Institute of Electrical and Electronics Engineers (IEEE) 802 standards. 4.8.3. Identify Local Area Network (LAN) performance factors (e.g., signal attenuation, signal propagation delay).					
Pathways		Information Support and Services				Programming and Software Dev
	x	Network Systems				Interactive Media
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.9. Network Operating Systems: Describe and install network operating systems (OSs).
Competencies	4.9.1. Explain how the components of a network OS (i.e., server platform, network services software, network redirection software, communications software) all support network operations).

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	4.9.2. Identify licensing requirements. 4.9.3. Describe the characteristics of the tiered model (e.g., peer-to-peer, thin client, thick client, cloud). 4.9.4. Analyze the advantages and disadvantages of the client/server model. 4.9.5. Select network and desktop OSs (e.g., Windows, Linux, MacOS, iOS, Android). 4.9.6. Install, test, and patch network OSs. 4.9.7. Log in to a network device (e.g., router, Secure File Transfer Protocol [SFTP] server, directory server). 4.9.8. Evaluate the performance of the network OS.					
Pathways		Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.10. Network Administration: Administer network operating systems and services.					
Competencies	4.10.1. Select physical and logical topology. 4.10.2. Connect devices to network systems. 4.10.3. Create domain trusts. 4.10.4. Maintain domain controllers. 4.10.5. Create user accounts, groups, and login scripts. 4.10.6. Establish shared network resources. 4.10.7. Define and set access controls on files, folders, shares, and directories. 4.10.8. Configure network domain accounts and profiles. 4.10.9. Create roaming user profiles. 4.10.10. Troubleshoot network performance connectivity (e.g., performance monitor, command line utilities). 4.10.11. Explain the fundamentals of Quality of Service (QoS).					
Pathways		Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

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Strand	4. Infrastructure Systems
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Outcome	4.11. Cloud Computing: Implement a hypervisor.					
Competencies	4.11.1. Differentiate between public, private, and hybrid clouds and describe the fundamental cloud components (e.g., shared or dedicated processing, storage, memory, networking, hypervisor). 4.11.2. Provision cloud services (e.g., Software as a Service [SaaS], Platform as a Service [PaaS], Infrastructure as a Service [IaaS], Security as a Service).					
Pathways		Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.12. Wide Area Network: Design a wide area network (WAN).
Competencies	4.12.1. Select WAN connections (e.g., satellite, Synchronous Optical Network (SONET), T1, T3, E1, E3, Digital Subscriber Line [DSL], cable, Worldwide Interoperability for Microwave Access [WiMAX], Multiprotocol Label Switching [MPLS], frame relay). 4.12.2. Describe point-to-point (PTP) and point-to-multipoint (PTMP) interconnection. 4.12.3. Evaluate and select basic telecommunications services (e.g., satellite, circuit switching, wireless, packet switching) and carriers for WAN requirements. 4.12.4. Identify the role of telecommunications tariffs. 4.12.5. Determine availability from Local Area Network (LAN) to meet WAN requirements. 4.12.6. Determine the speed needed between sites to access applications. 4.12.7. Determine the subnets needed on the WAN (e.g., Variable Length Subnet Masking [VLSM]). 4.12.8. Evaluate and select transmission options. 4.12.9. Evaluate and select routing protocols (e.g., Border Gateway Routing Protocol (BGRP), Open Shortest Path First (OSPF), Routing Information Protocol Version 2 (RIPv2]).

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Pathways		Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	4.13. Disaster Recovery: Recommend disaster recovery and business continuity plans.					
Competencies	4.13.1. Differentiate between disaster recovery and business continuity. 4.13.2. Identify common backup devices. 4.13.3. Identify the criteria for selecting a backup system. 4.13.4. Establish process for archiving files. 4.13.5. Develop a disaster recovery plan.					
Pathways	X	Information Support and Services			Programming and Software Dev	
	X	Network Systems			Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Career Field	Information Technology	**Page 1**
Strand	5. Programming and Software Systems	
Description	Learners apply principles of computer programming and software development to develop code; build, test, and debug programs; create finished products; and plan, analyze, design, develop, implement, and support software applications.	

Outcome	5.1. Programming Concepts: Describe programming concepts.					
Competencies	5.1.1. Describe how computer programs and scripts can be used to solve problems (e.g., desktop, mobile, enterprise). 5.1.2. Explain how algorithms and data structures are used in information processing. 5.1.3. Model the solution using both graphic tools (e.g., flowcharts) and pseudocode techniques. 5.1.4. Describe, compare, and contrast the basics of procedural, structured, object-oriented (OO), and event-driven programming. 5.1.5. Describe the concepts of data management through programming languages. 5.1.6. Analyze the strengths and weaknesses of different languages for solving a specific problem. 5.1.7. Compare and contrast the functions and operations of compilers and interpreters. 5.1.8. Describe version control and the relevance of documentation.					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	5.2. Computational and String Operations: Develop code that performs computational and string operations.					
Competencies	5.2.1. Compare and contrast primitive types of numeric and nonnumeric data (e.g., integers, floats, Boolean, strings). 5.2.2. Identify the scope of data (e.g., global vs. local, variables, constants, arrays). 5.2.3. Write code that uses arithmetic operations. 5.2.4. Write code that uses subtotals and final totals. 5.2.5. Write code that applies string operations (e.g., concatenation, pattern matching, substring).					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
		Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Career Field	Information Technology	Page 2
Strand	5. Programming and Software Systems	
Description	Learners apply principles of computer programming and software development to develop code; build, test, and debug programs; create finished products; and plan, analyze, design, develop, implement, and support software applications.	

Outcome	5.3. Logical Operations and Control Structures: Develop code that uses logical operations and control structures.					
Competencies	5.3.1. Explain Boolean logic. 5.3.2. Solve a truth table. 5.3.3. Write code that uses logical operators (e.g., and, or, not). 5.3.4. Write code that uses relational operators and compound conditions. 5.3.5. Write code that uses conditional control structures (e.g. if, if-then-else). 5.3.6. Write code that uses repetition control structures (e.g., while, for). 5.3.7. Write code that uses selection control structures (e.g., case, switch). 5.3.8. Write code that uses nested structures and recursion. 5.3.9. Write code that creates and calls functions. 5.3.10. Code error-handling techniques. 5.3.11. Write code to access data repositories.					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	5.4. Integrated Development Environment: Build and test a program using an integrated development environment (IDE).					
Competencies	5.4.1. Configure options, preferences, and tools. 5.4.2. Write and edit code in the IDE. 5.4.3. Compile or interpret a working program. 5.4.4. Define test cases. 5.4.5. Test the program using defined test cases. 5.4.6. Correct syntax and runtime errors. 5.4.7. Debug logic errors.					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	5.5. Programming Conventions: Develop programs using applications security best

	practices according to information security policies (e.g. cross-site scripting, Structured Query Language [SQL] injection attack, bounds-checking).					
Competencies	5.5.1. Develop programs using data validation techniques. 5.5.2. Develop programs that use reuse libraries. 5.5.3. Develop programs using operating system calls. 5.5.4. Develop programs that call other programs. 5.5.5. Use appropriate naming conventions and apply comments. 5.5.6. Format output (e.g., desktop, mobile, enterprise, reports, data files).					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	5.6. Software Development Lifecycle: Apply the software development lifecycle (SDLC).
Competencies	5.6.1. Determine requirements specification documentation. 5.6.2. Identify constraints and system processing requirements. 5.6.3. Develop and adhere to timelines. 5.6.4. Identify a programming language, framework, and an integrated development environment (IDE). 5.6.5. Identify input and output (I/O) requirements. 5.6.6. Design system inputs, outputs, and processes. 5.6.7. Document a design using the appropriate tools (e.g., program flowchart, dataflow diagrams, Unified Modeling Language [UML]). 5.6.8. Create documentation (e.g., implementation plan, contingency plan, data dictionary, user help). 5.6.9. Review the design (e.g., peer walkthrough). 5.6.10. Present system design to stakeholders. 5.6.11. Develop the application. 5.6.12. Compare and contrast software methodologies (e.g. agile, waterfall) 5.6.13. Perform code reviews (e.g. peer walkthrough, static analysis) 5.6.14. Ensure code quality by testing and debugging the application (e.g. system testing, user acceptance testing). 5.6.15. Train stakeholders.

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	5.6.16. Deploy the application. 5.6.17. Collect application feedback and maintain the application.					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	5.7. Configuration Management: Describe configuration management activities.					
Competencies	5.7.1. Explain version management and interface control. 5.7.2. Explain baseline and software lifecycle phases. 5.7.3. Analyze the impact of changes.					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

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Career Field	Information Technology	**Page 1**
Strand	6. Web Development	
Description	Learners apply principles of design and technology, including programming standards and protocols, to create, test, host, and maintain webpages and websites with text, graphics, multimedia, scripting, linking, and data integration in a structure that is easy to navigate and accessible for all users via a variety of hardware and software platforms.	

Outcome	6.1. Webpages: Create basic webpages.					
Competencies	6.1.1. Describe the basic principles of Hypertext Markup Language (HTML) and its functional relationship with web browsers. 6.1.2. Plan a webpage considering subject, devices, audience, layout, color, links, graphics, and Americans with Disabilities Act (ADA) requirements. 6.1.3. Format the text of a webpage in a WYSIWYG(What You See Is What You Get) editor and in a text editor using HTML formatting tags (e.g., hyperlink, e-mail, table formatting, graphic attributes). 6.1.4. Use writing process techniques (i.e., drafting, revising, editing, proofreading) to check the webpage for format and text accuracy. 6.1.5. Create and format ordered and unordered lists on a webpage using HTML list formatting tags. 6.1.6. Create and format a table in a webpage using HTML table formatting tags and attributes. 6.1.7. Integrate styles (e.g., inline or external Cascading Style Sheets [CSS]).					
Pathways	X	Information Support and Services	X	Programming and Software Dev		
	X	Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	6.2. Links and Multimedia: Add links to a webpage and insert multimedia files.			
Competencies	6.2.1. Create absolute links and relative links. 6.2.2. Write a Hypertext Markup Language (HTML) anchor that links to another section of the same webpage. 6.2.3. Create hyperlinks that send e-mail messages and download files. 6.2.4. Insert image and wrap text around the image using Cascading Style Sheets (CSS). 6.2.5. Resize a graphic image in a webpage using CSS. 6.2.6. Insert audio and video files into a webpage using HTML tags. 6.2.7. Build a hover or mouseover effect to change the style of a link.			
Pathways	X	Information Support and Services	X	Programming and Software Dev
		Network Systems	X	Interactive Media

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Career Field	Information Technology	**Page 2**
Strand	6. Web Development	
Description	Learners apply principles of design and technology, including programming standards and protocols, to create, test, host, and maintain webpages and websites with text, graphics, multimedia, scripting, linking, and data integration in a structure that is easy to navigate and accessible for all users via a variety of hardware and software platforms.	

Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	6.3. Scripting: Integrate scripting into a webpage.					
Competencies	6.3.1. Select and apply scripting languages used in web development. 6.3.2. Insert client-side script into a webpage. 6.3.3. Insert comments into client-side scripts.					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	6.4. Web Forms: Integrate forms into a webpage.					
Competencies	6.4.1. Design a data entry form from specifications that will accept variety of user inputs, (e.g., radio buttons, text entry fields, check boxes, drop-down menus). 6.4.2. Write the Hypertext Markup Language (HTML) code to add a form to a webpage. 6.4.3. Write the HTML code to add text entry fields, radio buttons, check boxes, drop-down menus, and other user inputs to a form. 6.4.4. Explain the concept of a form action. 6.4.5. Write the HTML code to add a working button (e.g., submit, reset) to a form. 6.4.6. Format a completed form using HTML and Cascading Style Sheets (CSS) (e.g., fieldset, tabindex). 6.4.7. Code scripting to interact with data sources (e.g., database, web services).					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	6.5. Websites: Create and update a website.
Competencies	6.5.1. Implement web programming standards and protocols (e.g., World Wide

	Web Consortium [W3C], Hypertext Markup Language [HTML] 5). 6.5.2. Plan a website's structure for navigation and usability. 6.5.3. Utilize standard web programming languages (e.g., markup, scripting languages) in website development. 6.5.4. Install and configure a content management system (CMS). 6.5.5. Select an integrated development environment (IDE). 6.5.6. Create and edit a webpage template. 6.5.7. Create and attach cascading style sheets (CSS). 6.5.8. Format website layout (e.g., targeted platforms, text formatting, background color, text, tables, lists, iframes). 6.5.9. Incorporate audio and video, forms, and links on a website. 6.5.10. Develop and execute usability tests on a completed website, checking for information accessibility, ease of use, and navigation. 6.5.11. Code a website for cross-platform and cross-browser compatibility and validation. 6.5.12. Publish the completed website to a web server.					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems	X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Career Field	Information Technology	**Page 1**
Strand	7. Digital Media	
Description	Learners apply principles of digital media to produce interactive media, develop and produce multimedia applications, integrate typography into media, create 3-D models and 2-D and 3-D animation, and create digital video, audio, and photographs.	

Outcome	7.1. Interactive Media: Describe and explain interactive media and interactive media production.						
Competencies	7.1.1. Identify the types and uses of interactive media environments (e.g., web-based, kiosks, games, mobile devices, video, print). 7.1.2. Describe the components of interactive media. 7.1.3. Identify the major characteristics of interactive media presentations. 7.1.4. Identify important historical developments and future trends in interactive media. 7.1.5. Identify the major interactive media genres. 7.1.6. Perform critical review of interactive media products in different genres. 7.1.7. Identify the intellectual property rights, responsibilities, and controls related to interactive media. 7.1.8. Analyze the social and cultural implications of interactive media. 7.1.9. Identify major applications for interactive media (e.g., sales and marketing, interactive advertising, education, corporate training, corporate communications, distance learning, news, entertainment). 7.1.10. Identify specific uses for interactive media in each potential market.						
Pathways	X	Information Support and Services		X	Programming and Software Dev		
	X	Network Systems		X	Interactive Media		
Green Practices		Green-specific	X	Context-dependent			Does not apply

Outcome	7.2. Multimedia Tools: Develop navigational structures, scripts, storyboards, and flowcharts for multimedia applications.
Competencies	7.2.1. Choose a navigational menu structure (e.g., rollovers, drop-downs, disjointed). 7.2.2. Construct and place navigational units. 7.2.3. Build in interactive elements. 7.2.4. Determine uses and needs for site maps, multimedia scripts, storyboards, and flowcharts. 7.2.5. Make preliminary sketches showing placement of images and text on screen. 7.2.6. Show placement of buttons and navigational graphics. 7.2.7. Provide information on color schemes.

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Career Field	Information Technology	
Strand	7. Digital Media	
Description	Learners apply principles of digital media to produce interactive media, develop and produce multimedia applications, integrate typography into media, create 3-D models and 2-D and 3-D animation, and create digital video, audio, and photographs.	Page 2

	7.2.8. Describe music, video, and special effects to be used. 7.2.9. Provide a sample layout to stakeholders for review. 7.2.10. Select and create visual design elements appropriate for the intended audience and use. 7.2.11. Develop characters and narrative to support intended outcomes.					
Pathways		Information Support and Services			Programming and Software Dev	
		Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	7.3. Production: Produce interactive media.					
Competencies	7.3.1. Select the media elements to be used (e.g., sound, video, graphics, text, animation). 7.3.2. Generate text for multi-image presentations (e.g., title graphics, charts, graphs). 7.3.3. Incorporate graphics (e.g., digital, hand-drawn, photographic). 7.3.4. Incorporate computer animation. 7.3.5. Prepare and integrate photographic images and special effects with graphic images. 7.3.6. Incorporate video footage. 7.3.7. Edit video footage. 7.3.8. Record and/or acquire sound track (e.g., narrative, voiceover, sound effects, music). 7.3.9. Integrate sound with visuals. 7.3.10. Produce, test, debug, and archive final product.					
Pathways		Information Support and Services	X		Programming and Software Dev	
		Network Systems	X		Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	7.4. Graphics: Construct and manipulate digital graphics.
Competencies	7.4.1. Identify the purpose and intended audience of graphics. 7.4.2. Select color, shape, size, and texture of objects.

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Career Field	Information Technology	
Strand	7. Digital Media	
Description	Learners apply principles of digital media to produce interactive media, develop and produce multimedia applications, integrate typography into media, create 3-D models and 2-D and 3-D animation, and create digital video, audio, and photographs.	Page 3

	7.4.3. Create or acquire graphics. 7.4.4. Manipulate and layer objects. 7.4.5. Differentiate between vector and raster images. 7.4.6. Select an appropriate graphic file format and resolution. 7.4.7. Optimize and export graphics files for intended use. 7.4.8. Select graphic software applications. 7.4.9. Manipulate graphic objects. 7.4.10. Compress and decompress graphic files. 7.4.11. Describe and select color profiles (e.g., Red Green Blue [RGB], Cyan Magenta Yellow Key [CMYK], Pantone)					
Pathways		Information Support and Services			Programming and Software Dev	
		Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	7.5. Typography: Integrate typography in media.					
Competencies	7.5.1. Identify typographic measurements (e.g., picas, points, pixels, ems). 7.5.2. Mix families of type within a project. 7.5.3. Select appropriate kerning, leading, tracking, and other related formatting. 7.5.4. Identify appropriate typefaces (e.g., serif, sans serif, Web Safe, screen, print). 7.5.5. Prepare a type style guide.					
Pathways		Information Support and Services			Programming and Software Dev	
		Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	7.6. Animation: Create 2-D and 3-D animation.
Competencies	7.6.1. Develop a plan and storyboard for an animation. 7.6.2. Import 2-D or 3-D assets. 7.6.3. Create key frames and apply tweens and paths. 7.6.4. Create special effects and virtual navigation. 7.6.5. Create 2-D or 3-D environments. 7.6.6. Render and export animations.

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Career Field	Information Technology	**Page 4**
Strand	7. Digital Media	
Description	Learners apply principles of digital media to produce interactive media, develop and produce multimedia applications, integrate typography into media, create 3-D models and 2-D and 3-D animation, and create digital video, audio, and photographs.	

Pathways		Information Support and Services			Programming and Software Dev	
		Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	7.7. Video: Create a video production.					
Competencies	7.7.1. Identify equipment and other production needs. 7.7.2. Analyze the script and storyboard to develop a production schedule. 7.7.3. Set up audio, lighting, and scenery for the shoot. 7.7.4. Select a video recording format and shoot the video. 7.7.5. Select a linear or nonlinear editing system and edit the video. 7.7.6. Add transitions (e.g., dissolves, wipes, cuts), titles, special effects, and digital effects. 7.7.7. Add a sound track, narration, and/or voiceover. 7.7.8. Export video to desired medium.					
Pathways		Information Support and Services			Programming and Software Dev	
		Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	7.8. Audio: Create an audio production.					
Competencies	7.8.1. Evaluate performance needs and technical resources. 7.8.2. Identify sound requirements based on script analysis. 7.8.3. Design score appropriate to production and postproduction needs. 7.8.4. Determine microphone and speaker placement. 7.8.5. Select and incorporate Foley mechanical and electrical sound effects. 7.8.6. Set up and operate audio-for-video recording devices. 7.8.7. Set up and operate time code system for audio-video synchronization. 7.8.8. Perform audio mixing.					
Pathways		Information Support and Services			Programming and Software Dev	
		Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

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Career Field	Information Technology	**Page 5**
Strand	7. Digital Media	
Description	Learners apply principles of digital media to produce interactive media, develop and produce multimedia applications, integrate typography into media, create 3-D models and 2-D and 3-D animation, and create digital video, audio, and photographs.	

Outcome	7.9. Photographs: Create photographs.					
Competencies	7.9.1. Select and set up lighting needed (e.g., electronic flash units, reflectors, bounce, spot, daylight). 7.9.2. Select a digital file format or film format and camera. 7.9.3. Select and attach lenses (e.g., wide-angle, telephoto, zoom) and filters (e.g., color-compensating, polarizing, special effects). 7.9.4. Determine composition, formal qualities, scale, and use of space. 7.9.5. Shoot photographs. 7.9.6. Edit photographs (e.g., color corrections, cropping, enhancements).					
Pathways		Information Support and Services			Programming and Software Dev	
		Network Systems		X	Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply

Career Field	Information Technology
Strand	8. Databases
Description	Learners apply principles of designing, creating, and maintaining databases, including data storage, retrieval, modeling, manipulation, and formatting; database access, management, and administration; and database hardware and software issues.

Outcome	8.1. Data Modeling: Develop a data model to describe an application's data.					
Competencies	8.1.1. Develop specifications for a database in consultation with client. 8.1.2. Identify the real-world entities (e.g., customers, purchases) to put in a table and the attributes of entities (e.g., customer names and addresses, purchase dates and amounts). 8.1.3. Identify the relationships between database entities. 8.1.4. Determine the data types (e.g., text, numbers) and domains (e.g., number greater than zero, text string of two letters) of attributes. 8.1.5. Determine whether attributes allow for null value. 8.1.6. Determine unique identifiers (i.e., keys) of entities. 8.1.7. Normalize data model as appropriate for the application. 8.1.8. Generate data modeling documentation (e.g., entity-relationship, workflow, Unified Modeling Language [UML]). 8.1.9. Verify that the data model matches specifications.					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	8.2. Design and Creation: Design and create databases.					
Competencies	8.2.1. Design and create database tables and relationships. 8.2.2. Create database columns and specify properties (e.g., name, type, domain). 8.2.3. Name tables and fields in conformance with naming conventions. 8.2.4. Define indexes as appropriate for the application.					
Pathways		Information Support and Services	X	Programming and Software Dev		
		Network Systems		Interactive Media		
Green Practices		Green-specific	X	Context-dependent		Does not apply

Outcome	8.3. Data Entry and Access: Enter and access data in databases.
Competencies	8.3.1. Create, edit, and delete records. 8.3.2. Enter and bulk import data into databases and transfer data between databases. 8.3.3. Write Structured Query Language (SQL) scripts and stored procedures.

Career Field	Information Technology
Strand	8. Databases
Description	Learners apply principles of designing, creating, and maintaining databases, including data storage, retrieval, modeling, manipulation, and formatting; database access, management, and administration; and database hardware and software issues.

	8.3.4. Retrieve, filter, sort, and parse data. 8.3.5. Commit and roll back transactions. 8.3.6. Generate and print forms, reports, and results of queries (e.g., calculated fields, functions).						
Pathways		Information Support and Services			X	Programming and Software Dev	
		Network Systems				Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply	

Outcome	8.4. Database Management: Manage databases.						
Competencies	8.4.1. House database files in an environment appropriate to anticipated user demand. 8.4.2. Control user access to data. 8.4.3. Log access to database by user and type of transaction. 8.4.4. Backup, verify, and recover data.						
Pathways		Information Support and Services			X	Programming and Software Dev	
		Network Systems				Interactive Media	
Green Practices		Green-specific	X	Context-dependent		Does not apply	

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Competency Based Course Map – ART 1110 CBE

Course Name	Art Appreciation – Introduction to Art and Art Media
Faculty Developers	Kelly Joslin
Department	ART
Program	LCS
Course Description	Emphasis on the language of art, exposure to many different art forms, formulative ideas about what is viewed and exploration of specific media.
Learning Resources	
Student Project Summary	Will this course have an associated student project? Yes: ☐ No: ☐x

1	**Competency 1 -** Recognize and differentiate various art media used throughout history, and describe the steps in the creation of a work of art.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
1.1	Describe various drawing techniques and tools	Unit 3 – Two-Dimensional Media - Drawing	Textbook & Online Lessons Writing Activity 3 & Pre/Post Assessment 3
1.2	Recognize and understand the difference between dry and liquid drawing media	Unit 3 – Two-Dimensional Media - Drawing	Textbook & Online Lessons Writing Activity 3 & Pre/Post Assessment 3

1.3	Describe painting as an artistic medium	Unit 4 – Two-Dimensional Media - Painting	Textbook & Online Lessons Writing Activity 4 & Pre/Post Assessment 4
1.4	Recognize a variety of painting mediums	Unit 4 – Two-Dimensional Media - Painting	Textbook & Online Lessons Writing Activity 4 & Pre/Post Assessment 4
1.5	Compare and contrast two styles using the same medium	Unit 3 – Two Dimensional Media – Drawing Unit 4 – Two-Dimensional Media - Painting	Textbook & Online Lessons Writing Activity 3 Writing Activity 6
1.6	Describe sculpture as an art form	Unit 5 – Three-Dimensional Media - Sculpture	Textbook & Online Lessons Pre/Post Assessment 5
1.7	Distinguish sculptural methods and materials	Unit 5 – Three-Dimensional Media - Sculpture	Textbook & Online Lessons Writing Activity 5 & Pre/Post Assessment 5
1.8	Describe sculpture as a three-dimensional art medium	Unit 5 – Three-Dimensional Media - Sculpture	Textbook & Online Lessons Writing Activity 5 & Pre/Post Assessment 5
1.9	Recognize the various ways in which the human figure is represented in sculptural form	Unit 5 – Three-Dimensional Media - Sculpture	Textbook & Online Lessons Writing Activity 5 & Pre/Post Assessment 5
1.10	Describe architecture as an art form	Unit 6 – Three-Dimensional Media - Architecture	Textbook & Online Lessons Pre/Post Assessment 6
1.11	Explain structural systems and materials	Unit 6 – Three-Dimensional Media - Architecture	Textbook & Online Lessons Writing Activity 6 & Pre/Post Assessment 6

1.12	Recognize architecture's various purposes	Unit 6 – Three-Dimensional Media - Architecture	Textbook & Online Lessons Pre/Post Assessment 6
1.13	Recognize recent directions in architecture	Unit 6 – Three-Dimensional Media - Architecture	Textbook & Online Lessons Pre/Post Assessment 6

2	**Competency 2 -** Analyze and evaluate a work of art utilizing art terminology.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
2.1	Explain the significance of studying works of art in person.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons
2.2	Assess your own experiences, preferences, and associations and how they shape/impact your appreciation of art.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons
2.3	Develop a working vocabulary of art terminology in regard to the Visual Elements.	Unit 2 – The Vocabulary of Art	Textbook & Online Lessons Writing Activity 2 & Pre/Post Assessment 2
2.4	Develop a working vocabulary of art terminology in regard to the Principles of Design.	Unit 2 – The Vocabulary of Art	Textbook & Online Lessons Pre/Post Assessment 2

3	**Competency 3 -**Describe and discuss how iconography (of various cultures and historical periods) is used in art.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**

3.1	Discuss how art is diverse in terms of its beauty, appearance, and meaning.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons Writing Activity 1 & Pre/Post Assessment 1
3.2	Explain why a work of art's meaning may be determined by learning more about its form, content, iconography, and context.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons Writing Activity 1 & Pre/Post Assessment 1

4	**Competency 4 -** Describe and discuss the various themes and purposes of art, as well as the motivation for art.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
4.1	Describe various impulses for art.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons Writing Activity I & Pre/Post Assessment 1
4.2	Assess how art plays a role in your own life.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons
4.3	Explain the artist's role within society.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons Writing Activity I & Pre/Post Assessment 1
4.4	Describe and understand creativity and the creative process.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons Pre/Post Assessment 1
4.5	Recognize that art has evolved and broadened over time.	Unit 1 – Living With Art & Defining Art	Textbook & Online Lessons Pre/Post Assessment 1
4.6	Understand the art patron's important role.	Unit 7 - The Art World - Buying, Selling, Collecting &	Textbook & Online Lessons Writing Activity 7 & Pre/Post

		Exhibiting	Assessment 7
4.7	Identify the art museum's evolution over time.	Unit 7 - The Art World - Buying, Selling, Collecting & Exhibiting	Textbook & Online Lessons Writing Activity 7 & Pre/Post Assessment 7
4.8	Recognize the art museum's role as a means for the conservation and maintenance of art.	Unit 7 - The Art World - Buying, Selling, Collecting & Exhibiting	Textbook & Online Lessons Pre/Post Assessment 7
4.9	Understand the impact of censorship and its consequences.	Unit 7 - The Art World - Buying, Selling, Collecting & Exhibiting	Textbook & Online Lessons Writing Activity 7 & Pre/Post Assessment 7

5	**Competency 5 -** Explain the organizing principles of art.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
5.1	Recognize and understand the Visual Elements of line, shape and mass, light, value, color, texture, pattern, space, time, and motion within a composition.	Unit 2 – The Vocabulary of Art	Textbook & Online Lessons Writing Activity 2 & Pre/Post Assessment 2
5.2	Describe the following Principles of Design: Unity & Variety; Balance; Emphasis & Subordination; Scale & Proportion; Rhythm.	Unit 2 – The Vocabulary of Art	Textbook & Online Lessons Pre/Post Assessment 2

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Competency Based Course Map

Course Name	**CIS 1411 – Network Fundamentals**
Faculty Developers	Jerry Snyder
Department	Business and Public Services Division
Program	Computer Information Systems
Course Description	Introduction to the architecture, structure, and models of the Internet and other computer networks. Principles and structure of Internet Protocol (IP) addressing and fundamentals of Ethernet concepts and operations are explored. Application of basic principles of cabling and configuration of network devices such as routers and switches.
Assessment Notes	Desired SME Qualifications: • Cisco Certified Network Associate (CCNA) qualified • Cisco Certified Academy Instructor (CCAI) qualified • A minimum of a bachelor degree in any program of study at a university
Learning Resources	*Network Basics Companion guide* (2013). Cisco Press. (2013). *Network Basics Course Booklet.* Cisco Press. (2013). *Network Basics Lab Manuel.* Cisco Press. Online curriculum is available when the instructor registers the student for the course Network Fundamental on cisco.netacad.net. This gives the student access to the online curriculum and the chapter tests, Final Skill Based Assessment and Final Exam to include a Course Feedback for Cisco.
Student Project Summary	Will this course have an associated student project? Yes: ☐ No: ☒ There is a final Skill Based Assessment on Packet Tracer 6.0.1 which is simulation software the students download to their PC where all the skills taught for the course are tested.

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Competency 1	Use network protocol models and RFCs to explain the layers of communications in data networks and how they access a network	
Learning Outcomes	**Learning Resource**	**Type**
Explain the role of standards organizations in establishing protocols for network interoperability	Chapter 3 Network Protocols and Communication	**Declarative & Procedural**
Explain why protocols are necessary communications.	Chapter 3 Network Protocols and Communication	**Declarative**
Explain the purpose of adhering to a protocol suite.	Chapter 3 Network Protocols and Communication	**Declarative**
Explain how the TCP/IP model and the OSI model are used to facilitate standardization in the communication process.	Chapter 3 Network Protocols and Communication	**Declarative & Procedural**
Explain why RFCs became the process for establishing standards.	Chapter 3 Network Protocols and Communication	**Declarative & Procedural**
Describe the RFC process.	Chapter 3 Network Protocols and Communication	**Declarative**
. Explain how data encapsulation allows data to be transported across the network	Chapter 3 Network Protocols and Communication	**Declarative**
Explain how local hosts access local resources on a network.	Chapter 3 Network Protocols and Communication	**Declarative & Procedural**
Explain how local hosts access remote resources on a network.	Chapter 3 Network Protocols and Communication	**Declarative**
Explain how the function of the application layer, session layer, and presentation layer work together to provide network services to end user applications.	Chapter 4 Application Layer	**Declarative**
Describe how common application layer protocols interact with end user	Chapter 4 Application Layer	**Declarative**

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applications.		
Describe common application layer protocols that provide Internet services to end users, including World Wide Web services and email.	Chapter 4 Application Layer	**Declarative & Procedural**
Describe application layer protocols that provide IP addressing services, including: DNS and DHCP.	Chapter 4 Application Layer	**Declarative & Procedural**
Describe the features and operation of well-known application layer protocols that allow for file sharing services, including: FTP, File Sharing Services, SMB protocol.	Chapter 4 Application Layer	**Declarative & Procedural**
Describe the Layer 2 frame structure and identify generic fields..	Chapter 9 Network Access	**Declarative**
Describe the purpose and function of the data link layer in preparing communication for transmission on specific media.	Chapter 9 Network Access	**Declarative**
Identify several sources for the protocols and standards used by the data link layer.	Chapter 9 Network Access	**Declarative**
Compare the functions of logical topologies and physical topologies.	Chapter 9 Network Access	**Declarative**
Describe the basic characteristics of media access control methods on WAN topologies.	Chapter 9 Network Access	**Declarative**
Describe the basic characteristics of media access control methods on LAN topologies.	Chapter 9 Network Access	**Declarative**
Describe the basic characteristics and functions of the data link frame.	Chapter 9 Network Access	**Declarative**
Describe the purpose and functions of the physical layer in the network.	Chapter 9 Network Access	**Declarative**
Describe how standards are established for the data link and physical layer.	Chapter 9 Network Access	**Declarative**
Identify the basic characteristics of copper cabling.	Chapter 9 Network Access	**Declarative**
Build a UTP cable used in Ethernet networks.	Chapter 9 Network Access	**Procedural**

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Describe fiber-optic cabling and its main advantages over other media.	Chapter 9 Network Access	**Declarative**
Connect devices using wired and wireless media.	Chapter 9 Network Access	**Procedural**
Explain how devices communicate across network media	Chapter 2 Configuring a Network Operating System	**Declarative**

Competency 2	**Design, calculate, and apply subnet masks and addresses**	
Learning Outcomes	**Learning Resource**	**Type**
Describe the structure of an IPv4 address.	Chapter 7 IP Addressing	**Declarative**
Describe the purpose of the subnet mask.	Chapter 7 IP Addressing	**Declarative**
Compare the characteristics and uses of the unicast, broadcast and multicast IPv4 addresses.	Chapter 7 IP Addressing	**Declarative**
Compare the use of public address space and private address space.	Chapter 7 IP Addressing	**Declarative**
Explain the need for IPv6 addressing.	Chapter 7 IP Addressing	**Declarative**
Describe the representation of an IPv6 address.	Chapter 7 IP Addressing	**Declarative**
Describe the types of IPv6 network addresses.	Chapter 7 IP Addressing	**Declarative**
Configure global unicast addresses.	Chapter 7 IP Addressing	**Procedural**
Describe multicast addresses.	Chapter 7 IP Addressing	**Declarative**

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Describe the role of ICMP in an IP network (include IPv4 and IPv6).	Chapter 7 IP Addressing	**Declarative**
Using ping and traceroute utilities to test network connectivity.	Chapter 7 IP Addressing	**Procedural**
Configure a host device with an IP address.	Chapter 2 Configuring a Network Operating System	**Procedural**

Competency 3	**Build and describe an Ethernet network using routers and switches to include device components, interfaces, and boot up process**	
Learning Outcomes	**Learning Resource**	**Type**
Describe the operation of the Ethernet sublayers.	Chapter 10 Ethernet	**Declarative**
Identify the major fields of the Ethernet frame.	Chapter 10 Ethernet	**Declarative**
Describe the purpose and characteristics of the Ethernet MAC address.	Chapter 10 Ethernet	**Declarative**
Compare the roles of the MAC address and the IP address.	Chapter 10 Ethernet	**Declarative**
Describe the purpose of ARP.	Chapter 10 Ethernet	**Declarative**
Explain how ARP requests impact network host performance.	Chapter 10 Ethernet	**Declarative**
Explain the basic switching concepts.	Chapter 10 Ethernet	**Declarative**
Compare fixed configuration and modular switches.	Chapter 10 Ethernet	**Declarative**
Configure a Layer 3 switch.	Chapter 10 Ethernet	**Procedural**
Describe the common components and interfaces of a router	Chapter 6 Network Layer	**Declarative & Procedural**
Describe the boot-up process of Cisco IOS router	Chapter 6 Network Layer	**Declarative**

Competency 4	**Employ network design and addressing scheme to connect devices**	
Learning Outcomes	**Learning Resource**	**Type**

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Verify connectivity between two end devices.	Chapter 1 Exploring the Network	**Procedural**
Identify the devices and protocols used in a small network.	Chapter 11 It's a Network	**Declarative**
Explain why routing is necessary for hosts on different subnets to communicate.	Chapter 8 Subnetting IP Networks	**Declarative**
Given a network and subnet mask, calculate the number of host addresses available.	Chapter 8 Subnetting IP Networks	**Declarative**
Calculate the necessary subnet mask in order to accommodate a given number of hosts.	Chapter 8 Subnetting IP Networks	**Declarative**
Describe the benefits of variable length subnet masking (VLSM).	Chapter 8 Subnetting IP Networks	**Declarative**
Design and implement a hierarchical addressing scheme.	Chapter 8 Subnetting IP Networks	**Declarative**
Explain how IPv6 address assignments are implemented in a business network.	Chapter 8 Subnetting IP Networks	**Declarative**
Competency 5	**Use Cisco CLI commands to perform basic router and switch configuration, performance, security, and verification**	
Learning Outcomes	**Learning Resource**	**Type**
Explain the purpose of Cisco IOS	Chapter 2 Configuring a Network Operating System	**Declarative**
Explain how to access and navigate Cisco IOS to configure network devices.	Chapter 2 Configuring a Network Operating System	**Declarative & Procedural**
Describe the command structure of Cisco IOS software.	Chapter 2 Configuring a Network Operating System	**Declarative**

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Describe the hostnames on a Cisco IOS device using CLI.	Chapter 2 Configuring a Network Operating System	**Declarative & Procedural**
Use Cisco IOS commands to limit access to device configurations.	Chapter 2 Configuring a Network Operating System	**Declarative & Procedural**
Use Cisco IOS commands to save the running configuration.	Chapter 2 Configuring a Network Operating System	**Declarative & Procedural**
Configure initial settings on a Cisco router	Chapter 6 Network Layer	**Procedural**
Configure two active interfaces on a Cisco IOS router.	Chapter 6 Network Layer	**Procedural**
Configure the default gateway on network devices.	Chapter 6 Network Layer	**Procedural**
Describe the boot up process of a Cisco IOS router	Chapter 6 Network Layer	**Declarative**
Use basic show commands to verify the configuration and status of a device interface.	Chapter 11 It's a Network	**Procedural**
Configure network devices with device hardening features to mitigate security threats.	Chapter 11 It's a Network	**Procedural**
Apply the commands to back up and restore an IOS configuration file.	Chapter 11 It's a Network	**Procedural**
Explain file systems on routers and switches.	Chapter 11 It's a Network	**Declarative**
Describe the need for basic security measures on network devices.	Chapter 11 It's a Network	**Declarative**
Identify security vulnerabilities and general mitigation techniques.	Chapter 11 It's a Network	**Procedural**
Use the output of the ping and tracert commands to establish relative network performance.	Chapter 11 It's a Network	**Procedural**
Competency 6	**Analyze the operations and feature of the transport and network layer protocols and services**	
Learning Outcomes	**Learning Resource**	**Type**
Describe the purpose of the transport layer in managing the transportation of data in end-to-end communication.	Chapter 5 Transport Layer	**Declarative**
Describe the characteristics of the TCP and UDP protocols, including port numbers and their uses.	Chapter 5 Transport Layer	**Declarative**

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Explain how TCP session establishment and termination processes facilitate reliable communication.	Chapter 5 Transport Layer	**Declarative & Procedural**
Explain how TCP protocol data units are transmitted and acknowledged to guarantee delivery.	Chapter 5 Transport Layer	**Declarative**
Describe the UDP client processes to establish communication with a server.	Chapter 5 Transport Layer	**Declarative & Procedural**
Determine whether high-reliability TCP transmissions, or non-guaranteed UDP transmissions, are best suited for common applications.	Chapter 5 Transport Layer	**Declarative & Procedural**
Describe the purpose of the network layer in data communication.	Chapter 6 Network Layer	**Declarative**
Explain why IPv4 protocol other layers provide reliability.	Chapter 6 Network Layer	**Declarative**
Explain the role of the major header fields in IPv4 and IPv6 packets.	Chapter 6 Network Layer	**Declarative**
Explain how devices use the routing tables to direct packets to itself, a local destination, or a default gateway.	Chapter 6 Network Layer	**Declarative**
Compare a host routing table to a routing table in a router.	Chapter 6 Network Layer	**Declarative & Procedural**

Competency 7	**The services, technologies, and issues encountered when designing, building, and maintaining a modern network**	
Learning Outcomes	**Learning Resource**	**Type**
Explain how networks affect the way we instruct, learn, work and play.	Chapter 1 Exploring the Network	**Declarative**
Describe how networks support communication.	Chapter 1 Exploring the Network	**Declarative & Procedural**
Explain the concept of a converged network.	Chapter 1 Exploring the Network	**Declarative & Procedural**

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Describe the four basic requirements of a reliable network.	Chapter 1 Exploring the Network	**Declarative**
Explain the use of network devices.	Chapter 1 Exploring the Network	**Declarative**
Compare the devices and topologies of a LAN to the devices and topologies of a WAN.	Chapter 1 Exploring the Network	**Declarative**
Explain the basic structure of the Internet.	Chapter 1 Exploring the Network	**Declarative & Procedural**
Explain how LANs and WANs interconnect to the Internet.	Chapter 1 Exploring the Network	**Declarative**
Describe the impact of BYOD online collaboration, video, and cloud computing in a business network.	Chapter 1 Exploring the Network	**Declarative**
Explain how expanding networking trends affect security considerations.	Chapter 1 Exploring the Network	**Declarative**
Explain how the three Cisco architectures work to meet the needs of the evolving network environment.	Chapter 1 Exploring the Network	**Declarative**
Explain how a small network serves as the basis of larger networks.	Chapter 11 It's a Network	**Declarative**

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Competency Based Course Map

Course Name	CIS 2212 CBE – Java Software Development I
Faculty Developers	Michelle Cheatham
Department	Business and Public Services Division
Program	Computer Information Systems
Course Description	Introduction to Java software development. Topics include object orientation, Java syntax, data types, logic structures of sequence, selection and iteration, processing calculations, files, methods, classes and objects, graphical user interface (GUI) applications, arrays and the ArrayList class, problem analysis and Java software solution design, coding and testing.
Assessment Notes	Desired SME Qualifications: ● Expertise in software design and development, expertise in Java
Learning Resources	*Introduction to JAVA Programming*, 9th ed. Y. Daniel Ling
Student Project Summary	Will this course have an associated student project? Yes: x No: ☐

1	**Competency 1 – 5.2** Computational and String Operations: Develop code that performs computational and string operations.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks**

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				Ref
1.1	5.2.1 Compare and contrast primitive types of numeric and nonnumeric data (e.g., integers, floats, Boolean, strings).	Topic 1	Declarative & Procedural	
1.2	5.2.2 Identify the scope of data (e.g., global vs. local, variables, constants, arrays).	Topic 4	Declarative & Procedural	
1.3	5.2.3 Write code that uses arithmetic operations.	Topic 1	Declarative & Procedural	
1.4	5.2.5 Write code that applies string operations (e.g., concatenation, pattern matching, substring).	Topic 7	Declarative & Procedural	

2	**Competency 2 – 5.3** Logical Operations and Control Structures: Develop code that uses logical operations and control structures.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
2.1	5.3.3 Write code that uses logical operators (e.g., and, or, not).	Topic 2	Declarative & Procedural	
2.2	5.3.4 Write code that uses relational operators and compound conditions.	Topic 2	Declarative & Procedural	
2.3	5.3.5 Write code that uses conditional control structures (e.g. if, if-then-else).	Topic 2	Declarative & Procedural	

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2.4	5.3.6 Write code that uses repetition control structures (e.g., while, for).	Topic 3	Declarative & Procedural	
2.5	5.3.7 Write code that uses selection control structures (e.g., case, switch).	Topic 2	Declarative & Procedural	
2.6	5.3.9 Write code that creates and calls functions.	Topic 4	Declarative & Procedural	

3	**Competency 3 – 5.4** Integrated Development Environment: Build and test a program using an integrated development environment (IDE).			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
3.1	5.4.2 Write and edit code in the IDE.	Topics 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 16	Declarative & Procedural	
3.2	5.4.3 Compile or interpret a working program.	Topics 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 16	Declarative & Procedural	
3.3	5.4.4 Define test cases.	Topic 7 Strings	Declarative & Procedural	
3.4	5.4.5 Test the program using defined test cases.	Topic 7 Strings	Declarative & Procedural	
3.5	5.4.6 Correct syntax and runtime errors.	Topics 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 16	Declarative & Procedural	

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3.6	5.4.7 Debug logic errors.	Topics 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 16	Declarative & Procedural	

4	**Competency 4 – 5.1** Programming Concepts: Describe programming concepts.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
4.1	5.1.4 Describe, compare, and contrast the basics of procedural, structured, object-oriented (OO), and event-driven programming.	Topic 4, 8, 12	Declarative & Procedural	
4.2	5.1.7 Compare and contrast the functions and operations of compilers and interpreters.	Topic 1	Declarative & Procedural	

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Competency Based Course Map

Course Name	**CIS 2550 - Linux Operating System**
Faculty Developers	Joe Lammers, Eric Renegar, Mike Libassi
Department	Business and Public Services Division
Program	Computer Information systems.
Course Description	Linux operating system installation, management, administration, troubleshooting techniques, writing and debugging shell procedures, pipes and interprocess communications, command lists and network configuration for beginning and intermediate students. This course prepares students for the CompTIA Linux+ exam.
Assessment Notes	
Learning Resources	Cisco Networking Academy https://www.netacad.com/home Baclit, R., Sicam, C., Membrey , P., & Newbigin, J. (2009). *Foundations of CentOS Linux: Enterprise Linux on the Cheap* . Apress. Haeder, A., Schneiter, S. A., Pessanha, B. G., & Stanger, J. (2010). *LPI Linux Certification in a Nutshell* (3rd ed.). O'Reilly Media.
Student Project Summary	Will this course have an associated student project? Yes: ☐ No: X

	Competency 1: System Architecture				
Sinclair Ref	**Learning Outcomes**		**Topic & Learning Resource**	**Type**	
1.1	Determine and configure hardware settings.		Topic 9 in eLearn Net Academy Module 5 -> Ch 15 Lab 15: Hardware Configuration	procedural/declarative	
1.2	Boot the system.		Topic 9 in eLearn Net Academy Module 5 -> Ch 16 Lab: 16: The Boot Process	procedural/declarative	
1.3	Change runlevels and shutdown or reboot the system.		Topic 10 in eLearn Net Academy Module 5 -> Ch 18 Lab 18: Runlevels	procedural/declarative	

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	Competency 2: Linux Installation and Package Management			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	
2.1	Design hard disk layout.	Topic 11 in eLearn Net Academy Module 6 -> Ch 19 Lab 19: Designing a Scheme	procedural/ declarative	
2.2	Install a boot manager.	Topic 10 in eLearn Net Academy Module 5 -> Ch 17 Lab 17: Bootloaders	procedural/ declarative	
2.3	Manage shared libraries.	Topic 16 in eLearn Net Academy Module 8 -> Ch 27 Lab 27: Managing Shared Libraries	procedural/ declarative	
2.4	Use Debian package management.	Topic 15 in eLearn Net Academy Module 8 -> Ch 26 Lab 26: Debian Package Management	procedural/ declarative	
2.5	Use RPM and YUM package management.	Topic 15 in eLearn Net Academy Module 8 -> Ch 25 Lab 25: RPM Package Management	procedural/ declarative	
2.6	Repair simple filesystem problems	Topic 11 in eLearn Net Academy Module 6 -> Ch 20 Lab: 20: Creating Partitions		

	Competency 3: GNU and Unix Commands			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	
3.1	Work on the command line.	Topic 1 in eLearn Net Academy Module 1 -> Ch 1 Lab 1: Using the Shell	procedural/ declarative	
3.2	Process text streams using filters.	Topic 6 in eLearn Net Academy Module 3 -> Ch 10	procedural/ declarative	

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		Lab 10: Standard Text Streams & Redirection		
3.3	Perform basic file management.	Topic 3 in eLearn Net Academy Module 2 ->Ch 5 Lab 5: File Manipulation	procedural/ declarative	
3.4	Use streams, pipes and redirects.	Topic 6 in eLearn Net Academy Module 3 -> Ch 10 Lab 10: Standard Text Streams & Redirection	procedural/ declarative	
3.5	Create, monitor and kill processes.	Topic 6 in eLearn Net Academy Module 3 -> Ch 11 Lab 11: Managing Processes	procedural/ declarative	
3.6	Modify process execution priorities.	Topic 6 in eLearn Net Academy Module 3 -> Ch 11		
3.7	Search text files using regular expressions.	Topic 5 in eLearn Net Academy Module 3 -> Ch 8 Lab 8: Regular Expressions	procedural/ declarative	
3.8	Perform basic file editing operations using vi.	Topic 5 in eLearn Net Academy Module 3 -> Ch 9 Lab 9: The vi Editor	procedural/ declarative	

	Competency 4: Devices, Linux Filesystems, Filesystem Hierarchy Standard			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	
4.1	Create partitions and filesystems.	Topic 13 in eLearn Net Academy Module 7 -> Ch 21 Lab 21: Creating Partitions & Mounting Filesystems	procedural/ declarative	
4.2	Maintain the integrity of filesystems.	Topic 7 in eLearn Net Academy Module 4 -> Ch 13		

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4.3	Control mounting and unmounting of file systems.	Topic 12 in eLearn Net Academy Module 6 -> Ch 21 Lab 21: Creating Partitions & Mounting Filesystems	procedural/ declarative	
4.4	Manage disk quotas.	Topic 14 in eLearn Net Academy Module 7 -> Ch 24 Lab 24: Disk Quotas	procedural/ declarative	
4.5	Manage file permissions and ownership.	Topic 7 in eLearn Net Academy Module 4 -> Ch 13 Lab 13: File Permissions & Ownership	procedural/ declarative	
4.6	Create and change hard and symbolic links.	Topic 8 in eLearn Net Academy Module 4 -> Ch 14 Lab 14: Filesystem Links	procedural/ declarative	
4.7	Find system files and place files in the correct location.	Topic 4 in eLearn Net Academy Module 2 -> Ch 7 Lab 7: Finding Files	procedural/ declarative	
4.8	Monitor free space and inodes	Topic 13 in eLearn Net Academy Module Module 7 -> Ch 22		

	Competency 5: Shells, Scripting and Data Management			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	
5.1	Customize and use the shell environment	Topic 2 in eLearn Net Academy Module 1 -> Ch 4 Lab 4: Configuring the Shell	procedural/ declarative	
5.2	Customize or write sample scripts	Topic 2 in eLearn		

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		Chapter 2 p52 *Foundations of CentOS Linux: Enterprise Linux on the Cheap* *Chapter 13 LPI Linux Certification in a Nutshell*		
5.3	SQL data management	Topic 2 in eLearn Chapter 12 *Foundations of CentOS Linux: Enterprise Linux on the Cheap* *Chapter 13 LPI Linux Certification in a Nutshell*		
5.4	Remove files and directories recursively	Topic 3 in eLearn Net Academy Module 2 -> Ch5		

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Competency Based Course Map

Course Name	CIS 1111 CBE
Faculty Developers	Martha Taylor
Department	Business and Public Services Division
Program	Computer Information Systems
Course Description	Introduction to problem solving techniques used in programming. Students learn to use tools such as flowcharts and pseudocode to plan solutions. Using current programming languages student will design, code, and test programs using the basic structures of sequence, selection, iteration, functions and one dimensional arrays.
Assessment Notes	Desired SME Qualifications: ● Expertise in software design and development, expertise in C++
Learning Resources	Starting out with C++ From Control Structures through Objects, by Tony Gaddis, Haywood Community College, 8th Edition, Pearson Education, 2015, 13:978-0-13-376939-5
Student Project Summary	Will this course have an associated student project? Yes: No: X

1	**Competency 1 –** Programming Concepts: Describe programming concepts.			5.1
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	***Type**	**ITWorks Ref**
1.1	Describe how computer programs and scripts can be used to solve problems (e.g., desktop, mobile, enterprise).	Topics 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15	Procedural	5.1.1

1.2	Explain how algorithms and data structures are used in information processing.	Topics 2, 3, 4	Declarative & Procedural	5.1.2
1.3	Model the solution using both graphic tools (e.g., flowcharts) and pseudocode techniques.	Topics 2, 3, 4	Declarative & Procedural	5.1.3

2	**Competency 2 –** Computational and String Operations: Develop code that performs computational and string operations.			5.2
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
2.1	Compare and contrast primitive types of numeric and nonnumeric data (e.g., integers, floats, Boolean, strings).	Topics 3, 4, 5	Declarative & Procedural	5.2.1
2.2	Identify the scope of data (e.g., global vs. local, variables, constants, arrays).	Topic 12	Declarative & Procedural	5.2.2
2.3	Write code that uses arithmetic operations.	Topics 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15	Declarative & Procedural	5.2.3
2.4	Write code that uses subtotals and final totals	Topics 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15	Declarative & Procedural	5.2.4

3	**Competency 3 –** Logical Operations and Control Structures: Develop code that uses logical operations and control structures.			5.3
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**

3.1	Solve a truth table.	Topics 7, 8	Declarative	5.3.1
3.2	Write code that uses logical operators (e.g., and, or, not).	Topics 7, 8, 10, 11	Declarative & Procedural	5.3.3
3.3	Write code that uses relational operators and compound conditions	Topics 7, 8, 10, 11	Declarative & Procedural	5.3.4
3.4	Write code that uses conditional control structures (e.g. if, if-then-else).	Topics 7, 8, 10, 11, 13, 14	Declarative & Procedural	5.3.5
3.5	Write code that uses repetition control structures (e.g., while, for).	Topics 11, 12, 13, 14	Declarative & Procedural	5.3.6
3.6	Write code that uses selection control structures (e.g., case, switch).	Topics 8	Declarative & Procedural	5.3.7
3.7	Write code that uses nested structures and recursion.	Topics 8, 11, 12, 13	Declarative & Procedural	5.3.8
3.8	Write code that creates and calls functions.	Topics 13, 14	Declarative & Procedural	5.3.9
3.9	Code error-handling techniques.	Topics 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15	Procedural	5.3.10

4	**Competency 4 –** Integrated Development Environment: Build and test a program using an integrated development environment (IDE).			5.4
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**

4.1	Configure options, preferences, and tools.	Topic 3	Procedural	5.4.1
4.2	Write and edit code in the IDE.	Topics 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14	Procedural	5.4.2
4.3	Compile or interpret a working program.	Topics 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15	Procedural	5.4.3
4.4	Define test cases.	Topics 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15	Procedural	5.4.4
4.5	Test the program using defined test cases.	Topics 6, 7, 8, 10, 11, 12, 13, 14, 15	Procedural	5.4.5
4.6	Correct syntax and runtime errors.	Topics 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15	Declarative & Procedural	5.4.6
4.7	Debug logic errors.	Topics 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15	Declarative & Procedural	5.4.7

5	**Competency 5 –** Write code to read and write to file.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
5.1	Write code to create and access arrays	Topic 14	Declarative & Procedural	None

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Competency Based Course Map

Course N..,e	CIS 1140- Information Systems Analysis & Design
Faculty Developers	Patty Santoianni
Department	Business and Public Service Division
Program	Computer Information Systems
Course Description	Introduction to the systems development life cycle and four-phase model (plannin& analysis,design and implementation). Emphasis on requirements gathering,methodology,modeling and skills related to specifications,design and documentation.Discussion of business processes,law,legal issues and ethics for IT professionals.
Assessment Notes	Desired SME Qualifications: • Master's Degree • Industry experience
learning Resources	Custom Bundle:Systems Analysis and Design,lOth ed. (Rosenblatt) Course Technology 2014& Course Mate Access code. Software to create diagrams (such as Visio)
Student Project Summary	Will this course have an associated student project? Yes:Ox No:D

Competency 1- Information Management and Technology: Demonstrate current

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information in business operations

Slndalr Ref	Learnlna Outcomes	Topic: & Learnfnl Resource	Type	nworlcs Ref
1.1	Use evidence-based research to explain how technology influences labor, efficiency, availability, and dissemination of informations.	Chapters 1& 2 Ch.1HW Exam 1	Both	1.1.1
1.2	Demonstrate compliance with security rules, regulations, and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to industry pathway.	Chapters 7,9,12 Exam 2& 3	Both	1.1.4

Competency 2 -Business Ethics and Law: Analyze how professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms contribute to continuous improvement in organizational performance and regulatory compliance.

Slndalr Ref	Learnins Outcomes	Topic & Learnins Resource	TyPe	nworlcs Ref
2.1	Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).	Chapters 10 & 12 ChIHW Ch4HW Ch6HW Exam3	Both	1.2.3
2.2	Identify deceptive practices (e.g., bait and switch, identity, theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their	Chapter9 & 12 Ch4HW Exam3	Both	1.2.5

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	overall impact on organizational performance.			
2.3	Use copyright, intellectual property, and computer laws and regulations to cite proprietary information appropriately (e.g., computer hacking, software piracy, source code, software license, copyright law, Internet, e-mail).	Chapters 7,9,12 Questions of Ethics HW Exam 2&3	Both	1.2.7
2.4	Resolve issues relating to any potential conflicts of interest (e.g., personal gain, project bidding) between personal and organizational ethics.	Chapter 1 Ch4HW Ch6HW Exam 1	Both	1.2.9
2.5	Describe business processes and issues for IT professionals including intellectual law, contracts, regulatory issues, legal, ethical and professional behavior.	Chapter7 Exam 2	Both	
2.6	Research an ethical topic in Information Technology. Analyze pros and cons, case studies, laws and solutions.	Toolkit Part D Internet sites Purdue site Ethics Project	Proc.	

Competency 3 -Operations Management: Plan, organize, and monitor an organization or department to maximize contribution to organizational goals and objectives

Slndalr Ref	Learnins Outcomes	Topic: ❙❙ Learnins Resource	Type	nworks Ref
3.1	Select and organize resources to develop a product or a service	Chapter 1	Both	1.4.1

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	to be rendered.	ChIHW Exam 1		
3.2	Identify the characteristics of a business plan.	Text- ch 2 Exam 1	Declarative	1.4.3
3.3	Identify the organizational structures of businesses.	Chapters 1,3,& 4 Exam 1	Declarative	1.4.4
3.4	Collect information and feedback to help assess the organization's strategic planning and policymaking processes.	Chapters 1,2 & 7 Ch2HW Exams 1&2	Both	1.4.7

Competency 4- Employability Skills: Develop career awareness and employability skills needed for gaining and maintaining employment in multicultural business settings.

Slndalr Ref	Learning Outmmes	Topic & Learning Resource		nworks Ref
4.1	Identify the personal qualifications,aptitudes,and skills necessary to succeed in careers	Chapters 1,4,11& 12 Toolkit A Exam 1&3	Both	1.7.1
4.2	Identify the scope of career opportunities and identify the requirements for education,training,and licensure.	Text- ch 1,websites (khake, Listening article,ITAA,ACM, SCC),Toolkit Part A, Interpersonal skills article & Chapter 12	Both	1.7.2

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		Exam 1&3		
4.3	Develop a career plan that reflects career interests,pathways, and secondary and postsecondary options.	Text- ch 1,websites (khake, Listening article,ITAA,ACM, SCC),Toolkit Part A Ch 12 HW	Both	1.7.3
4.4	Describe the role and function of professional organizations, industry associations,and organized labor and use networking techniques to develop professional relationships.	Chapter4 Ch 12 HW Exam 1	Both	1.7.4
4.5	Develop career awareness and employability skills needed for gaining and maintaining employment in business settings.	Text- ch 1,websites (khake, Listening article,ITAA,ACM, SCC),Toolkit Part A, Interpersonal skills article &Chapters 4&12 Ch 12 HW Exam 1&3	Both	1.7.2
4.6	Develop a personal, career strategic plan including goals, action plans and strategies to remain current and competitive.	Text- ch 1,websites (khake, Listening article,ITAA,ACM, SCC),Toolkit Part A Ch 12 HW	Both	1.7.3

	Competency 5 - Emerging Technologies: Identify trending technologies, their fundamental architecture, and value in the marketplace.			
Sinclair Ref	Learnlnc Outmmes	Topic & Learnlnc Resource	**Type**	nworks Ref

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5.1	Investigate the scope and the impact of mobile computing environments on society.	Chapter 7 Exam2	Declarative	2.4.1
5.2	Describe the differences,advantages,and limitations of cloud computing (e.g.,public cloud,private cloud,hybrid cloud) and on-premises computing.	Chapters 7 & 10 Exam 2&3	Declarative	2.4.2

Competency 6 -Web Architecture: Explain the fundamentals of delivering information and applications using web architecture.

Sindair Ref	Learnln1Outcomes	Topic: & Learnln1Resource	Type	nworks Ref
6.1	Describe ways to present data (e.g.,mobile applications, desktop applications,web applications).	Chapters 7,8,9 & 10 Ch lOHW Exams2&3	Both	2.7.2
6.2	Differentiate between a client and a server.	Text- ch 10 Exam3	Both	2.7.3
6.3	Compare the advantages and disadvantages of running an in-house server or using a service provider.	Chapter 7 Exam2	Both	2.7.7

Competency 7 - Project Concept Proposal: Develop a project concept proposal.

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Sindair Ref	Learning Outcomes	Topic & Learning Resource	Type	nworks Ref
7.1	Determine the scope and purpose of the project.	Chapters 2 & 3 Ch3HW Exam 1	Both	2.9.2
7.2	Develop a timeline,communication plan,task breakdown, costs (e.g., equipment,labor), deliverables,and responsibilities for completion.	Chapters 2 & 3 Ch3HW Exam 1	Both	2.9.5

Competency 8- Rollout and Handoff: Plan rollout and fadlitate handoff to customer.-

Sindair Ref	Learning Outcomes	Topic & Learning Resource	Type	nworks Ref
8.1	Identify support staff,training needs,and contingency plans in the rollout plan.	Chapters 9,10,11,& 12 Ch 11HW Exam3	Both	2.13.4
8.2	Test delivered application to assure that it is fully functional for the customer or user and meets all requirements.	Text- ch 11 Exam3	Declarative	2.13.5

	Competency 9 - Software Development Life Cycle: Apply the software development lifecycle (SDLC).			
Sindair Ref	Learning Outcomes	Topic & Learning Resource	**Type**	nworksRef

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9.1	Describe the need for an Information System methodology,and identify and define the phases of the life cycle approach. Explain the purpose and content of each phase.	Chapters 1& 12 Exam 1&3	Declarative	5.7.2
9.2	Create systems documentation including project plans,process models,data models,structure charts,test plans and user interface designs.	Video Learning Sessions,Luke Wroblewski site,Project Management Institute, Computerworld article Chapters 3,5,6,9,11,& 12 Ch5HW Ch6HW ChSWH Ch9HW Exams 1,2& 3	Both	5.6.7
9.3	Determine requirements specification documentation.	Chapters 2,3,4 & 7 Ch4HW Ch6HW Ch7HW Exam 1&2	Both	5.6.1
9.4	Identify constraints and system processing requirements.	Chapters 2,4,7 & 12 Ch7HW Exams 1,2,& 3	Both	5.6.2
9.5	Identify input and output (I/O) requirements	Chapters 5,7,8,& 11 Ch5HW ChSHW Exams 2 & 3	Both	5.6.5

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9.6	Design system inputs, outputs, and processes.	Chapters 5,7,8,9,10 & 11 ChSHW Exams 2 & 3	Both	5.6.6
9.7	Document a design using the appropriate tools (e.g., program flowchart, dataflow diagrams, Unified Modeling Language [UML]).	Chapter 5,6,7 & 11 Ch5HW Exams 2 & 3	Both	5.6.7
9.8	Compare and contrast software methodologies (e.g.agile, waterfall)	Chapters 1,4 & 11 Ch6HW Exam 1&3	Both	5.6.12

Competency 10 -Configuration Management: Describe configuration management activities.-

Sinclair Ref	Learnlns Outcomes	Topic & Learnins Resource	TyPe	nworksRef
10.1	Explain version management and interface control.	Chapter 1,11&12 Exam 1&3	Declarative	5.7.1
10.2	Explain baseline and software lifecycle phases.	Chapters 1,4,5,7,10,11&12 Exams 1,2& 3	Declarative	5.7.2

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Competency Based Course Map – CIS 1202 CBE

Course Name	C++ Software Development I
Faculty Developers	Reece Newman and Martha Taylor
Department	CIS
Program	
Course Description	Introduction to problem solving techniques used in programming. Students learn to develop C++ programs using expressions, loops, files, functions, and one dimensional arrays.
Learning Resources	Starting Out With C++ From Control Structures Through Objects, by Tony Gaddis, Haywood Community College, (c) 2015 by Pearson Education, ISBN-13: 978-0-13-376939-5
Student Project Summary	Will this course have an associated student project? Yes: ☐ No: ☐x

Guidelines for Completing the Competency Map:

1. There are typically 4-8 competencies per course, although this can vary if needed.
2. There are typically 4-10 learning outcomes per course, although this can vary if needed.
3. Feel free to add/delete tables and/or rows in this document.
4. Start with the IT Works documentation; feel free to add additional competencies or learning outcomes that you need that aren't on the IT Works document.

1	**Competency 1 -** Programming Concepts: Describe programming concepts.		
Sinclair Ref	**Learning Outcomes** Programming Concepts: Describe programming concepts.	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
1.1	Explain how algorithms and data structures are used in information processing.	Chapter 11, 13	Both
1.2	Describe, compare, and contrast the basics of structured, and object-oriented (OO).	Chapter 11, 13, 14	Both
1.3	Describe differences between primitive data types and structured data types including arrays and struts, enums, unions, and classes.	Chapter 11, 13, 14	Both
1.4	Describe concepts of search and sorting arrays and vectors especially linear and binary searches, and bubble and selection sorts.	Chapter 8	Both
1.5	Describe relationships between arrays and pointers	Chapter 7, 8 , 9	Both
1.6	Describe uses of pointers as function parameters and return types and the differences between passing by value, pass by pointer, and pass by reference	Chapter 7, 8, 9	Both

1.7	Use and describe the following object oriented concepts: instance of classes, constructor destructor, overloaded constructor, encapsulation of private data members or public member functions, and arrays of objects.	Chapter 13	Both
1.8	Use and describe the following object oriented concepts: instant of static members, friends of classes, constructors, operator and object overload, and aggregation.	Chapter 14	Both
1.9	Describe and explain the following object oriented concepts: single and multiple inheritance, polymorphism, and virtual functions.	Chapter 15	Both
1.10	Use and explain the following: exceptions, function and class templates, and the standard template library (STL).	Chapter 16	Both

2	**Competency 2** - TBD		
Sinclair Ref	**Learning Outcomes** Computational and String Operations: Develop code that performs computational and string operations.	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
2.1	Write code that applies string operations (e.g., concatenation, pattern matching, substring).	Chapter 10	Procedural

3	**Competency 3** -TBD		
Sinclair Ref	**Learning Outcomes** Logical Operations and Control Structures: Develop code that uses logical	**Topic & Learning Resource (book chapter or add'l**	**Type of assessment: Declarative (objective**

	operations and control structures.	resource)	exam) or Procedural (programming activity), or both
3.1	Demonstrate use of code error-handling techniques.	Chapter 16	Both
3.2	Write code that uses nested structures and recursion.	Chapter 7	Procedural
3.3	Write code that creates and calls functions.	Chapter 7	Procedural
3.4	Demonstrate use of proper code error-handling techniques.	Chapter 12, 16	Both
3.5	Write code to access data repositories.	Chapter 12	Procedural

4	**Competency 4 -** TBD		
Sinclair Ref	**Learning Outcomes** Integrated Development Environment: Build and test a program using an integrated development environment (IDE).	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
4.1	Configure options, preferences, and tools.	All chapters	Both
4.2	Write and edit code in the IDE.	All chapters	Procedural

4.3	Compile or interpret a working program.	All chapters	Procedural
4.4	Define test cases.	All chapters	Procedural
4.5	Test the program using defined test cases.	All chapters	Procedural
4.6	Correct syntax and runtime errors.	All chapters	Procedural
4.7	Debug logic errors.	All chapters	Procedural

5	**Competency 5 -** TBD		
Sinclair Ref	**Learning Outcomes** Programming Conventions: Develop programs using applications security best practices according to information security policies (e.g. bounds-checking).	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
5.1	Develop programs using data validation techniques.	All chapters	Both
5.2	Develop programs that use reuse libraries.	All chapters	Both
5.3	Develop programs that call other programs.	Chapter 13, 14	Procedural
5.4	Use appropriate naming conventions and apply comments.	All chapters	Both

6	**Competency 6-** TBD		
Sinclair Ref	**Learning Outcomes** Software Development Lifecycle: Apply the software development lifecycle (SDLC).	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
6.1	Determine requirements specification documentation.	All chapters	Both
6.2	Identify a programming language, framework, and an integrated development environment (IDE).	All chapters	Both
6.3	Identify input and output (I/O) requirements.	All chapters	Both
6.4	Design system inputs, outputs, and processes.	All chapters	Both
6.5	Document a design using the appropriate tools (e.g Unified Modeling Language [UML]).	All chapters	Both
6.6	Develop the application.	All chapters	Both
6.7	Ensure code quality by testing and debugging the application (e.g. system testing, user acceptance testing).	All chapters	Both

7	**Competency 7-** TBD		
Sinclair Ref	**Learning Outcomes** Demonstrate the appropriate use of advanced file operations.	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
7.1	Explain difference between fstream, ofstream, and ifstream datatypes.	Chapter 12	Both
7.2	Use fstream, ofstream, and ifstream properly and write and read to files.	Chapter 12	Both
7.3	Explain how to format file output.	Chapter 12	Both
7.4	Pass file stream objects to functions by reference.	Chapter 12	Both

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Competency Based Course Map – CIS 1350 CBE

Course Name	Web Site Development with HTML & CSS
Faculty Developers	Mohamed Ali and Mary Oberer
Department	Business and Public Services Division
Program	Computer Information Systems
Course Description	HyperText Markup Language (HTML) and Cascading Style Sheets (CSS) are widely used technologies to create and display content on the web. HTML is the primary language used for creating web pages, including basic text formatting, liking between pages, and adding images and other media. CSS is a styling language that enables the separation of content from style and provides precision control over the display including layout, colors, and fonts. Students will learn to apply best practices for web design and create sites that enhance the usability and interactivity of the pages.
Learning Resources	• *New Perspectives on Blended HTML, and CSS Fundamentals*, Henry Bojack and Sharon Scollard, 3rd Edition, Copyright 2013, ISBN: 978-1-133-52610-0, Course Technology - Cengage Learning • Personal computer with Internet access • HTML text editor (Aptana is recommended, but not required) - free

Guidelines for Completing the Competency Map:

1. There are typically 4-8 competencies per course, although this can vary if needed.
2. There are typically 4-10 learning outcomes per course, although this can vary if needed.
3. Feel free to add/delete tables and/or rows in this document.
4. Start with the IT Works documentation; feel free to add additional competencies or learning outcomes that you need that aren't on the IT Works document.

1	**Competency 1 – 6.1.** Webpages: Create basic webpages.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
1.1	6.1.1. Describe the basic principles of Hypertext Markup Language (HTML) and its functional relationship with web browsers.	Tutorial 1, 3, 5	Declarative
1.2	6.1.2. Plan a webpage considering subject, devices, audience, layout, color, links, graphics, and Americans with Disabilities Act (ADA) requirements.	Final Project	Declarative and Procedural
1.3	6.1.3. Format the text of a webpage in a WYSIWYG(What You See Is What You Get) editor and in a text editor using HTML formatting tags (e.g., hyperlink, e-mail, table formatting, graphic attributes).	Tutorial 1, 2, 3, 4, 5, 6, 7, 8, 9, Multimedia, Mobile, Final Project	Declarative and Procedural
1.4	6.1.4. Use writing process techniques (i.e., drafting, revising, editing, proofreading) to check the webpage for format and text accuracy.	Tutorial 2, Final Project	Procedural
1.5	6.1.5. Create and format ordered, unordered, and definition lists on a webpage using HTML list formatting tags.	Tutorial 1, 2, 3, 4, 5, 7	Declarative and Procedural
1.6	6.1.6. Create and format a table in a webpage using HTML table formatting tags, attributes and Cascading Style Sheet.	Tutorial 8	Declarative and Procedural
1.7	6.1.7. Integrate styles (e.g., embedded, inline or external Cascading Style Sheets [CSS]).	Tutorial 3, 4, 5, 6, 7, 8, 9, Multimedia, Mobile, Final Project	Declarative and Procedural

2	**Competency 2 – 6.2.** Links and Multimedia: Add links to a webpage and insert multimedia files.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type of assessment: Declarative**

		(book chapter or add'l resource)	(objective exam) or Procedural (programming activity), or both
2.1	6.2.1. Create absolute links and relative links.	Tutorial 2, 5	Declarative and Procedural
2.2	6.2.2. Write a Hypertext Markup Language (HTML) anchor that links to another section of the same webpage.	Tutorial 2, 5	Declarative and Procedural
2.3	6.2.3. Create hyperlinks that send e-mail messages and download files.	Tutorial 2	Declarative and Procedural
2.4	6.2.4. Insert image and wrap text around the image using Cascading Style Sheets (CSS).	Tutorial 5	Declarative and Procedural
2.5	6.2.5. Resize a graphic image in a webpage using CSS.	Tutorial 1, Mobile	Declarative and Procedural
2.6	6.2.6. Insert audio and video files into a webpage using HTML tags.	Tutorial Multimedia	Declarative and Procedural
2.7	6.2.7. Define a style for links; include font families and text effects.	Tutorial 3, 4, 5, 6, 7	Declarative and Procedural
2.8	6.2.8. Define Cascading Style Sheets for print styles and for mobile styles.	Tutorial 7, Mobile	Declarative and Procedural
2.9	6.2.9. Insert images and use as links	Tutorial 2, 4	Declarative and Procedural

3	**Competency 3 –** 6.3. Scripting: Integrate scripting into a webpage.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
3.1	6.3.1. Select and apply Java applet scripting language used in web development.	Tutorial Multimedia	Declarative and Procedural
3.2	6.3.2. Insert link for external JavaScript into a webpage.	Tutorial 2, 3, 4, 5, 6, 7, 8,	Procedural

		9, Multimedia, Mobile, Final Project	

4	**Competency 4 – 6.4.** Web Forms: Integrate forms into a webpage.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
4.1	6.4.1. Design a data entry form from specifications that will accept variety of user inputs, (e.g., radio buttons, text entry fields, check boxes, drop-down menus).	Tutorial 9, Final Project	Declarative and Procedural
4.2	6.4.2. Write the Hypertext Markup Language (HTML) code to add a form to a webpage.	Tutorial 9, Final Project	Declarative and Procedural
4.3	6.4.3. Write the HTML code to add text entry fields, radio buttons, check boxes, drop-down menus, and other user inputs to a form.	Tutorial 9, Final Project	Declarative and Procedural
4.4	6.4.4. Write the HTML code to add a working button (e.g., submit, reset) to a form.	Tutorial 9, Final Project	Declarative and Procedural
4.5	6.4.5. Format a completed form using HTML and Cascading Style Sheets (CSS) (e.g., fieldset, tabindex).	Tutorial 9, Final Project	Declarative and Procedural

5	**Competency 5 -** Websites: Create and update a website.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource (book chapter or add'l resource)**	**Type of assessment: Declarative (objective exam) or Procedural (programming activity), or both**
5.1	6.5.1. Implement web programming standards and protocols (e.g., World Wide Web Consortium [W3C], Hypertext Markup Language [HTML] 5).	Tutorial 1, 2, 3, 4, 5, 6, 7, 8, 9, Multimedia, Mobile,	Declarative and Procedural

		Final Project	
5.2	6.5.2. Plan a website's structure for navigation and usability.	Final Project	Procedural
5.3	6.5.3. Utilize standard web programming languages (e.g., markup, scripting languages) in website development.	Tutorial 1, 2, 3, 4, 5, 6, 7, 8, 9, Multimedia, Mobile, Final Project	Declarative and Procedural
5.4	6.5.4. Select an integrated development environment (IDE).	Tutorial Getting Ready, 1, 2, 3, 4, 5, 6, 7, 8, 9, Multimedia, Mobile, Final Project	Procedural
5.5	6.5.5. Create and attach cascading style sheets (CSS).	Tutorial 3, 4, 5, 6, 7, 8, 9, Multimedia, Mobile, Final Project	Declarative and Procedural
5.6	6.5.6. Format website layout (e.g., targeted platforms, text formatting, background color, text, tables, forms, and lists).	Tutorial 6, 7, 8, 9, Final Project	Declarative and Procedural
5.7	6.5.7. Develop and execute usability tests on a completed website, checking for information accessibility, ease of use, and navigation.	Final Project	Declarative and Procedural
5.8	6.5.8. Code a website for cross-platform and cross-browser compatibility and validation.	Tutorial 1, 2, 3, 4, 5, 6, 7, 8, 9, Multimedia, Mobile, Final Project	Declarative and Procedural
5.9	6.5.9. Publish the completed website to a web server.	Tutorial 1, 2, 3, 4, 5, 6, 7, 8, 9, Multimedia, Mobile, Final Project	Procedural

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Competency Based Course Map

CIS 2222 – ASP.Net with C#

Course Title	**ASP.Net with C#**
Faculty Developers	Mohamed Ali
Department	CIS
Program	
Course Description	This course introduces server side web programming to develop web applications based on ASP.NET technologies with Visual Studio. Students will learn how to develop ASP.NET applications employing web forms and data controls. Visual Studio will be used to develop these applications; Microsoft SQL Server will be used for database manipulations.
Assessment Notes	Faculty developed hands-on assessments (labs, final project). There is also a midterm and final exam based on test items written by the faculty.
Learning Resources	*Beginning ASP.NET 4.5 in C#* , Matthew MacDonald, ISBN 13: 978-1-4302-4251-2, Apress. This textbook is an open educational resource (OER) available to students free of charge in PDF format. From it-ebooks.info.

Recommendations: 5-8 Competencies per course; 4-8 Learning Outcomes per Competency

Competency 1 – Create Windows applications using C# syntax, instructions, and coding conventions.			
No.	**Learning Outcomes**	**Topic & Learning Resource**	**Type (Objective or Procedural, or both?)**
1.1	Develop web applications using Define .NET Framework concepts	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.2	Describe Common Language Runtime (CLR)	Unit 1, Textbook, online lessons, and multimedia resources	Objective
1.3	Explain .NET code compilation	Unit 1, Textbook, online lessons, and multimedia resources	Objective

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1.4	Describe what ASP.NET is and why it's used	Unit 1, Textbook, online lessons, and multimedia resources	Objective
1.5	Explain what ADO.NET and why it's used	Unit 1, Textbook, online lessons, and multimedia resources	Objective
1.6	Create an ASP.NET Web Forms page with code separation	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.7	Add HTML5 elements	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.8	Add text to form	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.9	Create a running form with the Visual Studio Development Server	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.10	Explain a brief history of C#	Unit 1, Textbook, online lessons, and multimedia resources	Objective
1.11	Explain C-Sharp language fundamentals and structure	Unit 1, Textbook, online lessons, and multimedia resources	Objective
1.12	Implement variables & Data Types, expressions & operators, selections, and loops	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.13	Explain a brief history of ASP	Unit 1, Textbook, online lessons, and multimedia resources	Objective
1.14	Develop ASP.NET Web Forms with Visual Studio	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.15	Describe the parts that make up an ASP.NET Web form	Unit 1, Textbook, online lessons, and multimedia resources	Objective
1.16	Describe the role of Server-Side Code Blocks in Web Forms	Unit 1, Textbook, online lessons, and multimedia resources	Objective
1.17	Explain the role of Visual Studio's code beside files	Unit 1, Textbook, online lessons, and multimedia resources	Objective

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1.18	Create, edit, and view a web form using Visual Studio	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.19	Use the Visual Studio IDE	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.20	Use ASP Server Controls on a web page	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.21	Add ASP.NET Standard Web Controls to a Web Page	Unit 1, Textbook, online lessons, and multimedia resources	Procedural
1.22	Explain the purpose of code renderingASP.NET with C#.	Unit 1, Textbook, online lessons, and multimedia resources	Objective

Competency 2 – Design secure log in pages and access a secured database.			
No.	**Learning Outcomes**	**Topic & Learning Resource**	**Type (Objective or Procedural, or both?)**
2.1	Update databases	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.2	Use an advanced SqlDataSource	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.3	Insert records with a DetailsView	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.4	Insert, edit, and delete data with a ListView	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.5	Use ASP.NET validation controls to handle user input errors	Unit 4, Textbook, online lessons, and	Procedural

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		multimedia resources	
2.6	Use ValidationGroups to apply different validation rules	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.7	Avoid duplicate records on page refresh	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.8	Generate a non-default event handler method signature for a control	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.9	Update databases	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.10	Use an advanced SqlDataSource	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.11	Insert records with a DetailsView	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.12	Insert, edit, and delete data with a ListView	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.13	Use ASP.NET validation controls to handle user input errors	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.14	Use ValidationGroups to apply different validation rules	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.15	Avoid duplicate records on page refresh	Unit 4, Textbook, online lessons, and multimedia resources	Procedural
2.16	Generate a non-default event handler method signature for a control	Unit 4, Textbook, online lessons, and multimedia resources	Procedural

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Competency 3 – Develop web applications using Microsoft's ASP.NET with C#.			
No.	**Learning Outcomes**	**Topic & Learning Resource**	**Type (Objective or Procedural, or both?)**
3.1	Explain the general flow of events in an ASP.NET Web Form lifecycle	Unit 2, Textbook, online lessons, and multimedia resources	Objective
3.2	Use Trace to explore the firing of events in a ASP.NET web form	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.3	Explain the difference between PostBack and Changed Events	Unit 2, Textbook, online lessons, and multimedia resources	Objective
3.4	List the different techniques to manage state data	Unit 2, Textbook, online lessons, and multimedia resources	Objective
3.5	Retrieve information from a QueryString	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.6	Use cookies for state data management	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.7	Use session variables to manage state	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.8	Use ViewState for maintaining the state of simple variables	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.9	Use the Global.asax class	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.10	Explain the difference between client-side versus server-side validation and why you need both	Unit 2, Textbook, online lessons, and multimedia resources	Objective
3.11	Use ASP.NET Validation Controls on Web Forms	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.12	Explain the BaseValidator class	Unit 2, Textbook, online lessons, and multimedia resources	Objective

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3.13	Describe how tracing is used to debug a program	Unit 2, Textbook, online lessons, and multimedia resources	Objective
3.14	Enable tracing on a web page	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.15	Add the Trace attribute to a page direction	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.16	Explain the difference between PostBack and ChangedEvents	Unit 2, Textbook, online lessons, and multimedia resources	Objective
3.17	List the different techniques for managing state data	Unit 2, Textbook, online lessons, and multimedia resources	Objective
3.18	Use the Global.asax class	Unit 2, Textbook, online lessons, and multimedia resources	Procedural
3.19	Explain the use of Master Pages	Unit 3, Textbook, online lessons, and multimedia resources	Objective
3.20	Use content pages with a master page	Unit 3, Textbook, online lessons, and multimedia resources	Procedural
3.21	Use Master Pages to specify layout	Unit 3, Textbook, online lessons, and multimedia resources	Procedural
3.22	Use a master page for declaring a site layout structure	Unit 3, Textbook, online lessons, and multimedia resources	Procedural
3.23	Use themes and skins with ASP.NET web pages	Unit 3, Textbook, online lessons, and multimedia resources	Procedural
3.24	Create Skins for AP.NET control properties	Unit 3, Textbook, online lessons, and multimedia resources	Procedural
3.25	Base a theme on existing controls	Unit 3, Textbook, online lessons, and multimedia resources	Procedural
3.26	Apply a theme to a website	Unit 3, Textbook, online lessons, and multimedia resources	Procedural

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3.27	Apply a theme programmatically	Unit 3, Textbook, online lessons, and multimedia resources	Procedural

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Competency Based Course Map

Course Name	**CIS 2421 – Scaling Networks**
Faculty Developers	Jerry Snyder
Department	Business and Public Services Division
Program	Computer Information Systems
Course Description	The focus of this course is on the architecture, components, and operations of routers and switches in a larger and more complex network. You will learn how to configure routers and switches for advanced functionality. You will do the following: ● Configure and troubleshoot DHCP and DNS operations for IPv4 and IPv6 ● Describe the operations and benefits of the Spanning Tree Protocol (STP) ● Configure and troubleshoot STP operations ● Describe the operations and benefits of link aggregation and Cisco VLAN Trunk Protocol (VTP) ● Configure and troubleshoot VTP, STP, and RSTP ● Configure and troubleshoot basic operations of routers in a complex routed network for IPv4 and IPv6 ● Configure and troubleshoot advanced operations of routers and implement RIP, OSPF, and EIGRP routing protocols for IPv4 and IPv6 ● Manage Cisco IOS® Software licensing and configuration files By the end of this course, you will be able to configure and troubleshoot routers and switches and resolve common issues with OSPF, EIGRP, STP, and VTP in both IPv4 and IPv6 networks. You will also develop the knowledge and skills needed to implement DHCP and DNS operations in a network.
Assessment Notes	Desired SME Qualifications: ● Cisco Certified Network Associate (CCNA) qualified ● Cisco Certified Academy Instructor (CCAI) qualified ● A minimum of a bachelor degree in any program of study at a university

Learning Resources	*Scaling Networks Companion Guide* (2013). Cisco Press. Online curriculum is available when the instructor registers the student for the course Network Fundamental on cisco.netacad.net. This gives the student access to the online curriculum and the chapter tests, Final Skill Based Assessment and Final Exam to include a Course Feedback for Cisco.
Student Project Summary	Will this course have an associated student project? Yes: ☐ No: ☒ There is a final Skill Based Assessment on Packet Tracer 6.0.1 which is simulation software the students download to their PC where all the skills taught for the course are tested.

Competency 1	**Describe, Configure, and Troubleshoot Wireless Network Technologies**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Describe wireless LAN technology and standards.	Chapter 4 Wireless LANs	Declarative & Procedural	4.4.1
Describe the components of a wireless LAN infrastructure.	Chapter 4 Wireless LANs	Declarative	4.4.3
Describe wireless topologies.	Chapter 4 Wireless LANs	Declarative	4.4.4
Describe the 802.11 frame structure.	Chapter 4 Wireless LANs	Declarative	4.4.2
Describe the media contention method used by wireless technology.	Chapter 4 Wireless LANs	Declarative	4.4.3
Describe channel management in a WLAN.	Chapter 4 Wireless LANs	Declarative	4.5.3
Describe threats to wireless LANs.	Chapter 4 Wireless LANs	Declarative	2.1.3
Describe wireless LAN security mechanisms.	Chapter 4 Wireless LANs	Declarative	2.1.7

Configure a wireless router to support a remote site.	Chapter 4 Wireless LANs	Declarative & Procedural	4.5.4
Configure wireless clients to connect to a wireless router.	Chapter 4 Wireless LANs	Declarative & Procedural	4.5.4
Troubleshoot common wireless configuration issues.	Chapter 4 Wireless LANs	Declarative & Procedural	4.5.5

Competency 2	**Design, build, and configure hierarchical networks with appropriate hardware using a IOS**		**It Works**
Learning Outcomes	**Learning Resource**	**Type**	
Describe the use of the hierarchical network for small business.	Chapter 1 Introduction to Scaling Networks	Declarative	4.1.1
Describe recommendations for designing a network that is scalable.	Chapter 1 Introduction to Scaling Networks	Declarative	4.10.1
Select the appropriate switch hardware features to support network requirements in small to medium sized business networks.	Chapter 1 Introduction to Scaling Networks	Declarative	2.10.1
Describe the types of routers available for small to medium sized business networks.	Chapter 1 Introduction to Scaling Networks	Declarative	2.10.3
Configure basic settings on a Cisco IOS device.	Chapter 1 Introduction to Scaling Networks	Declarative & Procedural	4.1.6

Competency 3	Advanced Switching Operations to include configurations, verification, and troubleshooting of switching protocols.		IT Works
Learning Outcomes	**Learning Resource**	**Type**	
Describe the issues with implementing a redundant network.	Chapter 2 LAN Redundancy	Declarative	4.8.3
Describe IEEE 802.1D STP operation.	Chapter 2 LAN Redundancy	Declarative	4.8.2
Describe the different spanning tree varieties.	Chapter 2 LAN Redundancy	Declarative	4.8.2
Describe PVST+ operation in a switched LAN environment.	Chapter 2 LAN Redundancy	Declarative	4.8.3
Describe Rapid PVST+ in a switched LAN environment.	Chapter 2 LAN Redundancy	Declarative	4.8.3
Configure PVST+ in a switched LAN environment.	Chapter 2 LAN Redundancy	Declarative & Procedural	4.1.6
Identify common STP configuration issues.	Chapter 2 LAN Redundancy	Declarative	4.10.10
Describe link aggregation.	Chapter 3 Link Aggregation	Declarative	4.8.1
Describe Etherchannel technology.	Chapter 3 Link Aggregation	Declarative	4.8.1
Configure link aggregation with Etherchannel.	Chapter 3 Link Aggregation	Declarative & Procedural	4.1.6
Verify and troubleshoot link aggregation with Etherchannel.	Chapter 3 Link Aggregation	Declarative & Procedural	4.10.10

Competency 4	Advanced router lookup process and troubleshooting routing table entries		IT Works
Learning Outcomes	**Learning Resource**	**Type**	
Troubleshoot missing route entries in an EIGRP routing table.	Chapter 8: EIGRP Advanced Configurations and Troubleshooting	Declarative/Procedural	4.10.10

Troubleshoot missing route entries in a single-area OSPFv2 route table.	Chapter 5: Adjust and Troubleshoot Single-Area OSPF	Declarative/Procedural	4.10.10
Troubleshoot missing route entries in a single-area OSPFv3 route table.	Chapter 5: Adjust and Troubleshoot Single-Area OSPF	Declarative/Procedural	4.10.10
Explain how multi area OSPF uses link state advertisements in order to maintain routing tables.	Chapter 6: Multi-Area OSPF	Declarative	4.10.10

Competency 5	**Describe EIGRP and apply advanced configuration, verification, and troubleshooting commands with routers implementing EIGRPv4 and EIGRPv6**		**IT WOrks**
Learning Outcomes	**Learning Resource**	**Type**	
Describe the features and operation of EIGRP.	Chapter 7 EIGRP	Declarative	4.8.2
Examine the different EIGRP packet formats.	Chapter 7 EIGRP	Declarative	4.8.2
Calculate the composite metric used by EIGRP.	Chapter 7 EIGRP	Declarative/Procedural	4.8.2
Describe the concepts and operation of DUAL.	Chapter 7 EIGRP	Declarative	4.8.2
Examine the commands to configure and verify basic EIGRP operations for IPv4 and IPv6.	Chapter 7 EIGRP	Declarative/Procedural	4.1.6
Configure EIGRP automatic summarization.	Chapter 8: EIGRP Advanced Configurations and Troubleshooting	Declarative/Procedural	4.1.6
Configure EIGRP manual summarization.	Chapter 8: EIGRP Advanced Configurations and Troubleshooting	Declarative/Procedural	4.1.6
Configure a router to propagate a default route in an EIGRP network.	Chapter 8: EIGRP Advanced Configurations and Troubleshooting	Declarative/Procedural	4.1.6

Modify EIGRP interface settings to improve network performance.	Chapter 8: EIGRP Advanced Configurations and Troubleshooting	Declarative/Procedural	4.10.10
Explain the process and tools used to troubleshoot an EIGRP network.	Chapter 8: EIGRP Advanced Configurations and Troubleshooting	Declarative	4.10.10
Troubleshoot neighbor adjacency issues in an EIGRP network.	Chapter 8: EIGRP Advanced Configurations and Troubleshooting	Declarative/Procedural	4.10.10
Configure EIGRP authentication to ensure secure routing updates.	Chapter 8 EIGRP Advanced Configurations and Troubleshooting	Declarative/Procedural	4.1.6

Competency 6	**Features and maintenance of IOS images and licensing**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Explain the IOS image naming conventions implemented.	Chapter 9: IOS Images and Licensing	Declarative	4.9.1
Calculate memory requirements needed when upgrading an IOS system image.	Chapter 9: IOS Images and Licensing	Declarative/Procedural	4.9.8
Explain the licensing process software in a small to medium siz business network.	Chapter 9: IOS Images and Licensing	Declarative	4.9.2
Configure a router to install an IOS software image license.	Chapter 9: IOS Images and Licensing	Declarative/Procedural	4.1.6

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Competency Based Course Map

OPT 1100 – Tooling and Machining Metrology

Course Title	**Tooling and Machining Metrology**
Faculty Developers	Phil Garland
Department	OPT
Program	SME
Course Description	Various measurement techniques involving shop measuring instruments; correct use and care of basic inspection instruments; interpretation of blueprints as well as machined products related to engineering needs. Introduction to Coordinate Measuring Machines (CMM). One classroom, three lab hours per week.
Assessment Notes	
Learning Resources	PRIME Modules 1-4, Wisconsin Online

Recommendations: 5-8 Competencies per course; 4-8 Learning Outcomes per Competency

Competency 1 – Define, explain and demonstrate knowledge of terms and procedures as they are used in metrology			
No.	**Learning Outcomes**	**Topic & Learning Resource**	**Type (Objective or Procedural, or both?)**
1.1	Explain what metrology is and why it's important	Prime Mod pgs. 1-11 Wisc. Online: Units of Measure; The History of Standards	Objective
1.2	List three categories of metrology	Prime Mod pgs. 1-11 Wisc. Online: Units of Measure; The History of Standards	Objective
1.3	Perform basic metrological conversions (English-metric, metric-metric)	Prime Mod pgs. 1-11	Both

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		Wisc. Online: Units of Measure; The History of Standards	
1.4	Distinguish between accuracy and precision; define discrimination and sensitivity	Prime Mod pgs. 96; 1-10	Both
1.5	Explain and interpret the Vernier scale – caliper	Prime Mod. pgs. 34-50 Wisconsin Online: Reading a Vernier	Both
1.6	Explain and interpret the Vernier scale – micrometer	Prime Mod. pgs. 69-77	Both
1.7	Distinguish between transfer/comparison measurement and direct measurement	Prime Mod. pgs.	Both
1.8	Explain the care and use of gage blocks	Prime Mod. pgs. 112-123 Wisc. Online: Gage blocks; Gabe block combination review	Procedural
1.9	Explain the role of thermal expansion in measurement	Prime Mod. pgs. 112-123, plus online lessons	Both
1.10	Explain the role of amplification in measuring instruments – dial ind	Prime Mod. pgs. 112-123, plus online lessons	Objective
1.11	Explain the role of amplification in measuring instruments – test ind	Prime Mod. pgs. 112-123, plus online lessons	Objective
1.12	Use Trigonometry to calculate sine bar angles	Prime Mod. pgs. 1-16; Wisc. Online: Practical trig	Both
1.13	Use Trigonometry to calculate sine bar angles; calculate angles w/0 measuring them	Prime Mod. pgs. 16-28, 35-43	Both
1.14	Describe the concept of surface finish	Prime Mod. pgs. 99-101 Wisconsin Online: Surface finish; Surface finish review	Procedural
1.15	Explain the use of optical flats and reference planes in surface measurement	Prime Mod. pgs. 99-122	Procedural
1.16	Explain the uses and roles of the CMM in measurement	Prime Mod. pgs. 1-17	Procedural
1.17	Identify the role of calibration; explain gage R&R and measurement error	Wisconsin Online and other online learning resources (Mitutoyo Gage Blocks, Gabe Block Calibration Process)	Procedural

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Competency 2 – Read and interpret engineering prints and parts requirements.			
No.	**Learning Outcomes**	**Topic & Learning Resource**	**Type (Objective or Procedural, or both?)**
2.1	Identify and interpret the contents of a title block and a revision block on a drawing	Prime Mod, pgs. 22, questions 1-6	Both
2.2	Identify the different line types used in a mechanical drawing	Prime Mod, pgs. 30	Both
2.3	Convert an isometric sketch to a three view drawing	Prime mod, pgs. 38-39	Both
2.4	Correctly read and interpret the dimensions and tolerances on an engineering part drawing	Prime mod, pgs. 58, pg. 88	Both
2.5	Correctly identify the symbols used in GD&T and categorize them as either position or form tolerances	Online learning resources	Both
2.6	Correctly identify and define the concept of primary, secondary, and tertiary datums	Online learning resources	Both

Competency 3 – Demonstrate use of conventional measuring tools such as rules, scales, calipers, micrometers, height & depth gauges, optical & pneumatic comparators, gauge blocks, electronic measurement equipment, profilometers, optical flats and coordinate measuring machines to measure various preselected items and compare to known values.			
No.	**Learning Outcomes**	**Topic & Learning Resource**	**Type (Objective or Procedural, or both?)**
3.1	Demonstrate proper and accurate use of hand gages, standard and metric Vernier calipers, dial calipers, digital calipers, micrometers, and combination sets	Prime Module pgs. pages 34 (Section 2.3.2) through page 56 Wisconsin Online activities	Procedural

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		Online lessons	
3.2	Demonstrate how to take accurate depth and height measurements	Prime Module pgs. pages 34 (Section 2.3.2) through page 56 Wisconsin Online activities Online lessons	Procedural
3.3	List the different types of height and depth gages	Prime Module pgs. pages 34 (Section 2.3.2) through page 56 Wisconsin Online activities Online lessons	Objective
3.4	Demonstrate the use of gage blocks	Prime Module pgs. pages 34 (Section 2.3.2) through page 56 Wisconsin Online activities Online lessons	Procedural
3.5	Demonstrate the appropriate use of surface plates	Prime Module 2, pgs. 112 - 123 Wisconsin Online activities Online lessons	Procedural
3.6	Explain the concept of thermal expansion	Prime Module 2, pgs. 112 - 123 Wisconsin Online activities Online lessons	Objective
3.7	Explain how thermal expansion affects measurement and accuracy	Prime Module 2, pgs. 112 - 123 Wisconsin Online activities Online lessons	Objective
3.8	Describe what a test set is	Online lessons and multimedia resources	Objective
3.9	Explain how a test set is used	Online lessons and multimedia resources	Objective
3.10	Demonstrate taking comparative measurements	Online lessons and multimedia resources	Procedural

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3.11	Demonstrate taking high amplification measurements	Online lessons and multimedia resources	Procedural
3.12	Demonstrate how to measure angles	Prime Module 3 pgs. 16-43 Wisconsin Online activities Online lessons	Procedural
3.13	Define "The Law of Cosines"	Prime Module 3 pgs. 16-43 Wisconsin Online activities Online lessons	Objective
3.14	Describe the use of sine bars	Prime Module 3 pgs. 16-43 Wisconsin Online activities Online lessons	Objective
3.15	Differentiate between a sine bar and a sine plate	Prime Module 3 pgs. 16-43 Wisconsin Online activities Online lessons	Objective
3.16	Using a surface plate and a Sine Bar, demonstrate the proper use of gage blocks with a sine bar to create specified angles	Prime Module 3 pgs. 16-43 Wisconsin Online activities Online lessons	Procedural
3.17	Describe what a compound sine plate is	Prime Module 3 pgs. 16-43 Wisconsin Online activities Online lessons	Objective
3.18	Explain how a compound sine plate is used	Prime Module 3 pgs. 16-43 Wisconsin Online activities Online lessons	Objective
3.19	Describe the concept of surface finish	Prime Module pgs. 98 - 119 Wisconsin Online activities Online lessons	Objective

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3.20	Explain the use of optical flats and reference planes in surface measurement	Prime Module pgs. 98 - 119 Wisconsin Online activities Online lessons	Objective

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Competency Based Course Map

Course Name	CIS 2217 CBE – Java Software Development II
Faculty Developers	Michelle Cheatham
Department	Business and Public Services Division
Program	Computer Information Systems
Course Description	
Assessment Notes	Desired SME Qualifications: ● Expertise in software design and development, expertise in Java
Learning Resources	*Introduction to JAVA Programming*, 9th ed. Y. Daniel Ling
Student Project Summary	Will this course have an associated student project? Yes: x No: ☐

*** NOTE:** "Assessment Type" refers to procedural (a hands-on activity), declarative (an objective, multiple choice exam), or both.

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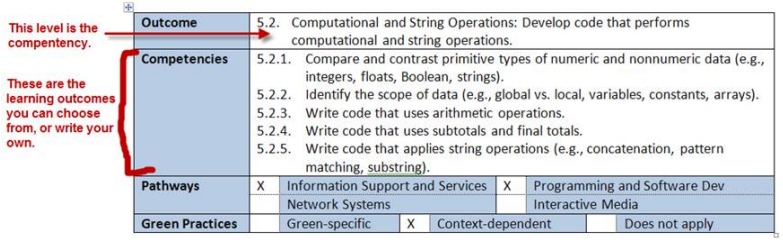

NOTE: You are not tied to the competencies and outcomes from the IT Strands documents. You can add your own if needed. The IT Strands document is a place to start, and you should use the ones in this document that are relevant. But you can also add your own.

1	**Competency 1 – 5. 4 Integrated Development Environment: Build and test a program using an integrated development environment (IDE)**			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Assessment Type? (Procedural, Declarative, or both) * see note above**	**ITWorks Ref**
1.1	Write and edit code in the IDE.	All topics except 8	Procedural	5.4.2
1.2	Compile or interpret a working program.	All topics except 8	Procedural	5.4.3
1.3	Correct syntax and runtime errors.	All topics except 8	Procedural	5.4.6
1.4	Debug logic errors.	All topics except 8	Procedural	5.4.7

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2	**Competency 2 – Data Structures: Apply the appropriate data structure to meet given application requirements**			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Assessment Type**	**ITWorks Ref**
2.1	Choose between and use list-based data structures such as lists, stacks, queues, and priority queues to solve problems	Topics 6 and 10	Both	N/A
2.2	Choose between and use collection-based data structures such as sets and maps to solve problems	Topic 7	Both	N/A
2.3	Choose between and use tree-based data structures such as heaps and binary search trees to solve problems	Topics 9 and 11	Both	N/A
2.4	Perform standard operations such as sorting, searching, and finding the minimum and maximum elements in various data structures	Topics 6-9	Both	N/A

3	**Competency 3 – Sorting: Choose the appropriate sorting algorithm to meet given application requirements**			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Assessment Type**	**ITWorks Ref**
3.1	Describe generic sorting algorithms such as insertion sort, bubble sort, quick sort, merge sort, and heap sort	Topics 5 and 9	Both	N/A
3.2	Describe integer-specific sorting algorithms such as radix sort and	Topic 9	Objective	N/A

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	bubble sort			
3.3	Analyze various sorting algorithms to determine their time complexity in terms of Big-O notation	Topics 8 and 9	Both	N/A
3.4	Use generics to implement sorting algorithms capable of sorting any comparable items	Topics 5 and 9	Both	N/A
3.5	Consider the pros and cons of recursive algorithms such as merge sort and quick sort when choosing a sorting algorithm	Topics 4, 8 and 9	Both	N/A

4	**Competency 4 – Reusable software development: Write programs that leverage Java constructs to increase reusability**			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Assessment Type**	**ITWorks Ref**
4.1	Choose between interfaces and abstract classes to meet specific application requirements	Topic 2	Both	N/A
4.2	Develop generic classes and methods	Topic 4	Both	N/A
4.3	Write programs that use built-in Java interfaces, such as Serializable, Comparable, and Cloneable	Topics 2 and 3	Both	N/A
4.4	Use classes from the Java Collections framework to store data of	Topics 6, 7, 9,	Procedural	N/A

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	various types	and 11		
4.5	Use subclasses of the abstract Java classes InputStream and OutputStream to read and write binary files.	Topic 3	Both	N/A

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Competency Based Course Map

Course Name	BIS 1120 - Computer Concepts & Applications
Faculty Developers	Jen Day and Cheryl Riendl-Johnson
Department	BIS
Program	CIS
Course Description	Uses word processing, spreadsheet, database and presentation software applications to create reports, spreadsheets, databases and presentations for business and other applications.
Assessment Notes	Desired SME Qualifications
Learning Resources	Shaffer, A., Carey, P., Finnegan, K., Adamski, J.J., & Zimmerman, B.B. (2014). *New Perspectives on Microsoft Office 2013*. Stamford: Cengage Learning. SAM - Testing and Training tool
Student Project Summary	Will this course have an associated student project? Yes: ☐ No: X

Note : P= procedural, O= objective, B=both for assessment type

	Competency 1: Spreadsheets - Use spreadsheet software to create spreadsheets and charts for business and other applications.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**

1.1	Open and close a workbook.	Excel Tutorial 1: Getting Started with Excel	P
1.2	Navigate through a workbook and worksheet.	Excel Tutorial 1: Getting Started with Excel	P
1.3	Select cells and ranges.	Excel Tutorial 1: Getting Started with Excel	P
1.4	Plan and create a workbook.	Excel Tutorial 1: Getting Started with Excel	P
1.5	Insert, rename, and move worksheets.	Excel Tutorial 1: Getting Started with Excel	P
1.6	Enter text, dates, and numbers.	Excel Tutorial 1: Getting Started with Excel	P
1.7	Undo and redo actions.	Excel Tutorial 1: Getting Started with Excel	P
1.8	Resize columns and rows.	Excel Tutorial 1: Getting Started with Excel	P
1.9	Enter formulas and the SUM and COUNT functions.	Excel Tutorial 1: Getting Started with Excel	P
1.10	Copy and paste formulas.	Excel Tutorial 1: Getting Started with Excel	P
1.11	Move or copy cells and ranges.	Excel Tutorial 1: Getting	P

		Started with Excel	
1.12	Insert and delete rows, columns, and ranges.	Excel Tutorial 1: Getting Started with Excel	P
1.13	Create patterned text with Flash Fill.	Excel Tutorial 1: Getting Started with Excel	P
1.14	Add cell borders and change font size.	Excel Tutorial 1: Getting Started with Excel	P
1.15	Change worksheet views.	Excel Tutorial 1: Getting Started with Excel	P
1.16	Prepare a workbook for printing.	Excel Tutorial 1: Getting Started with Excel	P
1.17	Save a workbook with a new filename.	Excel Tutorial 1: Getting Started with Excel	P
1.18	Change fonts, font style, and font color.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.19	Add fill colors and a background image.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.20	Create formulas to calculate sales data.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.21	Apply Currency and Accounting formats and the Percent style.	Excel Tutorial 2:	P

		Formatting Workbook Text and Data	
1.22	Format dates and times.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.23	Align, indent, and rotate cell contents.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.24	Merge a group of cells.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.25	Use the AVERAGE function	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.26	Apply cell styles.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.27	Copy and paste formats with the Format Painter.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.28	Find and replace text and formatting.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.29	Change workbook themes.	Excel Tutorial 2: Formatting Workbook	P

		Text and Data	
1.30	Highlight cells with conditional formats.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.31	Format a worksheet for printing.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.32	Set the print area, insert page breaks, add print titles, create headers and footers, and set margins.	Excel Tutorial 2: Formatting Workbook Text and Data	P
1.33	Make a workbook user-friendly.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.34	Translate an equation into an Excel formula.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.35	Understand function syntax.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.36	Enter formulas and functions with the Quick Analysis tool.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.37	Enter functions with the Insert Function dialog box.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P

1.38	Interpret error values.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.39	Change cell references between relative and absolute Session.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.40	Use the AutoFill tool to enter formulas and data and complete a series.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.41	Display the current date with the TODAY function.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.42	Find the next weekday with the WORKDAY function.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.43	Use the COUNT and COUNTA functions to tally cells.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.44	Use an IF function to return a value based on a condition.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.45	Perform an exact match lookup with the VLOOKUP function.	Excel Tutorial 3: Calculating Data with Formatting and Functions	P
1.46	Perform what-if analysis using trial and error and Goal Seek.	Excel Tutorial 3:	P

		Calculating Data with Formatting and Functions	

	Competency 2: Databases - Use database software to create databases for business applications.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
2.1	Learn basic database concepts and terms.	Access Tutorial 1: Creating a Database	P
2.2	Start and exit Access.	Access Tutorial 1: Creating a Database	P
2.3	Explore the Microsoft Access window and Backstage view.	Access Tutorial 1: Creating a Database	P
2.4	Create a blank database.	Access Tutorial 1: Creating a Database	P
2.5	Create and save a table in Datasheet view.	Access Tutorial 1: Creating a Database	P
2.6	Enter field names and records in a table datasheet.	Access Tutorial 1: Creating a Database	P
2.7	Open a table using the Navigation pane.	Access Tutorial 1: Creating a Database	P
2.8	Open an Access database.	Access Tutorial 1: Creating a Database	P

2.9	Copy and paste records from another Access database.	Access Tutorial 1: Creating a Database	P
2.10	Navigate a table datasheet.	Access Tutorial 1: Creating a Database	P
2.11	Create and navigate a simple query.	Access Tutorial 1: Creating a Database	P
2.12	Create and navigate a simple form.	Access Tutorial 1: Creating a Database	P
2.13	Create, preview, navigate, and print a simple report.	Access Tutorial 1: Creating a Database	P
2.14	Use Help in Access.	Access Tutorial 1: Creating a Database	P
2.15	Learn how to compact, back up, and restore a database.	Access Tutorial 1: Creating a Database	P
2.16	Learn the guidelines for designing databases and setting field properties.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.17	Create a table in Design view.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.18	Define fields, set field properties, and specify a table's primary key.	Access Tutorial 2: Building a Database and Defining Table Relationships	P

2.19	Modify the structure of a table.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.20	Change the order of fields in Design view.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.21	Add new fields in Design view.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.22	Change the Format property for a field in Datasheet view.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.23	Modify field properties in Design view.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.24	Import data from an Excel worksheet.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.25	Create a table by importing an existing table structure.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.26	Add fields to a table with the Data Type gallery.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.27	Delete and rename fields	Access Tutorial 2: Building a	P

		Database and Defining Table Relationships	
2.28	Change the data type for a field in Design view.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.29	Set the Default Value property for a field.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.30	Add data to a table by importing a text file.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.31	Define a relationship between two tables.	Access Tutorial 2: Building a Database and Defining Table Relationships	P
2.32	Find, modify, and delete records in a table.	Access Tutorial 3: Maintaining and Querying a Database	P
2.33	Hide and unhide fields in a datasheet.	Access Tutorial 3: Maintaining and Querying a Database	P
2.34	Work in the Query window in Design view.	Access Tutorial 3: Maintaining and Querying a Database	P
2.35	Create, run, and save queries.	Access Tutorial 3: Maintaining and Querying a Database	P
2.36	Update data using a query datasheet.	Access Tutorial 3: Maintaining and Querying a Database	P

2.37	Create a query based on multiple tables.	Access Tutorial 3: Maintaining and Querying a Database	P
2.38	Sort data in a query.	Access Tutorial 3: Maintaining and Querying a Database	P
2.39	Filter data in a query.	Access Tutorial 3: Maintaining and Querying a Database	P
2.40	Specify an exact match condition in a query.	Access Tutorial 3: Maintaining and Querying a Database	P
2.41	Use a comparison operator in a query to match a range of values.	Access Tutorial 3: Maintaining and Querying a Database	P
2.42	Use the AND and OR logical operators in queries.	Access Tutorial 3: Maintaining and Querying a Database	P
2.43	Change the font size and alternate row color in a datasheet.	Access Tutorial 3: Maintaining and Querying a Database	P
2.44	Create and format a calculated field in a query.	Access Tutorial 3: Maintaining and Querying a Database	P
2.45	Perform calculations in a query using aggregate functions and record group calculations.	Access Tutorial 3: Maintaining and Querying a Database	P
2.46	Change the display of database objects in the Navigation pane.	Access Tutorial 3: Maintaining and Querying a Database	P

P	**Competency 3: Presentations - Use presentation software to create**		

	presentations for business and other applications.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
3.1	Plan and create a new presentation.	PowerPoint Tutorial 1: Creating a Presentation	P
3.2	Create a title slide and slides with lists.	PowerPoint Tutorial 1: Creating a Presentation	P
3.3	Edit and format text.	PowerPoint Tutorial 1: Creating a Presentation	P
3.4	Move and copy text.	PowerPoint Tutorial 1: Creating a Presentation	P
3.5	Convert a list to a SmartArt diagram.	PowerPoint Tutorial 1: Creating a Presentation	P
3.6	Duplicate, rearrange, and delete slides.	PowerPoint Tutorial 1: Creating a Presentation	P
3.7	Close a presentation.	PowerPoint Tutorial 1: Creating a Presentation	P
3.8	Open an existing presentation.	PowerPoint Tutorial 1: Creating a Presentation	P
3.9	Change the theme and theme variant.	PowerPoint Tutorial 1: Creating a Presentation	P
3.10	Insert and crop photos.	PowerPoint Tutorial 1: Creating a Presentation	P

3.11	Modify photo compression options.	PowerPoint Tutorial 1: Creating a Presentation	P
3.12	Resize and move object.s	PowerPoint Tutorial 1: Creating a Presentation	P
3.13	Create speaker notes.	PowerPoint Tutorial 1: Creating a Presentation	P
3.14	Check the spelling.	PowerPoint Tutorial 1: Creating a Presentation	P
3.15	Run a slide show.	PowerPoint Tutorial 1: Creating a Presentation	P
3.16	Print slides, handouts, speaker notes, and the outline.	PowerPoint Tutorial 1: Creating a Presentation	P
3.17	Apply a theme used in another presentation.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.18	Insert online pictures.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.19	Insert shapes.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.20	Format shapes and pictures.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.21	Rotate and flip objects.	PowerPoint Tutorial 2: Adding Media and Special Effects	P

3.22	Create a table.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.23	Modify and format a table.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.24	Insert symbols.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.25	Change the proofing language.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.26	Apply and modify transitions.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.27	Animate objects and bulleted lists.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.28	Change how an animation starts.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.29	Add video and modify playback options.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.30	Understand animation effects applied to videos.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.31	Trim video and set a poster frame.	PowerPoint Tutorial 2: Adding Media and Special Effects	P
3.32	Compress media.	PowerPoint Tutorial 2: Adding Media and Special Effects	P

3.33	Add footers and headers.	PowerPoint Tutorial 2: Adding Media and Special Effects	P

	Competency 4: Word Processing - Use word processing software to create various documents and reports.		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
4.1	Create and save a document.	Word Tutorial 1: Creating and Editing a Document	P
4.2	Enter text and correct errors as you type.	Word Tutorial 1: Creating and Editing a Document	P
4.3	Use AutoComplete and AutoCorrect.	Word Tutorial 1: Creating and Editing a Document	P
4.4	Select text and move the insertion point.	Word Tutorial 1: Creating and Editing a Document	P
4.5	Undo and redo actions.	Word Tutorial 1: Creating and Editing a Document	P
4.6	Adjust paragraph spacing, line spacing, and margins.	Word Tutorial 1: Creating and Editing a Document	P
4.7	Preview and print a document.	Word Tutorial 1: Creating and Editing a Document	P
4.8	Create an envelope.	Word Tutorial 1: Creating and Editing a Document	P

4.9	Open an existing document.	Word Tutorial 1: Creating and Editing a Document	P
4.10	Use the Spelling and Grammar task pane.	Word Tutorial 1: Creating and Editing a Document	P
4.11	Change page orientation, font, font color, and font size.	Word Tutorial 1: Creating and Editing a Document	P
4.12	Apply text effects and align text.	Word Tutorial 1: Creating and Editing a Document	P
4.13	Copy formatting with the Format Painter.	Word Tutorial 1: Creating and Editing a Document	P
4.14	Insert a paragraph border and shading.	Word Tutorial 1: Creating and Editing a Document	P
4.15	Delete, insert, and edit a photo.	Word Tutorial 1: Creating and Editing a Document	P
4.16	Use Word Help.	Word Tutorial 1: Creating and Editing a Document	P
4.17	Read, reply to, delete, and add comments.	Word Tutorial 2: Navigating and Formatting a Document	P
4.18	Create bulleted and numbered lists.	Word Tutorial 2: Navigating and Formatting a Document	P
4.19	Move text using drag and drop.	Word Tutorial 2: Navigating and Formatting a Document	P

4.20	Cut and paste text.	Word Tutorial 2: Navigating and Formatting a Document	P
4.21	Copy and paste text.	Word Tutorial 2: Navigating and Formatting a Document	P
4.22	Navigate through a document using the Navigation pane.	Word Tutorial 2: Navigating and Formatting a Document	P
4.23	Find and replace text.	Word Tutorial 2: Navigating and Formatting a Document	P
4.24	Format text with styles.	Word Tutorial 2: Navigating and Formatting a Document	P
4.25	Apply a theme to a document.	Word Tutorial 2: Navigating and Formatting a Document	P
4.26	Review the MLA style for research papers.	Word Tutorial 2: Navigating and Formatting a Document	P
4.27	Indent paragraphs.	Word Tutorial 2: Navigating and Formatting a Document	P
4.28	Insert and modify page numbers.	Word Tutorial 2: Navigating and Formatting a Document	P
4.29	Create citations	Word Tutorial 2: Navigating and Formatting a Document	P
4.30	Create and update a bibliography.	Word Tutorial 2: Navigating and Formatting a Document	P

4.31	Modify a source.	Word Tutorial 2: Navigating and Formatting a Document	P
4.32	Review document headings in the Navigation pane.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.33	Reorganize document text using the Navigation pane.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.34	Collapse and expand body text in a document.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.35	Create and edit a table.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.36	Sort rows in a table.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.37	Modify a table's structure.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.38	Format a table.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.39	Set tab stops.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.40	Turn on automatic hyphenation.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.41	Create footnotes and endnotes.	Word Tutorial 3: Creating Tables and a Multipage Report	P

4.42	Divide a document into sections.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.43	Create a SmartArt graphic.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.44	Create headers and footers.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.45	Insert a cover page.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.46	Change the document's theme.	Word Tutorial 3: Creating Tables and a Multipage Report	P
4.47	Review a document in Read Mode.	Word Tutorial 3: Creating Tables and a Multipage Report	P

P	**Competency 5: Managing Files - Organize files and folders with Windows 8.**		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
5.1	Explore the differences between Windows 7 and Windows 8.	Managing your Files	P
5.2	Plan the organization of files and folders.	Managing your Files	P
5.3	Use File Explorer to view and manage libraries, folders, and files.	Managing your Files	P
5.4	Open and save files.	Managing your Files	P

5.5	Create folders.	Managing your Files	P
5.6	Copy and move files and folders.	Managing your Files	P
5.7	Compress and extract files.	Managing your Files	P

Competency Based Course Map

Course Name	**CIS 2416 – Routing and Switching Essentials**
Faculty Developers	Jerry Snyder
Department	Business and Public Services Division
Program	Computer Information Systems
Course Description	As the course title states, the focus of this course is on learning the architecture, components, and operations of routers and switches in a small network. In this course, you will learn how to configure a router and a switch for basic functionality. You will do the following: ● describe enhanced switching technologies such as VLANs, VLAN Trunking Protocol (VTP), Rapid Spanning Tree Protocol (RSTP), Per VLAN Spanning Tree Protocol (PVSTP), and 802.1q ● configure and troubleshoot basic operations of a small switched network ● configure and verify static routing and default routing ● configure and troubleshoot basic operations of routers in a small routed network ● configure and troubleshoot VLANs and inter-VLAN routing ● configure, monitor, and troubleshoot ACLs for IPv4 and IPv6 By the end of this course, you will be able to configure and troubleshoot routers and switches and resolve common issues with RIPv1, RIPv2, single-area and multi-area OSPF, virtual LANs, and inter-VLAN routing in both IPv4 and IPv6 networks
Assessment Notes	Desired SME Qualifications: ● Cisco Certified Network Associate (CCNA) qualified ● Cisco Certified Academy Instructor (CCAI) qualified ● A minimum of a bachelor degree in any program of study at a university
Learning Resources	*Routing and Switching Essentials Companion Guide* (2013). Cisco Press. Online curriculum is available when the instructor registers the student for the course Network Fundamental on cisco.netacad.net. This gives the student access to the online curriculum and the chapter tests, Final Skill Based Assessment and Final Exam to include a Course Feedback for Cisco.
Student Project Summary	Will this course have an associated student project?

	Yes: ☐ No: X

Competency 1	**Initial Switch Configuration and Operations**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Configure initial settings on a Cisco switch.	Chapter 2 Basic Switching Concepts and Configuration	Declarative & Procedural	4.1.6
Configure switch ports to meet network requirements.	Chapter 2 Basic Switching Concepts and Configuration	Declarative & Procedural	4.1.6
Configure the management switch virtual interface.	Chapter 2 Basic Switching Concepts and Configuration	Declarative & Procedural	4.10.2
Describe basic security attacks in a switched environment.	Chapter 2 Basic Switching Concepts and Configuration	Declarative	2.1.3
Describe security best practices in a switched environment.	Chapter 2 Basic Switching Concepts and Configuration	Declarative	2.1.7
Configure the port security feature to restrict network access.	Chapter 2 Basic Switching Concepts and Configuration	Declarative & Procedural	2.1.7
Describe convergence of data, voice, and video in the context of switched networks.	Chapter 1 Introduction to Switched Networks	Declarative	4.1.5
Describe a switched network in a small to medium sized business.	Chapter 1 Introduction to Switched Networks	Declarative	2.10.1
Explain the process of frame forwarding in a switched network.	Chapter 1 Introduction to Switched Networks	Declarative	4.1.2
Compare a collision domain to a broadcast domain.	Chapter 1 Introduction to Switched Networks	Declarative & Procedural	4.10.1

Competency 2	**VLAN Operation, Configuration, and Troubleshooting**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Explain the purpose of VLANs in a switched network.	Chapter 3 Implementing VLAN Security	Declarative	2.2.8
Analyze how a switch forwards frames based on VLAN configuration in multi-switched environment.	Chapter 3 Implementing VLAN Security	Declarative	4.1.2
Configure a switch port to be assigned to a VLAN based on requirements.	Chapter 3 Implementing VLAN Security	Declarative & Procedural	4.1.6
Configure a trunk port on a LAN switch.	Chapter 3 Implementing VLAN Security	Declarative & Procedural	4.1.6
Configure Dynamic Trunking Protocol (DTP).	Chapter 3 Implementing VLAN Security	Declarative & Procedural	4.1.6
Troubleshoot VLAN and trunk configurations in a switched network.	Chapter 3 Implementing VLAN Security	Declarative & Procedural	4.10.10
Configure security features to mitigate attacks in a VLAN segmented environment.	Chapter 3 Implementing VLAN Security	Declarative & Procedural	2.1.7
Explain security best practices for a VLAN segmented environment.	Chapter 3 Implementing VLAN Security	Declarative	2.1.3
Describe the three primary options for enabling inter-VLAN routing.	Chapter 5 Inter-VLAN Routing	Declarative	2.2.8
Configure legacy inter-VLAN routing.	Chapter 5 Inter-VLAN Routing	Declarative & Procedural	4.1.6
Configure router-on-a-stick inter-VLAN routing.	Chapter 5 Inter-VLAN Routing	Declarative & Procedural	4.1.6

Troubleshoot common inter-VLAN configuration issues.	Chapter 5 Inter-VLAN Routing	Declarative & Procedural	4.10.10
Troubleshoot common IP addressing issues in an inter-VLAN routed environment	Chapter 5 Inter-VLAN Routing	Declarative & Procedural	4.10.10
Configure inter-VLAN routing using Layer 3 switching.	Chapter 5 Inter-VLAN Routing	Declarative & Procedural	4.1.6
Troubleshoot inter-VLAN routing in a link Layer 3 switched environment.	Chapter 5 Inter-VLAN Routing	Declarative & Procedural	4.10.10

Competency 3	**Configure, troubleshoot, and verify router settings and interfaces on a router**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Describe the primary functions and features of a router.	Chapter 4 Routing Concepts	Declarative	2.2.8
Connect devices for a small routed network.	Chapter 4 Routing Concepts	Declarative/Procedural	4.10.2
Using CLI configure basic settings on a router between two directly connected networks.	Chapter 4 Routing Concepts	Declarative/Procedural	4.1.6
Verify connectivity between two networks that are directly connected to a router.	Chapter 4 Routing Concepts	Declarative/Procedural	4.10.10
Explain the encapsulation and de-encapsulation process used by routers when switching packets between interfaces.	Chapter 4 Routing Concepts	Declarative/Procedural	4.6.3
Explain the path determination function of a router.	Chapter 4 Routing Concepts	Declarative	2.2.8

Competency 4	**Design and implement a classful and a classless IP addressing scheme for a network**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Explain the use of legacy classful addressing in network implementation.	Chapter 6 Static Routing	Declarative	4.3.2
Explain the purpose of CIDR in replacing classful addressing.	Chapter 6 Static Routing	Declarative	4.7.7
Design and implement a hierarchical addressing scheme.	Chapter 6 Static Routing	Declarative/Procedural	4.7.9

Competency 5	**Describe RIP and apply basic RIPv2 and RIPng configuration, verification, and troubleshooting commands and evaluate RIPv2 and RIPng classless routing updates.**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Configure the RIP routing protocol.	Chapter 7 Routing Dynamically	Declarative/Procedural	4.1.6
Configure the RIPng routing protocol	Chapter 7 Routing Dynamically	Declarative/Procedural	4.1.6

Competency 6	**Identify the characteristics, features, and concepts of routing protocols**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Describe the algorithm used by distance vector routing protocols to determine the best path.	Chapter 7 Routing Dynamically	Declarative	4.1.6

Identify the types of distance vector routing protocols.	Chapter 7 Routing Dynamically	Declarative/Procedural	4.1.6
Describe the algorithm used by link state routing protocols to determine best path.	Chapter 7 Routing Dynamically	Declarative	4.1.6
Explain how the link state routing protocol uses information sent in a link state update.	Chapter 7 Routing Dynamically	Declarative/Procedural	4.1.6
Explain the advantage and disadvantages of using link state routing protocols.	Chapter 7 Routing Dynamically	Declarative/Procedural	4.1.6
Explain the process by which link state routers learn about other networks.	Chapter 8 Single Area OSPF	Declarative	4.1.6

Competency 7	**Router lookup process and routing table entries**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Explain routing table entries for directly connected networks.	Chapter 4 Routing Concepts	Declarative	4.1.6
Explain how a router builds a routing table for directly connected networks.	Chapter 4 Routing Concepts	Declarative	4.1.6
Explain how a router builds a routing table using static routes.	Chapter 4 Routing Concepts	Declarative	4.1.6
Explain how a router builds a routing table using a dynamic routing protocol.	Chapter 4 Routing Concepts	Declarative	4.1.6
Determine the route source, administrative distance, and metric for a given route.	Chapter 7 Routing Dynamically	Declarative/Procedural	4.1.6
Explain the concept of a parent/child relationship in a dynamically built routing table.	Chapter 7 Routing Dynamically	Declarative	4.1.6

Compare the IPv4 classless route lookup process and the IPv6 lookup process.	Chapter 7 Routing Dynamically	Declarative/Procedural	4.7.7
Analyze a routing table to determine which route will be used to forward a packet.	Chapter 7 Routing Dynamically	Declarative/Procedural	4.1.6

Competency 8	**Identify the characteristics of a dynamic routing protocol**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Explain the purpose of dynamic routing protocols.	Chapter 7 Routing Dynamically	Declarative	4.1.6
Explain the use of dynamic routing versus static routing.	Chapter 7 Routing Dynamically	Declarative	4.1.6
Explain how dynamic routing protocols share route information an achieve convergence.	Chapter 7 Routing Dynamically	Declarative/Procdural	4.1.6
Compare the different categories of routing protocols.	Chapter 7 Routing Dynamically	Declarative	4.1.6

Competency 9	**Identify the characteristics and configurations of a static route, summary route, and floating route**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Explain the advantages and disadvantages of static routing.	Chapter 6 Static Routing	Declarative	4.1.6
Explain the purpose of different types of static routes.	Chapter 6 Static Routing	Declarative	4.1.6
Configure IPv4 and IPv6 default routes.	Chapter 6 Static Routing	Declarative/Procedural	4.1.6
Configure IPv4 and IPv6 static routes specifying a next hop address.	Chapter 6 Static Routing	Declarative/Procedural	4.1.6
Configure an IPv4 and IPv6 summary network address to reduce the number of routing table updates.	Chapter 6 Static Routing	Declarative/Procedural	4.1.6

Configure a floating static route to provide a backup connection.	Chapter 6 Static Routing	Declarative/Procedural	4.1.6
Explain how a router processes packets when a static route is configured.	Chapter 6 Static Routing	Declarative	4.1.6
Troubleshoot common static and default route configuration issues.	Chapter 6 Static Routing	Declarative/Procedural	4.10.10

Competency 10	**Describe OSPF and apply advance configuration, verification, and troubleshooting commands with routers implementing OSPFv2 and OSPFv3**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Describe the types of packets used by Cisco IOS routers to establish and maintain an OSPF network.	Chapter 8: Single Area OSPF	Declarative	4.1.6
Explain how Cisco IOS routers achieve convergence in an OSPF network.	Chapter 8: Single Area OSPF	Declarative	4.1.6
Configure an OSPF router ID.	Chapter 8: Single Area OSPF	Declarative/Procedural	4.1.6
Configure single area OSPFv2 in a small routed IPv4 network.	Chapter 8: Single Area OSPF	Declarative/Procedural	4.1.6
Explain how OSPF uses cost to determine best path.	Chapter 8: Single Area OSPF	Declarative/Procedural	4.1.6
Verify single area OSPFv2 in a small routed network.	Chapter 8: Single Area OSPF	Declarative/Procedural	4.10.10
Compare the characteristics and operations of OSPFv2 to OSPFv3.	Chapter 8: Single Area OSPF	Declarative	4.1.6
Configure single area OSPFv3 in a small routed network.	Chapter 8: Single Area OSPF	Declarative/Procedural	4.1.6
Verify single area OSPFv3 in a small routed network.	Chapter 8: Single Area OSPF	Declarative/Procedural	4.10.10

Competency 11	**Features, concepts, and configurations of access control lists**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Explain how ACLs are used to filter traffic.	Chapter 9 Access Control Lists	Declarative	4.1.6
Compare standard and extended IPv4 ACLs.	Chapter 9 Access Control Lists	Declarative	4.1.6
Explain how ACLs use wildcard masks.	Chapter 9 Access Control Lists	Declarative	4.1.6
Explain the guidelines for creating ACLs.	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6
Explain the guidelines for placement of ACLs.	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6
Configure standard IPv4 ACLs to filter traffic according to network requirements.	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6
Modify a standard IPv4 ACL using sequence numbers.	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6
Configure a standard ACL to secure vty access.	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6
Explain the structure of an extended access control entry (ACE).	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6
Configure extended IPv4 ACLs to filter traffic according to networking requirements.	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6
Configure and ACL to limit debug output.	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6
Explain how a router processes packets when an ACL is applied.	Chapter 9 Access Control Lists	Declarative	4.1.6
Troubleshoot common ACL errors using CLI commands.	Chapter 9 Access Control Lists	Declarative/Procedural	4.10.10
Compare IPv4 and IPv6 ACL creation.	Chapter 9 Access Control Lists	Declarative	4.7.7

Configure IPv6 ACLs to filter traffic according to networking requirements.	Chapter 9 Access Control Lists	Declarative/Procedural	4.1.6

Competency 12	**DHCP Operation, Configuration, and Troubleshooting**		**IT Works**
Learning Outcomes	**Learning Resource**	**Type**	
Describe the operation of DHCPv4 in a small to medium sized business network.	Chapter 10 DHCP	Declarative	4.1.6
Configure a router as a DHCPv4 server.	Chapter 10 DHCP	Declarative & Procedural	4.1.6
Configure a router as a DHCPv4 client.	Chapter 10 DHCP	Declarative & Procedural	4.1.6
Troubleshoot a DHCP configuration for IPv4 in a switched network.	Chapter 10 DHCP	Declarative & Procedural	4.10.10
Explain the operation of DHCPv6.	Chapter 10 DHCP	Declarative	4.1.6
Configure stateless DHCPv6 for a small to medium sized business.	Chapter 10 DHCP	Declarative & Procedural	4.1.6
Configure stateful DHCPv6 for a small to medium sized business	Chapter 10 DHCP	Declarative & Procedural	4.1.6
Troubleshoot a DHCP configuration for IPv6 in a switched network.	Chapter 10 DHCP	Declarative & Procedural	4.10.10

Competency 13	**Configure, verify, and troubleshoot IP services on a router. Configure Network**		**IT Works**

	Address Translation (NAT) operations and troubleshoot NAT issues.		
Learning Outcomes	**Learning Resource**	**Type**	
Describe NAT characteristics.	Chapter 11: Network Address Translation for IPv4	Declarative	4.1.6
Describe the benefits and drawbacks of NAT.	Chapter 11: Network Address Translation for IPv4	Declarative	4.1.6
Configure statisc NAT, dynamic NAT, PAT, and port forwarding using CLI. Configure NAT-PT (v6 to v4).	Chapter 11: Network Address Translation for IPv4	Declarative/Procedural	4.1.6
Use show commands to verify NAT operation.	Chapter 11: Network Address Translation for IPv4	Declarative/Procedural	4.10.10

Network Security Competency Based Course Map

Course Name	CIS 2640 - Network Security
Faculty Developers	Joe Lammers, Bob Sherman, Bill Quigley
Department	Business and Public Services Division
Program	Computer Information Systems
Course Description	Intermediate computing and network security fundamentals. Topics include network vulnerabilities and attacks, network defenses, wireless network security, access control, network assessment and auditing, cyrptography and organizational security. Preparation will also be given for the CompTIA Security+ exam.
Assessment Notes	Desired SME Qualifications: Actively working now or past experience in an IT Security position; Security+ or CISSP certification.
Learning Resources	Ciampa, M. (2012). *Security + Guide to Network Security Fundamentals* (4th ed.). United states of America: Cengage Learning.
Student Project Summary	Will this course have an associated student project? Yes: No: X

	Competency 1 **1.0 Network Security**		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**

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1.1	Explain the security function and purpose of network devices and	Chapter 6, 9	Declarative/ Procedural

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	technologies.	Labs 1 & 7 Topic Quizzes Midterm/Final	
1.2	Apply and implement secure network administration principles	Chapters 6, 7, 9 Labs 2 & 7 Topic Quizzes Midterm/Final	Declarative/ Procedural
1.3	Distinguish and differentiate network design elements and compounds	Chapters 6, 7 Topic Quizzes Midterm/Final	Declarative
1.4	Implement and use common protocols	Chapters 4, 7 Labs 3 & 4 Topic Quizzes Midterm/Final	Declarative/ Procedural
1.5	Identify commonly used default network ports	Chapter 4 Labs 3 & 4 Topic Quiz Midterm/Final	Declarative/ Procedural
1.6	Implement wireless network in a secure manner	Chapter 8 Lab 5 Topic Quiz Midterm/Final	Declarative/ Procedural

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	Competency 2 **2.0 Compliance and Operational Security**		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
2.1	Explain risk related concepts	Chapters 4, 7, 14 Topic Quizzes Midterm/Final	Declarative
2.2	Carry out appropriate risk mitigation strategies	Chapter 14 Topic Quiz Midterm/Final	Declarative
2.3	Execute appropriate incident response procedures	Chapter 13 Labs 6 & 18 Topic Quiz Final	Declarative/Procedural
2.4	Explain the importance of security related awareness and training	Chapter 14 Topic Quiz Midterm/Final	Declarative
2.5	Compare and contrast aspects of business continuity	Chapter 13 Topic Quiz Final	Declarative
2.6	Explain the impact of proper use of environmental controls	Chapter 13 Topic Quiz Final	Declarative

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2.7	Execute disaster recovery plans and procedures	Chapter 13 Lab 8 Topic Quiz Final	Declarative/Procedural
2.8	Exemplify the concepts of confidentiality, integrity and availability (CIA)	Chapter 1 Topic Quiz Midterm/Final	Declarative

	Competency 3 **3.0 Threats and Vulnerabilities**		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
3.1	Analyze and differentiate among types of malware	Chapter 2 Lab 9 Topic Quiz Final	Declarative/Procedural
3.2	Analyze and differentiate among types of attacks	Chapters 1, 2, 3 Lab 10 Topic Quizzes Midterm/Final	Declarative/Procedural
3.3	Analyze and differentiate among types of social engineering attacks	Chapter 2 Topic Quiz Final	Declarative

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3.4	Analyze and differentiate among types of wireless attacks	Chapter 8 Topic Quiz Midterm/Final	Declarative
3.5	Analyze and differentiate among types of application attacks	Chapters 3, 4 9 Lab 11 Topic Quizzes Midterm/Final	Declarative/Procedural
3.6	Analyze and differentiate among types of mitigation and deterrent techniques	Chapters 4, 5, 6, 7 Labs 12 & 13 Topic Quizzes Midterm/Final	Declarative/Procedural
3.7	Implement assessment tools and techniques to discover security threats and vulnerabilities	Chapter 4 Lab 14 Topic Quiz Midterm/Final	Declarative/Procedural
3.8	Within the realm of vulnerability assessments, explain the proper use of penetration testing versus vulnerability scanning	Chapter 4 Topic Quiz Midterm/Final	Declarative

	Competency 4 **4.0 Application, Data and Host Security**		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**

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4.1	Explain the importance of application security	Chapter 5 Topic Quiz Final	Declarative
4.2	Carry out appropriate procedures to establish host security	Chapters 5, 7 Topic Quiz Midterm/Final	Declarative
4.3	Explain the importance of data security	Chapters 5, 7, 11, 12 Labs 15 & 16 Topic Quizzes Midterm/Final	Declarative/Procedural

	Competency 5 **5.0 Access Control and Identity Management**		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
5.1	Explain the function and purpose of authentication services	Chapter 9 Topic Quiz Midterm/Final	Declarative
5.2	Explain the fundamental concepts and best practices related to authentication, authorization, and access control	Chapters 1, 9 10 Topic Quizzes Midterm/Final	Declarative
5.3	Implement appropriate security controls when performing account management	Chapter 10 Lab 17	Declarative/Procedural

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		Topic Quiz Final	

	Competency 6 **6.0 Cryptography**		
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**
6.1	Summarize general cryptography concepts	Chapters 11, 12 Labs 19 & 20 Topic Quizzes Final	Declarative/Procedural
6.2	Use and apply appropriate cryptographic tools and products	Chapters 11, 12 Topic Quizzes Final	Declarative
6.3	Explain the core concepts of public key infrastructure	Chapter 12 Topic Quiz Final	Declarative
6.4	Implement PKI, certificate management and associated components	Chapter 12 Topic Quiz Final	Declarative

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Competency Based Course Map

Course Name	MAT 2170 - Business Statistics I
Faculty Developers	Robert Chaney
Department	Math
Program	Computer Information Systems and others
Course Description	Statistical techniques and methodology. Graphical and tabular presentation of data, probability, parameters, statistical distributions, sampling, confidence intervals and tests of hypotheses.
Assessment Notes	Desired SME Qualifications: ● Master's degree in Math or ● Master's degree with 18 graduate semester hours in math
Learning Resources	McClave, J.T., Benson, P.G., & Sincich, T. (2014). *Statistics for Business and Economics* (12th ed.). Boston: Pearson.
Student Project Summary	Will this course have an associated student project? Yes: ☐ No: X

	Competency 1: Confidence Intervals and Hypothesise Testing - Infer values of population parameters from confidence intervals; infer whether or not a hypothesis should be rejected; infer appropriate relationships between variables from scatter diagrams and correlation coefficients.			

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Sinclair Ref	Learning Outcomes	Topic & Learning Resource	Type	ITWorks Ref

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1.1	Know the general idea behind a sampling distribution and how it will be in inference.	Sampling Distributions / Chapter 5.1	Procedu ral	
1.2	Be able to calculate point estimates from samples taken from populations using a calculator and Excel.	Sampling Distributions / Chapter 5.2	Procedu ral	
1.3	Calculate the standard error of a Sampling Distribution of sample means.	Sampling Distributions / Chapter 5.3	Procedu ral	
1.4	Apply the Sampling Distribution for sample averages and the Central Li h Theorem to calculate probabilities that sample averages will fall within g intervals.	Sampling Distributions / Chapter 5.3	Procedu ral	
1.5	Calculate the standard error of a Sampling Distribution for proportions.	Sampling Distributions / Chapter 5.4	Procedu ral	
1.6	Apply the Sampling Distribution for sample proportions to calculate probabilities that sample percentages will fall within given intervals. Als know the conditions in which Normality can be assumed.	Sampling Distributions / Chapter 5.4	Procedu ral	
1.7	Identify and estimate a population parameter using a point estimate.	Inferences Based on a Single Sample (Estimation with Confidence Intervals)/ Chapter 6.1 / Lab 4	Procedu ral	
1.8	Determine and interpret interval estimates of a population mean when the population standard deviation is known.	Inferences Based on a Single Sample (Estimation with Confidence Intervals) / Chapter 6.2 / Lab 4	Procedu ral	
1.9	Determine and interpret interval estimates of a population mean when the population standard deviation is unknown. (t-distributions)	Inferences Based on a Single Sample	Procedu ral	

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		(Estimation with Confidence Intervals) / Chapter 6.3 / Lab 4		
1.10	Determine and interpret interval estimates of a population proportion.	Inferences Based on a Single Sample (Estimation with Confidence Intervals) / Chapter 6.4 / Lab 4	Procedural	
1.11	Control the margin of error with sample size.	Inferences Based on a Single Sample (Estimation with Confidence Intervals) / Chapter 6.5	Procedural	
1.12	Understand when to use and how to apply the finite correction factor	Inferences Based on a Single Sample (Estimation with Confidence Intervals) / Chapter 6.6	Procedural	
1.13	Know the basic elements of a hypothesis.	Inferences Based on a Single Sample (Tests of Hypotheses) / Chapter 7.1	Procedural	
1.14	Describe Type I & II error and interpret it in an applied problem.	Inferences Based on a Single Sample (Tests of Hypotheses) / Chapter 7.1	Procedural	
1.15	Determine the null and alternative hypothesis, test statistic and rejection region.	Inferences Based on a Single Sample (Tests of Hypotheses) / Chapter 7.2	Procedural	

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1.16	Determine a p-value and use it to run a hypothesis test.	Inferences Based on a Single Sample (Tests of Hypotheses) / Chapter 7.3, 7.4, 7.5, 7.6 / Lab 5	Procedu ral	
1.17	Perform a test of hypotheses about a population mean. (sigma known) Normal Distribution	Inferences Based on a Single Sample (Tests of Hypotheses) / Chapter 7.4 / Lab 5	Procedu ral	
1.18	Perform a test of hypotheses about a population mean. (sigma unknown) t-distribution	Inferences Based on a Single Sample (Tests of Hypotheses) / Chapter 7.5 / Lab 5	Procedu ral	
1.19	Perform a test of hypotheses about a population proportion. Normal Distribution	Inferences Based on a Single Sample (Tests of Hypotheses) / Chapter 7.6	Procedu ral	
1.20	Calculate Type II error probabilities and corresponding powers associate to a given population average for a given sample size and decision statem	Inferences Based on a Single Sample (Tests of Hypotheses) / Chapter 7.8 / Lab 5	Procedu ral	

	Competency 2: Descriptive Statistics - Compute descriptive statistics such as mean, median, percentiles, z-scores, and standard deviation in both a classroom and laboratory setting.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**

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2.1	Calculate and interpret the mean, median, mode and the skewness of a data set.	Methods Describing Sets of Data / Chapter 2.3 / Lab 1	Procedural	
2.2	Calculate & interpret percentiles and quartiles.	Methods Describing Sets of Data / Chapter 2.6	Procedural	
2.3	Interpret Standard Deviation using Chebyshev's Theorem and Empirical Rule.	Methods Describing Sets of Data / Chapter 2.5 / Lab 1	Procedural	
2.4	Calculate and interpret the Range and Interquartile range of a data set.	Methods Describing Sets of Data / Chapter 2.4	Procedural	
2.5	Calculate the Variance and Standard Deviation of population a sample data sets by creating tables and using the formulas.	Methods Describing Sets of Data / Chapter 2.4	Procedural	
2.6	Calculate and interpret a z-score	Methods Describing Sets of Data / Chapter 2.7	Procedural	
2.7	Use your scientific or graphing calculator to calculate the mea standard deviation of a data set.	Calculator Instructions	Procedural	
2.8	Use Excel to calculate Descriptive Statistics	Excel Instructions / Lab 1	Procedural	

	Competency 3: Frequency Distributions and Statistical Graphs - Construct frequency distributions, statistical graphs, and spreadsheets.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
3.1	Construct frequency and relative frequency distributions	Methods Describing Sets of	Procedural	

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	for quantitative data.	Data / Chapter 2		
3.2	Construct bar graphs and pie charts for categorical data.	Methods Describing Sets of Data / Chapter 2.1	Procedural	
3.3	Construct histograms for quantitative data.	Methods Describing Sets of Data / Chapter 2.2	Procedural	
3.4	Use Excel to create frequency distributions & histograms	Excel Instructions / Lab 1	Procedural	

	Competency 4: Probability - Evaluate basic probabilities using formulas and definitions; evaluate binomial, uniform, and normal probabilities from formulas and tables.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
4.1	Construct a sample space for an experiment by know the determining the sample points.	Probability / Chapter 3.1	Procedural	
4.2	Determine if probability assignments are valid.	Probability / Chapter 3.1	Procedural	
4.3	Develop a tree diagram for an experiment.	Probability / Chapter 3.1	Procedural	
4.4	List the sample points of an event and calculate the probability of the event.	Probability / Chapter 3.1	Procedural	
4.5	Understand the concept of "The Law of large Numbers".	Probability / Lab 2	Procedura	

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			l	
4.6	Use Combinations Rule to count the number of outcomes in a applicable sample space.	Probability / Chapter 3.1	Procedura l	
4.7	Find the union or intersection of two or more events.	Probability / Chapter 3.2	Procedura l	
4.8	Find the complement of a event and apply the Rule of Complements.	Probability / Chapter 3.3	Procedura l	
4.9	Calculate the probability for the union of two events or two Mutually exclusive events: Addition law	Probability / Chapter 3.4	Procedura l	
4.10	Determine conditional probabilities.	Probability / Chapter 3.5	Procedura l	
4.11	Determine if two events are independent and calculate probabilities using the Multiplication Rule.	Probability / Chapter 3.6	Procedura l	
4.12	Determine when a random variable is discrete or continuous.	Random Variables & Probability Distributions / Chapter 4.1	Procedura l	
4.13	Draw the graph of a probability distribution.	Random Variables & Probability Distributions / Chapter 4.2	Procedura l	
4.14	Determine the expected value and variance of a discrete rando variable.	Random Variables & Probability Distributions / Chapter 4.2	Procedura l	
4.15	Determine probabilities using the binomial probability functio	Random Variables & Probability Distributions / Chapter 4.3	Procedura l	

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4.16	Determine expected values and variances of the binomial probability function.	Random Variables & Probability Distributions / Chapter 4.3	Procedural	
4.17	Determine probabilities using the Poisson probability function	Random Variables & Probability Distributions / Chapter 4.4	Procedural	
4.18	Know the general idea behind using probability density functio to determine probabilities for continuous random variables.	Random Variables & Probability Distributions / Chapter 4.5	Procedural	
4.19	Use the Standard Normal Probability table of cumulative probabilities to make probability/percentage predictions on an interval of a normal continuous random variable.	Random Variables & Probability Distributions / Chapter 4.6 / Lab 3	Procedural	
4.20	Use the Standard Normal Probability table to approximate Binomial Probabilities.	Random Variables & Probability Distributions / Chapter 4.6	Procedural	

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Competency Based Course Map

Course Name	MAN 2150 - Management & Organizational Behavior
Faculty Developers	Ned Young
Department	Management
Program	Developed for CIS
Course Description	Introduction to fundamental concepts necessary for understanding management, motivation, and behavior in organizational settings. Emphasis on planning, organizing, leading, and controlling to continually improve effective management skills.
Learning Resources	Bateman, T. S., & Snell, S. A. (2013). *Management 2150: Management and Organizational Behavior*. New York: McGraw-Hill.
Student Project Summary	Will this course have an associated student project? Yes: ☐ No: X

	Competency 1 Management Terminology - Define the terms and identify generally accepted principles and contemporary approaches in management.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
1.1	Define the unit vocabulary terms.	Unit 1 , Unit 2, Unit 3, Unit 4, Unit 5	Declarative	
1.2	Describe your initial impressions of management and the functions of management and goals of Organizational Behavior	Unit 1	Procedural	
1.3	Identify the steps in making "rational" decisions	Unit 1	Procedural	

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1.4	Evaluate the barriers to effective decision making	Unit 1	Procedural	
1.5	Define the term "entrepreneur" and describe its major roles.	Unit 2	Declarative	
1.6	Describe how managers of large companies can foster entrepreneurship sometimes called "intrapreneurship".	Unit 2	Procedural	1.6.7
1.7	Identify the unique challenges of a matrix organization	Unit 3	Procedural	
1.8	Distinguish between roles of the Board of Directors, the CEO, and the stockholders	Unit 3	Procedural	
1.9	Define the terms "group" and "team" and explore their differences	Unit 4	Declarative	
1.10	Define the term "control" and its relationship to other managerial functions - particularly planning	Unit 5	Declarative	
1.11	Define the term "Paradigm" and list the major stages of a paradigm shift	Unit 5	Declarative	

	Competency 2 The Universality of Management - Explain management as a process of interrelated functions.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
2.1	Identify the evolution of management -- then and now.	Unit 1	Declarative	

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2.2	Describe how environmental forces influence organizations.	Unit 1	Declarative	
2.3	Summarize how organizations respond to environmental uncertainty.	Unit 1	Declarative	
2.4	Describe the relationship between ethics, social responsibility and management	Unit 2	Procedural, declarative	1.2.3, 1.2.8
2.5	Discuss the factors leading to effective communication	Unit 4	Declarative	
2.6	Consider the impact of electronic communications	Unit 1, 2, 3, 4, 5	Procedural	

	Competency 3 Organizational Networking/Relationship Skills - Analyze patterns of organizational behavior requiring skills necessary to interpret cause and effect relationships between the job and work situations.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
3.1	Identify the advantages and disadvantages to group decision making	Unit 1	Procedural	
3.2	Explain how society can help business meet its social obligations.	Unit 2	Declarative	
3.3	Summarize the influence of union and labor laws on an organization	Unit 3	Declarative	
3.4	Identify ways teams contribute to organizational effectiveness	Unit 4	Declarative	

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3.5	Identify ways to manage conflict between team members as well as with other teams	Unit 4	Declarative	
3.6	Explain how controls systems can actually empower employees.	Unit 5	Declarative	

	Competency 4 Motivational and Behavioral Theories and Approaches - Describe how organizational motivation and behavior can be modeled on various organizational theories and implemented by management and group leaders.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
4.1	Discuss how organizational culture impacts the ability to respond to the external environment	Unit 1	Declarative	
4.2	Discuss how span of control and reporting relationships affects organizational structure and managerial effectiveness	Unit 3	Procedural	
4.3	Explain how diversity goes beyond the visual dimension of what we see and how diversity can give organizations a competitive advantage.	Unit 3	Declarative	
4.4	Identify the various generations in the workforce, their strengths/challenges and keys to communicating and training them	Unit 3	Declarative	
4.5	Identify behavior modification and reinforcement and	Unit 4	Procedural	

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	explain the expectancy model of motivation.			
4.6	Describe the basics of human motivation.	Unit 4	Declarative	
4.7	Differentiate between various motivational theories.	Unit 4	Declarative	
4.8	Identify tactics for creating a successful organizational future	Unit 5	Procedural	

	Competency 5 Leadership - Analyze how individual and organizational leadership is key to the success of the organization, group, and personal life management. Describe the leadership role in providing the appropriate cultural influences for worker empowerment and organizational diversity.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
5.1	Distinguish between centralized and decentralized organizations	Unit 3	Declarative	
5.2	Define the term "Leader" and discuss what it means to be a leader	Unit 4	Declarative	1.3.7
5.3	List personal skills and traits associated with leaders.	Unit 4	Declarative	
5.4	Explain the association of power and leaders.	Unit 4	Declarative	
5.5	Identify advantages and disadvantages of strategic alliances	Unit 5	Declarative	
5.6	Compare and contrast working in a mechanistic versus an organic structure	Unit 5	Declarative	

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	Competency 6 Application of Management - Formulate goals, strategies, and plans to analyze the ever-changing internal and external organizational environment.			
Sinclair Ref	**Learning Outcomes**	**Topic & Learning Resource**	**Type**	**ITWorks Ref**
6.1	Explain the purpose of planning, its steps and relationship to organizational objectives	Unit 2	Procedural , declarative	
6.2	Identify the differences between tactical, operational, and strategic planning.	Unit 2	Declarative	
6.3	Recognize a SWOT analysis	Unit 2	Procedural	
6.4	Discuss how Human Resource Management is used to gain competitive advantages	Unit 3	Declarative	
6.5	Explain goal setting and its effects	Unit 4	Declarative	
6.6	Summarize how to design and implement basic control systems.	Unit 5	Declarative, procedural	
6.7	Explore various types of financial controls used by organizations	Unit 5	Declarative	
6.8	Identify ways in which companies can organize to meet customer needs/wants	Unit 5	Declarative	1.2.1, 1.4.4
6.9	Evaluate ways companies can organize around technology, speed and organizational change	Unit 5	Declarative	1.1.1

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Competency Based Course Map

Course N..,e	MAT 1460- Finite Mathematics for Business Analysis
Faculty Developers	Richard Uchida
Department	Mathematics
Program	Computer Information Systems and Others
Course Description	Applications of finite mathematics and functions to business analysis.Functions,financial mathematics, systems,matrices,inequalities,linear programing,sets,permutations and combinations and elementary probability and statistics.
Assessment Notes	Desired SME Qualifications: • Master's degree in math,or • Master's degree with a coherent set of 18graduate semester hours in math.
Learnlng Resources	Lial,M.,Hungerford,T.,& Holcomb,J. (2011).*Mathematics with Applications* (lOth ed.).Pearson MyMathLab & Mastering httg:l[www.gea :SQnmy:labandma tering. gm[nQ!lhameri /stydgnt /get-regi teredlindgx.html
Student Project Summary	Will this course have an associated student project? Yes:D No:X

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	Competency 1: Linear, Quadratic, Exponential and Logarithmic Equations: Demonstrate the ability to solve linear, quadratic, exponential and logarithmic equations.	Topic & Learning Resource	
Sinclair Ref			**Type**

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1.1	Solve a linear inequality.	linear Inequalities	Procedural
1.2	Write the answer as a graph, interval notation, or set-builder notation.	linear Inequalities	Procedural
1.3	Solve applications involving linear inequalities.	linear Inequalities	Procedural
1.4	Solve absolute value inequalities.	linear Inequalities	Procedural
1.5	Solve logarithmic equations	Logartithmic Functions/Logartithmic and Exponential Equations	Procedural
1.6	Solve exponential equations	Logartithmic Functions/Logartithmic and Exponential Equations	Both
1.7	Solve applications involving exponentials and/or logarithms	Logartithmic Functions/Logartithmic and Exponential Equations	Procedural
1.8	Identify financial terms such as Principal, Simple Interest, Present Value, Future Value, Interest Rate, Compounding Period, Effective Rate and Nominal Rate.	Simple Interest Compound Interest	Procedural

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1.9	Use Simple Interest Formulas to solve application Problems.	Simple Interest	Procedural
1.10	Use Compound Interest Formulas to solve application Problems.	Compound Interest	Both
1.11	Use Logarithms to solve fortime in Compound interest Formula.	Compound Interest	Procedural
1.12	Calculate the Effective Rate and Nominal Rate.	Compound Interest	Procedural
1.13	Use Effective Rate to compare investments and interest for various Compounding Periods.	Compound Interest	Procedural
1.14	Use a scientific or Graphing calculator to help solve application problems.	Compound Interest	Procedural
1.15	Identify situations that can be classified as Annuities	Annuities: Future Value	Procedural
1.16	Distinguish between Future Value and Present Value Annuities.	Annuities: Future Value	Procedural
1.17	Use Annuity formulas to solve application problems.	Annuities: Future Value Annuities: Present Value	Both
1.18	Calculate the payment for a Sinking Fund account.	Annuities: Future Value	Procedural
1.19	Distinguish between Future Value and Present Value Annuities.	Annuities: Present Value	Procedural

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1.20	Set up an amortization schedule for a loan.	Annuities: Present Value	Procedural
1.21	Calculate the Equity of a home mortgage.	Annuities: Present Value	Procedural
1.22	Calculate the total interest accumulated in a loan.	Annuities: Present Value	Both

	Competency 2:Matrix Operations:Demonstrate the ability to perform matrix operations.		
Sinclair Ref	Learnlns Outcomes	Topic & Learnins Resource	TYPe
2.1	Solve a system of equations by graphing	Systems of Linear Equations	Procedural
2.2	Solve a system of equations by the substitution method	Systems of Linear Equations	Both
2.3	Solve a system of equations by the elimination method	Systems of Linear Equations	Both
2.4	Solve applications involving systems of equations	Systems of Linear Equations	Procedural
2.5	Write a system of linear equations as an augmented matrix and vice-versa	Systems of 3 or More Equations	Procedural
2.6	Solve a system of linear equations using augmented matrices	Systems of 3 or More Equations	Procedural
2.7	Solve applications involving systems of linear equations	Applications of Systems of Equations	Procedural
2.8	Add/subtract matrices	Matrix Operations and Inverses	Procedural

2.9	Find the product of matrices	Matrix Operations and Inverses	Both
2.10	Apply operations on matrices to applications	Matrix Operations and Inverses	Procedural
2.11	Solve a system of equations using the inverse of a matrix.	Matrix Applications	Procedural
2.12	Identify,graph and solve a system of linear Inequalities	Linear Inequalities of Two Variables	Procedural
2.13	Construct a system of Linear Inequalities to solve an application problem	Linear Inequalities of Two Variables	Procedural
2.14	Identify & solve Linear Programming Problems.	Linear Programming	Both
2.15	Construct an objective function along with a set of constraints to solve a Linear Programming Application Problem using the Graphical Approach.	Applications of Linear Programming	Procedural

	Competency 3:Probability:Demonstrate the ability to compute probability of an event.		
Sindair Ref	LearnIn1Outcomes	Topic & LearnIn1Resource	type
3.1	Be familiar with Set Terminology,Properties & Notation	Set Theory	Procedural
3.2	Perform simple Set Operations such as Unions,Intersections and Complements.	Set Theory	Procedural
3.3	Construct Venn Diagrams to visualize sets and subsets	Set Theory	Procedural
3.4	Shade the appropriate region(s) of a Venn diagram.	Venn Diagrams	Procedural

3.5	Solve an application using a Venn diagram.	Venn Diagrams	Procedural
3.6	Identify an Experiment and its corresponding Sample Space	Introduction to Probability	Procedural
3.7	Identify an Event taken from a Sample Space	Introduction to Probability	Procedural
3.8	Calculate the probability of an Event	Introduction to Probability	Procedural
3.9	Choose the appropriate method for assigning probabilities to simple events from a sample space.	Introduction to Probability	Procedural
3.10	Apply Probability to solving Applied Problems	Introduction to Probability	Poth
3.11	Apply the Addition Rule of probability	Concepts of Probability	Procedural
3.12	Apply the Complement Rule of probability	Concepts of Probability	Procedural
3.13	Calculate the odds of probability	Concepts of Probability	Procedural
3.14	Apply the rules of probability and odds to applications	Concepts of Probability	Procedural
3.15	Use the Addition Principle to count the number of items in the Union of sets	Counting Techniques and Applications	Procedural
3.16	Use the Multiplication Principle to count the number of outcomes in a multiple step process	Counting Techniques and Applications	Both
3.17	Apply Basic Counting Principles along with Venn Diagrams to solve Application Problems	Counting Techniques and Applications	Both
3.18	Calculate a basicfactorial	Counting Techniques and	Procedural

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		Applications	
3.19	Find the number of possible Permutation that can be made from a set taken rat a time	Counting Techniques and Applications	Procedural
3.20	Find the number of possible Combinations that can be made from a set taken rat a time	Counting Techniques and Applications	Procedural
3.21	Calculate the arithmetic mean of a set of data.	Measure of Central Tendency	Both
3.22	Calculate the mean of a grouped distribution.	Measure of Central Tendency	Procedural
3.23	Calculate the median of a data set.	Measure of Central Tendency	Both
3.24	Find the mode of a set.	Measure of Central Tendency	Procedural

	Competency 4:Graphs of Polynomialand TranscendentalFunctions: Demonstrate the ability to graph polynomlal,exponentialand logarithmic functions.		
Slndalr Ref	Learning Outcomes	Topic & Learning Resource	Type
4.1	Use the Cartesian coordinate system	Graphs and The Cartesian Plane	Procedural
4.2	Graph equations of the form Ax+By=C	Graphs and The Cartesian Plane	Procedural
4.3	Understand the relationship between the solutions of an equation and the graph of an equation.	Graphs and The Cartesian Plane	Procedural
4.4	Sketch graphs of equations.	Graphs and The Cartesian Plane	Procedural

4.5	Determine the x- andy-intercepts of a graph.	Graphs and The Cartesian Plane	Procedural
4.6	Find the slope of a line.	Graphs of Linear Equations and Linear Models	Procedural
4.7	Find the equation of a line.	Graphs of Linear Equations and Linear Models	Both
4.8	Solve applications involving linear equations of two variables.	Graphs of Linear Equations and Linear Models	Procedural
4.9	Define a function	Introduction to Functions	Procedural
4.10	Determine if a relation is a function.	Introduction to Functions	Procedural
4.11	Determine if a function is linear,constant,or neither.	Introduction to Functions	Procedural
4.12	Evaluate a function.	Introduction to Functions	Both
4.13	Find the domain of a function.	Introduction to Functions	Procedural
4.14	Solve applications involving price-demand,revenue,and profit functions.	Introduction to Functions	Both
4.15	Solve cost analysis linear applications	Applications of Linear Functions	Both
4.16	Solve rates of change linear applications.	Applications of Linear Functions	Procedural
4.17	Solve break even analysis linear applications.	Applications of Linear Functions	Procedural
4.18	Solve supply and demand linear applications.	Applications of Linear Functions	Procedural

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4.19	Sketch a quadraticfunction.	Quadratic Functions	Procedural
4.20	Write a quadraticfunction in the standard form.	Quadratic Functions	Procedural
4.21	Find the x- andy-intercepts of a quadratic function.	Quadratic Functions	Procedural
4.22	Find the vertex of a quadratic function.	Quadratic Functions	Procedural
4.23	Find the maximum/minimum of a quadraticfunction.	Quadratic Functions	Both
4.24	Determine the intervals where a quadratic function is increasing/decreasing.	Quadratic Functions	Procedural
4.25	Determine the range of a quadratic function.	Quadratic Functions	Procedural
4.26	Solve a quadratic inequality.	Quadratic Functions	Procedural
4.27	Graph basic polynomial functions	Polynomial and Rational Functions	Procedural
4.28	Explain various properties of polynomial graphs.	Polynomial and Rational Functions	Procedural
4.29	Apply polynomial functions to applications	Polynomial and Rational Functions	Procedural
4.30	Determine the vertical asymptotes of a rational function.	Polynomial and Rational Functions	Procedural
4.31	Determine the horizontal asymptotes of a rational function.	Polynomial and Rational Functions	Procedural

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4.32	Solve applications involving rational functions.	Polynomial and Rational Functions	Procedural
4.33	Identify exponential and Log functions	Exponential Functions and Applications	Procedural
4.34	Graph exponential functions	Exponential Functions and Applications	Procedural
4.35	Work with exponential functions with base e.	Exponential Functions and Applications	Procedural
4.36	Identify logarithmic functions	Logartithmic Functions/Logartithmic and Exponential Equations	Procedural
4.37	Evaluate the logarithm of a number.	Logartithmic Functions/Logartithmic and Exponential Equations	Procedural
4.38	Apply the properties of logarithms.	Logartithmic Functions/Logartithmic and Exponential Equations	Both
4.39	Graph logarithmic functions.	Logartithmic Functions/Logartithmic and Exponential Equations	Procedural