Minnesota Business, Marketing, and Information Technology Frameworks:

Information Technology Cluster [Updated January 2024]

Information Technology Cluster

The Information Technology Cluster includes learning how to design, develop, and manage information, software, and hardware programs. Students develop skills including planning, problem solving, organizational skills, communication, and teamwork. Career opportunities in information technology are available in every sector of the economy in all career fields.

Cluster Courses

Introductory Courses	Intermediate Courses	Advanced Courses
64 Introduction to Information Technology	67 Multimedia and Video 2	75 Advanced Programming/Computer Science 2
65 Photography for Business Communications	69 Graphic Design 2	76 Management Information Systems (MIS)
66 Multimedia and Video 1	71 Web Development 2	77 Data Statistics and Analytics
68 Graphic Design 1	72 Digital Game Design 1	78 Networking (CISCO) (A+)
70 Web Design 1	73 Digital Game Design 2	79 AP Computer Science Principles
74 Intro to Programming/Computer Science 1		80 AP Computer Science A

Career Pathways

Career pathways developed through courses in this cluster include:

- Chief Technology Officer
- Business Systems Analyst
- Website Designer
- Graphic Designer and Digital Marketer
- Streaming Media Specialist
- Digital Media Designer

Experiential Learning and Work-Based Learning

Experiential Learning opportunities should be embedded throughout a CTE Business and Marketing program, and could include industry tours, job shadowing experiences, service learning experiences, and student-led business operations. Work-based Learning (WBL) experiences as a continuation and application of classroom learning can also be developed. Work-based Learning includes both internship and Youth Apprenticeship opportunities for approved WBL programs with licensed WBL coordinators. Experiential Learning is a required component of every business, marketing, and instructional technology education program, with the intention that opportunities will be available for every student. Through involvement in Experiential Learning activities, students experience multiple career pathway occupations, learn expected workplace behavior, develop industry-specific technical skills, and are given opportunities to apply academic and occupational skills in the workplace or a simulated workplace environment.

Career Technical Student Organizations: Business Professionals of America (BPA) and DECA

Student participation in career technical student organizations (CTSOs) is considered as essential component of a quality career and technical education program. Minnesota Business Professionals of America (BPA) and Minnesota DECA provide students with opportunities for growth through education, competition, community service and professional development. Career and leadership development activities are embedded throughout the entire career cluster through classroom instruction and projects, as well as the DECA and BPA competitive event programs.

Assessing Competencies with Formative and Summative Assessments

Employability skill performance indicators and benchmarks (found at the beginning of this document) are typically assessed with "formative assessments." The goal of formative assessment is to monitor student progress during an instructional unit to provide ongoing feedback that can be used by instructors to improve their teaching and by students to improve their learning. Formative assessments help students identify their strengths and weaknesses and target areas of needed improvement. They also help teachers recognize where students are struggling so that problems can be addressed in a timely manner. Formative assessments generally have low or no point value.

Career pathway technical skill performance indicators and benchmarks (identified by Table C course name and code later in the document) are typically assessed with "summative assessments." The goal of summative assessment is to evaluate student learning at the end of an instructional unit by comparing it against the performance indicator or benchmark to which the unit was aligned. Summative assessments have point values which generally are factored into a final course grade.

Resources Utilized in Frameworks Development

Performance Indicators/Standards and Measures/Benchmarks were developed from the following sources:

- Minnesota Common Core Competencies
- ISTE National Educational Technology Standards for Students (NETS-S)
- National Business Education Association Standards
- Computer Science Teachers Association (CSTA)
- National Council of Economic Education
- States' Career Clusters Initiative
- Business Professionals of America Competition Competencies
- Minnesota Academic Standards in the Arts
- International Baccalaureate Curriculum – Visual Arts
- Project Management Institute (PMI)
- CollegeBoard AP
- MBA Research National Standards for Business Administration

Employability Skills: Information Technology Cluster

NOTE: These are for general embedding in all Business/Marketing courses. They are NOT part of course alignment during the Program Approval process.

Topic/Strand 1: Academic Foundations

Performance Indicator/Standard	Measures/Benchmarks
IT01.01 Apply mathematical concepts to solve business problems and make business decisions.	IT01.01.01 Identify patterns and relationships among business data elements. IT01.01.02 Use estimation techniques to predict the reasonableness of a mathematical solution. IT01.01.03 Interpret graphical and numerical data to make conclusions on business performance. IT01.01.04 Recommend solutions to business problems based on data analysis. IT01.01.05 Create mathematical models to communicate data from projections, results, and recommendations.
IT01.02 Read and apply print and electronic information in task completion and business decision making.	IT01.02.01 Interpret facts and meaning from print and electronic business materials. IT01.02.02 Comprehend and apply written directions to complete business tasks.
IT01.03 Convey ideas and information in writing from print and electronic materials.	IT01.03.01 Compose multi-paragraph documents that present information clearly, succinctly, and accurately. IT01.03.02 Create and edit written communications with correct grammar, spelling, punctuation, and capitalization. IT01.03.03 Utilize career pathway technical concepts and terminology in written communications. IT01.03.04 Evaluate the reliability of information obtained from a variety of sources. IT01.03.05 Reference/cite sources of information created by others. IT01.03.06 Document and report on designs and codes used to develop a web site. IT01.03.07 Compose web site code and programming documentation that is clear, succinct, and accurate.
IT01.04 Convey ideas and information from print and electronic materials in verbal communication.	IT01.04.01 Communicate effectively with team members to foster positive relationships and accomplish project/business goals. IT01.04.02 Communicate effectively with customers to foster positive relationships that enhance the business image. IT01.04.03 Utilize career pathway technical concepts and terminology in verbal communications.

Topic/Strand 2: Employability and Career Development

Performance Indicator/Standard	Measures/Benchmarks
IT02.01 Identify and demonstrate positive work behaviors and personal qualities sought by employers.	IT02.01.01 Demonstrate self-discipline, self-worth, positive attitude, and integrity in a work situation. IT02.01.02 Demonstrate flexibility and willingness to learn new knowledge and skills. IT02.01.03 Demonstrate initiative in completing tasks and solving novel problems as they arise.
IT02.02 Develop knowledge and skills for an effective transition from school to career.	IT02.02.01 Investigate education and occupational opportunities using a variety of resources (e.g., speakers, research, job shadowing, etc.). IT02.02.02 Identify training, education, and certification requirements for occupational choice. IT02.02.03 Utilize personal inventory tools to identify personal traits, learning styles, and skills. IT02.02.04 Develop effective job seeking materials including resume, cover letter, and recommendation letters to include in a career portfolio. IT02.02.05 Develop and manage an online brand to convey a professional online presence with job seeking resources and social media accounts.

Topic/Strand 3: Critical Thinking and Problem Solving

Performance Indicator/Standard	Measures/Benchmarks
IT03.01 Use critical thinking skills to develop potential solutions to business problems.	IT03.01.01 Identify desired project or business outcomes. IT03.01.02 Identify information needed to develop potential solutions to business problems. IT03.01.03 Apply creativity and innovation to create ideas, proposals, and solutions to problems. IT03.01.04 Adjust problem-solving strategies based on data or changing circumstances to achieve desired results.
IT03.02 Perform data analysis to make business decisions.	IT03.02.01 Formulate questions that can be solved or answered through data. IT03.02.02 Collect relevant data to solve business problems. IT03.02.03 Perform data analysis to evaluate data and recommend solutions.
IT03.03 Evaluate the effectiveness of implemented solutions/strategies.	IT03.03.01 Recommend a proposed solution based on project goals and data analysis. IT03.03.02 Evaluate an implemented solution based on project goals and data analysis.

Topic/Strand 4: Information Technology Applications

Performance Indicator/Standard	Measures/Benchmarks
IT04.01 Use industry-standard information technology tools to create and deliver business presentations.	IT04.01.01 Create and deliver business presentations to multiple audiences using a variety of media and formats. IT04.01.02 Prepare and share support materials that will enhance audience understanding of a verbal presentation. IT04.01.03 Adjust presentation messages and methods from interpretation of audience verbal and nonverbal cues.
IT04.02 Operate electronic mail and social media applications for workplace communications.	IT04.02.01 Identify various communication and organization functions utilized in email systems. IT04.02.02 Use email to share files and documents. IT04.02.03 Create email communication messages appropriate for internal and external audiences. IT04.02.04 Apply netiquette skills in email and social media for internal and external communications. IT04.02.05 Facilitate group work through management of shared calendars, files, and communication tools.
IT04.03 Use computer-based systems and applications to perform work tasks.	IT04.03.01 Utilize computer application software to create and store business documents. IT04.03.02 Operate computer-managed equipment, peripherals, and network devices to complete work tasks.
IT04.04 Use Internet-based applications to perform work tasks.	IT04.04.01 Efficiently navigate and access Internet resources with web browsers. IT04.04.02 Utilize Internet-based applications to perform workplace tasks to industry standards.

Topic/Strand 5: Intercultural Competence

Performance Indicator/Standard	Measures/Benchmarks
IT05.01 Explain the environmental, social, global, and economic impacts of decisions within an organization.	IT05.01.01 Explain the cultural, social, historical, and business changes that have influenced technology use in business. IT05.01.02 Analyze data privacy and information security issues from personal, business, and cultural perspectives. IT05.01.03.Analyze current global issues related to industries and careers in this career field.
IT05.02 Recognize value in diverse perspectives of team members.	IT05.02.01 Utilize active listening to convey empathy and respect for multiple perspectives. IT05.02.02 Create positive team dynamics and effectively complete tasks by adapting to cultural differences and commonalities of team members.
IT05.03 Utilize conflict resolution skills to address stakeholder problems.	IT05.03.01 Resolve conflicts with and for customers using conflict resolution skills. IT05.03.02 Resolve conflicts with and for team members using conflict resolution skills.

Topic/Strand 6: Safety, Health and Environmental

Performance Indicator/Standard	Measures/Benchmarks
IT06.01 Maintain safe and healthy working environments by implementing personal and jobsite safety rules and industry-appropriate regulations.	IT06.01.01 Adhere to OSHA health and safety regulations to support a safe and healthy work environment. IT06.01.02 Apply ergonomic principles and technology use techniques to prevent technology-related injuries and fatigue. IT06.01.03 Demonstrate appropriate use of technology and equipment according to manufacturer rules and safety regulations. IT06.01.04 Explain and comply with sexual harassment policies to create a non-hostile work environment.

Topic/Strand 7: Leadership and Teamwork

Performance Indicator/Standard	Measures/Benchmarks
IT07.01 Demonstrate interpersonal skills to develop effective workplace relationships.	IT07.01.01 Build effective relationships with co-workers and supervisors appropriate to the workplace. IT07.01.02 Work cooperatively with co-workers representing different cultures, genders, and backgrounds.
IT07.02 Demonstrate teamwork to effectively achieve individual and collective goals.	IT07.02.01 Identify traits of effective teams in relation to self, team, community, diversity, and environment. IT07.02.02 Work with others to achieve objectives in a timely manner. IT07.02.03 Take responsibility for shared group and individual work tasks.
IT07.03 Demonstrate leadership to accomplish organizational goals and use team members' talents effectively.	IT07.03.01 Identify traits of effective leaders in relation to self, team, community, diversity, and environment. IT07.03.02 Distribute responsibility and work load fairly. IT07.03.03 Promote an environment of positive team relationships and goal attainment. IT07.03.04 Utilize conflict management skills to facilitate solutions.

Topic/Strand 8: Ethics and Legal Responsibilities

Performance Indicator/Standard	Measures/Benchmarks
IT08.01 Describe businesses' responsibility to know and comply with legal and ethical requirements of business operations.	IT08.01.01 Compare and contrast copyrights and trademarks. IT08.01.02 Explain appropriate copyright use including how to acquire formal permission to use proprietary information and intellectual property. IT08.01.03.Demonstrate adherence to copyright and intellectual property laws in using the work of others.
IT08.02 Describe the scope of social responsibility for local and international business operations and their potential impact on society.	IT08.02.01 Identify positive and negative social impacts of business on society. IT08.02.02 Compare and contrast legal versus social responsibility.
IT08.03 Demonstrate ethical behavior in the use of information technology.	IT08.03.01 Explain ethical and legal issues arising from the use of intellectual property. IT08.03.02 Demonstrate ethical behavior as it relates to creating and publishing information. IT08.03.03 Write web page code to meet W3C coding and accessibility standards.
IT08.04 Apply ethical reasoning to a variety of workplace situations in order to make ethical decisions.	IT08.04.01 Evaluate alternative responses to workplace situations based on legal responsibilities and employer policies. IT08.04.02 Evaluate alternative responses to workplace situations based on personal or professional ethical responsibilities. IT08.04.03 Explain personal and professional consequences of unethical or illegal behaviors.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710 or 040800**

Course Title: Introduction to Information Technology **Course Code: 64 or 17**

Alternate Course Titles: IT Exploration, IT Essentials

Course Description: This course introduces students to information technology utilized in modern business settings. The course typically provides preview and background curriculum units on subsequent courses available in this cluster to serve as a prerequisite for further study. The focus is on the processes and techniques of using information technology and not specific computer applications. The course will cover hardware, devices, software, processes and networks that allow use of information technology in our world.

CTSO Competitive Events:

BPA: Information Technology Concepts–Open

SkillsUSA: Information Technology Services, Technical Computer Applications

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Information Technology Fundamentals, Exploring Computer Science

Internet & Computing Core (IC3) Digital Literacy Certification

Instructional units in this course may include:

- Principles of Information Technology
- Information Privacy, Security, Credibility, and Source Citation
- Information Technology Applications
- Database Applications
- Programming and Coding
- Digital Media Applications
- Impact of Information Technology in a Global Society
- Exploration of Career Pathways in Information Technology

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT64.10.01 Explain the elements and principles of information technology.	IT64.10.01.01 Communicate ideas using appropriate information technology terminology. IT64.10.01.02 Provide examples to explain how information technology is utilized in all career clusters. IT64.10.01.03 Explain the fundamental principles of information technology and their impact on business communications and decision-making.	I will be able to explain how information technology is used for business operations in many career fields. I will be able to explain how information needs and technology capabilities influence the design of information systems.
IT64.10.02 Evaluate and use information from technology sources.	IT64.10.02.01 Explain the importance of information privacy and security. IT64.10.02.02 Use information technology resources to retrieve information. IT64.10.02.03 Cite information sources appropriately. IT64.10.02.04 Explain plagiarism and its consequences. IT64.10.02.05 Evaluate the credibility and bias of information sources. IT64.10.02.06 Analyze the effectiveness of information systems to support collaborative tasks, research, publications, communications, and increased productivity.	I will be able to access and acquire information using information technology resources. I will be able to appropriately cite source information used in my work. I will be able to evaluate electronic information sources for information credibility and potential of bias. I will be able to find accurate information on the internet.
IT64.10.03 Select and demonstrate use of information technology applications appropriate to data and business needs.	IT64.10.03.01 Compare and contrast features of information technology applications for business communication and problem-solving tasks. IT64.10.03.02 Evaluate and select appropriate applications to productively complete tasks. IT64.10.03.03 Demonstrate the transferability of skills between information technology applications.	I will be able to identify the format and content of information needed to complete business tasks and projects. I will be able to compare and contrast application features to determine suitability for a given task. I will be able to demonstrate how skills learned in one program transfer to other programs.
IT64.10.04 Apply database concepts and processes to solve business problems.	IT64.10.04.01 Explain how databases are used for school, personal and business applications. IT64.10.04.02 Connect database functions to their application in solving business problems. IT64.10.04.03 Create information databases to solve business information needs.	I will be able to explain how databases are used for school, personal and business applications to solve problems. I will be able to create databases to provide information for solving business problems.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT64.10.05 Utilize introductory programming skills to develop solutions to business problems.	IT64.10.05.01 Explain and diagram the software design process. IT64.10.05.02 Identify and demonstrate basic structures and controls used in programming. IT64.10.05.03 Create applications using a programming language to solve business problems. IT64.10.05.04 Create basic web pages using HTML5, Cascading Style Sheets (CSS), and JavaScript to gather and display information.	I will be able to explain and diagram the software design process. I will be able to identify and demonstrate basic programming structures and controls. I will be able to program basic software applications. I will be able to create basic web pages to gather and display information.
IT64.10.06 Use digital media to create solutions for business and communication needs.	IT64.10.06.01 Identify different types and formats of media and information typical in business and information use. IT64.10.06.02 Obtain, create, and/or edit information in multiple media formats to solve problems and communicate information. IT64.10.06.03 Utilize a design model or process to plan and implement an interactive digital media project. IT64.10.06.04 Create basic web pages using a GUI HTML editor to gather and display information.	I will be able to find, create and/or edit information in multiple media formats. I will be able to design and implement an interactive digital media project. I will be able to create basic web pages to gather and display information.
IT64.10.07 Analyze the impact of information technology in our global society.	IT64.10.07.01 Explain how developments in information technology affect the supply and demand characteristics of the job market. IT64.10.07.02 Explain how information technology impacts organizational structure and operations. IT64.10.07.03 Identify emerging trends in information technology and predict influences on business and industry. IT64.10.07.04 Analyze and compare society's influence on information technology and information technology's influence on society.	I will be able to explain how information technology has changed requirements and opportunities in the job market. I will be able to explain how organization structures and policies change as technology improves. I will be able to identify emerging trends in information technology and predict how they will influence business operations. I will be able to analyze the symbiotic relationship between society and information technology.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Photography for Business Communications **Course Code: 65**

Alternate Course Titles: Business Management

Alternate Course Titles: Business Photography, Photography in Advertising

Course Description: This course is an introduction to the basics of photography and explore the manner in which photography is used to convey information and experiences. The course provides students an opportunity to learn the mechanics of the camera, the history of photography and improve photocomposition skills, along with digital editing skills to apply photography to business operational aspects including employee training and print/digital/social media marketing to internal and external audiences.

CTSO Competitive Events:

SkillsUSA: Photo contest and Photography

Suggested Certifications or Industry-Recognized Credentials:

YouScience: 3D Animation I

Adobe Certified Associate: Visual Communication Using Adobe Photoshop

Instructional units in this course may include:

- History and Impact of Photography Innovations
- Using Industry-Standard Photography Equipment
- Composition and Lighting Techniques
- Photo-Editing Techniques
- Photography for Business Communication Messages
- Careers in Business Photography and 3D Animation

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT65.10.01 Explain the impact of photography technology innovations on communication messages and societal change.	IT65.10.01.01 Analyze photographic imagery in the context of history and current practice of photography. IT65.10.01.02 Identify and explain the impact major inventions and innovations have had on the field of photography.	I will be able to perform basic analysis of photographic imagery in relation to content and context. I will be able to identify innovations in photography and explain the impact they have had.
IT65.10.02 Produce visual media using industry-standard photography equipment.	IT65.10.02.01 Identify and utilize basic camera operations (ex: on/off, switching of shooting modes, flash settings, file settings and zoom features). IT65.10.02.02 Customize camera settings through the LCD display. IT65.10.02.03 Explain and demonstrate the various shooting modes on a digital camera and when to use each. IT65.10.02.04 Compare and contrast the characteristics and use of various image file types. IT65.10.02.05 Explain the importance of digital camera care and demonstrate basic maintenance techniques.	I will be able to demonstrate how proficiency with basic operations of industry-standard camera equipment. I will be able to utilize the functions of the LCD screen to customize settings. I will be able to compare and contrast the characteristics and use of various image file types. I will be able to demonstrate basic knowledge of camera maintenance.
IT65.10.03 Apply composition and lighting techniques in production of visual images for print and digital media.	IT65.10.03.01 Explain the foundational elements and principles of design in photography. IT65.10.03.02 Identify, analyze, and apply the various sources and basic characteristics of light. IT65.10.03.03 Explain the use and effects created by basic manual settings and techniques such as shutter speed, aperture, F-stops, depth of field and ISO. IT65.10.03.04 Apply and evaluate traditional composition strategies to create desired photographic effects.	I will be able to explain foundational photography principles using appropriate vocabulary. I will be able to identify various sources and characteristics of light using appropriate vocabulary. I will be able to explain and demonstrate the use of basic manual camera settings. I will be able to apply various aperture and F-stop settings and evaluate their effectiveness in creating desired effects.
IT65.10.04 Enhance visual impact of business messages through photo editing techniques.	IT65.10.04.01 Analyze the visual and emotional impact of a photograph in terms of composition, technique, and concept. IT65.10.04.02 Use photo editing software to edit photographs to correct defects and create effects. IT65.10.04.03 Prepare images in various output formats for use in social media, web page, and print formats.	I will be able to analyze photos for their visual and emotional impact on the viewer. I will be able to demonstrate use of retouching and design tools to make geometric corrections, tonal adjustment, color correction and photo retouching. I will be able to prepare images in various formats for use in social media, web page, and print formats.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT65.10.05 Enhance communication of sales, marketing, and human resource business messages with photographic images and techniques.	IT65.10.05.01 Explain the relationship between text and photographs in conveying messages in business communications. IT65.10.05.02 Create a variety of photographs for use in advertising publications. IT65.10.05.03 Create and format photographs to support specific appeals to various target market audiences. IT65.10.05.04 Utilize photographs and text to create effective human resources training and professional development documents. IT65.10.05.05 Identify and design color modes in preparing photos for print publications. IT65.10.05.06 Utilize appropriate file formats for specific industry situations.	I will be able to explain how text and photos work together to create effective business communications. I will be able to create photographs for distribution in various advertising platforms and formats. I will be able to create photographs with specific appeals to various target market audiences. I will be able to create training materials that make effective use of text and photographs to assist in the learning of new skills and information. I will be able to select and use appropriate color modes for preparing photographs for use in print or electronic formats.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Multimedia and Video 1 **Course Code: 66**

Alternate Course Titles: Digital Multimedia, Interactive Media, Multimedia and Video for Business

Course Description: Students in this course develop the knowledge and skills to create, design, and produce visual communication media products to support their use of technology in the current age. The key student outcome is developing the ability to present information through multimedia and video materials for effective business messaging. Topics may include 3D animation, graphic media, skills specific to various video-editing software tools, and virtual reality. [NOTE: Broadcast journalism and TV production courses do not meet the criteria for this course/Business program. See Trades and Industry courses in Communications for more information on courses related to video production and broadcast journalism.] The focus of the course is practical application of digital video content and/or digital/computer-generated media to support business communication functions including sales, marketing, and human resources.

CTSO Competitive Events:

BPA: Presentation (Individual and Team), Video Production Team, Digital Media Production

SkillsUSA: 3-D Visualization and Animation, Advertising Design, Audio/Radio Production, Community Service

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Digital Media I

YouScience: Digital Media II

Instructional units in this course may include:

- Multimedia and Video File Types and Formats
- Using Industry-Standard Hardware and Software Tools
- Messaging to Target Market Audiences
- Project Planning
- Synchronous Media Applications for Business
- Business Careers in Video and Digital Media

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT66.10.01 Compare and contrast multimedia and video file types and formats used in business communications.	IT66.10.01.01 Define and explain industry terminology related to multimedia and video. IT66.10.01.02 Compare and contrast the characteristics of different formats of multimedia (i.e. tutorials, website, print, presentation, simulation, and game). IT66.10.01.03 Compare and contrast the characteristics of different elements used in multimedia formats (i.e. audio, video, graphics/images, text, and animation). IT66.10.01.04 Compare and contrast characteristics of various types of video files (e.g. mov, avi, wmv, mpg).	I will be able to professionally communicate about multimedia and video using appropriate terminology. I will be able to compare and contrast characteristics of different multimedia formats. I will be able to compare and contrast characteristics of different multimedia elements. I will be able to compare and contrast characteristics of different types of video file formats.
IT66.10.02 Format and edit multimedia and video content using industry-standard hardware and software to create business messages.	IT66.10.02.01 Utilize industry-standard multimedia software to develop media-rich slideshows. IT66.10.02.02 Acquire, format, and edit digital images from a variety of sources (i.e. scanner, digital camera, cell phone, Internet/cloud). IT66.10.02.03 Acquire and edit audio files from a variety of sources and convert to other audio file formats. IT66.10.02.04 Acquire and edit video files from a variety of sources and convert to other video file formats. IT66.10.05 Develop animation files and objects utilizing 2-D and 3-D animation.	I will be able to create multimedia presentations using slideshow software. I will be able to access and use digital images from a variety of sources. I will be able to use audio files in one format and convert them to other file formats. I will be able to use video files in one format and convert them to other file formats. I will be able to create 2-D and 3-D animation files.
IT66.10.03 Develop business communication and media elements aligned with target market characteristics.	IT66.10.03.01 Identify characteristics of a target audience. IT66.10.03.02 Identify the communication objectives of multimedia or video productions created for them. IT66.10.03.03 Synthesize knowledge of the target audience and communication objectives to develop the messaging and media elements needed for an effective project or presentation.	I will be able to identify key characteristics of the target audience for my multimedia/video project. I will be able to explain the message and image I want to convey through my project/presentation. I will be able to determine the most effective messages and media to use to impact my desired audience.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT66.10.04 Apply project management skills to plan and organize multimedia and video projects for specific target market audiences.	IT66.10.04.01 Explain the planning and design process for storyboarding a multimedia or video project. IT66.10.04.02 Make decisions about project content including considerations such as copyright, permissions, and licensing. IT66.10.04.03 Develop a storyboard planning tool to organize content and technical elements for a multimedia or video project.	I will be able to explain the design process for developing multimedia and video projects. I will be able to explain the legal implications and requirements involved when using content created by others. I will be able to create a storyboard to organize planning for a multimedia or video project.
IT66.10.05 Utilize platform-specific features of multimedia and video to create information sources for synchronous business applications.	IT66.10.05.01 Compare and contrast use of synchronous and asynchronous communication to meet business objectives. IT66.10.05.02 Develop and deliver multimedia or video presentations to in-person business audiences. IT66.10.05.03 Develop multimedia or video presentations for distribution and display on web sites and through social media.	I will be able to discuss the differences between real-time and any-time information needs. I will be able to deliver a professional business presentation supported by multimedia or video resources. I will be able to create multimedia or video that can be viewed through access to an Internet or social media site.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Multimedia and Video 2 **Course Code: 67**

Alternate Course Titles: Advanced Digital Multimedia, Interactive Media II

Course Description: This course expands on the foundational elements of multimedia and video planning and development found in the Multimedia & Video 1 course. Students gain skills in utilization of more advanced systems and software tools in development of communication materials for school, student organization, and/or business/community entities. [NOTE: Broadcast journalism and TV production courses do not meet the criteria for this course/Business program. See Trades and Industry courses in Communications for more information on courses related to video production and broadcast journalism.] Focus is practical application of digital video content and/or digital/computer-generated media to support business communication functions including sales, marketing, and human resources.

CTSO Competitive Events:

BPA: Presentation (Individual and Team), Video Production Team, Digital Media Production, Podcast Production Team

SkillsUSA: 3-D Visualization and Animation, Advertising Design, Audio/Radio Production, Community Service

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Digital Media II

YouScience: Digital Media, Advanced

Instructional units in this course may include:

- Project Design and Management
- Content Creation and Editing for Business Messages
- Integrated Multimedia and Video Applications
- Multimedia/Video for Web Communications
- Asynchronous Media Applications for Business
- Evaluating Project and Communication Effectiveness
- Business Careers in Video and Digital Media

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT67.10.01 Apply project management skills to lead a project design team in the creation of multimedia and video projects.	IT67.10.01.01 Develop project communication goals and objectives and convey them to team members. IT67.10.01.02 Demonstrate the value of team member involvement through collaborative decision-making. IT67.10.01.03 Create action plans for tasks to be completed and determine team member responsibilities and deadlines for completion.	I will be able to lead a team in the creation of a multimedia or video project. I will be able to listen to and incorporate contributions of all team members in the development of a team project. I will be able to assign tasks, set deadlines, and monitor progress to achieve project completion by a desired date.
IT67.10.02 Create original and edit existing image and video content to enhance business communications messages and media.	IT67.10.02.01 Explain the legal implications of creating original images and utilizing content created by others. IT67.10.02.02 Use industry-standard hardware and software to create original images and graphics for business communications. IT67.10.02.03 Edit and enhance images and graphics from other sources to meet quality and messaging needs for a specific target audience.	I will be able to explain copyright and permission issues associated with creating my own images and editing work created by others. I will be able to create original photos and graphics using hardware and software tools used in industry. I will be able to edit exiting photos or graphics to suit business communication needs for a desired target audience.
IT67.10.03 Integrate technical capabilities of multiple video and multimedia applications into a single communication product.	IT67.10.03.01 Identify file types and formats of multimedia and video content most compatible for integration into a single communication product. IT67.10.03.02 Analyze communication needs to determine which elements in an integrated presentation would be most effectively delivered through multimedia and which through video. IT67.10.03.03 Utilize industry-standard hardware and software to create business communication products that integrate multimedia and video content.	I will be able to identify the file types and formats that are best to use when integrating multimedia and video into a single presentation. I will be able to determine when information is best delivered through video and when best through multimedia content. I will be able to combine multiple forms of technology to create an integrated communication product.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT67.10.04 Utilize web communication systems to enhance business communications.	IT67.10.04.01 Utilize internet communication tools such as blogs, wikis, and podcasts to distribute multimedia presentations. IT67.10.04.02 Describe the features and business uses of voice-over-IP and video chat systems such as Skype, iChat, and FaceTime. IT67.10.04.03 Distribute multimedia or video communications using real-time meeting programs such as Zoom, Webex, GoToMeeting, or Google Meets.	I will be able to share multimedia or video content on a blog or wiki. I will be able to describe how online audio and video communication systems are used in business. I will be able to use real-time meeting programs to participate in virtual meetings.
IT67.10.05 Utilize platform-specific features of multimedia and video to create information sources for asynchronous business applications.	IT67.10.05.01 Develop multimedia or video products in stand-alone information kiosk formats to convey business and consumer information. IT66.10.05.02 Develop multimedia or video products to provide employee training on aspects of job performance tasks.	I will be able to create a stand-alone information kiosk to convey information to workers or consumers. I will be able to create a multimedia presentation or video to provide training on performance of employee job tasks.
IT67.10.06 Measure effectiveness of communication products and processes in achieving desired business objectives.	IT67.10.06.01 Explain the nature and use of SMART goals and key performance indicators (KPI) in evaluating business communications. IT67.10.06.02 Identify tools used by businesses to determine the success rate in achieving key performance indicators (KPI). IT67.10.06.03 Evaluate the effectiveness of a multimedia or video communication using key performance indicators (KPI).	I will be able to define the concepts of SMART goals and KPI and how they are used in business. I will be able to create key performance indicators for a business presentation. I will be able to identify data tools and instruments businesses use to determine how well a presentation accomplishes key performance indicators.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Graphic Design 1 **Course Code: 68**

Alternate Course Titles: Design Basics, Web and Digital Design

Course Description: This course will introduce students to the technical, artistic, and conceptual principles of graphic design. Areas of study include past and current uses of graphic design, elements of design, technical software skills, media vocabulary, layout principles, structure and style, history of design, and ethical and legal issues related to graphic design. Students will use this knowledge of principles to create and present original graphic art products using both technical skill and artistic principles that communicate a message. Students will also analyze and comment on graphic presentations for their effectiveness, style and structure, intent, and message. Students will revise and improve graphic designs to meet the needs of the customer using feedback.

CTSO Competitive Events:

BPA: Graphic Design Promotion, Advanced Desktop Publishing

SkillsUSA: Graphic Design

Suggested Certifications or Industry-Recognized Credentials:

YouScience: 3D Animation I

YouScience: 3D Animation II

Instructional units in this course may include:

- Media Arts Principles
- Principles of Design
- Graphic Design for Business Communications
- Management of Graphic Design Projects
- Career Ladders in Graphic Design

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT68.10.01 Analyze the elements and principles of media arts in business graphic design.	IT68.10.01.01 Explain the characteristics of, and interaction between, the elements and principles of media arts. IT68.10.01.02 Analyze how the elements in media arts such as image, sound, space, time, motion, and sequence or visual art elements including color, line, shape, value, form, texture, and space are combined to communicate meaning in the creation of, presentation of, or response to graphic design. IT68.10.01.03 Evaluate how the principles of media arts such as repetition, unity, and contrast are used in the creation of, presentation of, or response to media artworks.	I will be able to communicate meaning through describing the use and purpose of media arts elements and their use in connection with each other. I will be able to explain how elements influence the design (dimensions of color, perceptions of color, relationship to other graphics).
IT68.10.02 Utilize professional design components in the creation and presentation of a graphic design project.	IT68.10.02.01 Select and apply typography styles aligned to audience needs and desired communication goals. IT68.10.02.02 Create compositional content that demonstrates application of shape, space, line, size color, texture, organization, and typography. IT68.10.02.03 Analyze how the principles of design affect design composition. IT68.10.02.04 Organize and present written, graphic, and numeric information in business infographic formats.	I will be able to demonstrate use of the principles of design in an original graphic design project. I will be able to create a portfolio or present my graphic design work or samples. I will be able to edit a graphic design using feedback from others. I will be able to provide feedback to others on how the principles of design are interpreted.
IT68.10.03 Create an original graphic design that effectively conveys an intended brand image and communicates an intended message.	IT68.10.03.01 Analyze the design and media characteristics needed to convey brand image and message meaning to intended target audiences. IT68.10.03.02 Develop graphic design projects to communicate brand image and information message to a specific audience.	I will be able to demonstrate professional graphic design techniques using industry-standard software. I will be able to create graphic designs that communicate to a target audience.
IT68.10.04 Use project management skills to improve workflow, quality, and on-time completion of projects.	IT68.10.04.01 Develop goals and objectives. IT68.10.04.02 Prioritize tasks to be completed. IT68.10.04.03 Develop timelines for completion of work tasks.	I will be able to develop and follow a work plan to meet project completion deadlines.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Graphic Design 2 **Course Code: 69**

Alternate Course Titles: Graphic Art & Design II, Digital Design II

Course Description: This course expands on the foundational elements in the Graphic Design 1 course. Students learn the use of artistic techniques to communicate ideas and information to business and customer audiences via illustrations and other forms of digital or printed media. Students gain skills in advanced graphic design software tools in preparation for industry certifications. Emphasis may be given to commercial graphic design techniques (completed through both manual and technological processes) such as 3-D computer graphics, 3-D printing, and sublimation printing. Student opportunities to address real-world business problems should be encouraged.

CTSO Competitive Events:

BPA: Graphic Design, Computer Animation Team

SkillsUSA: Graphic Communications, Pin Design, Screen Printing Technology, and T-Shirt Design

Suggested Certifications or Industry-Recognized Credentials:

YouScience: 3D Graphics

Adobe Certified Associate: Visual Communication Using Adobe Illustrator CC

Adobe Certified Associate: Visual Communication Using Adobe InDesign CC

Instructional units in this course may include:

- Professional Image Enhancement
- Creative Briefs for Project Planning
- Communication and Promotional Materials
- Branding Images, Logos, and Brand Identity
- Digital Portfolio Development
- Career Ladders in Graphic Design

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT69.10.01 Utilize industry-standard graphic design tools to create professional image enhancements.	IT69.10.01.01 Explain the purpose and function of various tools available in industry-standard graphic design software. IT69.10.01.02 Utilize object features to create vector graphics, 3D graphics, and animations. IT69.10.01.03 Use the color panel and swatches to enhance layouts and images according to color theory. IT69.10.01.04 Apply artistic techniques to images utilizing adjustment layers, filter effects, and image restoration techniques to enhance business messaging.	I will be able to manipulate text and graphic frames, lines, basic shapes and individual graphic selections. I will be able to manipulate images and image frames with transformation tools. I will be able to manipulate and use rulers, margin, column and all other guides. I will be able to differentiate among the various color models and matching systems. I will be able to use tools to manipulate shapes, type, vector and raster objects.
IT69.10.02 Develop a creative brief which applies artistic graphic design techniques as a blueprint for targeted business communication projects.	IT69.10.02.01 Demonstrate application of industry standards for page layout and design of text, photographs, and graphic elements. IT69.10.02.02 Develop and implement plans and procedures for a professional photo shoot. IT69.10.02.03 Develop a creative brief as a blueprint for targeted business communications.	I will be able to create and explain the use of thumbnail sketches. I will be able to create a variety of layouts using advanced design techniques. I will be able to apply the use of text, photos and graphics according to the rules of page design. I will be able to plan, prepare for and lead a photo shoot for creation of materials for business communications.
IT69.10.03 Create original graphic, text, and photograph elements for business communication and marketing purposes.	IT69.10.03.01 Plan and prepare storyboard layouts for promotional messages conveyed through print, web, and social media platforms. IT69.10.03.02 Present communication and promotion materials, explaining the purpose and interaction of space, line, shape, color, and text to accomplish business communication goals.	I will be able to explain the importance of design elements and principles in relation to creation of layouts. I will be able to explain logo planning procedures and create sketches to express a desired business identity.
IT69.10.04 Create branding images, logos, and promotional materials in multiple formats to develop brand awareness and positive brand identity for a product or service.	IT69.10.04.01 Explain how graphic design project development and design techniques are applied through various means of commercial production (silkscreen, lithography, cartooning, and computer graphics). IT69.10.04.02 Create branding images, logos, and promotional materials in multiple media formats to develop brand awareness and positive brand identity for a product or service.	I will be able to explain the basic process of offset printing. I will be able to explain the screen-printing process. I will be able to create various file formats and edit these settings depending on business communication needs.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT69.10.05 Develop a digital portfolio comprised of personally created graphic design products to highlight a range of knowledge and technical skills.	IT69.10.05.01 Develop a professional resume, optimized for ATS scanning, which highlights personal graphic design knowledge and skills. IT69.10.05.02 Analyze the advantages and disadvantages of traditional and interactive portfolios. IT69.10.05.03 Design and create a portfolio to include artifacts highlighting personal graphic design knowledge and technical skills.	I will be able to develop a resume for electronic job application submission that describes my graphic design knowledge and skills. I will be able to describe the pros and cons of traditional and interactive portfolios. I will be able to design a career portfolio with logical organization and easy navigation. I will be able to select items for inclusion in my career portfolio that demonstrate my graphic design knowledge and skills.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Web Design 1 **Course Code: 70**

Alternate Course Titles: Web Page Design, Website Design

Course Description: This course will introduce students to web page design. In this hands-on, project-oriented course, students will explore web site development using HTML5 and CSS3. Students will design and create multiple page Web sites with text, graphics, multimedia elements, and interactivity. This course covers the use of HTML5 (Hypertext Markup Language version 5), CSS3 (Cascading Style Sheets version 3), the optimization of graphics, and the application of multimedia elements to produce interactive web sites. Students will create web sites to communicate a client's message through the application of the principles and elements of design.

CTSO Competitive Events:

BPA: Fundamentals of Web Design

SkillsUSA: Web Design

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Web Development I

YouScience: Business Web Page Design I

Instructional units in this course may include:

- Getting Started with HTML: Site Maps and File Management
- Inserting and Working with Hyperlinks
- Inserting and Working with Images
- Organizing Content with Lists and Tables
- Getting Started with CSS
- Laying Out Elements with CSS
- Formatting Text with CSS
- Career Pathway Opportunities in Web Design and Website Development

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT70.10.01 Use site map and file folder management techniques to create and maintain a directory structure for a web site.	IT70.10.01.01 Create diagrams representing common organizational structures of web sites. IT70.10.01.02 Convert web site wireframes into individual web page wireframes that depict content elements on each page. IT70.10.01.03 Create a web site directory structure using a web site wireframe.	I will be able to create a diagram to depict the basic structure of a web site and the interconnection between its pages. I will be able to convert web site wireframes into individual web page wireframes depicting content elements of each page. I will be able to use file and folder management techniques to create and maintain a web site directory structure.
IT70.10.02 Create web page designs with page layouts that create visual appeal and provide easy access to information.	IT70.10.02.01 Explain the importance of specific page layout features in creating appealing and easy-to-use web sites. IT70.10.02.02 Explain the use of grid-based layouts to organize web page content. IT70.10.02.03 Create a diagram of web page content to guide programming.	I will be able to produce web site designs that demonstrate principles of website usability, readability, and accessibility. I will be able explain the use of two- and three-column grid layouts to display web page content. I will be able to create a web page diagram that I will use as a model for programming a web page.
IT70.10.03 Analyze copyright and licensing restrictions governing use of digital content for web pages.	IT70.10.03.01 Compare and contrast various types of stock images and free/open source images for possible use on web sites. IT70.10.03.02 Compare and contrast royalty-free and rights-managed licensing and explain how each licensing affects the use of images. IT70.10.03.03 Utilize images and graphics on web pages, following copyright and licensing restrictions and creating appropriate ALT tags.	I will be able to compare the features, advantages, and disadvantages of various types of images. I will be able to compare and contrast the rights and responsibilities of using royalty-free and rights-managed images. I will be able to follow legal requirements when incorporating images into my web page designs.
IT70.10.04 Apply image composition techniques to images displayed on web pages.	IT70.10.04.01 Explain the effects on digital images of pixels, color depth, resolution, and dithering. IT70.10.04.02 Compare and contrast characteristics and appropriate use of raster and vector graphics on web pages. IT70.10.04.03 Utilize image optimization techniques to prepare images for display on web pages.	I will be able to utilize appropriate terminology in describing image characteristics. I will be able to explain when to use raster graphics and when to use vector graphics on web pages. I will be able to edit images with appropriate techniques to optimize their display on my web pages.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT70.10.05 Write HTML code using a text editor and an HTML generator to create web site structure and content.	IT70.10.05.01 Describe the parts and appropriate use of HTML coding syntax. IT70.10.05.02 Use HTML to create websites that follow accepted W3C guidelines and function across browsers and platforms. IT70.10.05.03 Identify and solve coding errors (i.e. debug) throughout the web site development process.	I will be able to describe HTML syntax and the correct coding structure of each element. I will be able to create HTML documents with proper tags, comments, attributes, and div elements. I will be able to insert images and colors into a webpage using HTML/CSS. I will be able to create HTML links using images. I will be able to create HTML lists and tables. I will be able to debug my HTML code by identifying and correcting coding errors.
IT70.10.06 Generate cascading style sheet (CSS) code to format and layout web pages.	IT70.10.06.01 Describe the parts and appropriate use of CSS coding syntax. IT70.10.06.02 Use CSS coding to format HTML elements including background, fonts, text alignment, borders, and lists. IT70.10.06.03 Use CSS coding to format web page layout including the CSS box model, absolute and relative positioning, inline and block elements, and floating elements.	I will be able to describe CSS syntax and the correct coding structure of each element. I will be able to create an embedded style sheet using CSS (Cascading Style Sheets) to format HTML elements. I will be able to use CSS to format web page appearance and link to an external style sheet.
IT70.10.07 Create JavaScript code to create responsive, interactive elements that improve user experience with a web site.	IT70.10.07.01 Research and describe various examples of web page interactivity created through JavaScript coding. IT70.10.07.02 Compare and contrast the characteristics of variables and functions in writing JavaScript. IT70.10.07.03 Create JavaScript code that obtains and validates input from an HTML form and produces output based on multiple data fields (i.e. looping and conditional controls).	I will be able to describe examples of JavaScript use that allow the user to interact with web site information. I will be able to compare and contrast JavaScript variables and functions. I will be able to use JavaScript to develop an interactive form on a web page.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Web Development 2 **Course Code: 71**

Alternate Course Titles: Website Design II, Advanced Web Design, Web 2.0

Course Description: This course expands on the foundational elements of the Web Site Design 1 course. Students use a range of markup languages including (not limited to) Extensible Hypertext Markup, JavaScript, Dynamic HTML, and Document Object Model to develop and maintain entire web sites. Topics include use of forms and scripts for database access, information transfer methods, and networking fundamentals. Projects should include opportunities for design and management of web sites for school and community. Students will also research career pathway opportunities related to website design.

CTSO Competitive Events:

BPA: Website Design Team, Digital Communication and Design Concepts - Open

SkillsUSA: Web Design and Development

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Web Development II

YouScience: Business Web Page Design II

Instructional units in this course may include:

- Website Design, Enhancement, and Evaluation
- Network Protocols for Website Publishing and Administration
- Website Security Policies and Procedures
- Website Project Management
- Database Management Systems
- Career Pathway Opportunities in Web Design and Website Development

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT71.10.01 Design, implement, and evaluate web solutions to meet specified criteria.	IT71.10.01.01 Identify and utilize various types of resources for web development. IT71.10.01.02 Design and create interactive web pages that display real-time information from multiple sources. IT71.10.01.03 Publish websites on local and remote systems. IT71.10.01.04 Design and create websites that retrieve information from databases. IT71.10.01.05 Enhance websites by using scripting language(s). IT71.10.01.06 Enhance website utility by using query language(s).	I will be able to add features to my webpage using JavaScript. I will be able to create interactive web pages that display real-time information updates. I will be able to publish web site designs using local and remote systems. I will be able to create websites that retrieve information from databases. I will be able to use scripting languages to enhance the functionality and professionalism of my web site.
IT71.10.02 Design and configure network protocols and infrastructures for web site publishing and administration.	IT71.10.02.01 Identify and explain network protocols, standards, and theoretical models of website implementation. IT71.10.02.02 Install and configure network servers, routers, clients, and related hardware and software in simulated or virtual private network (VPN) environments. IT71.10.02.03 Design and develop network infrastructures in simulated or virtual private network (VPN) environments.	I will be able to identify the organization and function of my website network. I will be able to install and configure hardware in simulated or virtual environments. I will be able to design and develop a network system in simulated or virtual environments.
IT71.10.03 Design and implement security policies and procedures for information technology.	IT71.10.03.01 Explain configuration management strategies used to secure and protect data. IT71.10.03.02 Design controls to prevent loss of integrity of data and other information resources. IT71.10.03.03 Develop and implement mechanisms to protect an enterprise system from physical and cyber threats.	I will be able to explain web site configuration strategies used to secure and protect data. I will be able to design controls to secure and protect data. I will be able to create password authentication access to my website.
IT71.10.04 Use project management skills to direct completion and evaluation of web development projects.	IT71.10.04.01 Establish a plan for each of the knowledge areas of a web development project. IT71.10.04.02 Analyze the processes and products of a web development project using performance indicators and metrics. IT71.10.04.03 Follow the process groups of the Project Management Life Cycle when implementing a project.	I will be able to create a plan for my web development project using project management processes. I will be able to analyze each of the components of my web development project to aid in project design. I will be able to follow the Project Management Life Cycle to create an implement a web development project.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT71.10.05 Utilize database management systems and data analytics procedures to evaluate website traffic and content alignment to market needs.	IT71.10.05.01 Retrieve and use information from a database. IT71.10.05.02 Define and use basic database terminology. IT71.10.05.03 Use data mining techniques to extract database information for decision-making. IT71.10.05.04 Collect data using computational tools and transform the data to display and use for business problem solving.	I will be able to retrieve data using query language from my database. I will be able to organize data for easy retrieval. I will be able to use data mining techniques to find information needed to solve business problems. I will be able to collect and display information in useful formats to aid in communicating meaning.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Digital Game Design 1 **Course Code: 72**

Alternate Course Titles: Intro to Gaming, Gaming and Animation I, Intro to Game Programming

Course Description: This course is designed to introduce students to the elements, structure, and design of computer games and simulations. The course will prepare students to design and edit computer games, mobile applications, and simulations by studying game methodology, programming, game genres, game theory, and 2D and/or 3D interactive experiences. Students will also explore business and technology career fields related to digital game and mobile application design and development.

CTSO Competitive Events:

BPA: Computer Animation Team, Digital Communication & Design Concepts - Open

SkillsUSA: 3-D Visualization and Animation

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Gaming Development Fundamentals

Instructional units in this course may include:

- Game Design Industry Standards and Developments
- Logic and Function Programming for Game Design
- Programming and Debugging Code
- Careers in Video and Digital Game Design

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT72.10.02 Compare and contrast historical game design to current industry standards and developments.	IT72.10.01.01 Explain advances in video/digital game design as they apply to modern application of game design and virtual environments. IT72.10.01.02 Explain the process of the engineering design cycle. IT72.10.01.03 Describe game genres and types. IT72.10.01.04 Describe game design structure and features. IT72.10.01.05 Compare and contrast appropriate gaming platforms.	I will be able to describe advances in video and digital game design and innovations for simulated training applications. I will be able to describe the engineering design cycle and how it works as a practical problem-solving method in game design. I will be able to describe the different game genres and types. I will be able to explain game design functionality and feedback. I will be able to describe game design control, player view, and interface elements. I will be able to compare and contrast game consoles, mobile platforms and generations.
IT72.10.02 Identify and analyze programming for digital game/ simulation development.	IT72.10.02.01 Apply programming logic to game development. IT72.10.02.02 Describe programming functions in game development. IT72.10.02.03 Implement programming language concepts in a game design program.	I will be able to apply programming logic into the design of events and actions. I will be able to describe functions, conditions, actions, and sub-events in game development. I will be able to program a game design engine. I will be able to follow technical and increasingly complex programming instructions in order and detail.
IT72.10.03 Develop a digital game or simulation.	IT72.10.03.01 Document and design programming steps in a game design engine. IT72.10.03.02 Implement digital design resources in a game design engine. IT72.10.03.03 Debug programming code to correct operation errors and improve game performance.	I will be able to create a digital game by documenting and following programming steps. I will be able to use digital design resources to draw and animate sprites, objects, platforms, backgrounds, and loops. I will be able to effectively use game design functions to create, save, operate, and edit digital game applications. I will be able to debug existing game programs to fix errors and ensure performance.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Digital Game Design 2 **Course Code: 73**

Alternate Course Titles: Game and App Development, Gaming and Animation II, Advanced Game Programming

Course Description: This course expands on the foundational elements of digital game design found in the Digital Game Design 1 course while applying advanced programming and team building skills. Course topics include intellectual property and copyright, game engines, operating systems, game physics, intermediate programming and team development. Students will apply both creative and technical skills in an individual and/or team setting to develop, market, and publish original games, mobile device applications and/or training simulations in a software engine.

CTSO Competitive Events:

BPA: Computer Animation Team, Digital Communication & Design Concepts - Open

SkillsUSA: 3-D Visualization and Animation

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Gaming Development Fundamentals

Instructional units in this course may include:

- Game Development and Intellectual Property Rights
- Pre-Production Design Planning
- Programming Languages
- Post Production Maintenance
- Marketing Plans for Game Promotion
- Game Development Specifications
- Careers in Video and Digital Game Design

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT73.10.01 Describe the game design process and its relation to intellectual property rights and laws.	IT73.10.01.01 Describe the game design process. IT73.10.01.02 Describe intellectual property laws in relation to game development. IT73.10.01.03 Describe copyright laws in relation to game development.	I will be able to describe the game design process. I will be able to describe individual roles and job duties in the game design process. I will be able to describe intellectual property, IP subtypes, copyrights, trademarks, patents, and trade secrets in relation to the gaming industry. I will be able to describe copyright in games that cover software/coding, artwork/images, music/sounds, film, text, and gameplay.
IT73.10.02 Create and communicate plans for digital game/simulation development.	IT73.10.02.01 Create and present pre-production design plans for a game or simulation. IT73.10.02.02 Implement project management as part of the game design production cycle.	I will be able to develop and present a game proposal that includes an introduction, game description, delivery schedule and forecasted costs. I will be able to form a team and manage individual roles in relation to the game design production cycle.
IT73.10.03 Compare, contrast, and use programming languages in the creation of digital games and simulations.	IT73.10.03.01 Compare and contrast various programming languages used in game development software. IT73.10.03.02 Utilize variables, operators, expressions, and conditions in program development. IT73.10.03.03 Create and edit programming code for use in digital game/simulation development. IT73.10.03.04 Enhance existing games or simulations with programming code enhancements. IT73.10.03.05 Enhance existing games or simulations through addition of assets in a virtual environment.	I will be able to describe the different operating systems and game engines used in game development. I will be able to utilize variables, operators and expressions, and conditions in programming languages. I will be able to create assets into a digital game. I will be able to create and edit programing code in a game design engine. I will be able to enhance an existing game using enhanced programming/code capabilities.
IT73.10.04 Conduct post production program maintenance duties in a digital game or simulation.	IT73.10.04.01 Perform alpha testing on a game/simulation. IT73.10.04.02 Perform beta testing on a game/simulation. IT73.10.04.03 Maintain a game/simulation with updates, repairs and code fixes.	I will be able to perform in-house/controlled, small group testing to find errors and make adjustments as needed. I will be able to facilitate group testing and use feedback from end users to make game adjustments as needed. I will be able to maintain the game by providing updates and repairs throughout the life of the game.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT73.10.05 Develop a marketing plan for a digital game/simulation.	IT73.10.05.01 Identify characteristics of target audiences to guide development of marketing plan goals and promotional materials. IT73.10.05.02 Develop a promotional plan identifying media to be utilized in marketing a digital game/simulation. IT73.10.05.03 Design and develop a marketing plan aligned to needs and purchase habits of target markets.	I will be able to use demographic, psychographic, and behavioral segmentation to identify target markets. I will be able to create a promotional plan to identify marketing messages and media to connect to target market audiences. I will be able to develop a marketing plan for a digital game or simulation.
IT73.10.06 Develop a simulation/training application for a given set of specifications.	IT73.10.06.01 Create pre-production documents identifying software requirement specifications to guide simulation design and development. IT73.10.06.02 Design, develop, and test the simulation/training application. IT73.10.06.03 Perform quality assurance testing to ensure design specifications and operation goals have been met.	I will be able to develop a game script/storyboard based on the software requirement specifications given by the customer. I will be able to design, develop, and test the simulation/training application. I will be able to perform quality assurance testing to the simulation/training application when production is complete.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Introduction to Programming/Computer Science 1 **Course Code: 74**

Alternate Course Titles: Computer Programming, App Development

Course Description: This course will introduce students to computer science and programming concepts. The course content will cover both procedure-oriented and object-oriented programming. Structured programs will be written with a computer programming language with an emphasis on procedure-oriented programming. Topics may include: objects, methods/functions, properties, flowcharting, pseudocode, data types, calculations, decisions, and looping. Students will examine current events and ethical issues that related to technology, as well as computer science career pathways. Student participation in Business Professionals of America (BPA) is encouraged.

CTSO Competitive Events:

BPA: Python Programming, C++ Programming, Java Programming, C# Programming, Computer Programming Concepts – Open

SkillsUSA: Computer Programming, Interactive Application and Video Game Development

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Computer Programming I

YouScience: Computer Programming II (C#)

YouScience: Computer Programming II (C++)

PCEP: Certified Entry-level Python Programming Certification

Instructional units in this course may include:

- Software Development Cycle
- Coding for Common Tasks
- Coding for Data Values and Variables
- Relational Operators and Conditional Statements
- Programming with Control Loops
- Career Pathway Opportunities in Computer Programming and Application Development

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT74.10.01 Utilize programming tools to develop code for software development.	IT74.10.01.01 Diagram the software development cycle. IT74.10.01.02 Describe the types of languages used in software development. IT74.10.02.03 Summarize how data is organized in software development.	I will be able to develop an efficient algorithm for writing programs utilizing various programming concepts and determine the appropriate language. I will be able to develop software using an accepted programming methodology.
IT74.10.02 Code common tasks using application development tools.	IT74.10.02.01 Create appropriate and applicable comment code in a program. IT74.10.02.02 Utilize multiple print commands that print on the same line, different line and use escape characters for different types of print options.	I will be able to create descriptive comment codes for my program. I will be able to write a program that creates a variety of outputs to the screen.
IT74.10.03 Write a program that creates and utilizes data values for processing.	IT74.10.03.01 Create and declare the correct data type: String, integer, Boolean, floating-point numbers, character. IT74.10.03.02 Utilize variables to perform a variety of mathematical calculations. IT74.10.03.03 Write code using the built in Math methods using the Math library/class. IT74.10.03.04 Create and test output functions to calculate and report results.	I will be able to write a program that declares different variable types and reassigns variable values. I will be able to write code that performs calculations on given data that allows for data input and outputs the results.
IT74.10.04 Write a program that utilizes different decision structures to control program flow.	IT74.10.04.01 Use relational operators to build complex Boolean expression. IT74.10.04.02 Create multiple conditional statements for effective decision making in the program.	I will be able to write a program using one or more of the following conditional statements: if, if-else, if-elseif, switch.
IT74.10.05 Write a program utilizing control flow by using loops to solve real-world problems.	IT74.10.05.01 Write a program that uses control loop: for, do and while. IT74.10.05.02 Write a program that uses controlling loop execution (continue, break).	I will be able to write a program that effectively uses loops.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Advanced Programming/Computer Science 2 **Course Code: 75**

Alternate Course Titles: Advanced Computer Programming

Course Description: This course expands on the foundational elements in the Introduction to Programing 1 course. Students develop more advanced coding skills utilizing the previously learned programming languages. Topics will include: objects, classes, methods/functions, properties, pseudocode, data types, decisions, subroutines, looping, and arrays. Students will apply both creative and technical skills in an individual and/or team setting to develop a "real world" program. (When referring to functions in the Performance Indicator table for this course, if you are teaching using Java language you will be using static methods instead of functions.) Student participation in Business Professionals of America (BPA) is encouraged.

CTSO Competitive Events:

BPA: Python Programming, C++ Programming, Java Programming, C# Programming, Computer Programming Concepts – Open

SkillsUSA: Computer Programming, Interactive Application and Video Game Development

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Computer Programming II (Java)

YouScience: Computer Programming II (Python)

YouScience: Computer Programming, Advanced

PCAP: Certified Associate in Python Programming

Instructional units in this course may include:

- Testing and Debugging Code
- Programming Functions
- One-Dimensional Arrays
- ArrayLists
- Two-Dimensional Arrays
- Career Pathway Opportunities in Computer Programming and Application Development

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT75.10.01 Use pre-written code to analyze, test, debug and refine code resulting in working nested iterative statements.	IT75.10.01.01 Analyze and debug pre-written code to determine where errors are occurring. IT75.10.01.02 Update code to resolve errors. IT75.10.01.03 Test updated code to ensure proper program operation and result generation.	I will be able to test, debug, analyze and correct errors located in sample code which uses nested iterative statements (i.e., calculating monthly interest in a bank account for 10 years).
IT75.10.02 Use pre-written partial code to determine an action that will be performed multiple times and write a function that will perform the action and correctly call the function.	IT75.10.02.01 Determine and identify an action that needs to be performed multiple times in a program. IT75.10.02.02 Write code for a function that performs an action and returns the correct value. IT75.10.02.03 Write, test and debug code to ensure the function is being called correctly for desired results.	I will be able to write a program that determines an action that will be repeated throughout the program. I will be able to write a function to perform the action and correctly call the function for the desired outcome (i.e., write a function that adds numbers and returns the value).
IT75.10.03 Write a program to create, traverse and manipulate elements in a 1-dimensional array (1D).	IT75.10.03.01 Write code to declare and initialize elements in an array. IT75.10.03.02 Write code using a for next loop to correctly print out each item in an array. IT75.10.03.03 Write the code to sort the items in an array.	I will be able to write a program that creates a 1D array and initializes, sorts the array and print out all the elements in the array.
IT75.10.04 Write a program that creates a List or ArrayList and uses the List/ArrayList methods.	IT75.10.04.01 Create and test a List/ArrayList using the methods located in the library. IT75.10.04.02 Search for and replace an element in the list using a search and insertion method. IT75.10.04.03 Sort an ArrayList given specific parameters for desired results.	I will be able to write a program that will store the items in my backpacks. I will be able to alphabetically sort the items in the backpack. I will be able to add a new item to the backpack. I will be able to search for a specific item and replace with a new value and print out the final contents of the backpack.
IT75.10.05 Write a program to create, traverse and manipulate the elements in a two-dimensional array (2D).	IT75.10.05.01 Create, test and traverse a 2D array. IT75.10.05.02 Traverse a 2D array using nested for loops.	I will be able to write a program that creates and initializes a 2D array that will print out each element in the 2D array using nested for loops.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Management Information Systems (MIS) **Course Code: 76**

Alternate Course Titles: Business Information Systems, Business Analytics

Course Description: The Management Information Systems course provides an overview of the role of information systems in business operations, and hands-on application of data tools and systems. The focus of MIS is the process of designing, maintaining, securing, and communicating how information moves throughout an organization to support data-driven decision making by business leaders. This course introduces students to the applications of information technology utilized in modern business settings. Emphasis is placed on the processes and techniques of using information technology and not specific computer applications. The course will include software, hardware, security, and data management tools and techniques.

CTSO Competitive Events:

BPA: SQL Database Fundamentals, Information Technology Concepts - Open

SkillsUSA: Information Technology Services, Technical Computer Applications

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Algorithms and Data Structures

Instructional units in this course may include:

- Management Information System Tools and Processes
- Network Planning
- Security Planning
- Network and Device Configuration
- MIS for Business Decision-Making
- Careers in Network and Database Design and Management

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT76.10.01 Analyze the role of MIS in operation of modern business organizations.	IT76.10.01.01 Contrast Information Technology (tools) and Management Information Systems (processes). IT76.10.01.02 Explain how different functional areas of business operations utilize management information systems (ERP, CRM, MRP, financial, etc.). IT76.10.01.03 Summarize reasons for integrating products from specific application companies into a business MIS plan (SAP, Oracle, etc.).	I will be able to explain the impact MIS has in any business. I will be able to identify functional areas in a company and how MIS can be used to improve decision making.
IT76.10.02 Develop a plan to manage and control a network for businesses and organizations.	IT76.10.02.01 Utilize planning and design tools to create a network (Data Flow Diagram, What-if Analysis). IT76.10.02.02 Create a control plan to manage the usage and vulnerabilities of a network.	I will be able to diagram the flow of data throughout a company network. I will be able to create a plan to monitor a network.
IT76.10.03 Develop security measures to ensure network integrity within a business.	IT76.10.03.01 Develop security protocols for end users. IT76.10.03.02 Develop testing plans to audit effectiveness and usage of system safety protocols. IT76.10.03.03 Analyze the business, data, and technology support services provided by cybersecurity firms.	I will be able to assess risk within a network. I will be able to mitigate and avoid risks within a business network.
IT76.10.04 Configure network infrastructure and devices to meet security, data reporting, and business operation needs.	IT76.10.04.01 Configure basic networking devices and security for a network. IT76.10.04.02 Compare and contrast Information System Hierarchy and Organizational Structure (TPS, DSS, ESS, MIS) concepts. IT76.10.04.03 Design and develop network infrastructure to identify where data will be retrieved and processed.	I will be able to describe the components of a network. I will be able to explain the different levels of MIS within a business.
IT76.10.05 Utilize MIS for effective business decision-making.	IT76.10.05.01 Create procedures and nomenclature for several databases. IT76.10.05.02 Design query scripts to retrieve data and audit database design. IT76.10.05.03 Configure and communicate data into information used by business leaders.	I will be able to design an effective database. I will be able to pull data from a database. I will be able to design effective reports using spreadsheets.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Data Statistics and Analytics **Course Code: 77**

Alternate Course Titles: Business Statistics, Data Analysis

Course Description: This course examines the use of data and models to explain the performance of a business and how it can be improved through analysis of past performance. Students explore the challenges of data-driven business decision making, with emphasis on the analytical process and how essential data is identified and analyzed. Topics include: data collection and representation; descriptive analytics; predictive analytics; correlation, causation and regression; and probability models for decision making. Collaboration with school district Mathematics teachers on course development and delivery issues is encouraged to align performance indicators and benchmarks with district Mathematics standards.

CTSO Competitive Events:

BPA: Financial Math & Analysis Concepts, Financial Analyst Team, SQL Database Fundamentals

Suggested Certifications or Industry-Recognized Credentials:

Google Analytics Certification

YouScience: Algorithms and Data Structures

Instructional units in this course may include:

- Designing Data Collection Methods
- Visualizing and Analyzing Data
- Probability Concepts and Models
- Correlation and Causation: Business Activities and Business Success
- Predictive Analytics

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT77.10.01 Design data collection methods to produce information for analyzing and solving business questions.	IT77.10.01.01 Identify the features of a well-designed research study. IT77.10.01.02 Compare and contrast potential research variables for which data should be gathered and analyzed. IT77.10.01.03 Develop procedures for data collection to minimize sampling bias.	I will be able to identify the features and processes of a research study. I will be able to identify variables involved in the study of a business situation. I will be able to develop data collection procedures that minimize bias.
IT77.10.02 Visually depict descriptive business statistics to support descriptive analytics methods and communicate results.	IT77.10.02.01 Compare and contrast representation of data in various table and graph formats to enhance analysis and communication. IT77.10.02.02 Develop data tables and graphs to represent significant variables for research analysis and communication of findings.	I will be able to determine effective formats for representing statistical data. I will be able to represent data in tables and graphs to communicate research findings.
IT77.10.03 Utilize probability concepts and models to analyze business strategies and evaluate outcomes of decisions.	IT77.10.03.01 Calculate and interpret ranges, standard deviations, and z-scores of a data set to analyze business results. IT77.10.03.02 Perform and interpret calculations of probabilities related to statistical significance to analyze business results. IT77.10.03.03 Produce probabilities using simulation analysis.	I will be able to perform calculations on business data for analyzing business results. I will be able to use simulation analysis to produce probabilities for analyzing business results.
IT77.10.04 Analyze data to determine correlations and causation between business activities and business results to guide decision making.	IT77.10.04.01 Analyze correlation and causation relationships between business activities and business results. IT77.10.04.02 Analyze data on two quantitative variables represented on a scatter plot to determine how the variables are related. IT77.10.04.03 Explain and demonstrate the significance of slope and y-Intercept in business data analysis. IT77.10.04.04 Calculate and interpret the significance of a population correlation coefficient.	I will be able to analyze correction and causation between business activities and business results. I will be able to utilize statistical processes to represent and analyze business data. I will be able to utilize statistical processes to predict the impact of potential business decisions.
IT77.10.05 Compare and contrast the benefits of various predictive analytics methods (e.g., predicting, classifying, clustering, and associating data).	IT77.10.05.01 Develop and analyze classification and regression trees to predict the effectiveness of identified business activities for improving business results. IT77.10.05.02 Utilize cluster analysis to classify features of competitors' products as a guide for product, pricing, and marketing decision making. IT77.10.05.03 Calculate and interpret confidence intervals and prediction intervals of potential business decisions.	I will be able to utilize statistical processes to predict the impact of potential business decisions. I will be able to apply statistical analysis of competitor data to develop business and marketing decisions.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: Networking (CISCO) (A+) **Course Code: 78**

Alternate Course Titles: IT Essentials (ITE), Networking

Course Description: This course introduces the fundamentals of computers and networks. Students will learn how hardware and software work, how hardware and system elements work together, and how to troubleshoot hardware and software issues. Topics include: mobile devices, Linux, MacOS, virtualization and cloud computing, Microsoft Windows operating systems, networking, and troubleshooting. Students will research computer science career pathways in demand to meet future workforce needs.

CTSO Competitive Events:

BPA: Computer Network Technology, Server Administration Using Microsoft, Network Administration using CISCO, Computer Security, Linux Operating System Fundamentals

SkillsUSA: Customer Service, Information Technology Services, Internetworking, Technical Computer Applications

Suggested Certifications or Industry-Recognized Credentials:

CISCO Certified Technician (CCT): Exam 100- 890 CLTECH

CompTIA IT Fundamentals Exam (ITF+)

CompTIA A+

Instructional units in this course may include:

- Installing and Configuring Upgrades
- Computer Troubleshooting and Preventive Maintenance
- Network Protocols and Services
- Wired, Wireless, and IP Network Configurations
- Windows, OS, and Linux Operating Systems
- Computer Science Career Pathways

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT78.10.01 Install and configure components to upgrade a computer.	IT78.10.01.01 Explain and verify BIOS and UEFI settings when booting the computer. IT78.10.01.02 Explain the importance of the electrical power configurations. IT78.10.01.03 Identify and successfully upgrade components necessary to improve system performance.	I will be able to reconfigure settings in the BIOS and UEFI settings. I will be able to accurately trace electrical power sources. I will be able to determine what components need upgrading and successfully perform the upgrade.
IT78.10.02 Perform troubleshooting and preventive maintenance on personal computers.	IT78.10.02.01 Explain and analyze the importance of preventative maintenance on computers. IT78.10.02.02 Resolve common PC and/or peripheral device problems through best practice troubleshooting techniques and document solutions.	I will be able to create and deliver a presentation explaining the importance of preventative maintenance. I will be able to troubleshoot common computer problems and document my solutions.
IT78.10.03 Explain how computers communicate on a network and the roles of networks in a technically advancing world.	IT78.10.03.01 Explain the components and types of computer networks. IT78.10.03.02 Explain networking protocols, standards, services and the purpose of devices on a network. IT78.10.03.03 Evaluate the scalability and reliability of networks by describing the relationship between hubs, switches, routers, servers, topology, and addressing ISP.	I will be able to explain how a network operates and define the elements of a connected network. I will be able to identify network protocols as well as different network architectures (NIC, cable modem, DSL modem). I will be able to explain the advantages and disadvantages of network topologies (Bus, Ring, Star, and Mesh).
IT78.10.04 Identify, explain and connect multiple devices securely to different types of networks (Internet).	IT78.10.04.01 Perform basic configurations on devices for wired and wireless networks. IT78.10.04.02 Implement IP addressing schemes.	I will be able to configure basic settings on a wireless router. I will be able to connect various devices (i.e., laptop, printer, mobile devices) to a wire/wireless network.
IT78.10.05 Configure, secure and troubleshoot Windows, mobile, Mac and Linux operating systems.	IT78.10.05.01 Explain the purpose and characteristics of different operating systems (i.e., Linux, OS, Windows). IT78.10.05.02 Analyze and resolve operating system performance issues.	I will be able to create a presentation that compares and contrast the different operating systems. I will be able to troubleshoot and make necessary updates to ensure connectivity on the network.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: AP Computer Science Principles **Course Code: 79**

Alternate Course Titles: AP Mobile Computer Science Principles

Course Description: This course is designed for a full year or a minimum of two trimesters. AP Computer Science Principles introduces students to the field of computer science. Students will learn to design and evaluate programming solutions to solve real-world problems through the development of programs and algorithms. Fundamental topics in this course include: computational solution design; algorithms; abstraction in program development; code analysis; and ethical computing. The course does not have one designated programming language which must be used. Student opportunities to address real-world programs should be encouraged and could be completed through participation in Business Professionals of America (BPA) competitive events.

CTSO Competitive Events:

BPA: Computer Programming Concepts, Python Programming, C++ Programming, Java Programming, C# Programming

SkillsUSA: Computer Programming

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Computer Programming I

YouScience: Computer Programming, Advanced

YouScience: Computer Science Principles

Instructional units in this course may include:

- Iterative Program Development Process
- Data Extraction and Analysis for Solving Business Problems
- Programming with Algorithms
- Program Abstraction and Simulation
- Network Design and Functionality
- Intellectual Property, Legal and Ethical Concerns

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT79.10.01 Design and develop programs using an iterative and collaborative development process.	IT79.10.01.01 Explain the inputs, outputs, and coding segments that direct the functionality of computer programs. IT79.10.01.02 Design, develop and document a computer program and its user interface using an iterative design process. IT79.10.01.03 Utilize inputs and corresponding expected outputs to verify the correctness of a program, identify errors, and correct errors.	I will be able to explain how computer programs are developed to solve problems. I will be able to use an iterative process to develop a computer program and user interface. I will be able to use sample inputs to test the accuracy of my programming.
IT79.10.02 Explain and demonstrate the use of data to gather information, gain insights, and solve problems.	IT79.10.02.01 Explain the use of bits to represent data and the potential programming consequences. IT79.10.02.02 Compare and contrast data compression algorithms to determine which best minimizes data loss or data transmission time. IT79.10.02.03 Explain trends, correlations, and information that can be extracted from data sets and metadata. IT79.10.02.04 Demonstrate how information can be extracted from data to gain insight and solve problems using programs.	I will be able to explain the use and limitations of representing data using bits. I will be able to compare data compression algorithms to determine the best for a given need. I will be able to explain what information can be extracted from data and metadata. I will be able to write programs to process data and extract information.
IT79.10.03 Implement algorithms in computer programs and determine the result of code segments.	IT79.10.03.01 Create and test programs that determine the value of a variable as a result of an assignment. IT79.10.03.02 Write programs that enable data abstraction using lists to store multiple elements. IT79.10.03.03 Represent a step-by-step algorithmic process using sequential code statements. IT79.10.03.04 Create and test programs that incorporate string concatenation and substrings to handle varied input values. IT79.10.03.05 Write programming expressions using relational and logical operators to test relationships between variables. IT79.10.03.06 Create and test programs that include conditional statements, nested conditional statements, and iteration statements to determine algorithm execution. IT79.10.03.07 Write algorithm iteration statements to traverse a list. IT79.10.03.08 Create and test binary search algorithms to determine the number of iterations required to find a value in a data set.	I will be able to determine the value of a variable as a result of an assignment. I will be able to create lists and strings to store multiple elements. I will be able to explain and diagram an algorithm without using a programming language. I will be able to join multiple programming strings to create new program functionality. I will be able to develop programming statements to test relationships between variables. I will be able to write conditional programming statements to test program execution. I will be able to write iteration statements to traverse a list of data elements. I will be able to write binary search algorithms to search sorted data.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT79.10.04 Write computer programs using abstraction processes and structures to analyze data and evaluate solutions to business problems.	IT79.10.04.01 Write programming statements to call procedures and subprograms to improve code readability and efficiency. IT79.10.04.02 Create and test libraries of existing code segments to use in creating new programs. IT79.10.04.03 Write programming statements that generate random values to evaluate the range of possible results. IT79.10.04.04 Explain how computers can be used to represent real-world situations. IT79.10.04.05 Analyze the efficiency of attempting to solve potentially "undecidable problems" through algorithms and programming.	I will be able to develop modular subprograms to solve larger problems with greater efficiency. I will be able to create and use a software library to develop new programs. I will be able to write programs that generate random values to determine the range of results. I will be able to explain how computer simulations can be used to represent real-world situations. I will be able to analyze the inefficiency of having computers attempt to solve some problems.
IT79.10.05 Analyze the design and functionality of network systems to increase speed of access and system reliability.	IT79.10.05.01 Explain how computing devices work together in a network to provide access and distribute data. IT79.10.05.02 Analyze the benefits of network system fault-tolerance and redundancy for increasing reliability and scale of devices supported. IT79.10.05.03 Compare and contrast sequential, parallel, and distributed computing to process large data sets or solve complex problems.	I will be able to explain how computing devices work together in a network to transmit data. I will be able to analyze fault-tolerant systems like the Internet and identify vulnerabilities to system failure. I will be able to compare the efficiency of using sequential, parallel, or distributed computing to solve a given problem.
IT79.10.06 Analyze the legal and ethical concerns related to computing innovations and information transmission via the Internet.	IT79.10.06.01 Explain how computing innovations can have both positive and negative impacts beyond their intended purposes. IT79.10.06.02 Describe the issues of equity, access, and influence that contribute to the digital divide. IT79.10.06.03 Analyze the effect of crowdsourcing models for large-scale collaboration to solve problems. IT79.10.06.04 Explain intellectual property, legal methods of accessing intellectual property of others (i.e., Creative Commons, open source), and challenges of safeguarding intellectual property from unethical use. IT79.10.06.05 Analyze the privacy risks to storing personal data on computer systems and methods available to protect from unethical data access and use.	I will be able to explain how computing innovations can have both beneficial and harmful consequences. I will be able to describe socioeconomic and technological issues that contribute to the digital divide. I will be able to analyze crowdsourcing as a means of digital collaboration. I will be able to explain the ethical and legal risks to privacy from collecting and storing personal data on computer systems.

Career Field: Business, Management, and Administration

Cluster: Information Technology **Program: 140710**

Course Title: AP Computer Science A **Course Code: 80**

Alternate Course Titles: Computer Programming JAVA

Course Description: This course is designed for a full year or a minimum of two trimesters. AP Computer Science A introduces students to computer science through programming. Fundamental topics in this course include: program design to solve problems, the use of data structures to organize large sets of data, the development and implementation of algorithms to process data and discover new information, the analysis of potential solutions, and the ethical and social implications of computing systems. The course emphasizes object-oriented programming and design using the JAVA programming language. Student opportunities to address real-world programs should be encouraged and could be completed through participation in Business Professionals of America (BPA) competitive events.

CTSO Competitive Events:

BPA: Computer Programming Concepts, Python Programming, C++ Programming, Java Programming, C# Programming

SkillsUSA: Computer Programming

Suggested Certifications or Industry-Recognized Credentials:

YouScience: Computer Programming II (C#)

YouScience: Computer Programming II (C++)

YouScience: Computer Programming II (Java)

YouScience: Computer Programming II (Python)

Instructional units in this course may include:

- Programming with Variables and Arithmetic Expressions
- Classes, Methods and Objects
- Programming with Conditional Statements
- Programming with Iterative Statements
- Programming using Classes
- One-Dimensional Arrays, ArrayLists and Two-Dimensional Arrays

Topic/Strand 10: Technical Skills

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT80.10.01 Write a program to declare and assign variables and use basic computational operators to solve basic problems.	IT80.10.01.01 Identify appropriate data type for each value and declare variable type to represent the value. IT80.10.01.02 Evaluate arithmetic expressions in a program code and evaluate what is stored in a variable as a result of an expression with an assignment statement. IT80.10.01.03 Evaluate arithmetic expressions that use casting.	I will be able to write a program which correctly declares and assigns int, double and Boolean variable types. I will be able to use compound operators (+=, -=, *=, /=, %=, ++, --) in place of operators. I will be able to use casting to create temporary value.
IT80.10.02 Write a program using reference data types and differentiate between classes, methods and objects.	IT80.10.02.01 Explain the relationship between a class and an object. IT80.10.02.02 Create and test instantiation of an object using correct parameters as defined in class constructor. IT80.10.02.03 Create and test calling non-static void and return methods with and without parameters. IT80.10.02.04 Create String objects, call String methods, Integer objects, call Integer methods, create Double objects and call Double methods. IT80.10.02.05 Write program code that uses correct methods in the Math class.	I will be able to define the relationship between an object and a class. I will be able to create an object using constructors with or without parameters, call methods on the object. I will be able to write a program that uses concatenation on String objects and the following methods: Interger.MIN_VALUE, Integer.MAX_VALUE,length, substring, indexOf, equals, compareTo. I will be able to write the code to correctly use Math methods: abs, pow, random, and sqrt for both int and double variables.
IT80.10.03 Write a program that uses different conditional statements for decision making in a program.	IT80.10.03.01 Create and test Boolean expressions using relational operators. IT80.10.03.02 Create and test conditional statements. IT80.10.03.03 Create and test nested conditional statements. IT80.10.03.04 Determine when to use object references using Boolean expressions (i.e., equals) or primitive Boolean expressions (i.e., ==).	I will be able to write a program that correctly uses ==, !=, < , >, <=, >=, if, if-else and else if statements, and logical expressions and(&&), or (||), not(!). I will be able to determine and correctly use == or the .equals method.
IT80.10.04 Write and determine the results of program code that uses iterative statements.	IT80.10.04.01 Create and test while and for loops. IT80.10.04.02 Utilize iterative statements to evaluate String objects. IT80.10.04.03 Create and test nested iterative processes.	I will be able to write a program that uses a variety of iterative statements to evaluate and create a variety of String objects.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT80.10.05 Write a program which creates new, user-defined reference data types using classes.	IT80.10.05.01 Create and test a class which includes data, constructors, and methods. IT80.10.05.02 Create an instance/object of the class. IT80.10.05.03 Create functionality comment code. IT80.10.05.04 Define behaviors of an object through non-void and void methods with or without parameters. IT80.10.05.05 Define behaviors of a class through static methods. IT80.10.05.06 Describe the difference between public and private variables and the use of the keyword .this.	I will be able to write a program that instantiates an object of the class I created. I will be able to create accessor methods that will be called correctly. I will be able to write mutator methods that will be called correctly. I will be able to write a program that uses static methods. I will be able to correctly use public and private variables.
IT80.10.06 Write a program to create, traverse and manipulate elements in a 1D array.	IT80.10.06.01 Create, test and traverse a one-dimensional array (1D). IT80.10.06.02 Traverse the ID array using an enhanced for loop.	I will be able to write a program that creates a one-dimensional array and initialize the value of the array by traversing through elements of the array.
IT80.10.07 Write a program that creates an ArrayList and uses ArrayList methods.	IT80.10.07.01 Create and test an ArrayList using ArrayList methods. IT80.10.07.02 Traverse through the ArrayList using a variety of iterative statements. IT80.10.07.03 Search an ArrayList using a variety of search and insertion algorithms. IT80.10.07.04 Sort an ArrayList using a variety of sort algorithms.	I will be able to write a program that creates an ArrayList of 10 famous people. I will be able to sort the ArrayList alphabetically, search to find a specific name and replace a name with a new individual in the ArrayList.
IT80.10.08 Write a program that traverses and manipulates the elements in a two-dimensional (2D) array.	IT80.10.08.01 Create, test and traverse a 2D array. IT80.10.08.02 Traverse the 2D array using nested for loops.	I will be able to create a 2D array and initialize the value of the array by traversing the 2D array. I will be able to print out each element in the array using nested for loops.
IT80.10.09 Design and write a program that uses both super and subclasses.	IT80.10.09.01 Create inheritance relationship from subclass to superclass in constructors, methods, and using super keyword. IT80.10.09.02 Utilize the overriding method (i.e., toString) in a subclass from a superclass. IT80.10.09.03 Instantiate the class using the inheritance relationship. IT80.10.09.04 Develop programming code which incorporates calling methods using the inheritance relationship.	I will be able to write a program consisting of a main program, super class and sub classes. I will be able to call methods from the super class using a subclass object, and use the overriding method to call the toString method on the subclass object.

Performance Indicator/Standard	Measures/Benchmarks	Sample Learning Targets
IT80.10.10 Analyze the results of the recursive method calls.	IT80.10.10.01 Determine the result of executing recursive methods. IT80.10.10.02 Apply recursive search algorithms to information in a String, 1D array, or ArrayList objects.	I will be able to determine the results of code using the recursive method. I will be able to use recursive sorting algorithms on an ArrayList.